

D6.3 Biophysical model connection modules



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Deliverable Authors	Piotr Baranowski (IAPAS), Krzysztof Lamorski, (IAPAS) Jaromir Krzyszczak (IAPAS)
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Executive Summary

AGRICORE is a research project funded by the European Commission under the RUR-04-2018 call, part of the H2020 programme, which proposes an innovative way to apply agent-based modelling to improve the capacity of policymakers to evaluate the impact of agricultural-related measurements under and outside the framework of the Common Agricultural Policy (CAP).

Within the modular architecture of AGRICORE, which is presented in deliverable D6.1 of the Project, the connection of the agent-based simulation module (D6) with a series of external biophysical models (D15) is envisaged.

This connection will allow the incorporation of these models into the optimisation-simulation flow of each agent:

- On the one hand, the agro-management decisions taken by the agents can be passed as an argument and simulated in the biophysical model to represent the realisation of an agricultural campaign, with each agent receiving back its effective yield and the possible effects on its agricultural land, among other information.
- On the other hand, the biophysical models may be used as experimental models for optimisation, generating a series of alternative technological profiles among which the agents must decide which to implement.

To incorporate either of the two functionalities mentioned above, it is necessary to have connectors that allow the exchange of information between the agents and the biophysical models, as well as the launch of the execution of the biophysical models via command line, without the need to use the specific graphical interface of each model.

This document explains the implementation of such connectors (translators) to allow the interconnection of the AGRICORE tool with the WOFOST, DNDC and STICS biophysical models.

Abbreviations

Abbreviation	Full name
ABM	Agent Based Model
AGRICORE	Agent-based support tool for the development of agriculture policies
BIOMA	BIOphysical Model Applications
BMC	Biophysical Model Connector
CANEGROW	sugar CANE GROWth model
CROPSYST	CROPping SYSTems simulation model
DNDC	DeNitrification-DeComposition model
DWH	Data WareHouse
EU	European Union
gRPC	general-purpose Remote Procedure Call
I/0	Input/Output
SEAMLESS	System for Environmental and Agricultural Modelling; Linking European Science and Society
STICS	Simulateur mulTIdisciplinaire pour les Cultures Standard
WARM	WAste Reduction Model
WOFOST	the WOrld FOod STudies simulation model

List of Figures

Figure 1: The flowchart of Biophysical models connectors architecture.	20
Figure 2: The structure of the input (left panel) and output (right panel) for the DNDC model	
Figure 3: The examples of the input xlm (left panel) and output text (right panel) files for the STICS	model.
	23
Figure 4: The examples of the structure of input (left panel) and output (right panel) files for the W model	OFOST
Figure 5: The flowchart of the server code implementing the interface to the biophysical me software	odeling

List of Tables

List of CodeBlocks

CodeBlock 1: Interfaces Definition using Protocols Buffer Language	0
CodeBlock 2: Docker container creation configuration file	5

Table of Contents

1	Introduction	7
2	Requirements of the AGRICORE-linked Biophysical Models	3
3	Architecture of the AGRICORE's Biophysical Models Connectors)
3.1	DNDC Model I/O)
3.2	STICS Model I/O22	L
3.3	DNDC Model I/O	3
4	Implementation of the input/output translators 25 Interface definition 25	
4.1	Interface definition	5
4.1.	Interface constraints and assumptions	L
4.1.	2 Interface correctness check service	L
4.2	Input/output translators software development	L
4.2.	General architecture	2
4.2.	2 DNDC model interface implementation	2
4.2.	3 Docker microservice implementation	3
4.3	Functionality tests	3
4.3.	Unit testing	3
4.3.	 Bridde increase implementation	3
	Conclusions	
Ref	erences	7

1 Introduction

The objective of the deliverable *D6.3 Biophysical model connection modules* is to depict a software solution allowing to parse the ABM Simulation Module queries to an external biophysical model, such as the status of the land plot with a combination of agro management decisions that would be applied on them, and return the effect of these decisions on the future state of the land plot/livestock herd as well as the immediate resulting productivity to the ABM Simulation Module, as it was introduced in revised architecture for AGRICORE described in deliverable D6.1.

The biophysical model connection module will allow to incorporate into the ABM simulation the biophysical dynamics of the ecosystem, in which the agents being simulated are located, which in turn will allow to incorporate into the decision process of holding managers the (limited) knowledge they have about how their land and herds behave in the face of different combinations of crops and/or applied production factors, and to simulate the temporal evolution of the dynamics of the ecosystem, as a result of the aggregate effect of the decisions of all the holdings located in it (agro-management decisions) and of external factors (climatic disturbances, pests, etc.).

2 Requirements of the AGRICORE-linked Biophysical Models

Initially, it was planned to link AGRICORE to BioMA (Biophysical Model Applications), which is a public domain software framework designed and implemented for developing, parameterising and running modelling solutions based on biophysical models in the domains of agriculture and environment. The BioMA framework is a development of the work carried out under the 6th EU Framework Programme SEAMLESS project, and it is widely used within the EU. It consists of a rich library of biophysical models, including CROPSYST, WOFOST, WARM, CANEGROW or STICS. In the revised AGRICORE architecture described in deliverable D6.1, the BIOMA connection module has been replaced by a generic Biophysical Model Connector due to the impossibility to get access to the latest version of BIOMA (source code) and being unable to establish contact with their developers. Currently, this module aims to enable the connection to three different growth models, i.e. STICS, WOFOST, and DNDC (more specifically, DNDC v.CAN). The selection of these specific models resulted from several assumptions. First of all, only multi-crops models were considered which are able to simulate crop sequences in most production systems. Because AGRICORE agent-based modelling aims to be conducted on a regional scale, the used biophysical models had to include parametrized plant species and varieties belonging to various climatic zones. An additional requirement of the revised AGRICORE architecture was the ability to run the external models from the command line. Furthermore, the selected models were dedicated to simulating the externalities of agricultural production systems and studying the genotype and environment interactions. Selected models came from different approaches of modelling the potential and actual crop yield (they belong to the various model families), and each of them put the main focus on a specific process determining plant development. There are considerable differences in the complexity and composition of the selected models. The Denitrification-Decomposition (DNDC) model is a process-oriented model focused mainly on carbon and nitrogen biogeochemistry in agroecosystems. The crop growth and decomposition sub-models of DNDC are able to predict soil temperature, moisture, pH, redox potential and substrate concentration profiles, while the nitrification, denitrification and fermentation sub-models, aim to predict emissions of carbon dioxide, methane, ammonia, nitric oxide nitrous oxide and dinitrogen from the plant-soil systems. STICS model simulates crop growth and additionally calculates soil water and nitrogen balances from daily climatic data. It predicts agricultural variables (yield, input consumption) and environmental variables (water and nitrogen losses). A very important feature of STICS model is its adaptability to various crops, both annual and perennial. WOFOST model explains crop growth based mainly on photosynthesis, respiration and how these processes are influenced by environmental conditions. It calculates attainable crop production, biomass, water use, given knowledge about soil, crop, weather and crop management.

As each external biophysical model has its requirements for the input data needed for its initialization, the Biophysical Model Connector module can be initialized with different input datasets depending on the availability of the information in the external databases. For each of the three selected models, the set of input/output data has been identified and the minimal, optimal and maximal sets were defined. In Table 1 the optimal set of the input data is provided for the selected 3 models, whereas the complete information on the input/output datasets is attached to this deliverable as separate files.

		STICS			DNDC			WOFOST
	VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTIO UNIT
Site		altitude of simulated site altitude of the inpu metorological station	(m) t (m)	Site_name Simulated_years	name of the site (a string) number of total simulated years (an integer)	(-) (-)	SOFILE	N name of soil (-) file
	latitude	latitude of the site)	Latitude	latitude (decimal unit) of	(decimal degree)		
		atmospheric pressure reference height o meteorological data measurement	(mbar) f (m)					
Weather	weather file *.XXX where the XXX are the 3 last digits of the year		(-)	Air_CO2_concentration	atmospheric background CO ₂ concentration which affects plant photosynthesis	(ppm)	WCCYEARN R	the WCC- (y) variable 'WCCYEARN R' that gives the year
	1 st column	name of weather file	(-)	Climate_files	number of climate files included in the simulations and the name of the file with the link to the corresponding directory	(-)	LONG	longitude of (decimal the station degree)
	2 nd column	year	(y)	1 st column	Julian day;	(-)	LAT	latitude of the (decimal station degree)
	3 rd column	month	(m)	2 nd column	daily maximum air temperatures;	(ºC)	ALT	altitude of the (m) station
	4 th column	day in month	(d)	3 rd column	daily minimum air temperatures;	(ºC)	A	the A (-) coefficient for the Ängström formula
	5 th column	Julian day	(day of the year)	4 th column	daily precipitation sum	(cm)	В	the B (-) coefficients for the Ängström formula
	6 th column	minimum temperature	(°C)	5 th column	wind speed daily average	(m/s)	1 st column	station (-) number

Table 1: The optimal input datasets for STICS, DNDC and WOFOST models.

		STICS		DNDC			WOFOST			
	VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTIO N	UNIT	
	7 th column	maximum temperature	(°C)	6 th column	radiation daily sum	(MJ/m²/day)	2 nd column	year	(y)	
	8 th column	global radiation	(MJ·m ⁻² ∙ j ⁻¹)	7 th column	humidity daily average	(%) 3	3 rd column	day number	(day of year)	
	9 th column	Penman PET	(mm·j ⁻¹)				4 th column	irradiation	(kJ·m ⁻² ·d ⁻ ¹)	
	10 th column	rainfall	(mm·j ⁻¹)				5 th column	minimum temperature	(°C)	
	11 th column	wind	(m·s ⁻¹)				6 th column	maximum temperature	(°C)	
	12 th column	vapour pressure	(mbars)			2		early morning vapor pressure	(kPa)	
							8 th column	mean wind speed at 2 m above ground	(m·s ⁻¹)	
							9 th column	precipitation	(mm·d ⁻¹)	
Soil	argi	clay content after decarbonation	(%)	Land_use_ID	<pre>select a current land use (Options are: 1 - upland crop field, 2 - rice paddy field, 3 - moist grassland/pasture, 4 - dry grassland/Pasture, 5 - wetland 6 - tree plantation)</pre>	(-)	soil file *.new	name of the .new soil file	(-)	
	calc	total carbonate content	(%)	Soil_texture_ID	<pre>select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - silt loam, 5 - loam, 6 - sandy clay loam, 7 - silty clay loam,</pre>		SMTAB	volumetric soil moisture content as function of pF	([log (cm); cm ³ cm ⁻³])	

STICS				DNDC		WOFOST						
VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTIO N	UNIT				
				8 - clay loam, 9 - sandy clay, 10 - silty clay, 11 - clay, 12 - organic soil								
	bulk density of fine earth fraction in each soil layer	(g∙cm-³)	Bulk_density	bulk density (g/cubic cm) of top soil (0-10 cm).	(g/cm ³)	SMW	soil moisture content at wilting point					
	gravimetric water content at field capacity of each soil layer (/fine earth)	(% w)	_pH	pH of top soil	(-)	SMFCF	soil moisture content at field capacity	(cm ³ cm ⁻³)				
	gravimetric water content at wilting point of each soil layer (/fine earth)		Clay_fraction	clay fraction of soil by weight	(-)	SM0	soil moisture content at saturation	(cm ³ cm ⁻³)				
	soil organic N content in the first soil layer (supposed constant down to the depth profhum), equal to total nitrogen (Kjeldahl method)	soil)	_Field_capacity	water-filled porosity (WFPS) at soil field capacity	(-)	CRAIRC	critical soil air content for aeration	(cm ³ cm ⁻³)				
рН	Initial soil pH (water solution)	(pH)	_Wilting_point	water-filled porosity (WFPS) at soil wilting point	(-)	CONTAB	hydraulic	([log (cm); log (cm/day)])				
typsol	soil type	(SD)	_Hydro_conductivity	hydrological saturation conductivity	(m/hr)	К0	hydraulic conductivity of saturated soil	(cm d ⁻¹)				
			Top_layer_SOC	Content of total soil organic carbon (SOC), including litter residue, microbes,		SOPE	maximum percolation rate root zone	(cm d ⁻¹)				
								humads, and passive hum at surface layer (0-5 cm).	humads, and passive humus at surface layer (0-5 cm).		KSUB	maximum percolation rate subsoil
						SPADS	1st topsoil seepage parameter deep seedbed	(-)				

	STICS				WOFOST			
	VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTIO UNIT N
							SPODS	2nd topsoil (-) seepage parameter deep seedbed
							SPASS	1st topsoil (-) seepage parameter shallow seedbed
							SPOSS	2nd topsoil (-) seepage parameter shallow seedbed
							DEFLIM	required (-) moisture deficit deep seedbed
Сгор	Crop file *_plt.xml	Name of the crop *_plt.xml file: baresoil_plt.xml – bare soil, corn_plt.xml – maize, DurumWheat_ACALOU_plt.xml – durum wheat, DurumWheat_ALLUR_plt.xml – durum wheat, DurumWheat_AMARILLO_plt.xml – durum wheat, DurumWheat_ARCALIS_plt.xml – durum wheat, DurumWheat_ARTIMON_plt.xml – durum wheat, DurumWheat_BIENSUR_plt.xml – durum wheat, DurumWh	(-)	Crop_ID	one of the crop types parameterized in DNDC. The choices are: 0 Fallow 1 Corn 2 Winter_wheat 3 Soybean 4 Legume_hay 5 Non_legume_ha y 6 Spring_wheat 7 Sugarcane 8 Barley 9 Oats 10 Alfalfa 11 Annual_grass 12 Perennial_gras s 13 Sorghum 14 Cotton 15 Rye	(-)	crop file *.cab	name of the (-) .cab crop file BAR301.CAB - spring barley (EU) FBE0801.CAB - Faba bean (Vicia faba) (EU) MAG201.CAB - Maize (DE & LU) MAG202.CAB - Maize (Southern DE & Northern FR) MAG203.CAB - Maize (Central FR & Northern IT)

	STICS			DNDC				WOFOST		
v	ARIABLE	DESCRIPTION	UNIT	VARIABLE	DI	ESCRIPTION	UNIT	VARIABLE	DESCRIPTIO N	UNIT
		DurumWheat_NEODUR_plt.xml -			16	Vegetables			MAG204.CAB	
		durum wheat,			17	Рарауа			– Maize	
		DurumWheat_ORJAUNE_plt.xml			18	Potato			(Southern FR,	
		– durum wheat,			19	Beet			Northern IT,	
		grass_plt.xml – forage grass,			20	Paddy_rice			ES & PT)	
		mustard_CoverCrop_plt.xml -			21	Banana			MAG205.CAB	
		mustard,			22	Celery			– Maize (GR,	
		pea_plt.xml – pea,			23	Peanut			Southern IT,	
		proto_alfalfa_plt.xml			24	Upland_rice			Southern ES)	
		proto_banana_plt.xml – banana,			25	Rapeseeds			POT701.CAB	
		proto_barley_InterCrop_plt.xml -			26	Tobacco			– potato (DE,	
		barley,			27	Millet			FR, NL, BE,	
		proto_barley_plt.xml – barley,			28	Sunflower			LU, UK, IE,	
		proto_fescue_plt.xml – fescue,			29	Beans			DK)	
		proto_flax_plt.xml – flax,			30	DeepWater_ric			POT702.CAB	
		proto_lettuce_plt.xml – lettuce,			e 31	Onion			– potato (Southern	
		proto_pea_InterCrop_plt.xml - pea			32	Palm			FR)	
		pea proto_potato_plt.xml – potato,			33	Strawberry			POT703.CAB	
		proto_potato_pit.xiii – potato, proto_sorghum_plt.xml –			33 34	Lettuce			– potato	
		sorghum,			35	Artichoke			(Northern	
		proto_soybean_plt.xml – soybean,			36	Flowers			and Central	
		proto_strawberry_plt.xml -			37	Sprout			IT)	
		strawberry			38	Berries			POT704.CAB	
		proto_sugarcane_plt.xml -			39	Truck_crops			– potato	
		sugarcane			40	Fruit_trees			(Southern IT,	
		proto_sunflower_plt.xml –			41	Citrus			GR, ES, PR)	
		sunflower,			42	Grape			RAP1001.CA	
		proto_tomato_plt.xml – tomato,			43	Silage_corn			B – winter	
		proto_winterbarley_plt.xml –			44	Hops			oilseed rape	
		winter barley,			45	Tomato			(EU without	
		rapeseed_plt.xml - rapeseed			46	Rainfed_rice			Southern FR,	
		ryegrass_CoverCrop_plt.xml -			47	Cover_crop			Southern IT,	
		ryegrass,			48	Safflower			Southern ES)	
		sugarbeet_plt.xml – sugarbeet,			49	Flax			RAP1002.CA	
		vine_CABFRA_plt.xml - vine,			50	Sedge			B – winter	
		vine_CHARCCH_plt.xml - vine,			51	Cassava			oilseed rape	
		vine_CHARCC_plt.xml – vine,			52	Cattail			(Southern FR,	
		vine_CHARDOB_plt.xml - vine,			53	CA_broccoli			Southern IT)	
		vine_CHENIN_plt.xml - vine,			54	Evergreens				

	STICS		1	DNDC				WOFOST		
1	VARIABLE	DESCRIPTION	UNIT	VARIABLE		DESCRIPTION	UNIT	VARIABLE	DESCRIPTIO	UNIT
		vine_GRENAC_plt.xml - vine, vine_PINCCH_plt.xml - vine, vine_PINCC_plt.xml - vine, vine_PINOTB_plt.xml - vine, vine_SYRAH_plt.xml - vine, vine_UGNIB_plt.xml - vine, wheat_plt.xml - wheat		Planting_month	55 56 57 58 59 60 61 62 63 64 65 66 67 ay 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 a nur	Cabbage Green_onion Mustard Tule Moss Radish Shrub Boreal_sedge Almond Nut_tree Melon Pasture_hay Small_grain_h Carrots peppers Asparagus Cauliflower Artichokes Sweet_Potato Beans_green COT Olives Plums Cherries Peach Pears Apples Dates Avocados Apricots Figs Prunes Lemons Fpeas Ley Lentil	(-)		NRAP1003.CAB - winteroilseed rape(Southern ES)RAP1004.CAB - oilseedrape (ES)RIC501.CAB -rice (FR, IT,GR, ES, PR)SOY0901.CAB- soybean(NorthernFR)SOY0902.CAB- soybean(Central FR)SOY0903.CAB- soybean(NorthernES)SOY0904.CAB- soybean(NorthernES)SOY0904.CAB- soybean(SouthernFR)SOY0905.CAB- soybean (ES)& GR)SUG0601.CAB - sugar beet(DE,Northern andCentral FR,NL, BE, LU,UK, IE, DK)	
					the m	onth of planting			SUG0602.CA	

STICS				DNDC		WOFOST		
VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTION	UNIT	VARIABLE DESCRIPTIO	UNIT	
			Planting_day	a number from 1 to 31 for the day of planting	(-)	B – sugar beet (Southern FR,		
			Harvest_month	a number from 1 to 12 for the month of harvesting	(-)	Northern and Central IT, ES,		
			Harvest_day	a number from 1 to 31 for the day of harvesting	(-)	PT) SUG0603.CA B - sugar beet (Southern ES and Southern IT) SUG0604.CA B - sugar beet (GR) SUN1101.CA B - sunflower (FR, IT, ES, GR) WWH101.CA B - winter wheat (Northern IE, Scotland, northern UK, DK) WWH102.CA B - winter wheat (IE, central and southern UK, NL, northern DE) WWH103.CA B - winter wheat (southern NL, DE, BE, LU) WWH104.CA B - winter wheat		

	STICS				DNDC		WOFOST
	VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTION	UNIT	VARIABLE DESCRIPTIO UNIT
							(central DE, northern FR) WWH105.CA B – winter wheat (FR, northern & central IT, northern ES, northern PT) WWH106.CA B – winter wheat (southern IT, central & eastern ES, southern PT) WWH107.CA B – winter wheat (southern ES & Central and Southern GR)
Agrotechnic al practices	codcueille	option of harvest type (1 =single harvest (cutting), 2 = multiple harvests (picking))		Till_applications	number of tilling applications in the year	(-)	Irigation can be added indirectly – by adding the amount of water to the daily sum of the rainfall in the weather
	codefracapp N	option to activate splitting applications of N fertiliser $(1 = absolute value, 2 = \% of totalvalue)$		Till#	sequential number of each application.	(-)	file Fertilization can also be included indirectly – by adding the amount of NPK to the NBASE, PBASE, and KBASE
	doseI	irrigation amount	(mm·d ⁻ 1)	Till_month	month of the tilling application	(-)	variables (basic supply of nitrogen, phosphorus and potassium by the unfertilized soil)
	engrais	fertilizer type (1=ammonium nitrate, 2=UAN solution, 3=urea, 4=anhydrous ammonia, 5=ammonium sulfate, 6=ammonium phosphate, 7=calcium nitrate, 8= fixed efficiency fertiliser)		Till_day	day of the tilling application	(-)	

	STICS		WOFOST					
VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTIO	UNIT
fracN	proportion of fertiliser N applied at each application	(%)	Till_method	define tilling depth by selecting one of the default methods as 1 - no-till (i.e., only mulching) (0 cm), 2 - ploughing slightly (5 cm), 3 - ploughing with disk or chisel (10 cm), 4 - ploughing with moldboard (20 cm), 5 - deep ploughing (30 cm).	(-)		N	
iplt0	date of sowing	(julian.d)	Fertilizer_applications	number of applications in the year	(-)			
irec	date of harvest	(julian.d)	Fertilizing#	sequential number of each application	(-)			
julapI	date(s) of irrigation	(julian.d)	Fertilizing_month	month of the fertilization application	(-)			
julapN	date(s) of fertilizer application	(julian.d)	Fertilizing_day	day of the fertilization application	(-)			
juleclair	day of fruits removal	(julian.d)	Nitrate	nitrate fertilizer amount	(kg N/ha)			
julfauche	date(s) of each cut for forage crops	(julian.d)	Ammonium_bicarbon ate	ammonium bicarbonate fertilizer amount	(kg N/ha)			
jultrav	date(s) of soil tillage	(julian.d)	Urea	urea fertilizer amount	(kg N/ha)			
nbcueille	number of fruit harvestings (1= one at the end, 2 = many during the cycle)		Anhydrous_ammonia	anhydrous ammonia fertilizer amount	(kg N/ha)			
nbjtrav	number of tillage operations	(SD)	Ammonium	ammonium (NH4)NO3 fertilizer amount	(kg N/ha)			
Qtot_N	amount of total mineral N fertilizer applications	(kg·ha ⁻¹)	Sulphate	sulphate (NH4)2SO4 fertilizer amount	(kg N/ha)			
variete	cultivar number corresponding to the cultivar name in the plant	SD	Phosphate	phosphate (NH ₄) ₂ HPO ₄ fertilizer amount	(kg N/ha)			
	file		Irrigation_applications	number of applications in the year	(-)			

	STICS				DNDC		u	WOFOST		
	VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTIO	UNIT	
				Irrigation#	sequential number of each application	(-)		N		
				Irri_month	month of the fertilization application	(-)				
				Irri_day	day of the fertilization application	(-)				
				Water_amount	amount of water used	(cm)				
				Irri_method	sequential irrigation method used, flood, sprinkler and drip are options subject to different evaporation or leaching water losses and hence have different water use efficiencies 1 - furrow 2 - sprinkler 3 - drip (0cm) 4 - drip (15cm)					
(USM.xml) i n STICS/Time	datedebut	day of the beginning of the simulation	(julian.d)	Not applicable			ISYR	first year for which crop growth is simulated.	(y)	
r file in WOFOST	datefin	day of the end of simulation	(julian.d)				IDSOW	day of sowing (day of year).		of
	culturean	number of calendar years involved in the crop cycle (1 = 1 year e.g. for spring crops, 0 = two years, e.g. for winter crops)						Used if ISTCHO = 1.		
Site File	Not applicab	e		Not applicable				basic supply of nitrogen by the unfertilized soil (N, kg•ha- 1). Range: 0 - 100	kg ha ⁻¹	

STICS			DNDC			WOFOST		
VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTION	UNIT	VARIABLE	DESCRIPTIO N	UNIT
							basic supply of phosphorus by the unfertilized soil (P, kg•ha- 1). Range: 0 - 10.	
							basic supply of potassium by the unfertilized soil (K, kg•ha- 1). Range: 0 - 100.	

3 Architecture of the AGRICORE's Biophysical Models Connectors

To ensure the connectivity between ABM Simulation Module and the external biophysical models, which usually have their own structure and format of the input/output files, the input/output translators for biophysical models had to be developed. They are used to translate the ABM gRPC request with input parameters to the formats and structures specific for each of the used biophysical models. After the bio-simulation is executed properly, the output information from the biophysical model is delivered also as a gRPC response to the ABM simulation engine. The schematic flowchart describing the internal architecture of the Biophysical models connector and their communication with ABM Simulation Module is presented in Figure 1. Additionally, the flow of the data from the Data Warehouse to the ABM simulation engine is shown to understand what data is passed via gRPC request to Biophysical models connectors module.

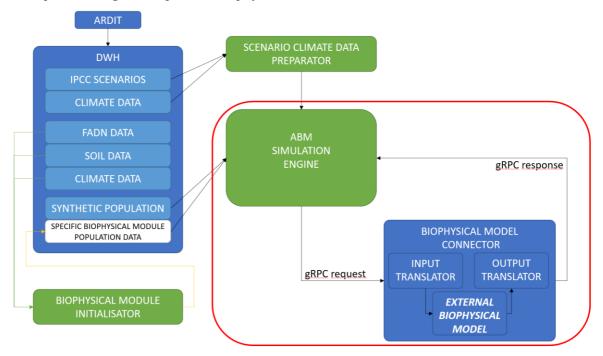


Figure 1: The flowchart of Biophysical models connectors architecture.

The translators of the request from ABM Simulation Module had to take into account the specificity of the structure of the input/out data files for each of the used external biophysical models. The selected models differ in the required number of input files necessary to initialize the simulations and output files with the results of simulations.

3.1 DNDC Model I/O

The DNDC model input file is in plain text format and contains the list of variables and their values, in individual lines. This file contains input values concerning: site information, soil and plant description, applications of soil tillage, fertilizers, irrigation, plant cutting and grazing as well as basic climate parameters such as N in rainfall, air NH₃ concentration, air CO_2 concentration and CO_2 increase rate. Only, the climate yearly time series data of daily values are contained in separate files and the names of these files, with the links to the corresponding directories, are included in a separate line of this input file. DNDC model is dedicated to simulating the

development and growth of annual and perennial crops. When working with perennial crops users have to specify it in the data input file. The results of the simulation are provided in annual report files. The units are strictly defined for all the input variables and cannot be changed. In Figure 2 an example of the input and output DNDC files is presented.

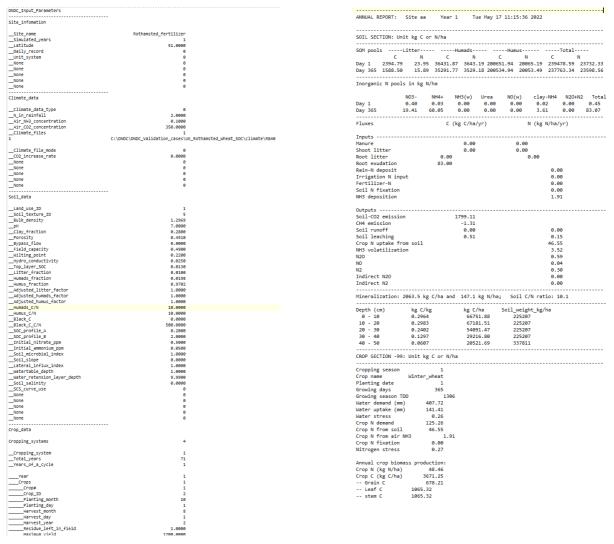


Figure 2: The structure of the input (left panel) and output (right panel) for the DNDC model.

3.2 STICS Model I/O

To initiate a simulations in STICS it is necessary to define simulation units, which correspond to a climate, a soil, a crop and a crop management. These parameter files are stored in a working directory called workspace in the interface. The input parameters are subdivided into two categories: global parameters (giving access to general parameters and crop parameters files) and local parameters (giving access to specific parameters files). The global parameters are grouped into different categories creating a structure and containing:

- parameters corresponding to options (with the different possible values).
- parameters for which a value has to be given (a specific value is entered in the box).

Two additional types of crop parameters are contained in a separate file:

- parameters corresponding to options (they can be chosen from possible values); for a chosen option there is a specific list of parameters. For example, if the 'annual' option is chosen, some specific parameters will be displayed in 'emergence and starting' for defining the germination or latency parameters and the type of plant growth; however, if the 'perennial' option is chosen, those parameters are no longer displayed.
- parameters for which a value has to be given (the value can be entered in the box in GUI).

The local parameters of STICS model include five sets of files which refer to:

- initialization of the system at simulation start.
- soils parameterization.
- crop management parameterization.
- climate data and weather station parameterization.

The list of available input parameters of STICS model is presented in Table 1. The results of the simulations are saved in output files, whose number and structure can be defined in a configuration file. There are the following types of output files:

- balance files: which describe the different stages of the simulated crop and balances.
- history file: is a log file that gives you the parameter values used and warning or error messages concerning the simulation.
- daily output files: containing the variables chosen within the state variables simulated by the model.
- report file: a file that gives a synthesis of the state variables chosen on a line corresponding to a date and/or stage.
- profile file: provides a state variable of temperature or soil moisture along with the depth of the soil for a set of chosen dates.



Figure 3: The examples of the input xlm (left panel) and output text (right panel) files for the STICS model.

3.3 WOFOST Model I/O

WOFOST is a dynamic simulation model for the quantitative analysis of the growth and production of annual field crops. There is no option for perennial crops included. With this model, it is possible to calculate potential production, and two levels of limited production: water-limited and nutrient-limited production. The potential production option allows obtaining yield in a simulation environment non-constrained by water or nutrient limitations, while the other predefined models available, as water-limited and nutrient-limited, allow calculating the production in a constrained simulation environment. Only in these pre-defined models, the simulation environment allows for establishing some agro-management decisions that are triggered by some simulation events, either dates or internal crop states. The decisions concern: irrigation regarding both the amount of water in mm and the date of treatment, the effectiveness and fertiliser dose amount of nitrogen, phosphorous, and potassium in kilograms per hectare. However, to run such a simulation using agro-management decisions, it is necessary to use the simulation engine rather than running a pre-defined model. This allows skipping some constraints of the model, which does not take into account the effect of these decisions on crop production directly. The particularity of using agro-management decisions is that each action can be triggered by events either dates or states related to simulation variables.

The input files containing the specific crop, soil, and weather parameters are written in separate data files with precisely defined units. There are also input run files that are used for the configuration of specific types of simulations. The first of them is the timer file with weather and crop calendar-related data; next, there is the site file with default values for soil and the rerun file which defines the series of consecutive WOFOST runs; and finally, there is the run option file with

general information. There are four different output file types in WOFOST: detailed output of the simulation, summary output for potential growth, summary output for water-limited growth, and summary output (which is created only when the simulation is made for more than two weather years).

<pre>* \$Id: wwh101.cab 1.3 1997/09/25 14:07:03 LEM release \$ * File WWH101.CAB * CROP DATA FILE for use with WOFOST Version 5.4, June 1992 ** WHEAT, WINTER 101 ** Regions : Northern Ireland, Scotland, northern UK (R71), Denmark ** start date 1 January ** mean date of flowering 10 Jun, mature 15 Aug ** Derived from SUCROS87 data set for wheat. ** Calibrated for use in WOFOST model at the Centre for Agrobiological ** Research (CABO-DLO) for the simulation of crop growth and yield on the ** basis of daily weather data. ** Purpose of application: Crop growth monitoring with agrometeorological ** model in the EC. ** Developed in the framework of JRC Agriculture Project Action 3.</pre>	**WOFOST version 7.1.7, release September 2013 RUMNUM -> WCC OUTPUT -> file: output\wcc.out RERUNS -> no reruns WEATHER-> name: Netherlands, Wageningen file: meteo\cabowe\nl. start year: 1980 RIN -> belonging to weather station CROP -> name: Spring barley 301, EC file: croopt\bar301.cab SOIL -> name: EC1-coarse file: solid\ec1.new START -> fixed sowing date start waterbalance99 sowing date = 1 emergence date = 45 POTENTIAL CROP PRODUCTION
CRPNAM='Winter wheat 101, N-U.K., Denmark'	
** emergence TBASEM = -10.0 ! lower threshold temp. for emergence [cel] TEFFMX = 30.0 ! max. eff. temp. for emergence [cel] TSUMEM = 0. ! temperature sum from sowing to emergence [cel d]	YEAR DAY IDSEM DVS TSUM WLV WST WSO TAGP LAI TRA GASS MRES DMI degrd kg/ha kg/ha kg/ha kg/ha mz/n2 mml/d CH2O CH2O kg/ha/d 1980 45 0 0.00 0. 24. 0. 0. 24. 0.05 0.00 0.0 0.0 0.0 1980 46 1 0.00 2. 24. 0. 0. 24. 0.05 0.01 0.6 0.3 0.2
** phenology	1980 47 2 0.01 7. 24. 0. 0. 24. 0.05 0.00 1.4 0.3 0.8 1980 48 3 0.02 13. 24. 0. 0. 24. 0.05 0.00 1.7 0.3 1.0
IDSL = 0 ! indicates whether pre-anthesis development depends	1980 49 4 0.02 17. 25. 0. 0. 25. 0.05 0.01 2.1 0.3 1.3
! on temp. (=0), daylength (=1) , or both (=2)	1980 50 5 0.03 22. 25. 0. 0. 25. 0.05 0.01 2.4 0.2 1.6
DLO = -99.0 ! optimum daylength for development [hr]	1980 51 6 0.03 25. 26. 0. 0. 26. 0.05 0.01 2.6 0.3 1.7
DLC = -99.0 ! critical daylength (lower threshold) [hr]	1980 52 7 0.04 29. 27. 0. 0. 27. 0.05 0.02 3.7 0.3 2.4
TSUM1 =1000. ! temperature sum from emergence to anthesis [cel d]	1980 53 8 0.04 35. 28. 0. 0. 28. 0.06 0.02 3.6 0.3 2.3
TSUM2 = 950. ! temperature sum from anthesis to maturity [cel d] DTSMTB = 0.00. 0.00. ! daily increase in temp. sum	1980 54 9 0.05 41. 29. 0. 0. 29. 0.06 0.01 0.3 0.3 0.0
DTSMTB = 0.00, 0.00, ! daily increase in temp. sum 30.00, 30.00, ! as function of av. temp. [cel; cel d]	1980 55 10 0.06 45. 29. 0. 0. 29. 0.06 0.01 0.7 0.3 0.3
45.00, 30.00	1980 56 11 0.06 50. 29. 0. 0. 29. 0.06 0.00 0.0 0.0 0.0 1980 57 12 0.07 54. 29. 0. 0. 29. 0.06 0.01 0.0 0.0 0.0
DVSI = 0. ! initial DVS	1980 58 13 0.07 57. 29. 0. 0. 29. 0.06 0.01 0.0 0.0 0.0
DVSEND = 2.00 ! development stage at harvest (= 2.0 at maturity [-])	1980 59 14 0.07 59. 29. 0. 0. 29. 0.06 0.01 0.0 0.0 0.0
	1980 60 15 0.08 62. 29. 0. 0. 29. 0.06 0.01 0.2 0.2 0.0
** initial	1980 61 16 0.09 69. 29. 0. 0. 29. 0.06 0.01 0.2 0.2 0.0
TDWI = 210.00 ! initial total crop dry weight [kg ha-1]	1980 62 17 0.09 74. 29. 0. 0. 29. 0.06 0.01 0.3 0.3 0.0
LAIEM = 0.1365 ! leaf area index at emergence [ha ha-1]	1980 63 18 0.10 77. 29. 0. 0. 29. 0.06 0.01 0.4 0.3 0.1
RGRLAI = 0.00817 ! maximum relative increase in LAI [ha ha-1 d-1]	1980 64 19 0.10 79. 29. 0. 0. 29. 0.06 0.01 0.0 0.0 0.0
**	1980 65 20 0.10 82. 29. 0. 0. 29. 0.06 0.01 0.0 0.0 0.0
** green area SLATB = 0.00, 0.00212, ! specific leaf area	1980 66 21 0.11 86. 29. 0. 0. 29. 0.06 0.01 0.0 0.0 0.0 1980 67 22 0.11 90. 29. 0. 0. 29. 0.06 0.02 0.1 0.1 0.0
0.50, 0.00212, ! as a function of DVS [-; ha kg-1]	1980 67 22 0.11 90. 29. 0. 0. 29. 0.06 0.02 0.1 0.1 0.0 1980 68 23 0.12 97. 29. 0. 0. 29. 0.06 0.01 0.0 0.0 0.0
2.00, 0.00212	1980 69 24 0.13 101. 29. 0. 0. 29. 0.06 0.01 0.0 0.0 0.0
SPA = 0.000 ! specific pod area [ha kg-1]	1980 70 25 0.13 102. 29. 0. 0. 29. 0.06 0.01 1.0 0.4 0.5
SSATB = 0.0, 0.0, ! specific stem area [ha kg-1]	1980 71 26 0.13 108. 29. 0. 0. 29. 0.06 0.00 0.7 0.3 0.3
2.0, 0.0 ! as function of DVS	1980 72 27 0.14 114. 29. 0. 0. 29. 0.06 0.00 1.1 0.3 0.6
SPAN = 31.3 ! life span of leaves growing at 35 Celsius [d]	1980 73 28 0.15 119. 29. 0. 0. 29. 0.06 0.02 3.2 0.4 2.0
TBASE = 0.0 ! lower threshold temp. for ageing of leaves [cel]	1980 74 29 0.16 126. 30. 0. 0. 30. 0.06 0.02 2.3 0.3 1.5
** assimilation	1980 75 30 0.16 131. 31. 0. 0. 31. 0.06 0.01 1.5 0.3 0.9 1980 76 31 0.17 133 31 0. 0 31 0.06 0.01 2.3 0.3 1.4
KDIFTB = 0.6, 0.60, ! extinction coefficient for diffuse visible light [-]	1000 76 21 0 17 122 21 0 0 21 0 06 0 01 7 2 0 2 1 /

Figure 4: The examples of the structure of input (left panel) and output (right panel) files for the WOFOST model.

4 Implementation of the input/output translators

4.1 Interface definition

The biophysical connection module was implemented as a server awaiting requests providing data indispensable for running the biophysical models and returning the response related to the yield and other plant production details. The communication between the biophysical module and other modules of the Agricore suite is realized using the gRPC protocol. As a result, Protocol Buffers are used for the interface definition. The third version of the Protocol Buffers language specification was used for interface definition.

The Protocol Buffers code defining the interfaces is presented below in CodeBlock 1.

```
Syntax = "proto3";
  service BiophysicalModels {
    rpc BiophysDndcRun (DndcRequest) returns (DndcReply) {}
    rpc BiophysDndcCheckRequest (DndcRequest) returns (DndcReply) {}
  }
  message DndcRequest {
    //The iophysical model to be used
    enum TmodelType {
      FAKE ENTRY MODEL TYPE = 0;
      DNDC = 1;
      WOFOST = 2;
      STICS = 3;
    };
    //Input parameters detailedness mode
    enum TmodelMode {
      FAKE ENTRY MODEL MODE = 0;
      MINI\overline{M}AL = \overline{1};
      OPTIMAL = 2;
      DETAILED = 3;
    }
    enum TtillMethod {
      NO TILLAGE = 0;
      MULCHING ONLY = 1;
      PLOUGHING_SLIGHTLY_5_CM = 2;
      PLOUGHING W_DISK_OR_CHISEL 10_CM = 3;
PLOUGHING W_MOLDBOARD 20_CM = 4;
      PLOUGHING_DEEP_30_CM = 5;
      LITTER BURYING TILL = 6;
      CROP TERMINATING TILL = 7;
    }
    enum TirrigationMethod {
      FURROW = 0;
      SPRINKLER = 1;
      DRIP_0_CM = 2;
      DRIP_{15}CM = 3;
    }
    enum TlandUse {
      FAKE_LAND_USE = 0;
      UPLAND CROP = 1;
      RICE PADDY = 2;
      MOIST GRASSLAND = 3;
      DRY \overline{GRASSLAND} = 4;
      WETLAND = 5;
      TREE = 6;
    }
    enum TsoilTextureClass {
      FAKE SOIL TEXTURE = 0;
      SAND = 1;
      LOAMY_SAND = 2;
      SANDY_LOAM = 3;
SILTY_LOAM = 4;
      LOAM = 5;
      SANDY CLAY LOAM = 6;
      SILTY CLAY LOAM = 7;
      CLAYLEY LOAM = 8;
      SANDY CLAY = 9;
      SILTY CLAY = 10;
      CLAY = 11;
      ORGANIC_SOIL = 12;
```

}

enum TCropName { FALLOW = 0;CORN = 1; WINTER WHEAT = 2;SOYBEAN = 3;LEGUME HAY = 4;NON LEGUME HAY = 5;SPRING WHEAT = 6;SUGARCANE = 7;BARLEY = 8;OATS = 9;ALFALFA = 10;ANNUAL GRASS = 11; PERENNIAL_GRASS = 12; SORGHUM = 13; COTTON = 14;RYE = 15;VEGETABLES = 16;PAPAYA = 17;POTATO = 18;BEET = 19;PADDY RICE = 20;BANANA = 21;CELERY = 22;PEANUT = 23;UPLAND RICE = 24;RAPESEEDS = 25;TOBACCO = 26;MILLET = 27;SUNFLOWER = 28;BEANS = 29;DEEPWATER RICE = 30; ONION = $3\overline{1}$; PALM = 32;STRAWBERRY = 33;LETTUCE = 34;ARTICHOKE = 35; FLOWERS = 36;SPROUT = 37;BERRIES = 38;TRUCK_CROPS = 39; FRUIT TREES = 40;CITRUS = 41;GRAPE = 42;SILAGE CORN = 43; HOPS = 44;TOMATO = 45;RAINFED RICE = 46; $COVER_CROP = 47;$ SAFFLOWER = 48; FLAX = 49;SEDGE = 50;CASSAVA = 51;CATTAIL = 52;CA BROCCOLI = 53; $\overline{\text{EVERGREENS}} = 54;$ CABBAGE = 55;GREEN ONION = 56;MUSTARD = 57;TULE = 58;MOSS = 59;RADISH = 60;SHRUB = 61;

```
BOREAL_SEDGE = 62;
  ALMOND = 63;
  NUT TREE = 64;
  MELON = 65;
  PASTURE HAY = 66;
  SMALL GRAIN HAY = 67;
  CARROTS = 68;
  PEPPERS = 69;
  ASPARAGUS = 70;
  CAULIFLOWER = 71;
  ARTICHOKES = 72;
  SWEET_POTATO = 73;
  BEANS_GREEN = 74;
COT = 75;
  OLIVES = 76;
  PLUMS = 77;
  CHERRIES = 78;
  PEACH = 79;
  PEARS = 80;
  APPLES = 81;
  DATES = 82;
  AVOCADOS = 83;
  APRICOTS = 84;
  FIGS = 85;
  PRUNES = 86;
  LEMONS = 87;
  FPEAS = 88;
 LEY = 89;
  LENTIL = 90;
}
//Weather data for a given year
message TWeatherYearlyData {
 int32 Year = 1;
 repeated TWeatherDailyData WeatherDailyData = 2;
}
//Weather data daily record definition
message TWeatherDailyData {
 int32 JulianDay = 1;
  float AirTMax = 2;
 float AirTMin = 3;
 float TotalPrecipitation = 4;
  optional float AverageWindSpeed = 5;
  optional float TotalRadiation = 6;
  optional float AverageAirHumidity = 7;
}
//Till application
message TTillApplication {
 int32 TillId = 1;
  int32 TillMonth = 2;
 int32 TillDay = 3;
  TTillMethod TillMethod = 4;
}
//Fertilizer application
message TFertilizerApplication {
  int32 FertilizingId = 1;
  int32 FertilizingMonth = 2;
  int32 FertilizingDay = 3;
  float FertNitrate = 4;
  float FertAmmoniumBicarbonate = 5;
  float FertUrea = 6;
  float FertAnhydrousAmmonia = 7;
  float FertAmmonium = 8;
```

```
float FertSulphate = 9;
    float FertPhosphate = 10;
  }
  //Irrigation application
  message TIrrigationApplication {
    int32 IrrigationId = 1;
    int32 IrrigationMonth = 2;
    int32 IrrigationDay = 3;
    float IrrigationWaterAmount = 4;
    TIrrigationMethod IrrigationMethod = 5;
  }
  //Crop data
  message TCropData {
    TCropName CropName = 1;
    int32 PlantingMonth = 2;
    int32 PlantingDay = 3;
    int32 HarvestMonth = 4;
    int32 HarvestDay = 5;
    int32 TillApplicationNo = 6;
    repeated TTillApplication TillApplication = 7;
    int32 FertilizerApplicationNo = 8;
    repeated TFertilizerApplication FertilizerApplication = 9;
    int32 IrrigationApplicationNo = 10;
    repeated TIrrigationApplication IrrigationApplication = 11;
  }
  TModelType ModelType = 1;
  TModelMode ModelMode = 2;
  //Site
  int32 SimulatedYears = 3;
  float Latitude = 4;
  //Climate
  float AirCo2Concentration = 5;
  repeated TWeatherYearlyData WeatherYearlyData = 6;
  //Soil
  TLandUse LandUse = 7;
  TSoilTextureClass SoilTextureClass = 8;
  float BulkDensity = 9;
  float pH = 10;
  float ClayFraction = 11;
  float FieldCapacityTheta = 13;
  float WiltingPointTheta = 14;
  float SaturatedConductivity = 15;
  float TopLayerSOC = 16;
  //Crop
  int32 CroppingSystemsNo = 17;
  repeated TCropData CropData = 18;
}
message DndcReply {
  enum TReturnCode {
    FAKE RETURN CODE = 0;
    OK = 1;
    ERR REQUEST = 2;
    ERR RUNTIME = 3;
  }
  message TModelReply {
   int32 YearNo = 1;
    string CropName = 2;
    float TotalCPool = 3;
    float TotalNPool = 4;
    float InorganicNInTotalPool = 5;
    float CMineralization = 6;
```

```
float NMineralization = 7;
   float CIn0_10Layer = 8;
float CIn10_20Layer = 9;
   float CIn20 30Layer = 10;
   float CIn30 40Layer = 11;
   float CIn40_50Layer = 12;
    float SoilCO2Emmision = 13;
    float SoilNH4Emmision = 14;
   float CropNUptake = 15;
   float N20 = 16;
    float N2 = 17;
    float WaterDemand = 18;
    float WaterUptake = 19;
   float CropNDemand = 20;
   float CropNFromSoil = 21;
   float CropNFromAirNH3 = 22;
   float CropNFixation = 23;
    float NitrogenStress = 24;
    float CropN = 25;
   float CropC = 26;
   float CropGrainC = 27;
    float CropLeafC = 28;
   float CropStemC = 29;
    float CropRootC = 30;
   float CropNPP = 31;
   float CropNEE = 32;
   float Stubble = 33;
   float FruitCut = 34;
   float LeafCut = 35;
   float StemCut = 36;
   float RootCut = 37;
   float LifestockFeedDemand = 38;
   float GrazedBiomass = 39;
   float FinalSoilProfileWater = 40;
   float FinalSoilP = 41;
    float PFluxOfLeaching = 42;
  }
 TReturnCode ReturnCode = 1;
  string RunInfo = 2;
  repeated TModelReply ModelReply = 3;
}
```

CodeBlock 1: Interfaces Definition using Protocols Buffer Language

4.1.1 Interface constraints and assumptions

Despite the provided definition of the request, which is only a formal specification of the structure (fields and their types) of the request, additional requisites must be fulfilled, which can't be specified within the Protocol Buffers specification. And have to be taken into account in the client code, which forms the request to be sent to the biophysical models' interface module.

The list of the constraints:

- 1. Some request fields are defined as the enumeration structures (ENUM). In some cases, the first field of ENUM has the name beginning with the phrase "FAKE_..." (e.g. FAKE_ENTRY_MODEL_TYPE, or FAKE_ENTRY_MODEL_MODE). Usage of these values in the request is prohibited. They had to be placed in the request definition due to the Protocol Buffers requirements to start ENUMs with 0, but this value is not acceptable due to the particular biophysical model requirements.
- 2. The repeated field WeatherDailyData (repeated TWeatherDailyData WeatherDailyData) in the message TWeatherYearlyData is providing the meteorological data for subsequent days of the given year:
 - a. the daily records have to appear in chronological order (the field JulianDay has to be sorted ascending),
 - b. the records have to be provided for all days within the considered year,
 - c. the field JulianDay enumerates days within the year starting from 1 for the 1st of January.
- 3. When variables indicating the tillage (TillApplicationNo), irrigation (IrrigationApplicationNo), and fertilizer (FertilizerApplicationNo) application events have the value 0 then the accompanying list defining particular events (TillApplication, IrrigationApplication and/or FertilizerApplication) have to be empty lists.
- 4. Value constraints to be fulfilled:
 - a. 0.5 < BulkDensity < 1.8,
 - b. 3 < pH < 10,
 - c. WiltingPointTheta < FieldCapacityTheta.

4.1.2 Interface correctness check service

The correctness of the request is checked prior to running the biophysical model. In case of a failing check, the response returns the ReturnCode::ERR_REQUEST. The additional endpoint was also provided (BiophysDndcCheckRequest) allowing checking the correctness of the request.

4.2 Input/output translators software development

The code was implemented using Python programming language. Some new Python language features were used in the code so at least version 3.10 of the Python interpreter is needed to run the code of the biophysical models interconnection module.

The server-side executable was implemented which provides two endpoints for running the biophysical model (BiophysDndcRun) and testing the correctness of the request (BiophysDndcCheckRequest).

4.2.1 General architecture

The general flowchart describing the functioning of the server is provided below. The server allows servicing multiple simultaneously connecting clients. Each of the clients sends the request to the server which will cause the biophysical model execution to prepare response data for the particular client. The runtime environment of the biophysical models is organized in such a way that the simultaneously running biophysical models are isolated and do not infer each other.

As the biophysical model run time might be quite long, especially to be used for optimisation purposes, a repository was conceived to store already calculated cases. After the biophysical model calculation, the solved case is saved on the disk storage together with the checksum of the model's configuration. The server reads this storage upon the startup and the new case runs only if the new-case configuration checksum differs from these already known case checksums. The appropriate results from the cases repository are returned immediately otherwise.

The server maintains the in-memory database of the cases checksum adding information about new calculated cases. The SHA256 checksum is used for this purpose to ensure the correct case configuration discrimination.

When the new case is to be run, the server prepares biophysical model configurations file(s) based on the content of the request, spawns the biophysical model, and finally parses the model output file(s) to form the response.

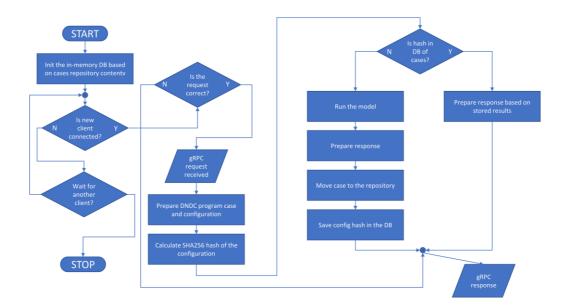


Figure 5: The flowchart of the server code implementing the interface to the biophysical modeling software.

4.2.2 DNDC model interface implementation

The general requirement for the preparation of the gRPC interface to the biophysical model is the ability of the biophysical model executable to be run in the CLI batch mode without the GUI interface. The standard distribution of the DNDC model does not have such property. To overcome this problem the fork DNDCv.CAN 9.5.3 of the original DNDC 9.5 was used instead which can be run from the command line. The DNDCv.CAN implements the same biophysical modelling framework extending it on a few minor, not important from the view of the AGRICORE

suite features. The binary of the DNDCv.CAN can be downloaded from the GitHUB service (<u>https://github.com/BrianBGrant/DNDCv.CAN</u>).

4.2.3 Docker microservice implementation

The server was implemented as a docker microservice. The Docker container creation configuration file defining essential software runtime dependencies for the biophysical model and the server itself is provided below in CodeBlock 2. The container is based on the Windows 10 OS due to the operating system requirements of the biophysical modelling software (DNDC, WOFOST).

4.3 Functionality tests

4.3.1 Unit testing

The set of the automated unit tests was performed to validate the correctness of the developed pieces of the source code implementing the biophysical models' interaction interface.

4.3.2 Functional tests

The exploratory functional tests were performed for a few scenarios in a non-automated manner using the client python-based (dndc_client.py) implementation forming the gRPC request based on the request data stored in the form of the JSON files.

```
FROM mcr.microsoft.com/windows:20H2
SHELL ["powershell", "-Command", "$ErrorActionPreference = 'Stop';
$ProgressPreference = 'SilentlyContinue';"]
ENV PYTHONIOENCODING UTF-8
ENV PYTHON VERSION 3.10.5
RUN $url = ('https://www.python.org/ftp/python/{0}/python-{1}-amd64.exe' -f
($env:PYTHON VERSION -replace '[a-z]+[0-9]*$', ''), $env:PYTHON VERSION); \
    Write-Host ('Downloading {0} ... ' -f $url); \
    [Net.ServicePointManager]::SecurityProtocol =
[Net.SecurityProtocolType]::Tls12; \
    Invoke-WebRequest -Uri $url -OutFile 'python.exe'; \
    Write-Host 'Installing ...'; \
# https://docs.python.org/3/using/windows.html#installing-without-ui
    $exitCode = (Start-Process python.exe -Wait -NoNewWindow -PassThru \
        -ArgumentList @( \
            '/quiet', \land
            'InstallAllUsers=1', \
            'TargetDir=C:\Python', \
            'PrependPath=1',
            'Shortcuts=0', \
            'Include_doc=0', \
            'Include_pip=0', \
            'Include_test=0' \
        ).ExitCode; \
    if ($exitCode -ne 0) { \
        Write-Host ('Running python installer failed with exit code: {0}' -f
$exitCode);
       Get-ChildItem $env:TEMP | Sort-Object -Descending -Property
LastWriteTime | Select-Object -First 1 | Get-Content; \
        exit $exitCode; \
    } \
# the installer updated PATH, so we should refresh our local value
    $env:PATH = [Environment]::GetEnvironmentVariable('PATH',
[EnvironmentVariableTarget]::Machine); \
    Write-Host 'Verifying install ...'; \
Write-Host ' python --version'; python --version; \
    Write-Host 'Removing ...'; \
    Remove-Item python.exe -Force; \
    Remove-Item $env:TEMP/Python*.log -Force; \
    Write-Host 'Complete.'
# if this is called "PIP VERSION", pip explodes with "ValueError: invalid truth
value '<VERSION>'"
ENV PYTHON PIP VERSION 22.0.4
# https://github.com/docker-library/python/issues/365
ENV PYTHON SETUPTOOLS VERSION 58.1.0
# https://github.com/pypa/get-pip
ENV PYTHON GET PIP URL https://github.com/pypa/get-
pip/raw/6ce3639da143c5d79b44f94b04080abf2531fd6e/public/get-pip.py
ENV PYTHON GET PIP SHA256
ba3ab8267d91fd41c58dbce08f76db99f747f716d85ce1865813842bb035524d
RUN Write-Host ('Downloading get-pip.py ({0}) ... ' -f $env:PYTHON GET PIP URL);
[Net.ServicePointManager]::SecurityProtocol =
[Net.SecurityProtocolType]::Tls12; \
    Invoke-WebRequest -Uri $env:PYTHON GET PIP URL -OutFile 'get-pip.py'; \
    Write-Host ('Verifying sha256 ({0}) ...' -f $env:PYTHON GET PIP SHA256); \
```

```
if ((Get-FileHash 'get-pip.py' -Algorithm sha256).Hash -ne
$env:PYTHON_GET_PIP_SHA256) { \
    Write-Host 'FAILED!'; \
        exit 1; \setminus
    }; \
    $env:PYTHONDONTWRITEBYTECODE = '1';
    Write-Host ('Installing pip=={0} ...' -f $env:PYTHON_PIP_VERSION); \
    python get-pip.py \
        --disable-pip-version-check \
        --no-cache-dir \
        --no-compile \
        ('pip=={0}' -f $env:PYTHON PIP VERSION) \
         ('setuptools=={0}' -f $env:PYTHON SETUPTOOLS VERSION) \
    ; \
    Remove-Item get-pip.py -Force; \
    Write-Host 'Verifying pip install ...'; \
    pip --version; \
    Write-Host 'Complete.'
RUN pip install grpcio
RUN pip install protobuf
RUN pip install pandas
RUN pip install checksumdir
#32-bit Visual C++ 2015 Redistributable needed by DNDC
USER ContainerAdministrator
ADD https://aka.ms/vs/17/release/vc redist.x86.exe /vc redist.x86.exe
RUN c:\vc redist.x86.exe /install /quiet /norestart
RUN del c:\vc redist.x86.exe
EXPOSE 50051
COPY ./install_repository/DNDC c:/DNDC
COPY ./install repository/dll dependencies c:/dll dependencies
COPY ./install_repository/far c:/far
COPY ./install_repository/DNDC/run_dndc_cmd_opt.bat c:/DNDC
COPY ./lib c:/server/lib
COPY dndc_server.py c:/server
COPY dndc config_templates.py c:/server
COPY bm int dndc pb2.py c:/server
COPY bm_int_dndc_pb2_grpc.py c:/server
CMD ["python.exe","c:/server/dndc_server.py"]
```

CodeBlock 2: Docker container creation configuration file

5 Conclusions

The module implementing interface allowing for calling the biophysical modeling software was prepared and tested.

During the module development, the feature of the DNDCvCAN binary was discovered which could be potentially an issue and have to be adequately addressed. The DNDCv.CAN although can be run in a batch mode without the GUI, but if any runtime error occurs during DNDCv.CAN execution the program raises the GUI message box showing the error message. As the GUI interaction can't be controlled, it will cause freezing of the further execution of the DNDCv.CAN, and as a result, the server python code is infinitely waiting for the finishing of the biophysical model run. As the developed module is preparing the DNDC configuration files correctly and the request is validated in advance this shouldn't happen. But to be sure about the DNDCv.CAN execution we will try to access the source code of the DNDCv.CAN and modify it so the potential errors were reported in the controllable by batch execution way.

References

Deliverable Number	Deliverable Title	Lead beneficiary	Туре	Dissemination Level	Due date
D6.1	AGRICORE architecture and interfaces	IDE	Report	Public	M23
D6.2	External Interface Module	IDE	Report	Public	M31
D6.6	Software Quality Assurance measures for AGRICORE	AAT	Report	Public	M15

For preparing this report, the following deliverables have been taken into consideration:

DNDC DETAILED INPUT/OUTPUT

	VARIABLE	DESCRIPTION	UNIT	In Optimal?	In Minimal?
Site	Site_name	INPUTS name of the site (a string)	(-)	+	+
	Simulated_years Latitude	number of total simulated years (an integer) latitude (decimal unit) of the site	(-) (decimal degree)	+ +	+ +
	 Daily_record	allow DNDC to record daily results (0=no; 1=yes)	(-)	default=0	default=0
	Unit_system	system of the units	(-)	default=0	default=0
Climate		 The climate data file can be constructed with eight different formats based on the original data source (1 - Column 1: Julian day; 2: daily average air temperatures; 3: daily precipitation; 2 - Column 1: Julian day; 2: daily maximum air temperatures; 3: daily precipitation; 3 - Column 1: Julian day; 2: daily maximum air temperatures; 4: daily precipitation; 4 - Column 1: Julian day; 2: daily maximum air temperatures; 4: daily precipitation; 5: radiation; 4 - Column 1: Julian day; 2: daily maximum air temperatures; 3: daily precipitation; 5: calaly average wind speed; 5 - Column 1: Julian day; 2: daily maximum air temperatures; 3: daily maximum air temperatures; 3: daily minimum air temperatures; 3: daily minimum air temperatures; 3: daily minimum air temperatures; 3: daily 		default=5 (Column 1: Julian day; 2: daily maximum air temperatures; 3: daily minimum air temperatures; 4: daily precipitation; 5: wind speed; 6: radiation; 7: humidity)	default=2 (Column 1: Julian day; 2: daily maximum air temperatures; 3: daily minimum air temperatures; 4: daily precipitation)
	Climate_data_type	 minimum air temperatures; 4: daily precipitation; 5: wind speed; 6: radiation; 7: humidity; 6 - Column 1: Julian day; 2: daily maximum air temperatures; 3: daily precipitation; 5: wind speed; 6: humidity; 7 - Column 1: Julian day; 2: daily maximum air temperatures; 4: daily precipitation; 5: humidspeed; 6: humidity; 8 - Column 1: Julian day; 2: daily minimum air temperatures; 4: daily precipitation; 5: humidspeed; 6: daily minimum air temperatures; 4: daily precipitation; 5: humidspeed; 6: daily 8 - Column 1: Julian day; 2: daily maximum air temperatures; 4: daily precipitation; 5: wind speed; 6: daily 			
	N_in_rainfall	Annual average N (dissolved nitrate and ammonium) concentration in rainfall	(mg N/l or ppm)	default=0.5000	default=0.5000
	N_m_raman	Average background concentration in faithful in the air, which affects NH ₃ dry deposition on plants.	(ug N/m ³)	default=0.0600	default=0.0600
	Air_CO2_concentration	atmospheric background CO ₂ concentration which affects plant photosynthesis	(ppm)	+	default=400.0000
	Climate_files	number of climate files included in the simulations and the name of the file with the link to the corresponding directory	(-)	+	+
	1 st column	Julian day;	(-)	+	+
	2 nd column 3 rd column	daily maximum air temperatures; daily minimum air temperatures;	(°C) (°C)	+ +	+ +
	4 th column	daily precipitation sum	(cm)	+	+
	5 th column 6 th column	wind speed daily average radiation daily sum	(m/s) (MJ/m ² /day)	+ +	no need to provide no need to provide
	7 th column	humidity daily average	(%)	+	no need to provide
	Climate_file_mode	mode of the climate files for multi-year simulations, the atmospheric CO ₂ concentration can be changed by setting this	(-) (ppm/yr)	default=0 default=0	default=0 default=0
	CO2_increase_rate CO2_File_Mode	annual change rate. mode of the CO ₂ file	(-)	default=0	default=0
Soil	CO2_FileName	filename and directory of the CO; file select a current land use (Options are: 1 - upland crop field, 2 - rice paddy field, 3 - moist grassland/pasture, 4 - dry grassland/Pasture, 5 - wetland	(-)	no need to provide +	no need to provide +
	Land use ID	6 - tree plantation)			
		 6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - silt loam, 5 - loam, 6 - sandy clay loam, 7 - silty clay loam, 8 - clay loam, 9 - sandy clay, 10 - silty clay, 	(-)	+	+
	Soil_texture_ID	 6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - sitl loam, 5 - loam, 6 - sandy clay loam, 7 - sitly clay loam, 8 - clay loam, 9 - sandy clay, 10 - sitly clay, 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 	(-) (g/cm ³)	+ +	default value from
		 6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - sili loam, 5 - loam, 6 - sandy clay loam, 7 - siliy clay loam, 8 - clay loam, 9 - sandy clay, 10 - siliy clay, 11 - clay, 12 - organic soil 	(g/cm ³)		
	Soil_texture_ID	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - silt loam, 5 - loam, 6 - sandy clay loam, 7 - silty clay loam, 8 - clay loam, 9 - sandy clay, 10 - sinty clay, 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm), pH of top soil	(g/cm ³) (-)	+	default value from Soil_parameters.txt default value from Soil_parameters.txt
	Soil_texture_ID Bulk_density	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - sitl loam, 5 - loam, 6 - sandy clay loam, 7 - sitly clay loam, 8 - clay loam, 9 - sandy clay, 10 - sitly clay, 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm), pH of top soil clay fraction of soil by weight	(g/cm ³) (-) (-)	+ + + + +	default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt
	Soil_texture_ID Bulk_density pH	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - silt loam, 5 - loam, 6 - sandy clay loam, 7 - silty clay loam, 8 - clay loam, 9 - sandy clay, 10 - silty clay, 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm), pH of top soil clay fraction of soil by weight soil porosity, a fraction	(g/cm ³) (-) (-) (-)	+ + + default value from Soil parameters.txt	default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt
	Soil_texture_ID Bulk_density pH Clay_fraction Porosity	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - silt loam, 5 - loam, 6 - sandy clay loam, 7 - silty clay loam, 9 - sandy clay, 10 - silty clay, 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm), pH of top soil clay fraction of soil by weight soil porosity, a fraction if the soil has macro-pores, the by-pass flow	(g/cm ³) (-) (-)	+ + + default value from	default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Gefault value from
	Soil_texture_ID Bulk_density pH Clay_fraction Porosity Bypass_flow	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - sitl loam, 5 - loam, 6 - sandy clay loam, 7 - sitly clay loam, 8 - clay loam, 9 - sandy clay, 10 - sitly clay, 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm). pH of top soil clay fraction of soil by weight soil porosity, a fraction if the soil has macro-pores, the by-pass flow rate can be fined as a fraction water-filed porosity (WFPS) at soil field	(g/cm ³) (-) (-) (-)	+ + + default value from Soil parameters.txt	default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default=0.0000 default value from
	Soil_texture_ID Bulk_density pH Clay_fraction Porosity Bypass_flow Field_capacity	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - silt loam, 5 - loam, 6 - sandy clay loam, 7 - silty clay loam, 8 - clay loam, 9 - sandy clay, 10 - silty clay, 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm). pH of top soil clay fraction of soil by weight soil porosity, a fraction if the soil has macro-pores, the by-pass flow rate can be fined as a fraction water-filled porosity (WFPS) at soil field capacity water-filled porosity (WFPS) at soil wilting	(g/cm ¹) (-) (-) (-) (-)	+ + default value from Soil_parameters.txt default=0.0000	default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default=0.0000 default=0.0000 defaultvalue from Soil_parameters.txt default=0.0000
	Soil_texture_ID Bulk_density pH Clay_fraction Porosity Bypass_flow	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - silt loam, 5 - loam, 6 - sandy clay loam, 7 - silty elay loam, 8 - elay loam, 9 - sandy clay loam, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm), pH of top soil clay fraction of soil by weight soil porosity, a fraction if the soil has macro-pores, the by-pass flow rate can be fined as a fraction water-filled porosity (WFPS) at soil field capacity water-filled porosity (WFPS) at soil witting point	(g/cm ³) (·) (·) (·) (·) (·) (·) (·)	+ + default value from Soil_parameters.txt default=0.0000 + + +	default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt
	Soil_texture_ID Bulk_density pH Clay_fraction Porosity Bypass_flow Field_capacity	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - sitl loam, 5 - loam, 6 - sandy clay loam, 7 - sitly clay loam, 9 - sandy clay, 10 - sitly clay, 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm). pH of top soil clay fraction of soil by weight soil porosity, a fraction if the soil has macro-pores, the by-pass flow rate can be fined as a fraction water-filled porosity (WFPS) at soil field capacity water-filled porosity (WFPS) at soil wilting point hydrological saturation conductivity	(g/cm³) (-) (-) (-) (-) (-) (-) (-) (m/hr)	+ + + default value from Soil parameters.txt default=0.0000 + + + +	default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default-value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt
	Soil_texture_ID Bulk_density pH Clay_fraction Porosity Bypass_flow Field_capacity Wilting_point Hydro_conductivity	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - silt loam, 5 - loam, 6 - sandy clay loam, 7 - silty clay loam, 8 - clay loam, 9 - sandy clay, 10 - silty clay, 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm). pH of top soil clay fraction of soil by weight soil parosity, a fraction if the soil has macro-pores, the by-pass flow rate can be fined as a fraction water-filled porosity (WFPS) at soil field capacity water-filled porosity (WFPS) at soil wilting point hydrological saturation conductivity Content of total soil organic carbon (SOC), including litter residue, microbes, humads, and passive humas at surface layer (0-5)	(g/cm ³) (·) (·) (·) (·) (·) (·) (·)	+ + default value from Soil_parameters.txt default=0.0000 + + +	default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default-20000
	Soil_texture_ID Bulk_density pH Clay_fraction Porosity Bypass_flow Field_capacity Wilting_point Hydro_conductivity Top_layer_SOC Litter_fraction	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - silt loam, 5 - loam, 6 - sandy clay loam, 7 - silty clay loam, 8 - clay loam, 9 - sandy clay loam, 10 - silty clay, 10 - silty clay, 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm), pH of top soil clay fraction of soil by weight soil porosity, a fraction if the soil has macro-pores, the by-pass flow rate can be fined as a fraction water-filled porosity (WFPS) at soil field capacity word -filled porosity (WFPS) at soil wilting point hydrological saturation conductivity Content of total soil organic carbon (SOC), including litter residue, microbes, humads, and passive humas at surface layer (0-5 cm). fraction of litter pool	(g/cm ³) (·) (·) (·) (·) (·) (·) (m/hr) (kg C/kg) (·)	+ + default value from Soil_parameters.txt default=0.0000 + + + + + + + default=0.0100	default value from Soil_parameters.txt default=0.000
	Soif_texture_ID Bulk_density pH Clay_fraction Porosity Bypass_flow Field_capacity Wilting_point Hydro_conductivity Top_Jayer_SOC	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - silt loam, 6 - sandy clay loam, 7 - silty clay loam, 8 - clay loam, 9 - sandy clay, 10 - silty clay, 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm). pH of top soil clay faction of soil by weight soil porosity, a fraction if the soil has macro-pores, the by-pass flow rate can be fined as a fraction water-filled porosity (WFPS) at soil wilting point hydrological saturation conductivity Content of total soil organic carbon (SOC), including litter residue, microbes, humads, and passive humus at surface layer (0-5 cm). fraction of humads (active humus) pool fraction of passive humus pool fraction of passive humus pool	(g/cm ¹) (-) (-) (-) (-) (-) (m/hr) (kg C/kg)	+ + + default value from Soil_parameters.txt default=0.0000 + + + + + + +	default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default=0.0000 default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default value from Soil_parameters.txt default=0.0275
	Soil_texture_ID Bulk_density PH Clay_fraction Porosity Bypass_flow Field_capacity Wilting_point Hydro_conductivity Top_layer_SOC Litter_fraction Humads_fraction Humus_fraction Adjusted_litter_factor	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - sill loam, 5 - loam, 6 - sandy clay loam, 7 - silly clay loam, 8 - clay loam, 9 - sandy clay loam, 8 - clay loam, 9 - sandy clay. 10 - silly clay. 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm), pH of top soil clay fraction of soil by weight soil porosity, a fraction if the soil has macro-pores, the by-pass flow rate can be fined as a fraction water-filled porosity (WFPS) at soil wilting point hydrological saturation conductivity Content of total soil organic carbon (SOC), including litter residue, microbes, humads, and passive humus at surface layer (0-5 cm). fraction of humads (active humus) pool fraction of justes to deal with unusual situation situations factor to systematically change the humads<	(g/cm ³) (·) (·) (·) (·) (·) (·) (·) (·) (kg C/kg) (·) (·) (·) (·)	+ + + default value from Soil_parameters.txt default=0.0000 + + + + + + + + + + + + + default=0.0100 default=0.0219 default=0.9681	default value from Soil_parameters.txt default value from Soil_parameters.txt default=0.0275 default=0.0100 default=0.0219 default=0.9681
	Soil_texture_ID Bulk_density pH Clay_fraction Porosity Bypass_flow Field_capacity Wilting_point Hydro_conductivity Top_layer_SOC Litter_fraction Humads_fraction Humads_fraction Adjusted_litter_factor Adjusted_humads_factor	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - sili loam, 6 - sandy clay loam, 7 - silty clay loam, 8 - clay loam, 9 - sandy clay, 10 - silty clay, 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm). pH of top soil clay fraction of soil by weight soil porosity, a fraction if the soil has macro-pores, the by-pass flow rate can be fined as a fraction water-filled porosity (WFPS) at soil wilting point hydrological saturation conductivity Content of total soil organic carbon (SOC), including litter residue, microbes, humads, and passive humus at surface layer (0-5 cm). fraction of humads (active humus) pool fraction of humads (active humus) pool fraction of passive humus pool fractor to systematically change the litter decomposition rates to deal with unusual situations factor to systematically change the passive humus decomposition rates to deal with unusual situations	(g/cm ³) (·) (·) (·) (·) (·) (m/hr) (kg C/kg) (·) (·) (·) (·) (·) (·) (·)	+ + + default value from Soil_parameters.txt default=0.0000 + + + + + + + + default=0.0100 default=0.0100 default=0.0219 default=0.0681 default=1.000	default value from Soil_parameters.txt default=0.000 default=0.0275 default=0.0100 default=0.0219 default=0.0281 default=1.000
	Soil_texture_ID Bulk_density pH Clay_fraction Porosity Porosity Bypass_flow Field_capacity Wilting_point Hydro_conductivity Top_layer_SOC Litter_fraction Humads_fraction Humus_fraction Adjusted_humads_factor Adjusted_humus_factor	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - silt loam, 5 - loam, 6 - sandy clay loam, 7 - silty clay loam, 9 - sandy clay, 10 - silty clay, 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm). pH of top soil clay fraction of soil by weight soil porosity, a fraction if the soil has macro-pores, the by-pass flow rate can be fined as a fraction water-filled porosity (WFPS) at soil field capacity water-filled porosity (WFPS) at soil withing point hydrological saturation conductivity hydrological sturation conductivity fraction of passive humus at surface layer (0-5 cm). fraction of passive humus at surface layer (0-5 cm). fraction of burde soil organic carbon (SOC), including litter residue, microbes, humads, and passive humus at surface layer (0-5 cm). fraction of passive humus pool fractor to systematically change the litter decomposition rates to deal with unusual situations factor to systematically change the planeds decomposition rates to deal with unusual situations factor to systematically change the passive humus decomposition rates to deal with unusual situations	(g/cm ¹) (·) (·) (·) (·) (·) (·) (·) (·	+ + + default value from Soil_parameters.txt default=0.0000 + + + + + + + + + + default=0.0100 default=0.0219 default=1.000 default=1.000	default value from Soil_parameters.txt default-0.0000 default-0.000 default-0.0275 default=0.0100 default=0.0219 default=1.000 default=1.000
	Soil_texture_ID Bulk_density pH Clay_fraction Porosity Bypass_flow Field_capacity Wilting_point Hydro_conductivity Top_layer_SOC Litter_fraction Humads_fraction Humads_fraction Adjusted_litter_factor Adjusted_humads_factor	6 - tree plantation) select a soil type based on either its texture or clay fraction (There are 12 soil types: 1 - sand, 2 - loamy sand, 3 - sandy loam, 4 - silt loam, 5 - loam, 6 - sandy clay loam, 7 - silty clay loam, 8 - clay loam, 9 - sandy clay, 10 - silty clay, 11 - clay, 12 - organic soil bulk density (g/cubic cm) of top soil (0-10 cm), pH of top soil clay fraction of soil by weight soil porosity, a fraction if the soil has macro-pores, the by-pass flow rate can be fined as a fraction water-filled porosity (WFPS) at soil wilting point hydrological saturation conductivity Content of total soil organic carbon (SOC), including litter residue, microbes, humads, and passive humus at surface layer (0-5 cm). fraction of binads (active humus) pool fraction of burnads (active humus) pool fraction of burnads (active humus) pool fractor to systematically change the humads decomposition rates to deal with unusual situations factor to systematically change the humads decomposition rates to deal with unusual situations factor to systematically change the humads decomposition rates to deal with unusual situations factor to systematically change the humads decomposition rates to deal with unusual situations factor to systematically change the passive humus decomposition rates to deal with unusual situations	(g/cm ³) (·) (·) (·) (·) (·) (·) (·) (·	+ + + + default value from Soil_parameters.txt default=0.0000 + + + + + + + + + + default=0.0100 default=0.0219 default=0.0219 default=1.000 default=1.000 default=1.000 default=1.000	default value from Soil_parameters.txt default=0.0000 default=0.0275 default=0.0219 default=1.000 default=1.000 default=1.000 default=1.000
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	1			default=2.000	default=2.000
		A rate, which determines how fast the SOC content decreases below the top soil. The	(-)	derault=2.000	default=2.000
		higher the rate, the faster the SOC content decreases. A fraction value (i.e., <1.0)			
		means SOC content increases along with			
	SOC_profile_B	increase in the soil depth (such as for peat soil).			
		the default initial nitrate content at surface layer	(mg N/kg) (ppm)	default=0.5000	default=0.5000
		the default initial ammonium content at	(mg N/kg)	default=0.0500	default=0.0500
	Initial_ammonium_ppm	surface layer an index ranging from 0.0 to 1.0 for	(ppm) (-)	default=1.000	default=1.000
		indicating impact of soil toxic materials on	0	uchum-1.000	deman=1.000
	Soil_microbial_index	soil microbial activity slope of the soil surface in percentage. The	(-)	default=0.000	default=0.000
	Soil_slope Lateral_influx_index	slope for a level soil is 0 index for lateral influx	(-)	default=1.000	default=1.000
	Drainage_Efficiency	efficiency of the drainage	(-)	default=0.000	default=0.000
		depth of water retention layer in m, which could be formed by soil compaction	(m)	default=2.000	default=2.000
	West Table David	(common for intensively grazed pasture) or			
	WaterTable_Depth	clay pan soil salinity index. If the index > 0, the soil	(-)	default=0.0000	default=0.0000
	_Soil_salinity	salinity will affect crop growth and soil microbial activity			
	Son_sammey	activates the Soil Conservation Service	(-)	default=1	default=1
		(SCS) curve number method and the Modified Universal Soil Loss Equation			
		(MUSLE) approach to simulate soil surface runoff and soil erosion			
	SCS_curve_use	(0 – no; 1 – yes)			
	SCS_curve_number	define soil hydrological curve number regulating soil surface runoff flow	(-)	default=73.0000	default=73.0000
		define soil surface roughness for calculating	(-)	default=0.1900	default=0.1900
	Land_surface_roughness	runoff flow define channel surface roughness for	(-)	default=0.1900	default=0.1900
	Channel_surface_roughness	calculating channel flow			
	Channel_slope Channel_length	define channel slope define channel length	(m/m) (km)	default=0.0000 default=0.0000	default=0.0000 default=0.0000
		define an index for adjusting land	(-)	default=0.0000	default=0.0000
	Land_management_factor	management on runoff flow flow rate to drains that is directly	(m)	default=3.0000	default=3.0000
	Deep WaterPoolRD	proportional to effective depth			
	Deep_WaterPoolBD	select the type of soil profile:	(-)	default=0	default=0
	Soil_Profile_Type	 0 - homogeneous soil profile (default) 1 - heterogeneous soil profile 			
		name and location of the file with soil	(-)	no need to provide	no need to provide
Crop	Profile_File_Name Cropping_systems	profile properties definition the number of different cropping systems	(-)	default=1	default=1
		consecutively applied during the entire			
		simulated time span sequential number of the cropping system	(-)	default=1	default=1
	Cropping_system	going to be defined. the number of total years modeled in this	(-)	default=1	default=1
	Total_years	simulation		uclauit=1	uciauit-1
	Years_of_a_cycle	the number of years a cycle of this cropping system lasts for	(-)		
		sequential number of the year in a cycle for	(-)	default=1	default=1
	Year Crops	current input process the number of the cropping systems	(-)	default=1	default=1
	Crop#	crop sequential number one of the crop types parameterized in	(-)	default=1 +	default=1 +
		DNDC. The choices are:	(-)	Ŧ	т
1		0 Fallow 1 Corn			
		1 Corn 2 Winter_wheat			
		1 Corn 2 Winter_wheat 3 Soybean 4 Legume_hay			
		1 Corn 2 Winter_wheat 3 Soybean 4 Legume_hay 5 Non_legume_hay			
		I Corn 2 Winter_wheat 3 Soybean 4 Legume_hay 5 Non_legume_hay 6 Spring_wheat 7 Sugarcane			
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		67 Small_grain_hay	1		
		68 carrots			
		69 peppers 70 Asparagus			
		71 Cauliflower			
		72 Artichokes 73 Sweet_Potato			
		74 Beans_green 75 COT			
		76 Olives			
		77 Plums 78 Cherries			
		79 Peach			
		80 Pears 81 Apples			
		82 Dates 83 Avocados			
		84 Apricots			
		85 Figs 86 Prunes			
		87 Lemons			
		89 Ley			
		90 Lentil a number from 1 to 12 for the month of	(-)	+	+
	Planting_month	planting			
	Planting_day	a number from 1 to 31 for the day of planting	(-)	+	+
		a number from 1 to 12 for the month of	(-)	+	+
	Harvest_month	a number from 1 to 31 for the day of	(-)	+	+
	Harvest_day	harvesting		default=1	default_1
	Harvest_year	a number defining the subsequent year of harvesting	(-)	derauit=1	default=1
	Residue left in field	a fraction of the above-ground crop residue left as stubble in the field after harvest	(-)	default=0.5000	default=0.5000
		the maximum biomass productions for	(kg C/ha)	default value from	default value from
	Maximum_yield	grain, leaves+stems and roots under optimum growing conditions	(1 kg dry matter contains 0.4 kg C)	Crop_parameters.xlsx	Crop_parameters.xlsx
	· · ·	the leaf fraction of total biomass at maturity	(-)	default value from	default value from
	Leaf_fraction	the stem fraction of total biomass at	(-)	Crop_parameters.xlsx default value from	Crop_parameters.xlsx default value from
	Stem_fraction	maturity		Crop_parameters.xlsx	Crop_parameters.xlsx
	Root_fraction	the root fraction of total biomass at maturity	(-)	default value from Crop_parameters.xlsx	default value from Crop_parameters.xlsx
		the grain fraction of total biomass at	(-)	default value from	default value from
	Grain_fraction	maturity ratio of C/N leaves	(-)	Crop_parameters.xlsx default value from	Crop_parameters.xlsx default value from
	Leaf_C/N			Crop_parameters.xlsx	Crop_parameters.xlsx
	Stem_C/N	ratio of C/N stems	(-)	default value from Crop_parameters.xlsx	default value from Crop_parameters.xlsx
	Root_C/N	ratio of C/N for roots	(-)	default value from Crop_parameters.xlsx	default value from Crop_parameters.xlsx
	ROOL_C/N	ratio of C/N for grain	(-)	default value from	default value from
	Grain_C/N	thermal degree days, accumulative air	(°C)	Crop_parameters.xlsx default value from	Crop_parameters.xlsx default value from
		temperature from seeding till maturity of	(0)	Crop_parameters.xlsx	Crop_parameters.xlsx
	Accumulative_temperature	the crop. the optimum temperature for the crop	(°C)	default value from	default value from
	Optimum_temperature	growth.		Crop_parameters.xlsx	Crop_parameters.xlsx
	Water_requirement	amount of water needed for the crop to produce a unit of dry matter of biomass	(g water/g dry matter)	default value from Crop_parameters.xlsx	default value from Crop_parameters.xlsx
		N fixation index. The default number is 1		default value from	default value from
			(-)		
		for non-legume crops. For legume crops, the N fixation index is equal to the ratio	(-)	Crop_parameters.xlsx	Crop_parameters.xlsx
	N fixation index	for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken			Crop_parameters.xlsx
	N_fixation_index Root_Depth	for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots	(m)	Crop_parameters.xlsx default=2.0000	default=2.0000
		for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally		Crop_parameters.xlsx	
		for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season	(m)	Crop_parameters.xlsx default=2.0000	default=2.0000
		for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction	(m)	Crop_parameters.xlsx default=2.0000	default=2.0000
	Root_Depth	for non-legume crops, For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop	(m)	Crop_parameters.xlsx default=2.0000 default=0 default value from	default=2.0000 default=0 default value from
	Root_Depth	for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yees	(m) (-)	Crop_parameters.xlsx default=2.0000 default=0	default=2.0000 default=0
	Root_DepthIf_cover_crop	for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted	(m) (-)	Crop_parameters.xlsx default=2.0000 default=0 default value from	default=2.0000 default=0 default value from
	Root_DepthIf_cover_cropIf_perennial_cropIf_transplanted	for non-legume crops, For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes	(m) (-) (-)	Crop_parameters.xlsx default=2.0000 default=0 default value from Crop_parameters.xlsx default=0	default=2.0000 default=0 default value from Crop_parameters.xlsx default=0
	Root_Depth If_cover_crop If_perennial_crop If_transplanted Tree_maturity_age	for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes maturity age of the tree	(m) (-) (-) (-) (y)	Crop_parameters.xlsx default=2.0000 default=0 default value from Crop_parameters.xlsx default=0 default=0 default=0	default=2.0000 default=0 default value from Crop_parameters.x1sx default=0 default=0.0000
	Root_Depth If_cover_crop If_perennial_crop If_transplanted Tree_maturity_age Tree_current_age Tree_max_leaf	for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes maturity age of the tree current age of the tree maximum number of leaves	(m) (-) (-) (-) (-) (-) (-) (-)	Crop_parameters.xlsx default=2.0000 default=0 default=0 default=0 default=0.0000 default=0.0000 default=0.0000	default=2.0000 default=0 default=0 default=0 default=0 default=0 default=0.0000 default=0.0000
	Root_Depth If_cover_crop If_perennial_crop If_transplanted Tree_maturity_age Tree_current_age	for non-legume crops. the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes minimum number of leaves	(m) (-) (-) (-) (-) (-) (-) (-) (-)	Crop_parameters.xlsx default=2.0000 default=0 default value from Crop_parameters.xlsx default=0 default=0 default=0.0000 default=0.0000	default=2.0000 default=0 default=0 default=0 default=0 default=0.0000 default=0.0000 default=0.0000
	Root_Depth If_cover_crop If_perennial_crop If_transplanted Tree_maturity_age Tree_current_age Tree_max_leaf	for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes maturity age of the tree current age of the tree current age of the tree maximum number of leaves minimum number of leaves The shape of the density distribution from the surface to maximum root length	(m) (-) (-) (-) (-) (-) (-) (-)	Crop_parameters.xlsx default=2.0000 default=0 default=0 default=0 default=0.0000 default=0.0000 default=0.0000	default=2.0000 default=0 default=0 default=0 default=0 default=0 default=0.0000 default=0.0000
	Root_DepthIf_cover_cropIf_perennial_cropIf_transplantedTree_maturity_ageTree_current_ageTree_max_leafTree_max_leafTree_min_leaf	for non-legume crops. For legume crops. the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes maturity age of the tree current age of the tree maximum number of leaves The shape of the density distribution from the surface to maximum root length 1 - nor emphasis on surface roots,	(m) (-) (-) (-) (-) (-) (-) (-) (-)	Crop_parameters.xlsx default=2.0000 default=0 default value from Crop_parameters.xlsx default=0 default=0 default=0.0000 default=0.0000	default=2.0000 default=0 default=0 default=0 default=0 default=0.0000 default=0.0000 default=0.0000
	Root_Depth If_cover_crop If_perennial_crop If_transplanted Tree_maturity_age Tree_maturity_age Tree_max_leaf Tree_max_leaf Tree_min_leaf Root_Shape	for non-legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes define of the tree maximum number of leaves minimum number of leaves The shape of the density distribution from the surface to maximum root length 1 - more enphasis on surface roots, 8 - more even distribution of root density	(m) (-) (-) (-) (-) (-) (-) (-) (-)	Crop_parameters.xlsx default=2.0000 default=0 default value from Crop_parameters.xlsx default=0 default=0 default=0.0000 default=0.0000	default=2.0000 default=0 default=0 default=0 default=0 default=0.0000 default=0.0000 default=0.0000
	Root_DepthIf_cover_cropIf_perennial_cropIf_transplantedTree_maturity_ageTree_current_ageTree_max_leafTree_max_leafTree_min_leaf	for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes define the crop is transplanted 0 - no 1 - yes maturity age of the tree current age of the tree current age of the tree maximum number of leaves minimum number of leaves The shape of the density distribution from the surface to maximum root length 1 - more emphasis on surface roots, 8 - more even distribution of root density plant Growth Stage (0-1) at which grain filling occurs maximum LAI value for a particular crop	(m) (-) (-) (-) (-) (-) (-) (-)	Crop_parameters.xlsx default=2.0000 default=0 default=0 default=0 default=0 default=0.0000 default=0.0000 default=0.0000 default=5.0000	default=2.0000 default=0 default=0 default=0 default=0.0000 default=0.0000 default=5.0000
	Root_DepthIf_cover_cropIf_perennial_cropIf_transplantedTree_maxity_ageTree_current_ageTree_max_leafTree_min_leafRoot_ShapeGrain_Fill	for non-legume crops. the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes maturity age of the tree current age of the tree maximum number of leaves minimum number of leaves The shape of the density distribution from the surface to maximum root length 1 - more explasion on surface roots, 8 - more even distribution of root density plant Growth Stage (0-1) at which grain filling occurs maximum LAI value for a particular crop type, has relevance for calculation potential	(m) (-) (-) (-) (-) (-) (-) (-)	Crop_parameters.xlsx default=2.0000 default=0 default=0 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=5.0000 default=5.0000	default=2.0000 default=0 default=0 default=0 default=0 default=0.0000 default=0.0000 default=5.0000 default=5.0000 default=0.5000
	Root_DepthIf_cover_cropIf_perennial_cropIf_transplantedTree_maturity_ageTree_current_ageTree_max_leafTree_min_leafTree_min_leafRoot_ShapeGrain_FillLAI_MaximumFrostKill_Temperature	for non-legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes define work the tree maximum number of leaves minimum number of leaves minimum number of leaves The shape of the density distribution from the surface to maximum root density plant Growth Stage (0-1) at which grain filling occurs maximum LA value for a particular crop type, has relevance for calculation potential evapotranspiration rates	(m) (-) (-) (-) (-) (-) (-) (-) (-) (-) (-	Crop_parameters.xlsx default=2.0000 default=0 default value from Crop_parameters.xlsx default=0 default=0 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=1.0000 default=2.0000 default=2.0000	default=2.0000 default=0 default=0 default=1 default=0.0000
	Root_Depth If_cover_crop If_perennial_crop If_transplanted Tree_maturity.age Tree_current_age Tree_current_age Tree_max_leaf Tree_min_leaf Root_Shape Grain_Fill ALAI_Maximum FrostKill_Temperature ALAF_CHRMX	for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes maturity age of the tree current age of the tree current age of the tree maximum number of leaves minimum number of leaves minimum rot of leaves minimum rot of leaves maturity age (1) at which grain filling occurs maximum for a particular crop type, has relevance for calculation potential evapotranspiration rates temperature of aflaffa	(m) (-) (-) (-) (-) (-) (-) (-) (-) (-) (-	Crop_parameters.xlsx default=2.0000 default=0 default=0 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=2.0000 default=2.0000 default=2.0000 default=4.0000	default=2.0000 default=0 default=0 default=0 default=0 default=0.0000 default=0.15000 default=0.5000 default=0.1840
	Root_Depth If_cover_crop If_perennial_crop If_transplanted Tree_maturity_age Tree_current_age Tree_current_age Tree_max_leaf Iree_min_leaf Root_Shape Grain_Fill FrostKill_Temperature ALF_CDRMX	for non-legume crops. For legume crops, the N fraation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes maturity age of the tree current age of the tree current age of the tree maximum number of leaves minimum number of leaves minimum otol length 1 - moe enphasis on surface roots, 8 - more even distribution from the surface to maximum root length 1 - moe enphasis on surface roots, 8 - more even distribution of root density plant Growth Stage (0-1) at which grain filling occurs maximum LAI value for a particular crop type, has relevance for calculation potential evapotranspiration rates temperature of alfalfa default 0.82 maximum cold tolerance of alfalfa cultivar	(m) (-) (-) (-) (-) (-) (-) (-) (-) (-) (-	Crop_parameters.xlsx default=2.0000 default=0 default value from Crop_parameters.xlsx default=0 default=0 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=1.0000 default=2.0000 default=2.0000	default=2.0000 default=0 default=0 default=1 default=0.0000
	Root_Depth If_cover_crop If_perennial_crop If_transplanted Tree_maturity_age Tree_max_leaf Tree_max_leaf Tree_max_leaf Crain_Fill LAI_Maximum FrostKill_Temperature ALF_CTRMX ALF_CTRMX ALF_CTMX ALF_CTMX ALF_CTMX	for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes maturity age of the tree current age of the tree current age of the tree maximum number of leaves The shape of the density distribution from the surface to maximum root length 1 - more emphasis on surface roots, 8 - more even distribution of root density plant Growth Stage (0-1) at which grain filling occurs maximum LAI value for a particular crop type, has relevance for calculation potential evapotranspiration rates temperature of the frostkill hardening rate of alfalfa	(m) (-) (-) (-) (-) (-) (-) (-) (-) (-) (-	Crop_parameters.xlsx default=2.0000 default=0 default=0 default=0 default=0 default=0 default=0 default=0.00000 defau	default=2.0000 default=0 default=0 default=0 default=0 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.1800 default=0.5000 default=0.1840 default=0.1840 default=0.1840 default=0.1840 default=1.5.0000
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Agrotechnical practices		for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes define the crop as a perennial crop 1 - yes define the crop as a perennial crop 1 - yes define whether the crop is transplanted 0 - no 1 - yes maturity age of the tree current age of the tree current age of the tree current age of the tree maximum number of leaves minimum number of leaves The shape of the density distribution from the surface to maximum root length 1 - more emphasis on surface roots, 8 - more even distribution of root density plant Growth Stage (0-1) at which grain filling occurs maximum LAI value for a particular crop type, has relevance for calculation potential evapotanspiration rates temperature of the frostkill hardening rate of alfalfa dehardening rate of alfalfa number of illing applications in the year sequential number of each application.	(m) (-) (-) (-) (-) (-) (-) (-) (-	Crop_parameters.xlsx default=2.0000 default=0 default=0 default value from Crop_parameters.xlsx default=0 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=5.0000 default=5.0000 default=0.1080 + +	default=2.0000 default=0 default=0 default=0 default=0.0000 default=0.5000 default=0.5000 default=0.5000 default=0.5000 default=0.5000 default=0.5000 default=0.5000 default=0.8200 default=0.8200 default=0.1840 default=0.1080 default=0.1080 default=0.1080
		for non-legume crops. For legume crops, the N fraxitor index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define the crop as a perennial crop 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes maturity age of the tree current age of the tree current age of the tree maximum number of leaves minimum number of leaves minimum for the crot, stars, 8 - more even distribution from the surface to maximum root length 1 - more emphasis on surface roots, 8 - more even distribution for ot density plant Growth Stage (0-1) at which grain filling occurs maximum LAI value for a particular crop type, has relevance for calculation potential evapotanspiration rates temperature of the frostkill hardening rate of alfalfa dehardening rate of alfalfa default 0.82 maximu cold tolerance of alfalfa cluitvar default -15.0 plant population death rate default 0.108 number of tiling applications in the year	(m) (·) (·) (·) (·) (·) (·) (·) (·	Crop_parameters.xlsx default=2.0000 default=0 default=0 default=0 default=0 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=1.0000 default=1.5.0000 default=1.5.0000 default=0.1840 default=	default=2.0000 default=0 default=0 default=0 default=0 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.5000 default=0.5000 default=0.5000 default=0.5000 default=0.5000 default=0.1840 default=0.1840 default=0.1840 default=0.1080 default=0.000 default=0.000
		for non-legume crops. For legume crops, the N fraation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes maturity age of the tree maximum number of leaves minimum number of leaves minimum number of leaves maximum number of leaves ninimum number of leaves maximum colter on the sufface to nage of the tree nage of the tree maximum number of leaves maximum colter of the tree nage of the tree maximum colter of the tree nage of the tree maximum colter of leaves maximum colter of leaves number of tilling applications in the year sequential number of each application. month of the tilling application define tilling deph by selecting one of the	(m) (·) (·) (·) (·) (·) (·) (·) (·	Crop_parameters.xlsx default=2.0000 default=0 default=0 default=0 default=0 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.5000 default=1.5.000 default=1.840 default=0.1840	default=2.0000 default=0 default=0 default=0 default=0.0000 default=0.000 default=0.5000 default=0.5000 default=0.8200 default=0.8200 default=15.0000 default=0.1080 default=0.1080 default=0.1080 default=0.1080
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	Root_Depth If_cover_crop If_cover_crop If_transplanted Tree_matrity_age Tree_matrity_age Tree_matrity_age Tree_matrity_age Tree_matrity_age Tree_matrity_age Tree_matrity_age Grain_Fill ALF_CTMXX ALF_CTMXX ALF_CTMX ALF_CTMX TTill_applications TTill_matrity	for non-legume crops. For legume crops, the N fraxiton index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes maturity age of the tree current age of the tree maximum number of leaves minimum number of leaves minimum number of leaves minimum number of leaves maximum context or density sufficient context of the crop type, has relevance for calculation potential evapotranspiration rates temperature of the frostAil hardening rate of alfaffa default 0.82 maximum CAI value for a particular crop type, has relevance for calculation potential evapotranspiration rates temperature of the frostAil hardening rate of alfaffa default 0.108 number of illing applications define thilling application day of the tilling application day of the firtilization application month of the tilling application day of the firtilization application month of the tilling application month of the firtilization application month of the firtili	(m) (·) (·) (·) (·) (·) (·) (·) (·	Crop_parameters.xlsx default=2.0000 default=0 default=0 default=0 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=5.0000 default=5.0000 default=1.0000 default=1.0000 default=0.1840 default=0.1840 default=0.1880 + + + + + - + - + - - - - - - - - - - - - -	default=2,0000 default=0 default=0 default=0 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.000 default=0.5000 default=0.5000 default=0.5000 default=0.5000 default=0.5000 default=0.000
	Root_Depth If_cover_crop If_rerennial_crop If_transplanted Tree_max_leaf Tree_max_leaf Tree_max_leaf Tree_max_leaf Tree_max_leaf Tree_max_leaf Root_Shape Grain_Fill LAI_Maximum FrostKill_Temperature ALF_CHRMX ALF_CDRMX ALF_CDRMX ALF_DOFMX TTill_applications TTill# TTill_method Trill_method Fertilizing_month Fertilizing_depth Karpended _	for non-legume crops. For legume crops, the N fixation index is equal to the ratio (total N content in the plant)/(plant N taken from soil) depth of the roots as a cover crop, its biomass will be totally left in the field without any fraction harvested by the end of the crop season 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes define whether the crop is transplanted 0 - no 1 - yes maturity age of the tree current age of the tree current age of the tree maximum number of leaves minimum number of leaves minimum fraction the surface to maximum routher the surface to maximum root length 1 - more emphasis on surface roots, 8 - more even distribution from the surface to maximum root length 1 - more emphasis on surface roots, 8 - more even distribution of root density plant Growth Stage (0-1) at which grain filling occurs maximum LAI value for a particular crop type, has relevance for calculation potential evapotranspiration rates temperature of the frostkill hardening rate of alfalfa default 0.82 maximum LOI tolerance of alfalfa dehardening rate of alfalfa default 0.108 number of tilling application. month of the tilling application day of the tilling application define tilling depth by selecting one of the define tilling depth by selecting one of the defaut methods as 1 - no-till (i.e., only muching) (0 cm), 2 - promaying isigntly	(m) (·) (·) (·) (·) (·) (·) (·) (·	Crop_parameters.xlsx default=2.0000 default=0 default=0 default=0 default=0 default=0 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=0.0000 default=1.5.0000 default=0.0000 default=0.1840 default=0.1840 default=0.1840 default=0.1840 default=0.1840 default=0.1840 default=0.1840 default=0.1840 default=0.1840 default=0.1840 default=0.1840 default=0.1840 default=0.1840 default=0.1840 default=0.1840 default=0.2000 + + + + +	default=2,0000 default=0 default=0 default=0 default=0 default=0,0000 default=0,0000 default=0,0000 default=0,0000 default=0,0000 default=0,0000 default=0,0000 default=0,0000 default=0,000 default=0,000 default=0,000 default=0,000 default=0,1840 no need to define no need to defi

NUUUUU	low_release_rate itrification_inhibitor_efficiency itrification_inhibitor_duration	the total days during which the fertilizer-N will be uniformly released must be specified the efficiency of the nitrification inhibitor the effective duration (days) of the	(d) (-) (d)	default=1.0000 default=0.0000	no need to define no need to define
NUUUUU	itrification_inhibitor_efficiency	the efficiency of the nitrification inhibitor			no need to define
U U Ferti	itrification_inhibitor_duration	the effective duration (days) of the	(d)		
U U Ferti	initiation_initionoi_dulution	nitrification inhibitor	(u)	default=0.0000	no need to define
U Ferti		the efficiency of the urease inhibitor must	(-)	default=0.0000	no need to define
Ferti	rease_inhibitor_efficiency	be specified the effective duration (days) of the urease	(d)	default=0.0000	no need to define
	rease_inhibitor_duration ilization_option	inhibitor must be specified Options for fertilization	(-)	default=0	default=0
	ure_applications	number of manure applications in the year	(-)	default=0	default=0
Film Metl	n_applications hod	number of film applications in the year method of film application	(-)	default=0 default=0	default=0 default=0
Floo	od_applications	number of flooding applications in the year 0 - irrigation	(-)	default=0 default=0	default=0 default=0
		1 - rainfed		deraun=0	deradit=0
Wat	er_control	 2 - observed water table fluctuation data 3 - empirical parameters 			
Flor	od_water_N	inorganic N received with the flooding water per application	(kg N/ha)	default=0.0000	default=0.0000
		rate of the flood water leaking from the bottom of the flooded soil profile	(mm water/day)	default=0.0000	default=0.0000
Lear	k_rate	factor (> or = 1) indicating the area from	(ha/ha)	default=1.0000	default=1.0000
Wat	er_gather_index	which the rain water is collected to supply a unit of the crop field			
Wat	ertable_file	Name and link to the water table file		default=None0.000000	default=None0.000000 default=0.0000
Emp	pirical_para_1 pirical_para_2	initial WT depth surface inflow fraction of precipitation	(cm) (-)	default=0.0000 default=0.0000	default=0.0000
	pirical_para_3 pirical_para_4	lowest WT depth ceasing surface outflow intensity factor for surface outflow,	(cm) (-)	default=0.0000 default=0.0000	default=0.0000 default=0.0000
Emp	pirical_para_5	lowest WT ceasing ground outflow	(cm)	default=0.0000	default=0.0000
	pirical_para_6 ation applications	intensity factor for ground outflow number of applications in the year	(-)	default=0.0000 +	default=0.0000 default=0
		allows the user to schedule drainage which is managed to keep the water table at a	(-)	default=0	default=0
Irrig	ation_control	certain depth		1.6.1.0.0777	1.6.1.0.0777
		define an irrigation index between 0 and 1. If a modeled water stress occurs, a fraction,	(-)	default=0.0000	default=0.0000
		equal to the index, of the water will be automatically delivered to the soil to meet			
Irrig	ation_index	the predicted water deficit irrigation method used, flood, sprinkler and	0		default=0
		drip are options subject to different	(-)	+	default=0
		evaporation or leaching water losses and hence have different water use efficiencies			
		1 - furrow 2 - sprinkler			
	ation mathed	3 - drip (0cm)			
	ation_method	4 - drip (15cm) sequential number of each application	(-)	+	no need to define
Ir	rigation#	month of the fertilization application	(-)	+	no need to define
	ri_month				
	ri_day Vater_amount	day of the fertilization application amount of water used	(-) (cm)	+	no need to define no need to define
		sequential irrigation method used, flood, sprinkler and drip are options subject to	(-)	+	no need to define
		different evaporation or leaching water			
		losses and hence have different water use efficiencies			
		1 - furrow 2 - sprinkler			
	- mathead	3 - drip (0cm)			
	ri_method ileIrriDays	4 - drip (15cm) duration of tile system used	(d)	default=0	no need to define
		Allows the user to schedule drainage which is managed to keep the water table at a	(-)	default=0	default=0
6		certain depth, number of applications			
	trolledDrainage_applications	sequential number of each application	(-)	no need to define	no need to define
C	Drain#	starting month from which the drainage was	(-)	no need to define	no need to define
C	Drain_stmonth	applied	~		
	Drain_sunontii	starting day from which the drainage was	(-)	no need to define	no need to define
С	Drain stday	applied			
	 Drain endmonth	end month to which the drainage was applied	(-)	no need to define	no need to define
C	Drain_endday	end day to which the drainage was applied	(-)	no need to define	no need to define
C	Drain_Depth	depth to which the drainage was applied number of grazing application periods in	(m) (-)	no need to define default=0	no need to define default=0
Graz	zing_applications	the year			
	applications ut#	number of cutting applications in the year sequential number of each cutting	(-)	default=0 no need to define	default=0 no need to define
	ut_month ut_day	month of the cutting application day of the cutting application	(-) (-)	no need to define no need to define	no need to define no need to define
		cut fraction of the defined part(s). The	(-)	no need to define	no need to define
C	ut_fraction	default value is 0.8. define which part of the plant is cut. The	(-)	no need to define	no need to define
		options are 1 - grain (or fruit),			
	ut part	2 - leaf,			
Extra parameters	ut_part	3 - stem and/or root tile drain location in the 2 m profile. Should	(m)	default=1.0000	default=1.0000
	rainDepth(m)	be placed within the profile so typically it is between 50cm and 150 cm			
		This is a mainly a 1-d model but the drain	(m)	default=10.0000	default=10.0000
		spacing is empirically used to simulate quasi-2d flow rate to tiles. Wider			
D	rainSpace(m)	drain spacing will result in lower flow to tiles.			
		this also controls the flow rate of water to tiles. Larger radius results in	(m)	default=0.0700	default=0.0700
D	rainRadius(m)	higher flow rates	()	1.6.1.2.0000	1. S., Jr. 2. 0000
		by default set to 3m. Flow rate to drains is directly proportional to	(m)	default=3.0000	default=3.0000
D	rain_to_Bedrock(m)	effective depth rate of horizontal effective saturated	(-)	default=0.6000	default=0.6000
		conductivity to the tiles. It is a function of the saturated conductivity defined in the			
		soil profile but this factor can be used to			
ki	eDrain_Factor	slow or increase the horizontal flow rate			
		primary control that influences the	(-)	default=0.5000	default=0.5000
		maximum nitrogen movement across the soil			
M	laxN_movement	layers. It is a factor that controls that maximum threshold value.			
		at a timestep of 1 hour, this determines the amount of NO3 available	(-)	default=0.9000	default=0.9000
		to be mobilized with water flux to move to			
1 1 1	lobileN_Factor	the next layer the fraction of N that is not susceptible to	(-)	default=0.7500	default=0.7500
N		preferential leaching			
<u>N</u>		(i.e. bypass all layers to move directly to the			

Number of the second	T		a factor that controls the fraction of NO3	(-)	default=1.4000	default=1.4000
John Sell Barte Strains Barte 10 Addres 1007 Annuel 10 Soll Databach Dark 112 (Datababalbach 10 Addres 1007 Addres 1007 Bartel Weiter Park Bartel Weiter Park Bartel Weiter Park 10 Addres 1007 Bartel Medica Bartel Weiter Park Bartel Medica			(and a small amount of	(-)	deraun=1.4000	default=1.4000
Solit Degree is not weak and the second of the se	Ļ	N_Leaching_Factor	fluxes between layers	ļ		
Bund War Date Second War D		Soil_Evaporation_Factor	>1 = increased soil evap	(-)		
Instrume Instrume control is sound of 200 61 Actual 1000 6000-11 Instrume control enter strume control 10 struth 1000 strume control Sound Labor enter strume control 10 strume control strume control Sound Labor enter strume control 10 strume control strume control Sound Labor enter strume control 10 strume control strume control Sound Labor enter strume control 10 strume control strume control Description Control index strume control strume contro strume control strume contro </td <td></td> <td></td> <td></td> <td>(-)</td> <td>default=0.2000</td> <td>default=0.2000</td>				(-)	default=0.2000	default=0.2000
Image: second multiple in space and multipl	ŀ	Runoff_Water_Factor		(-)	default=1.0000	default=1.0000
Image: specific statement and the specific statement		Runoff N Factor	moves with runoff from the top 2	~		
International control and and any			controls maximum nitrification kg/ha	(-)	default=1.0000	default=1.0000
Same Mandea Faver Same Margination Part of the second or a favore in		Overan_ivitincation	factor that controls the influence of snow on	(-)	default=1.0000	default=1.0000
Josephine of a comparison 10 decade - 10000 decade - 10000 Designed Base of a comparison of a comparison 10 decade - 10000 decade - 10000 Norre Corp Comparison of a comparison 10 decade - 10000 decade - 10000 Norre Corp Comparison of a comparison 10 decade - 10000 decade - 10000 NO Norre Corp Comparison of a comparison 10 decade - 10000 decade - 10000 NO Norre Corp Comparison of a comparison of		Snow_Insulation_Factor	temperatures			
Journels from We many Processing parts of second of the s		Snow_Melt_Factor	of air temperature	(-)	default=1.0000	default=1.0000
Output Gov Operating the group must introduce of an analysis of a set o				(-)	default=1.0000	default=1.0000
Image: Solution of the second bulkness () default 3000 default 3000 Stor Rate: Four interplant factor factor second 200, 500 default 3000 default 3000 Spring Mod. 200, F interplant factor factor factor and second 200, 500 default 3000 default 3000 Spring Mod. 200, F interplant factor factor and second 200, 500 default 3000 default 3000 default 3000 Spring Mod. 200, F interplant factor factor and second 200, 500 interplant 300, 510, 500 default 3000 default 3000 NELWards interplant 300, 510, 500 interplant 300, 510, 500 default 3000 default 400, 500 NELWards interplant 300, 510, 500, 500, 500, 500, 500, 500, 5		Denitrifier_Grow		(-)	default=1.0000	default=1.0000
Advinces Advinces Note Advinces Advinces <td< td=""><td>F</td><td>Nitrier_Grow</td><td>nitrifiers in the anaerobic balloon</td><td></td><td></td><td></td></td<>	F	Nitrier_Grow	nitrifiers in the anaerobic balloon			
NDD Pala Pairs and SQ manuta pairs in property 4 default 1000 4 default 1000 Spring Mein S201,F another for equility to the opting 6 default 1000 4 default 1000 Spring Mein S201,F another for equility to the opting 1 4 default 1000 4 default 1000 Spring Mein S201,F another for equility to the opting 1 4 default 1000 4 default 1000 Non-total for equility to the opting another for equility to the opting 1 4 default 1000 4 default 1000 Non-total for equility to the opting another for equility to the opting 1 4 default 1000 4 default 1000 Non-total for equility to the opting another for equility to the opting 1 4 default 1000 4 default 1000 Non-total for equility to the opting another for equility to the opting 1 4 default 1000 4 default 1000 Non-total for equility to the opting another for equility to the opting 1 4 default 1000 4 default 1000 Non-total for equility to the opting another for equility to the opting 1 4 default 1000 4 default 1000 Non-total for equility to the opting anothe			denitrification rate. This is an	(-)	denan=0.0000	default=0.0000
second balance of the induces of the second of th		N2O Dain Faster	and N2 emission peaks in response to			
Spring Mol: ND F product statutic string product statutic string product string distatution string dis	-	N2O_Kani_racio	controls the influence of freezing events on	(-)	default=1.0000	default=1.0000
a control and structures in an experiment of a control and structures in the structure in the structur			promote dentrifier activity in the spring			
No. Retention. If in proceeding deprine the makes Normal in proceeding deprin proceeding deprine the makes Normal in proceed	-	Spring_Melt_N2O_F	a control used to restrict N movement on a	(-)	default=0.3000	default=0.3000
N. Resettion P of X is a lost of Astronom V of X is a lost of X			per-layer basis. This is an exponential algorithm that makes N more			
NB kerming if of its is intractional properties in the intervent of its is intractional properties in the intervent of its is intractional properties in the intervent of its is is its intervent of its is is its intervent of its is is intervent of its is is intervent of its is is its intervent of its is is its intervent of its is is intervent of its is is its intervent of						
NRI Val Mala valation result of your Values of addition of the set of your Values of addition of the your Values of addition of your Values of addition of your Values<	Ļ	N_Retention_F	of N in a layer decreases		default=1.0000	default=1.0000
 Sub Ved Main Spatisfield Constants Not preferentially leads on a first of the constant Not preferentially leads on a first of the constant Not preferentially leads on a first of the constant Not preferentially leads on a first of the constant mathematic range when the constant not preferentially leads on a first of the constant mathematic range when the constant not preferentially leads on a first of the constant mathematic range when the constant not preferentially leads on a first of the constant not preferentially leads on a first of the constant not preferential the constant not preferentis at constant not preferentis at constan			volatilization rate of	(-)	actaut-1.0000	default=1.0000
Prof N Mon2 In the control program the layer to layer	L	NH3_Vol_Multi	equilibrium and Henry's law			
Image: second			that does not bypass the layer to layer	(-)	default=0.9600	default=0.9600
Jone X, More2 profits. control model induces cross show () default-1 default-1 Abord Stream Control a bord forward induces cross show () default-1 default-1 He tool durated induces cross show () default-1 default-1 default-1 SelfSourdEffect ergos of sol board induces cross show () default-1 default-1 SelfSourdEffect ergos of sol board induces cross show () default-1 default-1 SelfSourdEffect ergos of sol board induces cross show () default-0 default-0 SelfSourdEffect ergos of sol board induces cross show () default-0 default-0 SelfSourdEffect ergos of sol board induces cross show () default-0 default-0 SelfSourdEffect ergos of sol board induces cross are sol of model () default-0 default-0 BaadSpini [Vison default-0 default-0 default-0 default-0 BaadSpini [Vison default-0 default-1 default-1 default-1 BaadSpini [Vison default-0			of the soil			
- Anodiavod - Abid Aviar on driving	ŀ	Pref_N_Move2	profile.	(-)	default=1	default=1
SuiSinget/Filed Is and characteristics (i.e. stere holding capacity) characteristics (i.e. stere holding travery of call holding travery of call holding travery of call holding travery of call holding that is holding sequence (horning hill be a reprint) (-) default=0.0000 default=0.0000 SuiSinget/Filed that is holding sequence (horning hill be a reprint) (-) default=0.0000 default=0.0000 SuiReset that is holding sequence (horning hill be a reprint) (-) default=0.0000 default=0.0000 UseSpin1(prilie) that is hold and the frequency to read time that is normalically writen out in the DNIC Resent/Infrarect reprint (horning hill be and that is store that reprint) (-) default=0 default=0 UseSpin1(prilie) Uses (hill be reprint) that is store that reprint if the normal trans and the infrance of the ware that is store that reprint if the normal trans and the infrance of the ware that is store that reprint if the normal trans and the infrance of the ware that is store that reprint the normal trans and the normal of the normal of the ware table and the stransmith of the normal of the ware table and the stransmith of the normal of the ware table and the stransmith of the normal of the ware table and the stransmith of the normal of the ware table and the stransmith of the normal of the ware table and the stransmith of the normal of the stran		AutoHarvest	GDD/TDD reaches maturity and after			
Salkinetifict with onlight matter change (6. as a proor of and balance (commity tide to a chart of and balance (commity tide to a the two of controls here neer year) with the two of controls here neer years (control to a difference in the except subscript years is difference in the except subscript is difference of the except subscript is difference difference in the except subscript is difference in the except subscript is difference in the except subscript is difference difference in the except subscript is difference in the except subscript is difference din the except subscript is difference in the except subscript is	-	Autoriarvest	let soil characteristics (i.e. water holding	(-)	default=0.0000	default=0.0000
solitenest infer a 10 year sequence (normally lod to a princip princip of the to solit the to solit of the to solit solit of the to solit of the to solit of the to so		Sollowed Fift	with soil organic matter changes (i.e. as a			
In the soil conditions he rest every year after-area in the acty allocating year is after and the decy allocating year is after and year is an attransically written can in the DNC Clear and year is after and year is an attransically written can in the DNC Clear and year is after and year is an attransical is after an attransication is after attransication is after and year is an attransication is after and year is an attransication is after an attransication is after attransication is after an attransication is after attransication is after an attransication is after attransication is after attransication is after attransication is aft	-	SoilStructEffect	after a 10 year sequence (normally tied to a	(-)	default=0.0000	default=0.0000
SolReet initial conditions (-) default-0 default-0 UseSpinUpFile initial conditions (-) default-0 default-0 UseSpinUpFile using the signifile area (-) default-0 default-0 ReadSpinUpFile using the signifile area (-) default-0 default-0 ReadSpinUpFile using the signifile area (-) default-0 default-0 ReadSpinUpFile Using the signifile area (-) default-0 default-0 WTEffectorsSerWareContent Using the signifile area (-) default-0 default-0 WTEffectorsSerWareContent Using the signifile area (-) default-0 default-0 WTEffectorsSerWareContent Using the signifile area (-) default-0.0000 default-1.0000 Using the signifile area (-) default-0.0000 default-1.0000 default-1.0000 Using the signifile area (-) default-1.0000 default-1.0000 default-1.0000 Using the signifile area (-) default-1.0000 default-1.0000 defaul			let the soil conditions be reset every year			
SoliBoot (i.e., vort 11, vort 21 ++-) Image: SoliBoot to read from that the frequency to read from that the incompt interpreter in the DNDC (Result) interpreter interprete			afterwards so that every subsequent year is			
bit response io read from file and the frequency to sead from that file (ever) 1 year, 2 years ed.; Thus file is in the format year, 2 years ed.; Thus file is in the format pNDC/Resultations directory and labeled avail 1, seid 2 etc. i		SoilReset				
generalized year, 2 years etc). This file is in the format but is anomatically written out in the DNC CR-scalinger, directory and labeled i default-0 default-0	F	Johnese	to read from file and the frequency to read	(-)	default=0	default=0
JussSpirUpFile DNDCReating intercory and isbelled Control default=0 default=0 ReadSpirUpYears define hor many years are read from (-) default=0 default=0 default=0			year, 2 years etc). This file is in the format			
BeadSpinUpYears define how many years are read from spinp file (-) default=0 default=0 SpinUpFileName Define the spinp file name (-) default=1 default=1 Bits is lide to indire contents above table on water contents above water outputs of this water contents above water outputs of this increase sol water contents) default=1.0000 default=1.0000 WTEReconSolTWaterContent this lide to indire content above water update from the water table (not water table (not water contents)) default=1.0000 default=0.0000 RainFallIntercepFactor this lide to indire content above bage values controls the effect of other ranging on orarfae soil temperature. A higher value will recrease overall soil temperatures in the pak of summer growing season default=1.0000 default=1.0000 default=1.0000 Ureallydoubyis/Factor controls the refier of other ranging on orarfae soil temperature. A higher value will recrease overall soil temperatures in the pak of summer growing season (-) default=1.0000 default=1.0000 Ureallydoubyis/Factor controls the infine or out conton on reducing NIB emissions. This represents in a conde way the diffisitity ease of NB1 from defin above water with derive of other ranging water out of default=1.0000 default=1.0000 default=1.0000 NH3SoiIDephFactor default encound for default encound above filter not out an diffinet mo text and out			DNDC\Result\inter\ directory and labelled			
SpinDpPiteName Define the spinop file name (-) default= d			define how many years are read from	(-)	default=0	default=0
Image: second	-			(-)	default=	default=
bit water for transfirmed. Nover values witer controls) increase soit water table (and increase soit water controls). WTE:flectonSoitWaterContext this allows the user to control the amount of intercept rainfall (-) default=0.0000 default=0.000 RainFallInterceptFactor the is for to the control on or surface soil water contents). (-) default=1.0000 default=1.000		· ·	this is tied to the influence of the water			default=1.0000
Image: solurity of the second secon			the water table and the extractability of this			
WTEffectonSoilWaterContent increase soil water contents) default=0.0000 default=0.0000 RainFallInterceptFactor this allows the user to control the amount of intercepted rainfall (-) default=0.0000 default=0.0 SolarRadEffectonSoilTemp controls the effect of solar radiation on surface soil emperature. A higher value will increase overall soil temperatures in the peak of summer (-) default=1.0000 default=1.0			force more			
RainFallInterceptFactor intercepted minfall that is to to the canopy and evaporated offer (-) default=1.0000 default=1.0 SolarRadEffectonSoiTemp growing season (-) default=1.0000 default=1.0	Ļ	WTEffectonSoilWaterContent	increase soil water contents)			
SolarRadEffectonSoilTemp controls the offence on itemperature. A higher value will increase overall soil temperatures in the peak of summer growing season (-) default=1.0000 default=1.0			intercepted rainfall	(-)	default=0.0000	default=0.0000
surface coil temperatures. A higher value will increase overall soli temperatures in the peak of summer growing season (-) default=1.0000 default=1.0	-	RainFallInterceptFactor		(-)	default=1.0000	default=1.0000
SolarRadEffectonSoiTemp temperatures in the peak of summer controls the orvall hydrolysis are (temp, water, substrate)) (-) default=1.0000 default=1.0			surface soil temperature. A	~		
UreaHydrolysisFactor controls the oreral hydrolysis rate (temp, water, [substrate]) (-) default=1.0000 default=1.0000		SolarRadEffectonSoilTemp	temperatures in the peak of summer			
Litter C pool Litter C pool Litter C pool Litter C pool Control the information (-) default=1.0000 default=1.0 Soil section Litter C pool Litter C pool Control the information (-) default=4.0000 default=1.0 Humads N pool Litter C pool Control the information (-) default=1.0000 default=1.0 Mumads N pool Litter C pool Control the information (-) default=1.0000 default=1.0 Mumads N pool Mumads N pool Control used to control how fast urea can diffusion (-) default=1.0000 default=1.0 Mumads N will increase the rate of urea diffusion Control used to control how fast urea can diffusion (-) default=1.0000 default=1.0 Mumads N will increase the rate of urea diffusion Control used to control how fast urea can diffusion (-) default=4.0000 default=4	F	•	controls the overall hydrolysis rate (temp,	(-)	default=1.0000	default=1.0000
section Controls the influence of soil depth on reducing NH3 emissions. This represents in a crude way the diffusivity ease of NH3 from depth along with the binding of NH3 to soll colloids within the soil matrix. Default = 1.0000 default=1.0000 default=1.0000 NH3SoilDepthFactor Default = 1.0000 default=1.0000 default=1.0000	ŀ		controls the effect of water content on		default=1.0000	default=1.0000
section Litter C pool (-) default=1.0000 default=1.0000 Soil section Litter C pool Iarger values increases the amount of N20 (-) default=4.0000 default=4.0000 Soil section Litter C pool Iarger values increases the amount of N20 (-) default=4.0000 default=4.0000 Humads C pool Iarger values increases the amount of N20 (-) default=4.0000 default=4.0000 Toread from N20 Iarger values increases the amount of N20 (-) default=4.0000 default=4.0000 Iarger values increases the amount of N20 (-) default=4.0000 default=4.0000 Iarger values increases the amount of N20 0 0 no need to have this information no need to have	-	UreaHydrolysisWaterFactor		(-)	default=1.0000	default=1.0000
soil section Litter C pool consection (-) default=1.0000 default=1.0 Soil section Litter C pool arger values increases the amount of N20 (-) default=4.0000 default=4.0000 Humads C pool Litter C pool (-) default=4.0000 default=4.0000 Humads C pool (-) default=1.0000 default=4.0000 default=4.0000 Humads C pool (-) default=4.0000 default=4.0000 default=4.0000 Madd from N2O (-) default=4.0000 default=4.0000 default=4.0000 Mumads N pool (-) default=4.0000 default=4.0000 default=4.0000 Humads C pool (-) default=4.0000 default=4.0000 default=4.0000 Itter C pool (-) (-) default=4.0000 default=4.0000 default=4.0000 Humads C pool (-) default=4.0000 default=4.0000 <td></td> <td></td> <td>reducing NH3 emissions. This</td> <td></td> <td></td> <td></td>			reducing NH3 emissions. This			
Image: section Image: section Image: section (-) default=1.0000 default=1.0000 Image: section Image: section			ease of NH3 from depth along with the			
NH3SoilDephFactor make the impact of depth greater control used to control how fast urea can diffuse into the soil matrix. (-) default=1.0000 default=1.0			to soil colloids within the soil matrix.			
Image: section Litter C pool (-) default=1.0000 default=1.0 Image: section Image: section (-) default=1.0000 default=1.0 Soil section Litter C pool Image: section (-) default=4.0 default=4.0 Mumads VB Image: section Image: section (-) default=4.0000 default=4.0 Soil section Litter C pool (-) default=4.0 default=4.0 Humads C pool (-) No need to have this information			make the impact of			
Litter C pool (kg Cha) no need to have this information no need to have this information Humads N pool Litter C pool (kg Cha) no need to have this information no need to have this information Humads N pool (kg Cha) no need to have this information no need to have this information Humads N pool (kg Cha) no need to have this information no need to have this information Humads N pool (kg Cha) no need to have this information no need to have this information Humads N pool (kg Cha) no need to have this information no need to have this information Humads N pool (kg Cha) no need to have this information no need to have this information Total C pool (kg Nha) no need to have this information no need to have this information Total N pool (kg Nha) no need to have this information no need to have this information Inorganic Ni in NO ₂ pool (kg Nha) no need to have this information no need to have this information	ŀ	NH350IIJeptnPactor	control used to control how fast urea can	(-)	default=1.0000	default=1.0000
UreaDiffusionFactor upwards will increase the rate of urea diffusion			The default is 0.08 and increasing the value			
		UreaDiffusionFactor	upwards will increase the rate of urea			
OUTPUTS Soil section Litter C pool (kg C/ha) no need to have this information	F		larger values increases the amount of N2	(-)	default=4.0000	default=4.0000
Litter N pool (kg Nha) no need to have this information no need to no need to have this information no ne	Soil mation			(kg C/ha)	no need to have this is former for	no need to have this is former for
Humads N pool (kg Nha) no need to have this information no need to Humus C pool (kg Cha) no need to have this information no need to Humus N pool (kg Cha) no need to have this information no need to Total C pool (kg Cha) + no need to Total N pool (kg Nha) + no need to Inorganic N in NO ₂ pool (kg Nha) no need to have this information no need to	5011 SCH011	Litter N pool	<u> </u>	(kg N/ha)	no need to have this information	no need to have this information no need to have this information
Humus C pool (kg Cha) no need to have this information no need to Humus N pool (kg Nha) no need to have this information no need to Total C pool (kg Cha) + no need to Total N pool (kg Nha) + no need to Inorganic N in NO ₃ - pool (kg Nha) no need to have this information no need to	ŀ	Humads N pool		(kg N/ha)	no need to have this information	no need to have this information no need to have this information
Total C pool (kg Cha) + no need to Total N pool (kg Nha) + no need to no need to Inorganic N in NO ₂ - pool (kg Nha) no need to have this information no need to	F	Humus C pool		(kg C/ha)	no need to have this information	no need to have this information no need to have this information
Inorganic N in NO ₃ : pool (kg N/ha) no need to have this information no need to	F	Total C pool	<u> </u>	(kg C/ha)	+	no need to have this information
	F	Inorganic N in NO3- pool		(kg N/ha)	no need to have this information	no need to have this information no need to have this information
	F	Inorganic N in NH ₄ + pool Inorganic N in NH ₃ (w) pool		(kg N/ha) (kg N/ha)	no need to have this information no need to have this information	no need to have this information no need to have this information
Inorganic N in Urea pool (kg N/ha) no need to have this information no need to	F	Inorganic N in Urea pool	Į	(kg N/ha)	no need to have this information	no need to have this information
Inorganic N in clay-NH ₄ pool (kg N/ha) no need to have this information no need to	Ľ	Inorganic N in clay-NH4 pool	<u> </u>	(kg N/ha)	no need to have this information	no need to have this information no need to have this information
	ŀ		<u> </u>			no need to have this information no need to have this information
C mineralization (kg C/ha) + no need to	F	C mineralization		(kg C/ha)		no need to have this information no need to have this information
C content in 0 – 10 cm layer (kg C/kg) + no need to			<u> </u>	(kg C/kg)	+	no need to have this information no need to have this information
C content in 20 – 30 cm layer (kg C/kg) + no need to	Ļ	7 content in 10 20 cm loss				
C content in 30 – 40 cm layer (kg C/kg) + no need to				(kg C/kg)	+	no need to have this information

	C content in 40 - 50 cm layer	(kg C/kg)	+	no need to have this information
	C content in 0 – 10 cm layer	(kg C/ha)	no need to have this information	no need to have this information
	C content in 10 - 20 cm layer	(kg C/ha)	no need to have this information	no need to have this information
	C content in 20 – 30 cm layer	(kg C/ha)	no need to have this information	no need to have this information
	C content in 30 – 40 cm layer	(kg C/ha)	no need to have this information	no need to have this information
	C content in 40 – 50 cm layer	(kg C/ha)	no need to have this information	no need to have this information
	Soil weight in 0 - 10 cm layer	(kg/ha)	no need to have this information	no need to have this information
	Soil weight in 10 – 20 cm laver	(kg/ha)	no need to have this information	no need to have this information
	Soil weight in 20 – 30 cm layer	(kg/ha)	no need to have this information	no need to have this information
	Soil weight in 30 - 40 cm layer	(kg/ha)	no need to have this information	no need to have this information
	Soil weight in 40 - 50 cm layer	(kg/ha)	no need to have this information	no need to have this information
El				
Fluxes section	Manure input C flux	(kg C/ha/yr)	no need to have this information	no need to have this information
	Manure input N flux	(kg N/ha/yr)	no need to have this information	no need to have this information
	Shoot litter input C flux	(kg C/ha/yr)	no need to have this information	no need to have this information
	Shoot litter input N flux	(kg N/ha/yr)	no need to have this information	no need to have this information
	Root litter input C flux	(kg C/ha/yr)	no need to have this information	no need to have this information
	Root litter input N flux	(kg N/ha/yr)	no need to have this information	no need to have this information
	Root exudation input C flux	(kg C/ha/yr)	no need to have this information	no need to have this information
	Rain-N deposit	(kg N/ha/yr)	no need to have this information	
				no need to have this information
	Irrigation N input	(kg N/ha/yr)	no need to have this information	no need to have this information
	Fertilizer-N	(kg N/ha/yr)	no need to have this information	no need to have this information
	Soil N fixation	(kg N/ha/yr)	no need to have this information	no need to have this information
			no need to have any information	
	Soil-CO ₂ emission	(kg C/ha/yr)	+	no need to have this information
	CH ₄ emission	(kg C/ha/yr)	+	no need to have this information
	Soil C runoff	(kg C/ha/yr)	no need to have this information	no need to have this information
	Soil N runoff		no need to have this information	no need to have this information
		(kg N/ha/yr)		
	Soil C leaching	(kg C/ha/yr)	no need to have this information	no need to have this information
	Soil N leaching	(kg N/ha/yr)	no need to have this information	no need to have this information
	Crop N uptake from soil	(kg N/ha/yr)	+	no need to have this information
			no need to have this information	
	NH ₃ volatilization	 (kg N/ha/yr)	no need to have this information	no need to have this information
	N ₂ O	 (kg N/ha/yr)	+	no need to have this information
	NO	(kg N/ha/yr)	no need to have this information	no need to have this information
	N ₂	(kg N/ha/yr)	±	no need to have this information
			and the first of the second se	
	Indirect N ₂ O	(kg N/ha/yr)	no need to have this information	no need to have this information
	Indirect N ₂	(kg N/ha/yr)	no need to have this information	no need to have this information
Crop section	Cropping season	(-)	no need to have this information	no need to have this information
crop section			no need to have this information	no need to have this information
	Crop name	(-)	+	+
	Planting date	(d)	no need to have this information	no need to have this information
	Growing days	(d)	no need to have this information	no need to have this information
	Growing season TDD	(°C)	no need to have this information	no need to have this information
	Water demand (mm)	(mm)	+	no need to have this information
	Water uptake (mm)	(mm)	+	no need to have this information
	Water stress	(-)	no need to have this information	no need to have this information
	Crop N demand	(kg N/ha)		no need to have this information
			- T	
	Crop N from soil	(kg N/ha)	+	no need to have this information
	Crop N from air NH3	(kg N/ha)	+	no need to have this information
	Crop N fixation	(kg N/ha)	+	no need to have this information
			+	
	Nitrogen stress	(-)		no need to have this information
	Crop N (kg N/ha)	(kg N/ha)	+	+
	Crop C (kg C/ha)	(kg C/ha)	+	+
	Crop Grain C	(kg C/ha)	+	±
		(Kg C/IId)		T
	Crop Leaf C			no need to have this information
		(kg C/ha)	+	
	Crop stem C	(kg C/ha) (kg C/ha)	+ +	no need to have this information
		(kg C/ha)		no need to have this information
	Crop Root C	(kg C/ha) (kg C/ha)	+ +	no need to have this information no need to have this information
	Crop Root C Photosynthesis	(kg C/ha) (kg C/ha) (kg C/ha)	+ + no need to have this information	no need to have this information no need to have this information no need to have this information
	Crop Root C	(kg C/ha) (kg C/ha)	+ +	no need to have this information no need to have this information
	Crop Root C Photosynthesis Shoot respiration	(kg C/ha) (kg C/ha) (kg C/ha) (kg C/ha/yr)	+ + no need to have this information no need to have this information	no need to have this information no need to have this information no need to have this information no need to have this information
	Crop Root C Photosynthesis Shoot respiration Root respiration	(kg C/ha) (kg C/ha) (kg C/ha) (kg C/ha/yr) (kg C/ha/yr)	+ + no need to have this information	no need to have this information no need to have this information
	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP	(kg C/ha) (kg C/ha) (kg C/ha) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha/yr)	+ + no need to have this information no need to have this information +	no need to have this information no need to have this information
	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE	(kg C/ha) (kg C/ha) (kg C/ha) (kg C/ha/yr) (kg C/ha/yr)	+ + no need to have this information no need to have this information	no need to have this information no need to have this information
	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP	(kg C/ha) (kg C/ha) (kg C/ha) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha/yr)	+ + no need to have this information no need to have this information +	no need to have this information no need to have this information
	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble	(kg C/ha) (kg C/ha) (kg C/ha) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha/yr)	+ + no need to have this information no need to have this information no need to have this information + +	no need to have this information no need to have this information
	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Stubble Fruit cut	(kg C/ha) (kg C/ha) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha) (kg C/ha)	+ + no need to have this information no need to have this information no need to have this information + +	no need to have this information no need to have this information
	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut	(kg C/ha) (kg C/ha) (kg C/ha) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha) (kg C/ha) (kg C/ha)	+ + no need to have this information no need to have this information + + + + + + +	no need to have this information no need to have this information
	Crop Root C Photosynthesis Shoot respiration Crop NPP NEE Stubble Fruit cut Leaf cut Stem cut	(kg Cha) (kg Cha) (kg Cha) (kg Cha/yr) (kg Cha/yr) (kg Cha/yr) (kg Cha/yr) (kg Cha) (kg Cha) (kg Cha) (kg Cha) (kg Cha) (kg Cha)	+ + no need to have this information no need to have this information no need to have this information + +	no need to have this information no need to have this information
	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut	(kg C/ha) (kg C/ha) (kg C/ha) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha/yr) (kg C/ha) (kg C/ha) (kg C/ha)	+ + no need to have this information no need to have this information + + + + + + +	no need to have this information no need to have this information
	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut	(kg Cha) (kg Cha)	+ + no need to have this information no need to have this information no need to have this information + + + + + + + + + + + + + + + + + + +	no need to have this information no need to have this information + + + + + +
	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand	(kg Cha) (kg Cha)	+ + no need to have this information no need to have this information + + + + + + + + +	no need to have this information no need to have this information + + +
	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Stubble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass	(kg Cha) (kg Cha)	+ + no need to have this information no need to have this information no need to have this information + + + + + + + + + + + + + + + + + + +	no need to have this information no need to have this information + + + + + + + + + +
Water section	Crop Root C Photosynthesis Shoot respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand	(kg Cha) (kg Cha)	+ + no need to have this information no need to have this information no need to have this information + + + + + + + + + + + + + + + + + + +	no need to have this information no need to have this information + + + + + +
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Stubble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass	(kg Cha) (kg Cha)	+ + no need to have this information no need to have this information no need to have this information + + + + + + + + + + + + + + + + + + +	no need to have this information no need to have this information + + + + + + + + + +
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation	(kg Cha) (kg Cha)	+ + no need to have this information no need to have this information + + + + + + + + + + + no need to have this information no need to have this information no need to have this information	no need to have this information no need to have this information + + + + + + + no need to have this information no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure water	(kg Cha) (kg Cha) (mm water/year) (mm water/year)	+ + + no need to have this information no need to have this information no need to have this information + + + + + + + + + no need to have this information no need to have this information no need to have this information	no need to have this information no need to have this information + + + + + + no need to have this information no need to have this information no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation	(kg Cha) (kg Cha) (mm water/year) (mm water/year) (mm water/year) (mm water/year)	+ + no need to have this information no need to have this information + + + + + + + + + + + no need to have this information no need to have this information no need to have this information	no need to have this information no need to have this information + + + + + + + no need to have this information no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Seem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure water PET	(kg Cha) (kg Cha) (mm water/year) (mm water/year) (mm water/year) (mm water/year)	+ + no need to have this information no need to have this information + + + + + + + + + + + + + no need to have this information	no need to have this information no need to have this information + + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Stubble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure water PET Transpiration	(kg Cha) (kg Cha) (mm water/year) (mm water/year) (mm water/year) (mm water/year) (mm water/year) (mm water/year)	+ + no need to have this information no need to have this information no need to have this information + + + + + + no need to have this information	no need to have this information no need to have this information + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure water PET Transpiration Soil evaporation	(kg Cha) (kg Cha) (mm water/year) (mm water/year) (mm water/year) (mm water/year) (mm water/year) (mm water/year)	+ + + no need to have this information no need to have this information no need to have this information + + + + + + + no need to have this information	no need to have this information no need to have this information + + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure water PET Transpiration Soil evaporation Run off	(kg Cha) (mm water/year) (mm water/year) (mm water/year) (mm water/year) (mm water/year) (mm water/year)	+ + no need to have this information no need to have this information + + + + + + + + + no need to have this information	no need to have this information no need to have this information + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure water PET Transpiration Soil evaporation	(kg Cha) (kg Cha) (mm water/year) (mm water/year) (mm water/year) (mm water/year) (mm water/year) (mm water/year)	+ + + no need to have this information no need to have this information no need to have this information + + + + + + + no need to have this information	no need to have this information no need to have this information + + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure water PET Transpiration Soil evaporation Run off Leaching	(kg Cha) (mm water/year) (mm water/year) (mm water/year) (mm water/year) (mm water/year)	+ + + no need to have this information no need to have this information no need to have this information + + + + + + no need to have this information	no need to have this information no need to have this information + + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure water PET Transpiration Soil evaporation Run off Leaching Initial soil profile water	(kg Cha) (kg Cha) (mm water/year) (mm water/year)	+ + no need to have this information no need to have this information + + + + + + + + + + + no need to have this information	no need to have this information no need to have this information + + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Stubble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Infrigation Manure water PET Transpiration Soil evaporation Run off Leaching Initial soil profile water End soil profile water	(kg Cha) (kg Cha) (mw water/year) (mm water/year) (mm water/year) (mm water/year) (mm water/year) (mm water/year)	+ + no need to have this information no need to have this information no need to have this information + + + + + + no need to have this information	no need to have this information no need to have this information + + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure water PET Transpiration Soil evaporation Run off Leaching Initial soil profile water	(kg Cha) (kg Cha) (mm water/year) (mm water/year)	+ + no need to have this information no need to have this information + + + + + + + + + + + no need to have this information	no need to have this information no need to have this information + + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Stubble Fruit cut Leaf cut Stem cut Root cut Grazed biomass Precipitation Irrigation Manure water PET Transpiration Soil evaporation Run off Leaching Initial soil profile water Initial beep water pool	(kg Cha) (kg Cha) (mm water/year) (mm water/year)	+ + + no need to have this information no need to have this information no need to have this information + + + + + + no need to have this information ho need ho have this information ho need ho have this information ho need ho have	no need to have this information no need to have this information + + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure water PET Transpiration Soil evaporation Run off Leaching Initial soil profile water End soil profile water End soil profile water Initial Soil profile water End soil profile water End soil profile water Initial Soil profile water End soil profile water End soil profile water Def Son	(kg Cha) (kg	+ + no need to have this information no need to have this information + + + + + + + + no need to have this information h to have this information h h h h h h h h h h h h h h h h h h h	no need to have this information no need to have this information + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Stubble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure water PET Transpiration Soil evaporation Run off Leaching Initial soil profile water Initial Deep water pool End Deep vater pool Mean wind speed (m/s)	(kg Cha) (kg Cha) (kg Cha) (kg Cha) (kg Cha)yr) (kg Cha)yr) (kg Cha)yr) (kg Cha)yr) (kg Cha) (kg Cha)	+ + no need to have this information no need to have this information no need to have this information + + + + + + no need to have this information no need to have t	no need to have this information no need to have this information + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure water PET Transpiration Soil evaporation Run off Leaching Initial soil profile water End soil profile water End soil profile water Initial Soil profile water End soil profile water End soil profile water Initial Soil profile water End soil profile water End soil profile water Def Son	(kg Cha) (kg	+ + no need to have this information no need to have this information + + + + + + + + no need to have this information h to have this information h h h h h h h h h h h h h h h h h h h	no need to have this information no need to have this information + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure water PET Transpiration Soil evaporation Run off Leaching Initial bege water pool End Deep water pool	(kg Cha) (mm water/year) (ms water/year) (ms water/year) (ms water/year) (ms water/year) (ms water/year)	+ + no need to have this information no need to have this information no need to have this information + + + + + + no need to have this information no need to have t	no need to have this information no need to have this information + + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Stubble Fruit cut Leaf cut Stem cut Root cut Grazed biomass Precipitation Inrigation Manure water PET Transpiration Soil evaporation Run off Leaching Initial soil profile water End Deep water pool Mean wind speed (m/s) Soil P Day 1 Soil P Day 365	(kg Cha) (kg Cha) (mm water/year) (mm water/year) (m	+ + no need to have this information no need to have this information no need to have this information + + + + + + no need to have this information + +	no need to have this information no need to have this information + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Stem cut Root cut Grazed biomass Precipitation Irrigation Manure water PET Transpiration Soil evaporation Run off Leaching Initial soil profile water Initial beep water pool End beep water pool Mean wind speed (m/s) Soil P Day 1 Soil P Day 365	(kg Cha) (mm water/year) (mm water/year) </td <td>+ + no need to have this information no need to have this information no need to have this information + + + + + + + no need to have this information h= no need to have this information h= h=</td> <td>no need to have this information no need to have this information + + + + + no need to have this information no need to have this information</td>	+ + no need to have this information no need to have this information no need to have this information + + + + + + + no need to have this information h= no need to have this information h=	no need to have this information no need to have this information + + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Stubble Fruit cut Leaf cut Stem cut Root cut Grazed biomass Precipitation Inrigation Manure water PET Transpiration Soil evaporation Run off Leaching Initial soil profile water End Deep water pool Mean wind speed (m/s) Soil P Day 1 Soil P Day 365	(kg Cha) (kg Cha) (mm water/year) (mm water/year) (m	+ + no need to have this information no need to have this information no need to have this information + + + + + + no need to have this information + +	no need to have this information no need to have this information + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Root respiration Crop NPP NEE Stubble Fruit cut Leaf cut Stem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure vater PET Transpiration Soil evaporation Run off Leaching Initial soil profile water End soil profile water End soil profile water End soil profile water Initial Soil profile water End soil profile water Initial Soil profile water Soil PDay 1 Soil PDay 1 Soil PDay 1 Soil PDay 365 Fertilizer P (kg Pha): 0.00 Manure P (kg Pha): 0.00	(kg Cha) (kg Cha) (mm water/year) (mm water	+ + no need to have this information no need to have this information no need to have this information + + + + + + + + no need to have this information + no need to have this information ho need to	no need to have this information no need to have this information + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Stubble Fruit cut Leaf cut Stem cut Root cut Initiation Grazed biomass Precipitation Inrigation Manure water PET Transpiration Soil evaporation Run off Leaching Initial soil profile water End Deep water pool Mean wind speed (m/s) Soil P Day 1 Soil P Day 365 Fertilizer P (kg Pha): 0.00 Manure P (kg Pha): 0.00 Pholice (kg Pha)	(kg Cha) (kg Cha) (mm water/year) (mm	+ + no need to have this information no need to have this information no need to have this information + + + + + + + no need to have this information no need to have	no need to have this information no need to have this information + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Subble Fruit cut Leaf cut Siem cut Root cut Livestock feed demand Grazed biomass Precipitation Irrigation Manure water PET Transpiration Soil evaporation Run off Leaching Initial soil profile water End Soil P Day 1 Soil P Day 1 Soil P Day 1 Soil P Day 365 Fertilizer P (kg Pha): 0.00 Manure P (kg Pha): 0.00 P flux of roupdke (kg Pha)	(kg Cha) (mm water/year) (kg Pha)	+ + no need to have this information no need to have this information no need to have this information + + + + + + + + no need to have this information + no need to have this information ho need to	no need to have this information no need to have this information + + + + no need to have this information no need to have this information
Water section	Crop Root C Photosynthesis Shoot respiration Root respiration Crop NPP NEE Stubble Fruit cut Leaf cut Stem cut Root cut Initiation Grazed biomass Precipitation Inrigation Manure water PET Transpiration Soil evaporation Run off Leaching Initial soil profile water End Deep water pool Mean wind speed (m/s) Soil P Day 1 Soil P Day 365 Fertilizer P (kg Pha): 0.00 Manure P (kg Pha): 0.00 Pholice (kg Pha)	(kg Cha) (kg Cha) (mm water/year) (mm	+ + no need to have this information no need to have this information no need to have this information + + + + + + + no need to have this information no need to have	no need to have this information no need to have this information + + + + no need to have this information no need to have this information

STICS DETAILED INPUT/OUTPUT

	VARIABLE	DESCRIPTION INPUTS	UNIT	In Optimal?	In Mini
	ahres	GLOBAL PARAMETERS parameter of organic residues humification: hres=1-ahres*CsurNres/(bhres+CsurNres)	(g·g ⁻¹)	default value from	default valu
uml	akres	parameter of organic residues decomposition: kres=akres+bkres/CsurNres	(d ⁻¹)	param_gen.xml file default value from	param_gen default valu
-	albedomulchresidus	albedo of crop mulch	(SD)	param_gen.xml file default value from	param_gen default val
-				param_gen.xml file	param_ger default val
	alphapH	maximal soil pH variation per unit of inorganic N added with slurry	(kg ⁻¹ ·ha)	default value from param_gen.xml file	param_gei
	awb	parameter determining C/N ratio of biomass during organic residues decomposition: CsurNbio=awb+bwb/CsurNres	(SD)	default value from param_gen.xml file	default val param_ger
	beta	parameter of increase of maximal transpiration when a water stress occurs	(SD)	default value from param_gen.xml file	default val param_ger
Ī	bformnappe	coefficient for the water table shape (artificially drained soil)	(SD)	default value from param_gen.xml file	default val param_gen
Ī	bhres	parameter of organic residues humification: hres=1-ahres*CsurNres/(bhres+CsurNres)	(g·g ⁻¹)	default value from param gen.xml file	default va param_ge
ŀ	bkres	potential rate of decomposition of organic residues: kres=akres+bkres/CsurNres	(g·g ⁻¹)	default value from	default va
ŀ	bwb	parameter determining C/N ratio of biomass during organic residues decomposition:	(g·g ⁻¹)	param_gen.xml file default value from	param_ge default va
-	cmax_pdenit	CsurNbio=awb+bwb/CsurNres Corg value above which denitrification potential is constant and max	(-)	param_gen.xml file default value from	param_ge default va
-	cmin_pdenit	Corg value below which denitrification potential is constant and min	(-)	param_gen.xml file default value from	param_ge default va
ŀ	CNresmax	maximum value of C/N ratio of organic residue	(g·g ⁻¹)	param_gen.xml file default value from	param_ge default va
-	CNresmin	minimum value of C/N ratio of organic residue		param_gen.xml file default value from	param_ge default va
		-	(g·g ⁻¹)	param_gen.xml file	param_ge
	code_hourly_wfps_denit	choice of activating or not hourly WFPS calculation for denit (1 = yes, 2 = no)	(-), code 1/2	default value from param_gen.xml file	default va param_ge
	code_hourly_wfps_nit	choice of activating or not hourly WFPS calculation for nit (1 = yes, 2 = no)	(-), code 1/2	default value from param_gen.xml file	default va param_ge
ľ	code_pdenit	choice of denitrification potential (1 = soil parameter or 2 = calculated from Corg)	(-), code 1/2	default value from param gen.xml file	default va param_ge
ŀ	code_ratiodenit	choice of constant (= 1) or variable(= 2) N_2O ratio for denitrification	(-), code 1/2	default value from	default va
ŀ	code_rationit	choice of constant or variable N ₂ O ratio for nitrification (1 = constant, 2 = variable)	(-), code 1/2	param_gen.xml file default value from	param_ge default va
-	code_tnit	choice of temperature function for nitrification (1 = piecewise linear or 2 = gaussian)	(-), code 1/2	param_gen.xml file default value from	param_ge default va
ŀ	code_vnit	choice of nitrification rate dependence on NH ₄ (1 = linear or 2 = Michaelis-Menten)	(-), code 1/2	param_gen.xml file default value from	param_ge default va
-	codeactimulch	option to activate the natural mulch effect i.e. drying out of soil surface (1 = yes, 2 = no)	(-), code 1/2	param_gen.xml file default value from	param_ge default va
				param_gen.xml file	param_ge
	codefrmur	code defining the maturity status of the fruits in the output variable CHARGEFRUIT (1 = including ripe fruits (last box N), 2 = excluding ripe fruits (first N-1 boxes))	(-), code 1/2	default value from param_gen.xml file	default va param_ge
	codefxn	option defining the effect of soil nitrate on N fixation (1 = no effect, 2 = effect of nitrate amount, 3 = effect of nitrate concentration)	(-), code 1/2/3	default value from param_gen.xml file	default va param_ge
ſ	codeh2oact	option to activate water stress effect on the crop (1 = yes, 2 = no)	(-), code 1/2	default value from param_gen.xml file	default va param_ge
Ī	codeinitprec	option to activate reinitialization of initial conditions in case of chained simulations (1 = yes, 2 = no)	(-), code 1/2	default value from param_gen.xml file	default va param_ge
Ī	codeinnact	option of activation of N stress effect on the crop $(1 = yes, 2 = no)$	(-), code 1/2	default value from	default va
r	codemicheur	option of calculation of hourly microclimatic outputs (output file humidite.sti) (1 = yes, 2 =	(-), code 1/2	param_gen.xml file default value from	param_ge default va
ŀ	codeminopt	no) option to maintain a constant water content in bare soil during the simulation (1 = yes, 2 = no)	(-), code 0/1	param_gen.xml file default value from	param_ge default va
-	codemsfinal	option defining the biomass and yield conservation after harvest (1 = yes (values maintained	(-), code 1/2	param_gen.xml file default value from	param_ge default va
-	codeoutscient	equal to harvest), 2 = no (values set at 0)) option to write outputs files with scientific format (1 = yes, 2 = no)	(-), code 1/2	param_gen.xml file default value from	param_ge default va
-				param_gen.xml file	param_ge
_	codeprofmes	option of soil depth for calculating water and N stocks (1 = profines, 2 = soil depth)	(-), code 1/2	default value from param_gen.xml file	default va param_ge
	codesensibilite	option to activate the sensitivity analysis version of the model (1 = yes, 2 = no)	(-), code 1/2	default value from param_gen.xml file	default va param_ge
	codeseprapport	option to select the column separator in the rapport.sti output file (1 = space separator, 2 = separator indicated in the separateurrapport parameter)	(-), code 1/2	default value from param_gen.xml file	default va param_ge
Ī	codesymbiose	option for calculating symbiotic N fixation (1 = critical dilution curve, 2 = calculated N fixation)	(-), code 1/2	default value from param_gen.xml file	default va param_ge
Ī	codetycailloux	pebble type code	(-), code 1 to 10	default value from	default va
ŀ	codetypeng	fertiliser type code	(-), code 1 to 8	param_gen.xml file default value from	param_ge default va
ŀ	codetypres	organic residue type code	(-), code 1 to 21	param_gen.xml file default value from	param_ge default va
ŀ	codhnappe	mode of calculation of watertable level (1 = mean height, 2 = height at the distance distdrain)	(-), code 1/2	param_gen.xml file default value from	param_ge default va
-	coefb	parameter defining radiation effect on conversion efficiency	(SD)	param_gen.xml file default value from	param_ge default va
_	солг	inorganic N concentration (NH4+NO3-N) in the rain		param_gen.xml file default value from	param_ge default va
_			(kg·ha ⁻¹ mm ⁻¹)	param_gen.xml file	param_ge
	СгоСо	fraction of organic residue which is decomposable	(SD)	default value from param_gen.xml file	default va param_ge
[cwb	minimum ratio C/N of microbial biomass decomposing organic residues	(g·g ⁻¹)	default value from param_gen.xml file	default va param_ge
Ī	dacohes	bulk density of soil below which root growth is reduced due to a lack of soil cohesion	(g·cm⁻³)	default value from param gen.xml file	default va param_ge
ľ	daseuilbas	bulk density of soil above which root growth is maximal	(g·cm ⁻³)	default value from	default va
ŀ	daseuilhaut	bulk density of soil above which root growth becomes impossible	(g·cm ⁻³)	param_gen.xml file default value from	param_ge default va
ŀ	deneng	maximal fraction of the mineral fertilizer that can be denitrified (used if codedenit is not	(SD)	param_gen.xml file default value from	param_ge default va
ŀ	difN	activated) diffusion coefficient of nitrate N in soil at field capacity	(cm ² ·d ⁻¹)	param_gen.xml file default value from	param_ge default va
ŀ	diftherm	soil thermal diffusivity	(cm ² ·s ⁻¹)	param_gen.xml file default value from	param_ge default va
Ļ				param_gen.xml file	param_ge
	distdrain	distance to the drain to calculate watertable height	(cm)	default value from param_gen.xml file	default va param_ge
[dpHvolmax	maximal pH increase following the application of slurry	(SD)	default value from param_gen.xml file	default va param_ge
ľ	engamm	fraction of ammonium in the N fertilizer	(SD)	default value from param gen.xml file	default va param_ge
ľ	fhminsat	relative soil mineralisation rate at water saturation	(SD)	default value from	default va
	finert	initial fraction of soil organic N inactive for mineralisation (= stable SON/ total SON)	(SD)	param_gen.xml file default value from	param_ger default val

flagecriture	option for writing the output files (1 = mod_history.sti, 2=daily outputs,4= report outputs, 8=balance outputs,16 = profile outputs, 32= debug outputs, 64 = screen outputs, 128 = agmip	(0-511)	default value from param_gen.xml file	default value from param_gen.xml file
fmin1	outputs) add them to have several types of outputs relative potential mineralization rate: K2 = fmin1 * exp(-fmin2*argi) / (1+fmin3*calc)	(d ⁻¹)	default value from	default value from
fmin2	parameter defining the effect of clay on the potential mineralization rate: K2 = fmin1 * exp(-	(-1%)	param_gen.xml file default value from	param_gen.xml file default value from
	fmin2*argi) / (1+fmin3*calc)		param_gen.xml file	param_gen.xml file
fmin3	parameter defining the effect of CaCO3 on the potential mineralization rate: K2 = fmin1 * exp(-fmin2*argi) / (1+fmin3*calc)	(-1%)	default value from param_gen.xml file	default value from param_gen.xml file
fNCbiomin	minimal value for the ratio N/C of the microbial biomass when N limits decomposition	(SD)	default value from param gen.xml file	default value from param_gen.xml file
fnx	potential proportion of NH4 nitrified each day if linear model	(d ⁻¹)	default value from param_gen.xml file	default value from param_gen.xml file
fredkN	reduction factor of decomposition rate of organic residues when mineral N is limiting	(SD)	default value from	default value from
fredIN	reduction factor of decomposition rate of microbial biomass when mineral N is limiting	(SD)	param_gen.xml file default value from	param_gen.xml file default value from
fredNsup	additional reduction factor of residues decomposition rate when mineral N is very limited in	(SD)	param_gen.xml file default value from	param_gen.xml file default value from
	soil		param_gen.xml file default value from	param_gen.xml file
ftemh	parameter (1/2) of the temperature function on humus decomposition rate	(K ⁻¹)	param_gen.xml file	default value from param_gen.xml file
ftemha	parameter (2/2) of the temperature function on humus decomposition rate	(*)	default value from param_gen.xml file	default value from param_gen.xml file
ftemr	parameter (1/2) of the temperature function on decomposition rate of organic residues	(K ⁻¹)	default value from param_gen.xml file	default value from param_gen.xml file
ftemra	parameter (2/2) of the temperature function on decomposition rate of organic residues	(*)	default value from	default value from
hcccx	gravimetric water content at field capacity of each type of pebble	(% w)	param_gen.xml file default value from	param_gen.xml file default value from
hminm	relative water content (fraction of field capacity) below which mineralisation rate is nil	(SD)	param_gen.xml file default value from	param_gen.xml file default value from
hminn	relative water content (fraction of field capacity) below which nitrification rate is nil	(SD)	param_gen.xml file default value from	param_gen.xml file default value from
			param_gen.xml file	param_gen.xml file
hoptm	relative water content (fraction of field capacity) below which mineralisation rate is maximum	(SD)	default value from param_gen.xml file	default value from param_gen.xml file
hoptn	relative water content (fraction of field capacity) below which nitrification rate is maximum	(SD)	default value from param_gen.xml file	default value from param_gen.xml file
iniprofil	option of smoothing out the initial N and water profiles (spline function) (1 = yes, 2 = no)	(-), code 0/1	default value from param_gen.xml file	default value from param_gen.xml file
irrlev	amount of irrigation applied automatically on the sowing day to allow germination when the	(mm)	default value from	default value from
	model calculates irrigation		param_gen.xml file	param_gen.xml file
Kamm	affinity constant for NH4 in nitrification if michaelis_menten option used	(mg N/L)	default value from param_gen.xml file	default value from param_gen.xml file
kbio	potential decay rate of microbial biomass decomposing organic residues	(d ⁻¹)	default value from param_gen.xml file	default value from param_gen.xml file
kcouvmlch	extinction coefficient connecting the soil cover to the amount of plant mulch	(*)	default value from	default value from
Kd	Affinity constant for NO ₃ in denitrification	(mg N/L)	param_gen.xml file default value from	param_gen.xml file default value from
kdesat	rate constant of de-saturation	(d ⁻¹)	param_gen.xml file default value from	param_gen.xml file default value from
khaut	extinction coefficient connecting LAI to crop height	(*)	param_gen.xml file default value from	param_gen.xml file default value from
Kilaut	extinction coefficient connecting EAI to crop height	0	param gen.xml file	param_gen.xml file
		. 4	· ~	
lvopt	root length density (RLD) above which water and N uptake are maximum and independent of RLD	(cm·cm ⁻³)	default value from param_gen.xml file	default value from param_gen.xml file
lvopt masvolcx		(cm·cm ⁻³) (g·cm ⁻³)	default value from	default value from
-	RLD		default value from param_gen.xml file default value from param_gen.xml file default value from	default value from param_gen.xml file default value from param_gen.xml file default value from
masvolex	RLD bulk density of each type of pebble	(g·cm ⁻³)	default value from param_gen.xml file default value from param_gen.xml file default value from param_gen.xml file default value from	default value from param_gen.xml file default value from param_gen.xml file default value from param_gen.xml file default value from
masvolcx max_pdenit	RLD bulk density of each type of pebble max value of denitrification potential	(g.cm ³) (-)	default value from param_gen.xml file default value from param_gen.xml file default value from param_gen.xml file	default value from param_gen.xml file default value from param_gen.xml file default value from param_gen.xml file default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential	(g·cm ³) (-) (-) (mm·t ¹ ·ha)	default value from param_gen.xml file default value from param_gen.xml file default value from param_gen.xml file default value from param_gen.xml file	default value from param_gen.xml file default value from param_gen.xml file default value from param_gen.xml file default value from param_gen.xml file
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min	RLD	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg)	default value from param_gen.xml file default value from param_gen.xml file default value from param_gen.xml file default value from param_gen.xml file default value from param_gen.xml file	default value from param gen.xml file default value from param gen.xml file
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH4 concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8)	(g: cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ³)	default value from param gen.xntl file default value from param gen.xntl file	default value from param gen.xml file default value from param gen.xml file
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH4 concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation)	(g·cm ³) (-) (-) (mm·t ⁻¹ ·ha) (mg N/kg) (kg·ha ³) (SD)	default value from param gen.xml file default value from param gen.xml file	default value from param_gen.xml file default value from param_gen.xml file
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH4 concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8)	(g: cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ³)	default value from param_gen.xml file default value from	default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH4 concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation)	(g·cm ³) (-) (-) (mm·t ⁻¹ ·ha) (mg N/kg) (kg·ha ³) (SD)	default value from param gen.xnil file default value from	default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₅ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ³) (SD) (pH)	default value from param gen.xml file default value from	default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH ₄ concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ³) (SD) (pH) (pH)	default value from param gen.xml file default value from	default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit pHmaxvol pHminden	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH4 concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N2O molar fraction is minimum (<= ratiodenit)	(g: cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ³) (SD) (pH) (pH) (pH) (pH)	default value from param_gen.xml file default value from param_gen.xml file	default value from param_gen.xml file default value from param_gen.xml file
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit pHmaxvol pHminden pHminnit	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH4 concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N50 molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ¹) (SD) (pH) (pH) (pH) (pH)	default value from param_gen.xml file default value from param_gen.xml file	default value from param_gen.xml file default value from param_gen.xml file
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit pHmaxvol pHminden pHminnit pHminnol	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ³) (SD) (pH) (pH) (pH) (pH) (pH) (pH)	default value from param gen.xml file default value from param gen.xml file	default value from param_gen.xml file default value from param_gen.xml file
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxvol pHmaxvol pHminit pHminvol pHminvol pHwinvol	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ³) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH)	default value from param_gen.xml file default value from param_gen.xml file	default value from param_gen.xml file default value from param_gen.xml file
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit pHmaxvol pHminden pHminnit pHminnol	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ³) (SD) (pH) (pH) (pH) (pH) (pH) (pH)	default value from param_gen.xml file default value from	default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxvol pHmaxvol pHminit pHminvol pHminvol pHwinvol	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ³) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH)	default value from param gen.xml file default value from	default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit pHmaxvol pHminden pHminit pHminit pHminit	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ³) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH)	default value from param gen.xml file default value from	default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit pHmaxnit pHmaxnol pHminden pHminnit pHminnit pHminnit pHminnit pHminnit	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ³) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (mm·d ³)	default value from param_gen.xml file default value from param_gen.xml file	default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit pHmaxvol pHminden pHminnit pHminnit pHminvol pHminvol pHminvol pHminvol pHminyol pHminyol pHminyol pHminyol pHols primingmax proflabour	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH4 concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N3O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ⁻¹ ·ha) (mg N/kg) (kg·ha ⁻¹) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (cmm·d ⁻¹) (SD)	default value from param_gen.xml file default value from	default value from param_gen.xml file default value from param_gen.xml file
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxvol pHmaxvol pHminden pHminnit pHminnit pHminnit pHminnit pFminnit profiabour proflabour proftravmin	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ⁻¹) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (cm) (Cm) (cm)	default value from param gen.xml file default value from	default value from param_gen.xml file default value from param_gen.xml file
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxvol pHmaxvol pHminvol pHminvol pHminvol pHwinvol pINmin pminruis profiabour proflabour profhavmin profhavmin	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N;O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ⁻¹) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (cmm·d ⁻¹) (SD) (cm) (SD)	default value from param_gen.xml file default value from param_gen.xml file	default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxvol pHmaxvol pHminden pHminnit pHminnit pHminnit pHminnit pFminnit profiabour proflabour proftravmin	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH4 concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N50 molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ⁻¹) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (cm) (Cm) (cm)	default value from param_gen.xml file default value from	default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxvol pHmaxvol pHminvol pHminvol pHminvol pHwinvol pINmin pminruis profiabour proflabour profhavmin profhavmin	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH4 concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N3O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ⁻¹) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (cmm·d ⁻¹) (SD) (cm) (SD)	default value from param, gen.xml file default value from	default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit pHmaxnit pHmaxvol pHminit pHminit pHminit pHminit pHminit pHminit profiabour proflabour proflabour proflabour proflamassee	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ⁻¹) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (cmm·d ⁻¹) (SD) (cm) (cm) (SD) (SD)	default value from param gen.xml file default value from	default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxntt pHmaxntt pHmaxntt pHmaxnol pHminden pHminntt pHminntt pHminntt pHminnt pIminnts profinatour proflabour proflabour proflabour proflabour proflabour proflabour proflasten prophumtasseen prophumtasseen	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ³) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (cmm·d ³) (cm) (SD) (cm) (SD) (SD) (SD) (SD)	default value from param gen.xml file default value from param gen.xml file	default value from param_gen.xml file default value from param_gen.xml file
masvolcx max_pdenit min_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit pHmaxvol pHminden pHminnit pHminvol pHminvol pHwins profinatou profinatou profinatou profinatou prophumtasseec prophumtasseen propac psihucc psihumin	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH4 concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N2O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ⁻¹ ·ha) (mg N/kg) (kg·ha ⁻¹) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (sD) (SD) (Cm) (SD) (SD) (SD) (SD) (G) (g·g ⁻¹) (Mpa)	default value from param_gen.xml file default value from param_gen.xml file	default value from param_gen.xml file default value from param_gen.xml file
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit pHmaxvol pHminden pHminnit pHminvol pHwinol pHwinsol pINmin profitavonin profitavonin profitasseen prophumtasseen propta psihuuci psihuuci quulchdec	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (-) (mm·t ⁻¹ ·ha) (mg N/kg) (kg·ha ⁻¹) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (cm·d ⁻¹) (SD) (cm) (SD) (g·g ⁻¹) (Mpa) ((ha ⁻¹)	default value from param, gen.xml file default value from param, gen.xml file	default value from param_gen.xml file default value from param_gen.xml file
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit pHmaxvol pHminden pHminvol pHminvol pHwins pINmin pminruis proflabour proflabour proflabour prophumtasseen prophumtasseen proprac psihucc psihucc qmulchuec qmulchueso qmulchueso	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ⁻¹) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (cm·d ⁻¹) (SD) (cm) (SD) (cm) (SD) (kg·ha ⁻¹) (kg·ha	default value from param_gen.xml file default value from param_gen.xml file	default value from param_gen.xml file default value from param_gen.xml file
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit pHmaxvol pHminden pHminnit pHminvol pHwinol pHwinsol pINmin profitavonin profitavonin profitasseen prophumtasseen propta psihuuci psihuuci quulchdec	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (-) (mm·t ⁻¹ ·ha) (mg N/kg) (kg·ha ⁻¹) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (cm·d ⁻¹) (SD) (cm) (SD) (g·g ⁻¹) (Mpa) ((ha ⁻¹)	default value from param, gen.xml file default value from	default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit pHmaxvol pHminden pHminvol pHminvol pHwins pINmin pminruis proflabour proflabour proflabour prophumtasseen prophumtasseen proprac psihucc psihucc qmulchuec qmulchueso qmulchueso	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (mm·t ¹ ·ha) (mg N/kg) (kg·ha ⁻¹) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (cm·d ⁻¹) (SD) (cm) (SD) (cm) (SD) (kg·ha ⁻¹) (kg·ha	default value from param, gen.xml file default value from	default value from param_gen.xml file default value from
masvolcx max_pdenit min_pdenit min_pdenit mouillabilmulch nh4_min orgeng parsurrg pHmaxden pHmaxnit pHmaxvol pHminvol pHminvol pHminvol pHwinvol pINmin pminruis proflabour proflabour proflabour proflabour proflabour proflabour proflabour prophumtasseec prophumtassee proppac estimation prophameteste prophamete	RLD bulk density of each type of pebble max value of denitrification potential min value of denitrification potential maximum wettability of crop mulch minimum (fixed ?) NH, concentration found in soil maximal amount of fertilizer N that can be immobilized in the soil (fraction for type 8) ratio of PAR to RG (global radiation) pH beyond which the N ₂ O molar fraction is minimum (<= ratiodenit)	(g·cm ³) (-) (-) (-) (mm·t ¹ ·ha) (mg Nkg) (kg·ha ⁻¹) (SD) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (pH) (g·H) (mm·d ⁻¹) (SD) (cm) (cm) (SD) (cm) (cm) (sD) (sD) (kg·ha ⁻¹) (kg·ha ⁻¹)	default value from param_gen.xml file default value from param_gen.xml file	default value from param_gen.xml file default value from param_gen.xml file

r	r				
	rdrain	drain radius	(cm)	default value from param_gen.xml file	default value from param_gen.xml file
	scale_tdenitopt	parameter related to the range of optimum temperature for denitrification	(-)	default value from param_gen.xml file	default value from param_gen.xml file
	scale_tnitopt	parameter related to the range of optimum temperature for nitrification	(-)	default value from	default value from
	separateurrapport	column separator in rapport.sti file	(SD)	param_gen.xml file default value from	param_gen.xml file default value from
	tdenitopt_gauss	optimum temperature for denitrification	(°C)	param_gen.xml file default value from	param_gen.xml file default value from
	tnitmax	maximal temperature above which nitrification stops	(°C)	param_gen.xml file default value from	param_gen.xml file default value from
	tnitmin	minimal temperature below which nitrification stops	(°C)	param_gen.xml file default value from	param_gen.xml file default value from
				param_gen.xml file	param_gen.xml file
	tnitopt	optimal temperature (1/2) for nitrification	(°C)	default value from param_gen.xml file	default value from param_gen.xml file
	tnitopt_gauss	optimal temperature (1/2) for nitrification	(°C)	default value from param_gen.xml file	default value from param_gen.xml file
	tnitopt2	optimal temperature (2/2) for nitrification	(°C)	default value from param_gen.xml file	default value from param_gen.xml file
	trefh	reference temperature for decomposition of humified organic matter	(°C)	default value from	default value from
	trefr	reference temperature for decomposition of organic residues	(°C)	param_gen.xml file default value from	param_gen.xml file default value from
	Vabs2	N uptake rate at which fertilizer loss is divided by 2	(kg·ha ⁻¹ ·d ⁻¹)	param_gen.xml file default value from	param_gen.xml file default value from
	vnitmax	maximum nitrification rate if michaelis_menten option used	(mg N kg ⁻¹ d ⁻¹)	param_gen.xml file default value from	param_gen.xml file default value from
				param_gen.xml file	param_gen.xml file
	voleng	maximal fraction of mineral fertilizer that can be volatilized	(SD)	default value from param_gen.xml file	default value from param_gen.xml file
	wfpsc	wfps threshold beyond which denitrification occurs	(SD)	default value from param_gen.xml file	default value from param_gen.xml file
	Wh	N/C ratio of soil humus	(g·g ⁻¹)	default value from param_gen.xml file	default value from param_gen.xml file
	Xorgmax	maximal amount of N immobilised in soil derived from the mineral fertilizer	(kg·ha⁻¹)	default value from	default value from
	y0msrac	minimal amount of root mass at harvest (when aerial biomass is nil)	(t·ha ⁻¹)	param_gen.xml file default value from	param_gen.xml file default value from
	yres	Carbon assimilation yield by the microbial biomass during crop residues decomposition	(g·g ⁻¹)	param_gen.xml file default value from	param_gen.xml file default value from
Plant parameters	Crop file *_plt.xml	Name of the crop *_plt.xml file:	(-)	param_gen.xml file	param_gen.xml file
(*_plt.xml file)	crop me •_pic.xiii	baresoil_plt.ml - bare soil, corn_plt.ml - maize,	(-)	Ŧ	Ŧ
		DurumWheat_ALCLOU_pit.xml – durum wheat, DurumWheat_ALLUR_pit.xml – durum wheat, DurumWheat_ARCALIS_pit.xml – durum wheat, DurumWheat_ARCALIS_pit.xml – durum wheat, DurumWheat_ARCALIS_pit.xml – durum wheat, DurumWheat_ARCALIS_pit.xml – durum wheat, DurumWheat_LOYD_pit.xml – durum wheat, DurumWheat_NEFER_pit.xml – durum wheat, DurumWheat_NEFER_pit.xml – durum wheat, DurumWheat_NEFER_pit.xml – durum wheat, DurumWheat_ORIAUNE_pit.xml – durum wheat, DurumWheat_ORIAUNE_pit.xml – durum wheat, DurumWheat_ORIAUNE_pit.xml – durum wheat, DurumWheat_ORIAUNE_pit.xml – durum wheat, paramWheat_ORIAUNE_pit.xml – durum wheat, paramWheat_ORIAUNE_pit.xml – durum wheat, proto_barley_pit.xml – banana, proto_barley_pit.xml – banana, proto_barley_pit.xml – barley, proto_fscuc_pit.xml – barley, proto_barley_pit.xml – barley, proto_barley_pit.xml – barley, proto_barley_pit.xml – barley, proto_barley_pit.xml – barley, proto_pit.xml – fac.x, proto_pit.tml – fac.x, proto_potato_pit.xml – lettuce, proto_potato_pit.xml – botato, proto_songhum_pit.xml – strawberry proto_songhum_pit.xml – strawberry proto_sufforwer_pit.xml – strawberry proto_sufforwer_pit.xml – strawberry proto_sufforwer_pit.xml – sufforwer, proto_sufforwer_pit.xml – uninet barley, rapesed_pit.xml – sufforwer, proto_sufforwer_pit.xml – uninet barley, rapesed=pit.xml – sufforwer, proto_sufforwer_pit.xml – winet barley, rapesed=pit.xml – sufforwer, vine_CHARCDQ pit.xml – vine, vine_CHARCDB_pit.xml – vine, vine_CHARCDB_pit.xml – vine, vine_MEALISUM_pit.xml – vine, vine_MEALISUM_pit.xml – vine, vine_MEALISUM_pit.xml – vine, vine_MEALISUM_pit.xml – vine, vine_Pit.CH_pit.xml – vine, vine_Pit.CH_p			
	abscission	wheat_plt.xml - wheat fraction of senescent leaves falling to the soil	(SD)	default value from *_plt.xml file	default value from *_plt.xml file
	adens	Interplant competition parameter	(SD)	default value from	default value from
	adfol	parameter determining the leaf density evolution within the chosen shape	(m ⁻¹)	*_plt.xml file default value from	*_plt.xml file default value from
	adil	parameter of the critical dilution curve [Nplante]=adil MS4(-bdil)	(% DM)	*_plt.xml file default value from	*_plt.xml file default value from
	adilmax	parameter of the maximum dilution curve [Nplante]=adilmax MS ⁴ (-bdilmax)	(% DM)	*_plt.xml file default value from	*_plt.xml file default value from
				*_plt.xml file	*_plt.xml file
	afpf	parameter of the logistic function defining sink strength of fruits (indeterminate growth) : relative fruit age at which growth is maximal	(SD)	default value from *_plt.xml file	default value from *_plt.xml file
	afruitpot	maximal number of set fruits per degree-day (indeterminate growth)	(degree-d ⁻¹)	default value from *_plt.xml file	default value from *_plt.xml file
	allocfrmax	maximal daily allocation to fruits	(SD)	default value from *_plt.xml file	default value from *_plt.xml file
	alphaCO2	coefficient accounting for the modification of radiation use efficiency in case of atmospheric	(SD)	default value from	default value from
	alphaphot	CO2 increase parameter of photoperiodic effect on leaf lifespan	(SD)	*_plt.xml file default value from	*_plt.xml file default value from
	ampfroid	semi thermal amplitude for vernalising effect	(°C)	*_plt.xml file default value from	*_plt.xml file default value from
				*_plt.xml file	*_plt.xml file
	bdens	minimal density above which interplant competition starts	(m ⁻²)	default value from *_plt.xml file	default value from *_plt.xml file
	bdil	parameter of the critical dilution curve [Nplante]=adil MS^(-bdil)	(SD)	default value from *_plt.xml file	default value from *_plt.xml file
	bdilmax	parameter of the maximum dilution curve	(SD)	default value from	default value from
		[Nplante]=adilmax MSY(-bdilmax)		*_plt.xml file	*_plt.xml file

belong	parameter of the curve of coleoptile elongation	(degree · d ⁻¹)	default value from	default value from
			*_plt.xml file	*_plt.xml file
bfpf	parameter of the logistic curve defining sink strength of fruits (indeterminate growth): maximum growth rate relative to maximum fruit weight	(SD)	default value from *_plt.xml file	default value from *_plt.xml file
celong	parameter of the plantlet elongation curve	(SD)	default value from *_plt.xml file	default value from *_plt.xml file
cfpf	parameter of the first potential growth phase of fruit, corresponding to an exponential type function describing the cell division phase	(SD)	default value from *_plt.xml file	default value from *_plt.xml file
cgrain	slope of the relationship between grain number and growth rate	(grains·g ⁻¹ ·d)	default value from *_plt.xml file	default value from * plt.xml file
cgrainv0	number of grains produced when growth rate is zero	(grains·m ⁻²)	default value from *_plt.xml file	default value from *_plt.xml file
codazofruit	option to activate the direct effect of N plant status on the fruit/grain number (1 = no, 2 = yes)	(code 1/2)	default value from	default value from
codazorac	option to activate the N influence on root partitioning within the soil profile (1 = yes, 2 = no)	(code 1/2)	*_plt.xml file default value from	*_plt.xml file default value from
codcalinflo	option for calculating the inflorescences number (1 = read in param.par, 2 = calculated at the	(code 1/2)	*_plt.xml file default value from	*_plt.xml file default value from
codebeso	amf stage) option of computation water requirements (1 = k.ETP approach, 2= resistive approach)	(code 1/2)	*_plt.xml file default value from	*_plt.xml file default value from
codebfroid	option of chilling requirements (1 = no need, 2 = vernalising days, 3 = development stage)	(code 1/2/3)	*_plt.xml file default value from	*_plt.xml file default value from
codedormance	option for the calculation of dormancy and chilling requirements (1 = forcing, 2 = Richardson,	(code 1/2/3)	*_plt.xml file default value from	*_plt.xml file default value from
	3 = Bidabe)		*_plt.xml file	<pre>*_plt.xml file</pre>
codefixpot	option of calculation of the maximal symbiotic fixation (1 = fixed, 2 =depending on growth rate)	(code 1/2)	default value from *_plt.xml file	default value from *_plt.xml file
codegdh	time step used for calculating development units (1 = hourly, 2 = daily)	(code 1/2)	default value from *_plt.xml file	default value from *_plt.xml file
codegdhdeb	option of time step used for calculating bud break date (1 = daily, 2 = hourly growing degrees)	(code 1/2)	default value from *_plt.xml file	default value from *_plt.xml file
codegermin	option of simulation of a germination phase or a delay at the beginning of the crop (1) or direct starting (2)	(code 1/2)	default value from *_plt.xml file	default value from * plt.xml file
codehypo	option of simulation of a phase of hypocotyl growth (1) or planting of plantlets (2)	(code 1/2)	default value from	default value from
codeindetermin	option of simulation of the leaf growth and fruit growth (1 = determinate, 2 = indeterminate)	(code 1/2)	*_plt.xml file default value from	*_plt.xml file default value from
codeINN	option to compute INN (1 = cumulative, 2 = instantaneous)	(code 1/2)	*_plt.xml file default value from	*_plt.xml file default value from
codeintercept	option of simulation rainfall interception by leaves $(1 = yes, 2 = no)$	(code 1/2)	*_plt.xml file default value from	*_plt.xml file default value from
codeir	option of computing the ratio grain weight/total biomass: proportional to time (1),	(code 1/2)	*_plt.xml file default value from	*_plt.xml file default value from
	proportional to sum temperatures (2)		<pre>*_plt.xml file</pre>	<pre>*_plt.xml file</pre>
codelaitr	option used for calculating intercepted radiation (1 = LAI, 2 = soil cover)	(code 1/2)	default value from *_plt.xml file	default value from *_plt.xml file
codelegume	is the crop a legume fixing N ? $(1 = yes, 2 = no)$	(code 1/2)	default value from *_plt.xml file	default value from *_plt.xml file
codemonocot	type of plant: 1 = monocot, 2 =dicot	(code 1/2)	default value from *_plt.xml file	default value from *_plt.xml file
codeperenne	option defining the annual (1) or perenial (2) character of the plant	(code 1/2)	default value from *_plt.xml file	default value from *_plt.xml file
codephot	option of plant photoperiodism (1 = yes, 2 = no)	(code 1/2)	default value from	default value from
codeplante	Name code of the plant in 3 letters	(SD)	*_plt.xml file default value from	*_plt.xml file default value from
codeplisoleN	code for N requirement calculations at the beginning of the cycle (1 = dense plant population,	(code 1/2)	*_plt.xml file default value from	*_plt.xml file default value from
coderacine	2 = isolated plants) option of simulating root growth and extension (1 = standard profile, 2 = root length density)	(code 1/2)	*_plt.xml file default value from	*_plt.xml file default value from
coderetflo	option to activate the slow down effect of water stress on development before the stage DRP	(code 1/2)	*_plt.xml file default value from	*_plt.xml file default value from
	(starting date of filling of harvested organs), (1 = yes, 2 = no)		*_plt.xml file	*_plt.xml file
codestrphot	option to activate the photoperiodic stress on lifespan $(1 = yes, 2 = no)$	(code 1/2)	default value from *_plt.xml file	default value from *_plt.xml file
codetemp	option to calculate thermal time for plant growth (1 = air temperature, 2 = crop temperature)	(code 1/2)	default value from *_plt.xml file	default value from *_plt.xml file
codetemp codetemprac	option to calculate thermal time for plant growth (1 = air temperature, 2 = crop temperature) option to calculate thermal time for root growth (1 = crop temperature, 2 = soil temperature)	(code 1/2) (code 1/2)	*_plt.xml file default value from	default value from *_plt.xml file default value from
-			*_plt.xml file default value from *_plt.xml file default value from	default value from *_plt.xml file default value from *_plt.xml file default value from
codetemprac	option to calculate thermal time for root growth (1 = crop temperature, 2 = soil temperature)	(code 1/2)	*_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from	default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from
codetemprac	option to calculate thermal time for root growth (1 = crop temperature, 2 = soil temperature) option of simulating radiation interception (1 = Beer's law, 2 = radiative transfer)	(code 1/2) (code 1/2)	*_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from	default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from
codetemprac codetransrad codetremp	option to calculate thermal time for root growth (1 = crop temperature, 2 = soil temperature) option of simulating radiation interception (1 = Beer's law, 2 = radiative transfer) option to activate heat effect on grain filling (1 = yes, 2 = no)	(code 1/2) (code 1/2) (code 1/2)	*_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from	default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from * plt.xml file
codetemprac codetransrad codetremp codevar	option to calculate thermal time for root growth (1 = crop temperature, 2 = soil temperature) option of simulating radiation interception (1 = Beer's law, 2 = radiative transfer) option to activate heat effect on grain filling (1 = yes, 2 = no) cultivar name	(code 1/2) (code 1/2) (code 1/2) (SD)	*_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file	default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file
codetemprac codetransrad codetremp codevar codgelflo codgelflo	option to calculate thermal time for root growth (1 = crop temperature, 2 = soil temperature) option of simulating radiation interception (1 = Beer's law, 2 = radiative transfer) option to activate heat effect on grain filling (1 = yes, 2 = no) cultivar name option to activate frost effect at anthesis (1 = no, 2 = yes) option to activate frost effect on LAI at the juvenile stage (1 = no, 2 = yes)	(code 1/2) (code 1/2) (code 1/2) (SD) (code 1/2) (code 1/2)	• plt.xml file default value from * plt.xml file	default value from * plt.xml file default value from * plt.xml file
codetemprac codetransrad codetremp codevar codgelflo codgeljuv codgeljev	option to calculate thermal time for root growth (1 = crop temperature, 2 = soil temperature) option of simulating radiation interception (1 = Beer's law, 2 = radiative transfer) option to activate heat effect on grain filling (1 = yes, 2 = no) cultivar name option to activate frost effect at anthesis (1 = no, 2 = yes) option to activate frost effect on LAI at the juvenile stage (1 = no, 2 = yes) option to activate frost effect on plantlet (1 = no, 2 = yes)	(code 1/2) (code 1/2) (code 1/2) (SD) (code 1/2) (code 1/2) (code 1/2)	• plt.xml file default value from • plt.xml file	default value from * plt.xml file default value from * plt.xml file
codetemprac codetransrad codetremp codevar codgelflo codgeljuv codgellev codgellev	option to calculate thermal time for root growth (1 = crop temperature, 2 = soil temperature) option of simulating radiation interception (1 = Beer's law, 2 = radiative transfer) option to activate heat effect on grain filling (1 = yes, 2 = no) cultivar name option to activate frost effect at anthesis (1 = no, 2 = yes) option to activate frost effect on LAI at the juvenile stage (1 = no, 2 = yes) option to activate frost effect on plantlet (1 = no, 2 = yes) option to activate frost effect on LAI at adult stage (1 = no, 2 = yes)	(code 1/2) (code 1/2) (code 1/2) (SD) (code 1/2) (code 1/2) (code 1/2) (code 1/2)	* plt.xml file default value from * plt.xml file	default value from * plt.xml file default value from * plt.xml file
codetemprac codetransrad codetremp codevar codgelflo codgeljuv codgellev codgellev codgelveg codlainet	option to calculate thermal time for root growth (1 = crop temperature, 2 = soil temperature) option of simulating radiation interception (1 = Beer's law, 2 = radiative transfer) option to activate heat effect on grain filling (1 = yes, 2 = no) cultivar name option to activate frost effect at anthesis (1 = no, 2 = yes) option to activate frost effect on LAI at the juvenile stage (1 = no, 2 = yes) option to activate frost effect on plantlet (1 = no, 2 = yes) option to activate frost effect on LAI at adult stage (1 = no, 2 = yes) option to activate frost effect on LAI at adult stage (1 = no, 2 = yes) option of calculation of the LAI (1 : direct LAInet, 2 : LAInet = gross LAI - senescent LAI)	(code 1/2) (code 1/2) (code 1/2) (SD) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2)	* plt.xml file default value from * plt.xml file	default value from * plt.xml file default value from * plt.xml file
codetemprac codetransrad codetremp codevar codgelflo codgelflo codgelluv codgellev codgelveg codtranet codtrophrac	option to calculate thermal time for root growth (1 = crop temperature, 2 = soil temperature) option of simulating radiation interception (1 = Beer's law, 2 = radiative transfer) option to activate heat effect on grain filling (1 = yes, 2 = no) cultivar name option to activate frost effect at anthesis (1 = no, 2 = yes) option to activate frost effect on LAI at the juvenile stage (1 = no, 2 = yes) option to activate frost effect on plantlet (1 = no, 2 = yes) option to activate frost effect on LAI at adult stage (1 = no, 2 = yes) option to activate frost effect on LAI at adult stage (1 = no, 2 = yes) option of calculation of the LAI (1 : direct LAInet, 2 : LAInet = gross LAI - senescent LAI) trophic effect on root length growth (1 = permanent link, 2 = link by thresholds, 3 = no effect)	(code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2)	• plt.xml file default value from * plt.xml file	default value from * plt.xml file default value from * plt.xml file
codetemprac codetransrad codetremp codevar codgelflo codgeljuv codgellev codgellev codgelveg codlainet	option to calculate thermal time for root growth (1 = crop temperature, 2 = soil temperature) option of simulating radiation interception (1 = Beer's law, 2 = radiative transfer) option to activate heat effect on grain filling (1 = yes, 2 = no) cultivar name option to activate frost effect at anthesis (1 = no, 2 = yes) option to activate frost effect on LAI at the juvenile stage (1 = no, 2 = yes) option to activate frost effect on plantlet (1 = no, 2 = yes) option to activate frost effect on LAI at adult stage (1 = no, 2 = yes) option to activate frost effect on LAI at adult stage (1 = no, 2 = yes) option of calculation of the LAI (1 : direct LAInet, 2 : LAInet = gross LAI - senescent LAI)	(code 1/2) (code 1/2) (code 1/2) (SD) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2)	• ptl.xml file default value from * ptl.xml file	default value from * plt.xml file default value from * plt.xml file
codetemprac codetransrad codetremp codevar codgelflo codgelflo codgelluv codgellev codgelveg codtranet codtrophrac	option to calculate thermal time for root growth (1 = crop temperature, 2 = soil temperature) option of simulating radiation interception (1 = Beer's law, 2 = radiative transfer) option to activate heat effect on grain filling (1 = yes, 2 = no) cultivar name option to activate frost effect at anthesis (1 = no, 2 = yes) option to activate frost effect on LAI at the juvenile stage (1 = no, 2 = yes) option to activate frost effect on lantlet (1 = no, 2 = yes) option to activate frost effect on LAI at adult stage (1 = no, 2 = yes) option to activate frost effect on LAI at adult stage (1 = no, 2 = yes) option of calculation of the LAI (1 : direct LAInet, 2 : LAInet = gross LAI - senescent LAI) trophic effect on root length growth (1 = permanent link, 2 = link by thresholds, 3 = no effect) multiplier coefficient of the development phase AMF (maximum acceleration of leaf growth, end of juvenile phase) - LAX (maximum leaf area index, end of leaf growth) to use crop temperature multiplier coefficient of the development phase DRP (starting date of filling of harvested	(code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2)	* ptl.xml file default value from * ptl.xml file	default value from * plt.xml file default value from * plt.xml file
codetemprac codetremp codevar codevar codgelflo codgeljuv codgellev codgellev codgelveg codlainet coddrophrac coefamflax	option to calculate thermal time for root growth (1 = crop temperature, 2 = soil temperature) option of simulating radiation interception (1 = Beer's law, 2 = radiative transfer) option to activate heat effect on grain filling (1 = yes, 2 = no) cultivar name option to activate frost effect at anthesis (1 = no, 2 = yes) option to activate frost effect on LAI at the juvenile stage (1 = no, 2 = yes) option to activate frost effect on LAI at the juvenile stage (1 = no, 2 = yes) option to activate frost effect on LAI at adult stage (1 = no, 2 = yes) option to activate frost effect on LAI at adult stage (1 = no, 2 = yes) option of calculation of the LAI (1 : direct LAInet, 2 : LAInet = gross LAI - senescent LAI) trophic effect on root length growth (1 = permanent link, 2 = link by thresholds, 3 = no effect) multiplier coefficient of the development phase DRP (starting date of filling of harvested organs) - MAT to use crop temperature multiplier coefficient of the development phase FLO (anthesis) - DRP (starting date of filling	(code 1/2) (code 1/2) (code 1/2) (SD) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2)	* plt.xml file default value from * plt.xml file	default value from * plt.xml file default value from * plt.xml file
codetemprac codetransrad codetremp codevar codgelflo codgeljuv codgeljuv codgellev codgelveg codlainet codforphrac coefamflax coefdrpmat	option to calculate thermal time for root growth (1 = crop temperature, 2 = soil temperature) option of simulating radiation interception (1 = Beer's law, 2 = radiative transfer) option to activate heat effect on grain filling (1 = yes, 2 = no) cultivar name option to activate frost effect at anthesis (1 = no, 2 = yes) option to activate frost effect on LAI at the juvenile stage (1 = no, 2 = yes) option to activate frost effect on LAI at the juvenile stage (1 = no, 2 = yes) option to activate frost effect on LAI at adult stage (1 = no, 2 = yes) option to activate frost effect on LAI at adult stage (1 = no, 2 = yes) option of calculation of the LAI (1 : direct LAInet, 2 : LAInet = gross LAI - senescent LAI) trophic effect on root length growth (1 = permanent link, 2 = link by thresholds, 3 = no effect) multiplier coefficient of the development phase AMF (maximum acceleration of leaf growth, end of juvenile phase) - LAX (maximum leaf area index, end of leaf growth) to use crop temperature multiplier coefficient of the development phase DRP (starting date of filling of harvested organs) - MAT to use crop temperature multiplier coefficient of the development phase LAX (maximum leaf area index, end of leaf multiplier coefficient of the development phase LAX (maximum leaf area index, end of leaf	(code 1/2) (code 1/2) (code 1/2) (SD) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (code 1/2) (SD)	* ptl.xml file default value from * ptl.xml file	default value from * plt.xml file default value from * plt.xml file
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dfolbas	minimal foliar density within the considered shape	$(m^2 \text{ leaf} \cdot m^{-3})$	default value from	default value from
dfolhaut	maximal foliar density within the considered shape	(m ² leaf·m ⁻³)	*_plt.xml file default value from	*_plt.xml file default value from
dfpf	parameter of the first potential growth phase of fruit, corresponding to an exponential type	(SD)	*_plt.xml file default value from	*_plt.xml file default value from
dlaimax	function describing the cell division phase maximum rate of the setting up of LAI	(m ² leaf-plant ⁻¹ ·degree-d ⁻¹)	*_plt.xml file default value from	*_plt.xml file default value from
	maximum rate of the setting up of LAI	(m ² leaf-plant ⁻¹ ·degree-d ⁻¹)	*_plt.xml file	*_plt.xml file
dlaimaxbrut			default value from *_plt.xml file	default value from *_plt.xml file
dlaimin	accelerating parameter for the lai growth rate	(SD)	default value from *_plt.xml file	default value from *_plt.xml file
dltamsmaxsen	threshold value of growth rate from which there is no more photoperiodic effect on senescence	(t-ha ⁻¹ ·d ⁻¹)	default value from *_plt.xml file	default value from *_plt.xml file
dltamsminsen	threshold value of growth rate from which the photoperiodic effect on senescence is maximal	$(t \cdot ha^{-1} \cdot d^{-1})$	default value from *_plt.xml file	default value from *_plt.xml file
draclong	maximum rate of root length production per plant	(cm·plant ⁻¹ ·degree-d ⁻¹)	default value from *_plt.xml file	default value from *_plt.xml file
dureefruit	total growth period of a fruit at the setting stage to the physiological maturity	(degree-d)	default value from *_plt.xml file	default value from *_plt.xml file
durvieF	maximal lifespan of an adult leaf expressed in summation of Q10=2 (2**(T-Tbase))	(SD)	default value from *_plt.xml file	default value from *_plt.xml file
durviesupmax	relative additional lifespan due to N excess in plant (INN > 1)	(SD)	default value from *_plt.xml file	default value from *_plt.xml file
efcroijuv	maximum radiation use efficiency during the juvenile phase(LEV=emergence - AMF= maximum acceleration of leaf growth, end of juvenile phase)	(g·MJ ⁻¹)	default value from *_plt.xml file	default value from *_plt.xml file
efcroirepro	maximum radiation use efficiency during the grain filling phase (DRP= starting date of filling of harvested organs - MAT= maturity)	(g·MJ ^{−1})	default value from *_plt.xml file	default value from *_plt.xml file
efcroiveg	maximum radiation use efficiency during the vegetative stage (AMF = maximum acceleration	(g·MJ ^{·1})	default value from	default value from
elmax	of leaf growth, end of juvenile phase - DRP=starting date of filling of harvested organs) maximum elongation of the coleoptile in darkness condition	(cm)	*_plt.xml file default value from	*_plt.xml file default value from
envfruit	fraction of envelop in grainmaxi (w:w)	(SD)	*_plt.xml file default value from	*_plt.xml file default value from
extin	extinction coefficient of photosynthetic active radiation in the canopy	(SD)	*_plt.xml file default value from	*_plt.xml file default value from
fixmax	maximal N symbiotic fixation rate	(kg·ha ⁻¹ ·d ⁻¹)	*_plt.xml file default value from	*_plt.xml file default value from
fixmaxgr	maximal N symbiotic fixation rate per unit of grain growth rate	(kg·t ⁻¹)	*_plt.xml file default value from	*_plt.xml file default value from
			*_plt.xml file default value from	*_plt.xml file default value from
fixmaxveg	maximal N symbiotic fixation rate per unit of vegetative growth rate	(kg·t ⁻¹)	*_plt.xml file	*_plt.xml file
forme	option to define the shape of leaf density profile (1 = rectangle, 2 = triangle)	(code 1/2)	default value from *_plt.xml file	default value from *_plt.xml file
h2ofeuiljaune	water content of yellow leaves (relative to fresh matter)	(g·g ⁻¹ FW)	default value from *_plt.xml file	default value from *_plt.xml file
h2ofeuilverte	water content of green leaves (relative to fresh matter)	(g⋅g ⁻¹ FW)	default value from *_plt.xml file	default value from *_plt.xml file
h2ofrvert	water content of fruits before the beginning of dehydration (DEBDESHYD) (/fresh matter)	(g·g ⁻¹ FW)	default value from *_plt.xml file	default value from *_plt.xml file
h2oreserve	reserve water content (/fresh matter)	$(g \cdot g^{-1} FW)$	default value from *_plt.xml file	default value from *_plt.xml file
h2otigestruc	structural stem part water content (/fresh matter)	(g.g-1 FW)	default value from *_plt.xml file	default value from *_plt.xml file
hautbase	basal height of crop	(m)	default value from *_plt.xml file	default value from *_plt.xml file
hautmax	maximum height of crop	(m)	default value from *_plt.xml file	default value from *_plt.xml file
idebdorm	day of the dormancy entrance	julian.d	default value from	default value from
ifindorm	day of dormancy break	julian.d	*_plt.xml file default value from	*_plt.xml file default value from
inflomax	maximal number of inflorescences per plant	SD	*_plt.xml file default value from	*_plt.xml file default value from
infrecouv	ulai at the stage AMF (maximal rate of leaf growth)	SD	*_plt.xml file default value from	*_plt.xml file default value from
inngrain l	minimal INN for net absorption of N during grain filling	SD	*_plt.xml file default value from	*_plt.xml file default value from
inngrain2	INN minimal for null net absorption of N during grain filling	SD	*_plt.xml file default value from	*_plt.xml file default value from
INNimin	INNI (instantaneous INN) corresponding to INNmin	SD	*_plt.xml file default value from	*_plt.xml file default value from
INNmin	minimum value of INN possible for the crop	SD	*_plt.xml file default value from	*_plt.xml file default value from
		SD	*_plt.xml file	*_plt.xml file
innsen	parameter of the N stress function active on senescence (INNsenes), bilinear function vs INN passing through the point (INNmin, INNsen)		default value from *_plt.xml file	default value from *_plt.xml file
innturgmin	parameter of the N stress function active on leaf expansion (INNLAI), bilinear function vs INN passing through the point (INNmin, INNturgmin)	SD	default value from *_plt.xml file	default value from *_plt.xml file
irmax	maximum harvest index	SD	default value from *_plt.xml file	default value from *_plt.xml file
julvernal	day of initiation of vernalisation in perennial crops (between 1 and 365)	julian.d	default value from *_plt.xml file	default value from *_plt.xml file
jvc	number of vernalising days	d	default value from *_plt.xml file	default value from *_plt.xml file
jvemini	minimum number of vernalising days	d	default value from *_plt.xml file	default value from *_plt.xml file
Kmabs1	affinity constant of N uptake by roots for the fast uptake system	µmole.L-1	default value from *_plt.xml file	default value from *_plt.xml file
Kmabs2	affinity constant of N uptake by roots for the low uptake system	µmole.L-1	default value from *_plt.xml file	default value from * plt.xml file
kmax	maximum crop coefficient for water requirements (= MET/PET)	SD	default value from	default value from
krepracperm	parameter of biomass root partitioning : evolution of the ratio root/total (permanent trophic	SD	*_plt.xml file default value from	*_plt.xml file default value from
krepracseu	link) parameter of biomass root partitioning : evolution of the ratio root/total (trophic link by	SD	*_plt.xml file default value from	*_plt.xml file default value from
kstemflow	thresholds) extinction coefficient connecting LAI to stemflow	*	*_plt.xml file default value from	*_plt.xml file default value from
ktrou	extinction coefficient of PAR through the crop (used in the radiative transfer module)	*	*_plt.xml file default value from	*_plt.xml file default value from
laicomp	LAI above which competition between plants starts	m2.m-2	*_plt.xml file default value from	*_plt.xml file default value from
laiplantule	LAI of plantlet at the plantation	m2.m-2	*_plt.xml file default value from	*_plt.xml file default value from
longsperac	specific root length	cm.g-1	*_plt.xml file default value from	*_plt.xml file default value from
			*_plt.xml file	*_plt.xml file
lvfront	root density at the root apex	cm.cm-3	default value from *_plt.xml file	default value from *_plt.xml file
masecmeta	biomass of the plantlet supposed to be composed of metabolic N	t.ha-1	default value from *_plt.xml file	default value from *_plt.xml file
masecNmax	aerial biomass above which N dilution occurs (critical and maximal curves)	t.ha-1	default value from *_plt.xml file	default value from *_plt.xml file
masecplantule	initial shoot biomass of plantlet	t.ha-1	default value from *_plt.xml file	default value from *_plt.xml file

minore	minand Magna antimizer in self-balance which as strength in a local	ha ha 1 am 1	defealt as her for	default in the form
minazorac	mineral N concentration in soil below which root growth is reduced	kg.ha-1.cm-1	default value from *_plt.xml file	default value from *_plt.xml file
minefnra	reduction factor on root growth when soil mineral N is limiting (< minazorac)	SD	default value from *_plt.xml file	default value from *_plt.xml file
mouillabil	maximum wettability of leaves	mm.LAI-1	default value from *_plt.xml file	default value from *_plt.xml file
nbfeuilplant	leaf number per plant when planting	nb pl-1	default value from *_plt.xml file	default value from *_plt.xml file
nbfgellev	leaf number at the end of the juvenile phase (frost sensitivity)	nb pl-1	default value from *_plt.xml file	default value from *_plt.xml file
nbgrmax	maximum number of fruits per surface area	nb.m-2	default value from *_plt.xml file	default value from *_plt.xml file
nbgrmin	minimum number of fruits per surface area	nb.m-2	default value from	default value from
nbinflo	imposed number of inflorescences per plant	nb.pl-1	*_plt.xml file default value from	*_plt.xml file default value from
nbjgerlim	maximum number of days after grain imbibition allowing full germination	d	*_plt.xml file default value from	*_plt.xml file default value from
nbjgrain	number of days used to compute the number of viable grains	d	*_plt.xml file default value from	*_plt.xml file default value from
nboite	number of boxes or age classes of fruits used to calculate fruit growth for undeterminate crops	SD	*_plt.xml file default value from	*_plt.xml file default value from
nlevlim1	number of days after germination after which plant emergence is reduced	d	*_plt.xml file default value from	*_plt.xml file default value from
nlevlim2	number of days after germination after which plant emergence is impossible	d	*_plt.xml file default value from	*_plt.xml file default value from
Nmeta	proportion of metabolic N in the plantlet	%	*_plt.xml file default value from	*_plt.xml file default value from
			<pre>*_plt.xml file</pre>	*_plt.xml file
Nreserve	maximal amount of N in plant reserves (difference between the maximal and critical dilution curves) (percentage of aerial biomass)	%	default value from *_plt.xml file	default value from *_plt.xml file
parazofmorte	parameter relating the C/N of dead leaves and the INN	SD	default value from *_plt.xml file	default value from *_plt.xml file
pentinflores	parameter used to calculate the inflorescences number	10*inflo*kg-1	default value from *_plt.xml file	default value from *_plt.xml file
pentlaimax	parameter of the logistic curve of LAI growth	SD	default value from *_plt.xml file	default value from *_plt.xml file
pentrecouv	parameter of the logistic curve of soil cover rate	SD	default value from *_plt.xml file	default value from *_plt.xml file
pgrainmaxi	maximum grain weight (at 0% water content)	g	default value from *_plt.xml file	default value from *_plt.xml file
phobase	basal photoperiod	hours	default value from *_plt.xml file	default value from *_plt.xml file
phobasesen	photoperiod under which the photoperiodic stress affects the lifespan of leaves	hours	default value from	default value from
phosat	saturating photoperiod	hours	*_plt.xml file default value from	*_plt.xml file default value from
phyllotherme	thermal duration between the apparition of two successive leaves on the main stem	degree-d	*_plt.xml file default value from	*_plt.xml file default value from
potgermi	soil water potential under which seed imbibition is impeded	MPa	*_plt.xml file default value from	*_plt.xml file default value from
profnod	maximum depth of N2 fixation by legume crops	cm	*_plt.xml file default value from	*_plt.xml file default value from
propjgermin	minimal proportion of the duration nbjgerlim when the temperature is higher than the	%	*_plt.xml file default value from	*_plt.xml file default value from
	temperature threshold Tdmax	bars	*_plt.xml file default value from	*_plt.xml file default value from
psisto	potential of stomatal closing (absolute value)		<pre>*_plt.xml file</pre>	*_plt.xml file
psiturg	potential of the beginning of decrease of the cellular extension (absolute value)	bars	default value from *_plt.xml file	default value from *_plt.xml file
q10	Q10 used for the dormancy break calculation	SD	default value from *_plt.xml file	default value from *_plt.xml file
rapforme	ratio of thickness to /width of the crop shape (negative when the base of the form < top)	SD	default value from *_plt.xml file	default value from *_plt.xml file
rapsenturg	threshold soil water content active to simulate water senescence stress as a proportion of the turgor stress	SD	default value from * plt.xml file	default value from * plt.xml file
ratiodurvieI	life span of early leaves expressed as a fraction of the life span of the last leaves emitted DURVIEF	SD	default value from * plt.xml file	default value from * plt.xml file
ratiosen	fraction of senescent biomass (relative to total biomass)	SD	default value from * plt.xml file	default value from * plt.xml file
remobres	fraction of daily remobilisable C reserves	SD	default value from * plt.xml file	default value from * plt.xml file
repracpermax	maximum root biomass relative to total biomass (permanent trophic link)	SD	default value from	default value from
repracpermin	minimum root biomass relative to total biomass (permanent trophic link)	SD	*_plt.xml file default value from	*_plt.xml file default value from
repracseumax	maximum root biomass relative to total biomass (trophic link by thresholds)	SD	*_plt.xml file default value from	*_plt.xml file default value from
repracseumin	minimum root biomass relative to total biomass (trophic link by thresholds)	SD	*_plt.xml file default value from	*_plt.xml file default value from
rsmin	minimal stomatal resistance of leaves	s.m-1	*_plt.xml file default value from	*_plt.xml file default value from
sea	specific area of fruit envelops	cm2.g-1	*_plt.xml file default value from	*_plt.xml file default value from
sensanox	index of anoxia sensitivity (0 = insensitive)	SD	*_plt.xml file default value from	*_plt.xml file default value from
sensiphot	index of photoperiod sensitivity (1=insensitive)	SD	*_plt.xml file default value from	*_plt.xml file default value from
sensrec		SD	*_plt.xml file default value from	*_plt.xml file default value from
	index of root sensitivity to drought (1=insensitive)		*_plt.xml file	*_plt.xml file
slamax	maximum SLA (specific leaf area) of green leaves	cm2.g-1	default value from *_plt.xml file	default value from *_plt.xml file
slamin	minimum SLA (specific leaf area) of green leaves	cm2.g-1	default value from *_plt.xml file	default value from *_plt.xml file
spfrmax	maximal sources/sinks value allowing the trophic stress calculation for fruit onset	SD	default value from *_plt.xml file	default value from *_plt.xml file
spfrmin	minimal sources/sinks value allowing the trophic stress calculation for fruit onset	SD	default value from * plt.xml file	default value from * plt.xml file
splaimax	maximal sources/sinks value allowing the trophic stress calculation for leaf growing	SD	default value from * plt.xml file	default value from * plt.xml file
splaimin	minimal value of ratio sources/sinks for the leaf growth	SD	default value from * plt.xml file	default value from * plt.xml file
stadebbchamf	equivalent stage in BBCH-scale (amf= maximum acceleration of leaf growth, end of juvenile	SD	default value from	default value from
stadebbchdebdes	phase) equivalent stage in BBCH-scale (debdes= date of onset of water dynamics in harvested	SD	*_plt.xml file default value from	*_plt.xml file default value from
stadebbchdrp	organs) equivalent stage in BBCH-scale (drp = starting date of filling of harvested organs)	SD	*_plt.xml file default value from	*_plt.xml file default value from
stadebbchfindorm	equivalent stage in BBCH-scale (end of domancy)	SD	*_plt.xml file default value from	*_plt.xml file default value from
stadebbchflo	equivalent stage in BBCH-scale (flowering)	SD	*_plt.xml file default value from	*_plt.xml file default value from
stadebochiro	equivalent stage in BBCH-scale (germination)	SD	*_plt.xml file default value from	*_plt.xml file default value from
		SD	*_plt.xml file default value from	*_plt.xml file default value from
stadabbablar				
stadebbchlax stadebbchlev	equivalent stage in BBCH-scale (lax = maximum leaf area index, end of leaf growth) equivalent stage in BBCH-scale (emergence)	SD	*_plt.xml file default value from	*_plt.xml file default value from

stadebbchmat	equivalent stage in BBCH-scale (maturity)	SD	default value from	default value from
stadebbchnou	equivalent stage in BBCH-scale (fruit set)	SD	*_plt.xml file default value from	*_plt.xml file default value from
stadebbchplt	equivalent stage in BBCH-scale (sowing)	SD	*_plt.xml file default value from	*_plt.xml file default value from
statebochpa	equivalent stage in BBCH-scale (harvest)	SD	*_plt.xml file default value from	*_plt.xml file default value from
statebbchsen	equivalent stage in BBCH-scale (senescence)	SD	*_plt.xml file default value from	*_plt.xml file default value from
stanflax	cumulative thermal time between the stages AMF (maximum acceleration of leaf growth, end		*_plt.xml file default value from	*_plt.xml file default value from
	of juvenile phase) and LAX (maximum leaf area index, end of leaf growth)	degree-d	<pre>*_plt.xml file</pre>	*_plt.xml file
stdnofno	cumulative thermal time between the beginning and the end of nodulation	degree-d	default value from *_plt.xml file	default value from *_plt.xml file
stdordebour	cumulative thermal time between the dormancy break and the bud break	degree-d	default value from *_plt.xml file	default value from *_plt.xml file
stdrpdes	cumulative thermal time between the DRP stage (starting date of filling of harvested organs) and DEBDES (date of onset of water dynamics in harvested organs)	degree-d	default value from *_plt.xml file	default value from *_plt.xml file
stdrpmat	cumulative thermal time between the stages DRP (starting date of filling of harvested organs) and MAT (maturity)	degree-d	default value from *_plt.xml file	default value from *_plt.xml file
stdrpnou	cumulative thermal time between the stages DRP (starting date of filling of harvested organs) and NOU (end of setting)	degree-d	default value from *_plt.xml file	default value from *_plt.xml file
stemflowmax	maximal fraction of rainfall flowing down along the stems	SD	default value from *_plt.xml file	default value from *_plt.xml file
stflodrp	cumulative thermal time between FLO (anthesis) and DRP (starting date of filling of harvested organs) (only for indication)	degree-d	default value from *_plt.xml file	default value from *_plt.xml file
stfnofvino	cumulative thermal time between the end of the nodulation and the end of the nodule life	degree-d	default value from *_plt.xml file	default value from *_plt.xml file
stlaxsen	cumulative thermal time between the stages LAX (maximum leaf area index, end of leaf growth) and SEN (beginning of leaf senescence)	degree-d	default value from *_plt.xml file	default value from *_plt.xml file
stlevamf	cumulative thermal time between the stages LEV (emergence) and AMF (maximum	degree-d	default value from	default value from
stlevdno	acceleration of leaf growth, end of juvenile phase) cumulative thermal time between emergence and the beginning of nodulation	degree-d	*_plt.xml file default value from	*_plt.xml file default value from
stlevdrp	cumulative thermal time between the stages LEV (emergence) and DRP (starting date of	degree-d	*_plt.xml file default value from	*_plt.xml file default value from
stoprac	filling of harvested organs) stage when root growth stops (LAX= maximum leaf area index, end of leaf growth or	SD	*_plt.xml file default value from	*_plt.xml file default value from
stpltger	SEN=beginning of leaf senescence) cumulative thermal time allowing germination	degree-d	*_plt.xml file default value from	*_plt.xml file default value from
stressdev	maximum phasic delay allowed due to stresses	SD	*_plt.xml file default value from	*_plt.xml file default value from
stsenlan	cumulative thermal time between the stages SEN (beginning of leaf senescence) et LAN		*_plt.xml file default value from	*_plt.xml file default value from
tauxrecouvkmax		degree-d m2.m-2	*_plt.xml file default value from	*_plt.xml file default value from
	soil cover rate corresponding to the maximal crop coefficient for water requirement (plant surface / soil surface)		<pre>*_plt.xml file</pre>	*_plt.xml file
tauxrecouvmax	maximal soil cover rate (plant surface / soil surface)	m2.m-2	default value from *_plt.xml file	default value from *_plt.xml file
tcmax	maximum temperature at which growth ceases	degreeC	default value from *_plt.xml file	default value from *_plt.xml file
temin	minimum temperature at which growth ceases	degreeC	default value from *_plt.xml file	default value from *_plt.xml file
tcxstop	temperature beyond which foliar growth stops	degreeC	default value from *_plt.xml file	default value from *_plt.xml file
tdebgel	temperature below which frost affects plant growth	degreeC	default value from *_plt.xml file	default value from *_plt.xml file
tdmax	maximum temperature above which development stops	degreeC	default value from *_plt.xml file	default value from *_plt.xml file
tdmaxdeb	maximal temperature for hourly calculation of phasic duration between dormancy and bud	1 0		
tdmaxdeb		degreeC	<pre>default value from * plt.xml file</pre>	default value from * plt xml file
tdmaxdeb tdmin	maximal emperature for nourly calculation of prastic unation between domainly and out breaks minimum temperature below which development stops	degreeC	*_plt.xml file default value from	*_plt.xml file default value from
	breaks minimum temperature below which development stops minimal thermal threshold for hourly calculation of phasic duration between dormancy and		*_plt.xml file default value from *_plt.xml file default value from	*_plt.xml file default value from *_plt.xml file default value from
tdmin	breaks minimum temperature below which development stops	degreeC	*_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from	*_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from
tdmin tdmindeb	breaks minimum temperature below which development stops minimal thermal threshold for hourly calculation of phasic duration between dormancy and bud breaks	degreeC degreeC	* plt.xml file default value from * plt.xml file default value from * plt.xml file default value from * plt.xml file default value from	*_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from
tdmin tdmindeb temax	breaks minimum temperature below which development stops minimal thermal threshold for hourly calculation of phasic duration between dormancy and bud breaks maximal temperature above which plant growth stops	degreeC degreeC degreeC	*_plt.xml file default value from * plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file	*_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file
tdmin tdmindeb temax temin	breaks minimum temperature below which development stops minimum temperature below which development stops minimal thermal threshold for hourly calculation of phasic duration between dormancy and bud breaks maximal temperature above which plant growth stops minimum temperature for development	degreeC degreeC degreeC degreeC	*_plt.xml file default value from *_plt.xml file	* plt.xml file default value from *_plt.xml file
tdmin tdmindeb temax temin tempdeshyd	breaks minimum temperature below which development stops minimum temperature below which development stops minimal thermal threshold for hourly calculation of phasic duration between dormancy and bud breaks maximal temperature above which plant growth stops minimum temperature for development increase in fruit dehydration rate due to the increase in crop temperature (Tcult-Tair)	degreeC degreeC degreeC degreeC % water.degreeC-1	* plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file	* plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file default value from *_plt.xml file
tdmin tdmindeb temax temin tempdeshyd tempnol1	breaks minimum temperature below which development stops minimum temperature below which development stops minimal thermal threshold for hourly calculation of phasic duration between dormancy and bud breaks maximal temperature above which plant growth stops minimum temperature for development increase in fruit dehydration rate due to the increase in crop temperature (Tcult-Tair) temperature parameter (1/4) used to calculate N fixation by legumes	degreeC degreeC degreeC degreeC % water.degreeC-1 degreeC	• plt.xml file default value from • plt.xml file	* plt.xml file default value from * plt.xml file
tdmin tdmindeb temax temin tempdeshyd tempnod1 tempnod2	breaks minimum temperature below which development stops minimum temperature below which development stops minimal thermal threshold for hourly calculation of phasic duration between dormancy and bud breaks maximal temperature above which plant growth stops minimum temperature for development increase in fruit dehydration rate due to the increase in crop temperature (Tcult-Tair) temperature parameter (1/4) used to calculate N fixation by legumes temperature parameter (2/4) used to calculate N fixation by legumes	degreeC degreeC degreeC degreeC % water.degreeC-1 degreeC degreeC	• plt.xml file default value from • plt.xml file	* plt.xml file default value from * plt.xml file
tdmin tdmindeb temax temin tempnod1 tempnod2 tempnod3	breaks minimum temperature below which development stops minimal thermal threshold for hourly calculation of phasic duration between dormancy and bud breaks maximal temperature above which plant growth stops minimum temperature for development increase in fruit dehydration rate due to the increase in crop temperature (Tcult-Tair) temperature parameter (1/4) used to calculate N fixation by legumes temperature parameter (2/4) used to calculate N fixation by legumes temperature parameter (3/4) used to calculate N fixation by legumes	degreeC degreeC degreeC degreeC % water.degreeC-1 degreeC degreeC degreeC	• plt.xml file default value from • plt.xml file of fault value from • plt.xml file default value from • plt.xml file	* plt.xml file default value from * plt.xml file
tdmin tdmindeb temax temin tempdeshyd tempnod1 tempnod2 tempnod4 teopt	breaks minimum temperature below which development stops minimum temperature below which development stops minimal thermal threshold for hourly calculation of phasic duration between dormancy and bud breaks maximal temperature above which plant growth stops minimum temperature for development increase in fruit dehydration rate due to the increase in crop temperature (Tcult-Tair) temperature parameter (1/4) used to calculate N fixation by legumes temperature parameter (3/4) used to calculate N fixation by legumes temperature parameter (4/4) used to calculate N fixation by legumes temperature parameter (4/4) used to calculate N fixation by legumes temperature parameter (4/2) for plant growth	degreeC degreeC degreeC degreeC % water.degreeC-1 degreeC degreeC degreeC degreeC degreeC	• plt.xml file default value from * plt.xml file	* plt.xml file default value from * plt.xml file
tdmin tdmindeb temax temin tempdeshyd tempnod1 tempnod2 tempnod3 tempnod4 teopt teoptbis	breaks minimum temperature below which development stops minimum temperature below which development stops minimal thermal threshold for hourly calculation of phasic duration between dormancy and bud breaks maximal temperature above which plant growth stops minimum temperature of development increase in fruit dehydration rate due to the increase in crop temperature (Tcult-Tair) temperature parameter (1/4) used to calculate N fixation by legumes temperature parameter (3/4) used to calculate N fixation by legumes temperature parameter (3/4) used to calculate N fixation by legumes temperature parameter (4/4) used to calculate N fixation by legumes temperature parameter (3/2) for plant growth optimal temperature (2/2) for plant growth	degreeC degreeC degreeC degreeC % water.degreeC-1 degreeC degreeC degreeC degreeC degreeC degreeC degreeC	• ptl.xml file default value from * ptl.xml file	* plt.xml file default value from * plt.xml file
tdmin tdmindeb temax temin temphod1 tempnod2 tempnod4 teopt teoptbis tfroid	breaks minimum temperature below which development stops minimum temperature below which development stops minimal thermal threshold for hourly calculation of phasic duration between dormancy and bud breaks maximal temperature above which plant growth stops minimum temperature for development increase in fruit dehydration rate due to the increase in crop temperature (Tcult-Tair) temperature parameter (1/4) used to calculate N fixation by legumes temperature parameter (3/4) used to calculate N fixation by legumes temperature parameter (4/4) used to calculate N fixation by legumes temperature parameter (4/4) used to calculate N fixation by legumes temperature parameter (4/2) for plant growth optimal temperature (2/2) for plant growth optimal temperature for vernalisation	degreeC degreeC degreeC degreeC % water.degreeC-1 degreeC degreeC degreeC degreeC degreeC degreeC degreeC degreeC degreeC	• ptl.xml file default value from • ptl.xml file	* ptl.xml file default value from * ptl.xml file
tdmin tdmindeb temax temin temphodshyd tempnod1 tempnod2 tempnod4 teopt teoptbis tfroid tgelflo10	breaks minimum temperature below which development stops minimum temperature below which development stops minimal thermal threshold for hourly calculation of phasic duration between dormancy and bud breaks maximal temperature above which plant growth stops minimum temperature for development increase in fruit dehydration rate due to the increase in crop temperature (Tcult-Tair) temperature parameter (1/4) used to calculate N fixation by legumes temperature parameter (3/4) used to calculate N fixation by legumes temperature parameter (4/4) used to calculate N fixation by legumes temperature parameter (4/4) used to calculate N fixation by legumes temperature parameter (1/2) for plant growth optimal temperature (2/2) for plant growth optimal temperature for vernalisation temperature resulting in 10% of frost damages on flowers and fruits	degreeC degreeC degreeC % water.degreeC-1 degreeC degreeC degreeC degreeC degreeC degreeC degreeC degreeC degreeC degreeC degreeC	• ptl.xml file default value from * ptl.xml file	* ptl.xml file default value from * ptl.xml file
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	vitirazo	rate of increase of the N harvest index vs time	g grain.g-1.d-1	default value from *_plt.xml file	default value from *_plt.xml file
	vitircarb	rate of increase of the C harvest index vs time	g grain.g-1.d-1	default value from *_plt.xml file	default value from *_plt.xml file
	vitircarbT	rate of increase of the C harvest index vs thermal time	g grain.g-1.d-1	default value from * plt.xml file	default value from * plt.xml file
	vitno	rate of nodule onset expressed as a proportion of fixmax per degree day	degree-d-1	default value from	default value from * plt.xml file
	vitprophuile	rate of increase of oil harvest index vs time	g oil.g-1.d-1	*_plt.xml file default value from	default value from
	vitpropsucre	rate of increase of sugar harvest index vs time	g sugar.g-1.d-1	*_plt.xml file default value from	*_plt.xml file default value from
	vlaimax	ulai at the inflexion point of the function DELTAI=f(ULAI)	SD	*_plt.xml file default value from	*_plt.xml file default value from
				*_plt.xml file	*_plt.xml file
	Vmax1	maximum specific N uptake rate with the low affinity transport system	ĵmole.cm-1 h-1	default value from *_plt.xml file	default value from *_plt.xml file
	Vmax2	maximum specific N uptake rate with the high affinity transport system	µmole.cm-1 h-1	default value from *_plt.xml file	default value from *_plt.xml file
	zlabour	depth of ploughing (reference profile)	cm	default value from * plt.xml file	default value from * plt.xml file
	zpente	depth at which root density is 50% of the surface root density (reference profile)	cm	default value from	default value from
	zprlim	maximum depth of the root profile (reference profile)	cm	*_plt.xml file default value from	*_plt.xml file default value from
	zracplantule	initial depth of root apex of the plantlet	cm	*_plt.xml file default value from	*_plt.xml file default value from
	··· I ··· ··	LOCAL PARAMETERS		*_plt.xml file	*_plt.xml file
Soil parameters	albedo	albedo of the bare dry soil	SD	default value from	default value from
(sols.xml)	argi	clay content after decarbonation	%	sols.xml file +	sols.xml file default value from
	cailloux	volumetric content of pebbles per soil layer	m3.m-3	default value from	sols.xml file default value from
		total carbonate content	%	sols.xml file	sols.xml file
	calc capiljour	capillary rise upward water flux	% mm.d-1	+ default value from	+ default value from
	cfes	parameter defining the soil contribution to evaporation versus depth	SD	sols.xml file default value from	sols.xml file default value from
	codecailloux	option to take into account pebbles in the water and N balances (1 = yes, 2 = no,)	code 0/1	sols.xml file default value from	sols.xml file default value from
				sols.xml file	sols.xml file
	codedenit	option to activate the calculation of denitrification model (1 = yes, 2 = no)	code 1/2	default value from sols.xml file	default value from sols.xml file
	codefente	option to activate an additional water compartment for swelling soils (1 = yes, 2 = no)	code 0/1	default value from sols.xml file	default value from sols.xml file
	codemacropor	option to activate calculation of water flux in soil macroporosity (1 = yes, 2 = no)	code 0/1	default value from sols.xml file	default value from sols.xml file
	codenitrif	option to activate nitrification rate model (1 = yes, 2 = no)	code 1/2	default value from	default value from
	coderemontcap	option to activate capillary rise $(1 = yes, 2 = no)$	code 1/2	sols.xml file default value from	sols.xml file default value from
	codrainage	option to simulate artificial drainage (1 = yes, no = 2)	code 1/2	sols.xml file default value from	sols.xml file default value from
				sols.xml file	sols.xml file
	concseuil	minimum concentration of HNO3 in soil	kg.ha-1 mm-1	default value from sols.xml file	default value from sols.xml file
	CsurNsol	Initial C to N ratio of soil humus	SD	default value from sols.xml file	default value from sols.xml file
	DAF ecartdrain	bulk density of fine earth fraction in each soil layer distance between mole drains	g.cm-3 cm	+ default value from	+ default value from
				sols.xml file	sols.xml file
	epc	thickness of each soil layer	cm	default value from sols.xml file	default value from sols.xml file
	epd	thickness of mixing cells in each soil layer (= 2 * dispersion length)	cm	default value from sols.xml file	default value from sols.xml file
	hccf	gravimetric water content at field capacity of each soil layer (/fine earth)	% w	+	default value from sols.xml file
	hminf	gravimetric water content at wilting point of each soil layer (/fine earth)	% w	+	default value from
	humcapil	threshold of soil gravimetric water content under which capillary rise occurs	% w	default value from	sols.xml file default value from
	infil	infiltrability rate at the base of each soil layer (if codemacropor = 1)	mm.d-1	sols.xml file default value from	sols.xml file default value from
	ksol	soil hydraulic conductivity in the vicinity of mole drains	SD	sols.xml file default value from	sols.xml file default value from
				sols.xml file	sols.xml file
	mulchbat	mulch depth from which a crust occurs (a value must be given but if in the plt.xml the vigueurbat parameter is equal to 1 then the parameter is inactive)	cm	default value from sols.xml file	default value from sols.xml file
	Norg	soil organic N content in the first soil layer (supposed constant down to the depth profhum), equal to total nitrogen (Kjeldahl method)	% dry soil	+	+
	numsol	soil number	SD	default value from	default value from
	obstarac	soil depth at which root growth is stopped due to physical constraints	cm	sols.xml file default value from	sols.xml file default value from
	penterui	runoff coefficient taking account for plant mulch	SD	sols.xml file default value from	sols.xml file default value from
	pH	Initial soil pH (water solution)	pH	sols.xml file	sols.xml file
	pri pluiebat	minimal amount of rain required to create a soil crust (a value must be given but if in the	mm.d-1	+ default value from	+ default value from
	profdenit	plt.xml the vigueurbat parameter is equal to 1 then the parameter is inactive) soil depth on which denitrification is active (if codedenit is activated)	cm	sols.xml file default value from	sols.xml file default value from
	profdrain	depth of mole drains	cm	sols.xml file default value from	sols.xml file default value from
		-		sols.xml file	sols.xml file
	profhum	maximum soil depth with an active biological activity (max.60 cm)	cm	default value from sols.xml file	default value from sols.xml file
	profimper	Upper depth of the impermeable layer (from the soil surface). May be greater than the soil depth.	cm	default value from sols.xml file	default value from sols.xml file
	q0	cumulative soil evaporation above which evaporation rate is decreased	mm	default value from sols.xml file	default value from sols.xml file
	ruisolnu	fraction of runoff (relative to total rainfall) in a bare soil	SD	default value from	default value from
	sol nom	Name of the soil defined in the soil file	(-)	sols.xml file default value from	sols.xml file default value from
	typecailloux	Pebbles type defined by a volumetric mass value (masvolx) and a field capacity moisture	SD	sols.xml file default value from	sols.xml file default value from
		value (HCCCX) only used if codecailloux=1. (typecailloux=1:Beauce limestone1, 2:Beauce limestone2, 3:Iutecian limestone, 4:Lutetian Brackish marl and limestone,5:Norainic gravels,6:Unweathered flint, sandstone or granite,7:weathered granite,8:Jurassic limestone,9:Pebbles from Magneraud, 0:Other pebbles)		sols.xml file	sols.xml file
	typsol vpotdenit	soil type	SD kg.ha-1.d-1	+ default value from	+ default value from
	vpotdenit	potential rate of denitrification for the whole denitrifying layer		sols.xml file	sols.xml file
	z0solnu	roughness length of bare soil	m	default value from sols.xml file	default value from sols.xml file
	zesx	maximal soil depth affected by soil evaporation	cm	default value from	default value from
				sols.xml file	sols.xml file

	fracN h2ograinmax	proportion of fertiliser N applied at each application maximal water content of fruits at harvest (/fresh matter)	% g.g-1 FW	+ default value from	+ default value
		5=ammonium sulfate, 6=ammonium phosphate, 7=calcium nitrate, 8= fixed efficiency fertiliser)			
ŀ	engrais	fertilizer type (1=ammonium nitrate, 2=UAN solution, 3=urea, 4=anhydrous ammonia,	*	Mais_tec.xml file	Mais_tec.xm +
ļ	effirr	irrigation efficiency	0-1 SD	Mais_tec.xml file default value from	Mais_tec.xm default value
ļ	eaures effeuil	water content of organic residue (relative to fresh weight) fraction of daily leaf removed at thinning	% FW 0-1	default value from Mais_tec.xml file default value from	default value Mais_tec.xm default value
ļ	dosimx	maximum water amount of irrigation authorised at each time step (mode automatic irrigation)	mm.d-1 % FW	default value from Mais_tec.xml file default value from	default value Mais_tec.xn default value
ļ	doseN	daily amount of N added through fertilizers	kg.d-1	default value from Mais_tec.xml file	default value Mais_tec.xn
ļ	doseirrigmin	minimal amount of irrigation	mm	default value from Mais_tec.xml file	default valu Mais_tec.xn
ļ	doseI	irrigation amount	mm.d-1	Mais_tec.xml file +	Mais_tec.xr +
ŀ	densitesem	plant sowing density	plants.m-2	Mais_tec.xml file default value from Mais_tec.xml file	Mais_tec.xr default valu
ŀ	dasemis	bulk density of soil after sowing	g.cm-3	Mais_tec.xml file default value from	Mais_tec.xi default valu
ŀ	darecolte	bulk density of soil after harvest	g.cm-3	Mais_tec.xml file default value from	Mais_tec.x default value
	dalabour	bulk density of soil after full inversion tillage (plough)	g.cm-3	Mais_tec.xml file default value from	Mais_tec.x
ŀ	dachisel	bulk density of soil after soil tillage (Chisel)	g.cm-3	Mais_tec.xml file default value from	Mais_tec.x default valu
ŀ	CsurNres	C/N ratio of residue	g.g-1	Mais_tec.xml file default value from	Mais_tec.x default valu
ŀ	Crespc	C content in organic residue	% FW	Mais_tec.xml file default value from	Mais_tec.xi default valu
ŀ	couvermulchplastique	fraction of soil covered by the plastic mulch	SD	Mais_tec.xml file default value from	Mais_tec.xi default valu
-	concirr	concentration of mineral N (NH4+NO3-N) in irrigation water	kg.ha-1 mm-1	Mais_tec.xml file default value from	Mais_tec.xi default valu
	codregnage	decision to harvest (1 = physiological maturity, 2 = water content, 5=sugar content, 4=nitrogen content, 5=oil content) option of foliage control by trimming (1 = no, 2 = yes)	code 1 to 5 code 1/2	default=1 default value from	default=1
ļ	codlocirrig	code of irrigation localisation: 1= above the foliage, 2= below the foliage above the soil, 3 = in the soil decision to harvest (1 = physiological maturity, 2 = water content, 3=sugar content,	code 1/2/3 code 1 to 5	default value from Mais_tec.xml file default=1	default val Mais_tec.x default=1
	codlocferti	option to code of fertilisation localisation (1 = at soil surface, 2 = in the soil)	code 1/2	default value from Mais_tec.xml file	default val Mais_tec.x
	codhauteff	option of leaf removal height (1 = bottom of the canopy, 2 = top of the canopy)	code 1/2	default value from Mais_tec.xml file	default valu Mais_tec.x
	codetradtec	description of crop structure with use of radiation transfer (1 =yes, 2 = no)	code1/2	default value from Mais_tec.xml file	default value Mais_tec.x
ļ	codetaille	option to activate pruning (1 = no, 2 = yes)	code 1/2	default value from Mais_tec.xml file	default val Mais_tec.x
	codestade	option to force one or several development stages (1 =yes, 2 = no)	code 1/2	default value from Mais_tec.xml file	default val Mais_tec.x
	coderes	residue type: 1=Main crop on surface, 2=Intermediate crop on surface, 3=Manure on surface, 4=Green compost on surface, 5=Sewage sludge on surface, 6=Vinase on surface, 7=Hom on surface, 8=Grapevine shoots on surface, 9=Others. I on surface, 01=Others.2 on surface, 11=Main crop ploughed in, 12=Intermediate crop ploughed in, 13=Manure ploughed in, 14=Green compost ploughed in, 15=Sewage sludge ploughed in, 16=Others.1 ploughed in, 17=Cattle horm ploughed in, 18=Grapevine shoots ploughed in, 19=Others.1 ploughed in, 20=Others.2 ploughed in, 21=Dead roots in soil	code 1 to 21	default value from Mais_tec.xml file	default valı Mais_tec.x
	coderecolteassoc	option to harvest intercrop species simultaneously, at the physiological maturity date of the earliest one (1 = no, 2 = yes)	code 1/2	default value from Mais_tec.xml file	default value Mais_tec.x
	codepalissage	option defining if the plant is fixed onto a vertical support (palissage) (1 = no, 2 =yes)	code 1/2	default value from Mais_tec.xml file	default val Mais_tec.x
	codepaillage	option: 1 = no cover, 2 = plastic cover partly covering the soil	code 1/2	default value from Mais_tec.xml file	default val Mais_tec.y
Ì	codemodfauche	option defining the cut mode (1 = automatic calculation depending on phenologic and trophic state, 2 = pre-established calendar in days, 3 = pre-established calendar in degree-days)	code 1/2/3	default value from Mais_tec.xml file	default val Mais_tec.y
	codefracappN	option to activate unmining (1 – nos, 2 – yes) option to activate splitting applications of N fertiliser (1 = absolute value, 2 = % of total value)	code 1/2	Mais_tec.xml file	Mais_tec.x
-	codeffeuil	option to activate cuts of forage crops (1 = yes, 2 = no) option to activate thinning (1 = nos, 2 = yes)	code 1/2	Mais_tec.xml file default value from	Mais_tec.x default val
ŀ	codefauche	option to activate the soil compaction at sowing and narvest (1 = yes, 2 = no) option to activate cuts of forage crops (1 = yes, 2 = no)	code 1/2 code 1/2	Mais_tec.xml file default value from	Mais_tec.x default val
	codeDSTnbcouche	number of compacted soil layers (1 = one layer, 2 = two layers) option to activate the soil compaction at sowing and harvest (1 = yes, 2 = no)	code 1/2 code 1/2	default value from Mais_tec.xml file default value from	default value Mais_tec.x default value
	codeDST	option to activate the variations in soil physical soil conditions due to tillage (1 = yes, 2 = no)	code 1/2	default value from Mais_tec.xml file	default val Mais_tec.x
	codedecisemis	option to activate the moisture effect on harvest decision (1 = yes, 2 = no)	code 1/2	default value from Mais_tec.xml file	default val Mais_tec.x
ĺ	codedecirecolte	option to activate moisture and frost effects on harvest decision (1 = yes, 2 = no)	code 1/2	default value from Mais_tec.xml file	default val Mais_tec.
ľ	codedateappN	mineral fertilizer application dates given as sum of temperatures (1 = yes, 2 = no)	code 1/2	default value from Mais_tec.xml file	default val Mais_tec.2
ľ	codedateappH2O	irrigation application dates given as sum of temperatures (1 = yes, 2 = no)	code 1/2	default value from Mais tec.xml file	default val Mais tec.x
	codeclaircie	option for the method of fruit removal (1 = no, 2 = yes for smallest fruits)	code 1/2	Mais_tec.xml file default value from Mais tec.xml file	Mais_tec.y default val Mais_tec.y
	codecalirrig	code to activate the automatic calculation of irrigation requirements (1 = yes, 2 = no)	code 1/2	Mais_tec.xml file default value from	Mais_tec.> default val
ŀ	codeaumin	option to activate the harvest as a function of grain/fruit water content	code 1/2	default value from	Mais_tec.x default val
	codcueille	option of harvest type (1 =single harvest (cutting), 2 = multiple harvests (picking))	code 1/2	Mais_tec.xml file +	Mais_tec.y default val
	codcalrogne	option of calculation of tipping (1 = forced topping, 2 = automatic calculation)	code 1/2	Mais_tec.xml file default value from	Mais_tec.>
	codcaleffeuil	option to activate cropping under shere (1 = no, 2 = yes) option for the method to use for the calculation of leaf removal (1 = no, 2 = yes)	code 1/2	Mais_tec.xml file default value from	Mais_tec.x default val
	CNgrainrec codabri	minimal N content of grain at harvest option to activate cropping under shelter (1 = no, 2 = yes)	SD code 1/2	default value from Mais_tec.xml file default value from	default val Mais_tec.x default val
	cadencerec	number of days between two harvests	d	default value from Mais_tec.xml file	default val Mais_tec.x
	biorognem	minimal biomass to be removed when topping (automatic calculation)	t.ha-1	default value from Mais_tec.xml file	default val Mais_tec.x

1				
hautmaxtec	maximal height of the plant allowed by the management	m	default value from Mais_tec.xml file	default value from Mais_tec.xml file
hautrogne	cutting height for trimmed plants	m	default value from Mais_tec.xml file	default value from Mais tec.xml file
huilerec	minimal oil content of fruits at harvest (/fresh matter)	g.g-1 FW	default value from	default value from
iamf	day of the stage AMF (maximal rate of leaf growth, end of juvenile phase) when the stage is	julian.d	Mais_tec.xml file default value from	Mais_tec.xml file default value from
idrp	observed (else 999) day of the stage DRP (beginning of grain filling) when the stage is observed (else 999)	julian.d	Mais_tec.xml file default value from	Mais_tec.xml file default value from
		-	Mais_tec.xml file	Mais_tec.xml file
iflo	day of anthesis	julian.d	default value from Mais_tec.xml file	default value from Mais_tec.xml file
ilan	day of the stage LAN () if the stage is observed (else 999)	julian.d	default value from Mais_tec.xml file	default value from Mais_tec.xml file
ilax	day of the stage LAX (maximal leaf area index) when the stage is observed (else 999)	julian.d	default value from	default value from
ilev	day of the stage LEV (emergence) when the stage is observed (else 999)	julian.d	Mais_tec.xml file default value from	Mais_tec.xml file default value from
imat	day of the stage MAT (physiological maturity) when the stage is observed (else 999)	julian.d	Mais_tec.xml file default value from	Mais_tec.xml file default value from
	width of the crop interrow		Mais_tec.xml file default value from	Mais_tec.xml file default value from
interrang		m	Mais_tec.xml file	Mais_tec.xml file
iplt0 irec	date of sowing date of harvest	julian.d julian.d	+ +	+ +
irecbutoir	latest date of harvest (imposed if the crop cycle is not finished at this date)	julian.d	default value from Mais_tec.xml file	default value from Mais_tec.xml file
isen	day of the stage SEN (beginning of net senescence) when the stage is observed (else 999)	julian.d	default value from	default value from
julapI	date(s) of irrigation	julian.d	Mais_tec.xml file +	Mais_tec.xml file +
julapN	date(s) of fertilizer application	julian.d	+	+
juleclair juleffeuil	day of fruits removal day of leaf removal	julian.d julian.d	+ default value from	+ default value from
julfauche	date(s) of each cut for forage crops	julian.d	Mais_tec.xml file	Mais_tec.xml file
julouvre2	day (1/2) of opening the shelter	julian.d	default value from	default value from
julouvre3	day (2/2) of opening the shelter	julian.d	Mais_tec.xml file default value from	Mais_tec.xml file default value from
julres	date(s) of organic residue addition to soil	julian.d	Mais_tec.xml file default value from	Mais_tec.xml file default value from
	day of plant trimming	-	Mais_tec.xml file	Mais_tec.xml file
julrogne		julian.d	default value from Mais_tec.xml file	default value from Mais_tec.xml file
jultaille	day of pruning	julian.d	default value from Mais_tec.xml file	default value from Mais_tec.xml file
jultrav	date(s) of soil tillage	julian.d	+	default value from Mais_tec.xml file
laidebeff	LAI of the beginning of leaf removal	m2.m-2	default value from	default value from
laieffeuil	LAI removed from the crop at day juleffeuil	m2.m-2	Mais_tec.xml file default value from	Mais_tec.xml file default value from
lairesiduel	residual LAI after each cut of forage crop	m2.m-2	Mais_tec.xml file default value from	Mais_tec.xml file default value from
			Mais_tec.xml file	Mais_tec.xml file
largrogne	trimmed width	m	default value from Mais_tec.xml file	default value from Mais_tec.xml file
largtec	technical width	m	default value from Mais_tec.xml file	default value from Mais_tec.xml file
locferti	soil depth at which fertiliser is applied	cm	default value from	default value from
locirrig	soil depth at which irrigation is applied	cm	Mais_tec.xml file default value from	Mais_tec.xml file default value from
margerogne	topping occurs when plant height exceeds (hautrogne+margerogne) when automatic trimming	m	Mais_tec.xml file default value from	Mais_tec.xml file default value from
mscoupemini	is activated minimum value of aerial biomass required to make a cut of forage crop	t.ha-1	Mais_tec.xml file default value from	Mais_tec.xml file default value from
			Mais_tec.xml file	Mais_tec.xml file
msresiduel	residual aerial biomass after a cut of a forage crop	t.ha-1	default value from Mais_tec.xml file	default value from Mais_tec.xml file
nbcueille nbinfloecl	number of fruit harvestings (1= one at the end, 2 = many during the cycle) number of inflorescences or fruits removed at fruit removal	code 1/2 nb.pl-1	+ default value from	+ default value from
			Mais_tec.xml file	Mais_tec.xml file
nbjmaxapresrecolte	maximal delay allowed for harvest (number of days) (if the soil compaction option is activated)	d	default value from Mais_tec.xml file	default value from Mais_tec.xml file
nbjmaxapressemis	maximal delay allowed for sowing (number of days) (if the soil compaction option is activated)	d	default value from Mais tec.xml file	default value from Mais_tec.xml file
nbjres	number of residue additions	d	default value from	default value from
nbjseuiltempref	number of days without frost for sowing (if sowing decision option is activated)	d	Mais_tec.xml file default value from	Mais_tec.xml file default value from
nbjtrav	number of tillage operations	SD	Mais_tec.xml file	Mais_tec.xml file
Nminres	proportion of N mineral content of organic residues (/fresh matter)	% FW	default value from Mais_tec.xml file	default value from Mais_tec.xml file
orientrang	direction of crop rows (relative to north)	rad	default value from	default value from
profhumrecolteuse	soil depth at which moisture is considered to allow harvesting (if soil compaction is activated)	cm	Mais_tec.xml file default value from	Mais_tec.xml file default value from
profhumsemoir	soil depth at which moisture is considered to allow sowing (if soil compaction is activated)	cm	Mais_tec.xml file default value from	Mais_tec.xml file default value from
			Mais_tec.xml file	Mais_tec.xml file
			default value from	default value from
profmes	depth of measurement of the soil water reserve	cm	Mais_tec.xml file	Mais_tec.xml file
profres	depth of measurement of the soil water reserve upper depth of organic residue incorporation	cm		Mais_tec.xml file default value from Mais_tec.xml file
			Mais_tec.xml file default value from Mais_tec.xml file default value from	default value from Mais_tec.xml file default value from
profres	upper depth of organic residue incorporation	cm	Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file default value from	default value from Mais_tec.xml file default value from Mais_tec.xml file default value from
profres profsem	upper depth of organic residue incorporation depth of sowing	cm cm	Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file default value from	default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file default value from
profres profsem profrav qres	upper depth of organic residue incorporation depth of sowing maximum depth of organic residue incorporation mass of organic residues added to soil (fresh weight)	cm cm cm t.ha-1	Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file	default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file
profres profsem proftrav	upper depth of organic residue incorporation depth of sowing maximum depth of organic residue incorporation	cm cm cm	Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file + default value from	default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file + default value from
profres profsem proftrav qres Qtot_N	upper depth of organic residue incorporation depth of sowing maximum depth of organic residue incorporation mass of organic residues added to soil (fresh weight) amount of total mineral N fertilizer applications water stress index below which irrigation is started in automatic mode (0 in manual mode) type of crop residue (roots or whole_crop or straw+roots or stubble+roots or	cm cm cm t.ha-1 kg.ha-1	Mais_tec.xml file default value from Mais_tec.xml file default value from	default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file + default value from Mais_tec.xml file default value from
profres profsem profrav qres Qtot_N ratiol ressuite	upper depth of organic residue incorporation depth of sowing maximum depth of organic residue incorporation mass of organic residues added to soil (fresh weight) amount of total mineral N fertilizer applications water stress index below which irrigation is started in automatic mode (0 in manual mode) type of crop residue (roots or whole_crop or straw+roots or stubble-roots or stubble_of_residu (type_9+roots or stubble_of_residu type_10+roots prunings)	cm cm t.ha-1 kg.ha-1 SD SD	Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file + default value from Mais_tec.xml file default value from Mais_tec.xml file	default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file + default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file
profres profsem proftrav qres Qtot_N ratiol ressuite rugochisel	upper depth of organic residue incorporation depth of sowing maximum depth of organic residue incorporation mass of organic residues added to soil (fresh weight) amount of total mineral N fertilizer applications water stress index below which irrigation is started in automatic mode (0 in manual mode) type of crop residue (roots or whole_crop or straw+roots or stubble+roots or stubble_of_residu_type_9+roots or stubble_of_residu_type_10+roots,prunings) roughness length of bare soil after chisel tillage (if soil compaction is activated)	cm cm tha-1 kg.ha-1 SD SD m	Mais_tec.xml file default value from Mais_tec.xml file	default value from Mais_tec.xml file default value from Mais_tec.xml file
profres profsem proftrav qres Qtot N ratiol ressuite rugochisel rugolabour	upper depth of organic residue incorporation depth of sowing maximum depth of organic residue incorporation mass of organic residues added to soil (fresh weight) amount of total mineral N fertilizer applications water stress index below which irrigation is started in automatic mode (0 in manual mode) type of crop residue (roots or whole_crop or straw+roots or stubble+roots or stubble_of_residu_type_9+roots or stubble_of residu_type_10+roots, prunings) roughness length of bare soil after chisel tillage (if soil compaction is activated) roughness length of bare soil after mouldboard ploughing (if soil compaction is activated)	cm cm cm t.ha-1 kg.ha-1 SD SD m m	Mais_tec.xml file default value from Mais_tec.xml file	default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file + default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file
profres profsem proftrav qres Qtot_N ratiol ressuite rugochisel	upper depth of organic residue incorporation depth of sowing maximum depth of organic residue incorporation mass of organic residues added to soil (fresh weight) amount of total mineral N fertilizer applications water stress index below which irrigation is started in automatic mode (0 in manual mode) type of crop residue (roots or whole_crop or straw+roots or stubble+roots or stubble_of_residu_type_9+roots or stubble_of_residu_type_10+roots,prunings) roughness length of bare soil after chisel tillage (if soil compaction is activated)	cm cm tha-1 kg.ha-1 SD SD m	Mais_tec.xml file default value from Mais_tec.xml file default value from	default value from Mais_tec.xml file default value from Mais_tec.xml file
profres profsem profrav qres Qtot_N ratiol ressuite rugochisel rugolabour	upper depth of organic residue incorporation depth of sowing maximum depth of organic residue incorporation mass of organic residues added to soil (fresh weight) amount of total mineral N fertilizer applications water stress index below which irrigation is started in automatic mode (0 in manual mode) type of crop residue (roots or whole_crop or straw+roots or stubble+roots or stubble_of_residu_type_9+roots or stubble_of residu_type_10+roots, prunings) roughness length of bare soil after chisel tillage (if soil compaction is activated) roughness length of bare soil after mouldboard ploughing (if soil compaction is activated)	cm cm cm t.ha-1 kg.ha-1 SD SD m m	Mais_tec.xml file default value from Mais_tec.xml file default value from	default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file + default value from Mais_tec.xml file default value from
profres profsem profrav qres Qtot_N ratiol ressuite rugochisel rugolabour stadecoupedf	upper depth of organic residue incorporation depth of sowing maximum depth of organic residue incorporation mass of organic residues added to soil (fresh weight) amount of total mineral N fertilizer applications water stress index below which irrigation is started in automatic mode (0 in manual mode) type of crop residue (roots or whole_crop or straw+roots or stubble+roots or stubble of residu (type 3+roots or stubble_of residu type_10+roots, prunings) roughness length of bare soil after chisel tillage (if soil compaction is activated) roughness length of bare soil after mouldboard ploughing (if soil compaction is activated) stage of automatic cut for forage crops	cm cm cm t.ha-1 kg.ha-1 SD SD m m SD	Mais_tec.xml file default value from Mais_tec.xml file	default value from Mais_tec.xml file default value from Mais_tec.xml file default value from Mais_tec.xml file + default value from Mais_tec.xml file default value from
profres profsem profsem proftrav qres Qtot_N ratiol ressuite rugochisel rugolabour stadecoupedf sucrerec	upper depth of organic residue incorporation depth of sowing maximum depth of organic residue incorporation mass of organic residues added to soil (fresh weight) amount of total mineral N fertilizer applications water stress index below which irrigation is started in automatic mode (0 in manual mode) type of crop residue (roots or whole_crop or straw+roots or stubble+roots or stubble_of residu type_9+roots or stubble of residu type_10+roots, prunings) roughness length of bare soil after chisel tillage (if soil compaction is activated) stage of automatic cut for forage crops minimal sugar concentration at harvest (/ fresh matter)	cm cm cm tha-1 kg.ha-1 SD SD m m SD g.g-1 FW	Mais_tec.xml file default value from Mais_tec.xml file default value from	default value from Mais_tec.xml file default value from
profres profsem profsem proftrav qres Qtot_N ratiol ressuite rugochisel rugolabour stadecoupedf sucrerec surfouvre 1	upper depth of organic residue incorporation depth of sowing maximum depth of organic residue incorporation mass of organic residues added to soil (fresh weight) amount of total mineral N fertilizer applications water stress index below which irrigation is started in automatic mode (0 in manual mode) type of crop residue (roots or whole_crop or straw+roots or stubble+roots or stubble of residu type Jvroots or stubble-of residu type_10+roots prunings) roughness length of bare soil after chisel tillage (if soil compaction is activated) roughness length of bare soil after mouldboard ploughing (if soil compaction is activated) stage of automatic cut for forage crops minimal sugar concentration at harvest (/ fresh matter) relative area of the shelter opened the first day of opening	cm cm cm t.ha-1 kg.ha-1 SD SD m m SD g.g-1 FW SD	Mais_tec.xml file default value from Mais_tec.xml file	default value from Mais_tec.xml file default value from Mais_tec.xml file

1	tempfauche	cumulative thermal time between two cuts of forage crops	degree-d	default value from	default value from
	transplastic	transmission coefficient of the plastic shelter	SD	Mais_tec.xml file default value from	Mais_tec.xml file default value from
				Mais_tec.xml file	Mais_tec.xml file
	upvttapI	thermal time from emergence (UPVT units) driving irrigation	degreeC	default value from Mais_tec.xml file	default value from Mais_tec.xml file
	upvttapN	thermal time from emergence (UPVT units) driving fertilization	degreeC	default value from Mais_tec.xml file	default value from Mais_tec.xml file
Weather file	variete weather file *.XXX	cultivar number corresponding to the cultivar name in the plant file name of the weather file	SD (-)	+ +	+ +
	where the XXX are the 3 last digits of the year 1st column	name of weather file	(-)	+	+
	2 nd column	vear	(y)	+	+
	3 rd column 4 th column	month day in month	(m) (d)	+ +	+
	5 th column	Julian day	(day of the year)	+	+
	6 th column 7 th column	minimum temperature maximum temperature	(°C) (°C)	+ +	+ +
	8 th column	global radiation	(MJ.m-2. j-1)	+	+
	9 th column 10 th column	Penman PET rainfall	(mm.j-1) (mm.j-1)	+ +	default=-999 +
	11 th column 12 th column	wind vapour pressure	(m.s-1) (mbars)	+ +	default=-999 default=-999
Weather station	13 th column	CO2 content	(ppm)	default=400	default=400
file (*_sta.xml)	aangst	coefficient of the Angstrom's relationship for extraterrestrial radiation	SD	default value from CLIMAISJ_sta.xml	default value from CLIMAISJ_sta.xml
	aclim	climatic component of A to calculate actual soil evaporation	mm	default value from CLIMAISJ_sta.xml	default value from CLIMAISJ_sta.xml
	aks	parameter of calculation of the energetic loss between the inside and the outside of a greenhouse	W.m-2.K-1	default value from CLIMAISJ_sta.xml	default value from CLIMAISJ_sta.xml
	albveg	albedo of the vegetation	SD	default value from CLIMAISJ_sta.xml	default value from CLIMAISJ_sta.xml
	alphapt	parameter of Priestley-Taylor formula	SD	default value from CLIMAISJ_sta.xml	default value from CLIMAISJ sta.xml
	altinversion	altitude of inversion of the thermal gradient	m	default value from CLIMAISJ_sta.xml	default value from CLIMAISJ sta.xml
	altisimul	altitude of simulated site	m	+	+
	altistation bangst	altitude of the input metorological station coefficient of the Angstrom's relationship for extraterrestrial radiation	m SD	+ default value from	+ default value from
	bks	parameter of calculation of the energetic lost between the inside and the outside of a	W.m-2.K-1	CLIMAISJ_sta.xml default value from	CLIMAISJ_sta.xml default value from
	cielclair	greenhouse fraction of sunny hours allowing the inversion of thermal gradient with altitude	SD	CLIMAISJ_sta.xml default value from	CLIMAISJ_sta.xml default value from
	codadret	option to calculate mountain climate taking into account the orientation $(1 = \text{south}, 2 = \text{north})$	code 1/2	CLIMAISJ_sta.xml default value from	CLIMAISJ_sta.xml default value from
	codaltitude	option to activate the calculation of the climate in altitude (1 = no, 2 = yes)	code 1/2	CLIMAISJ_sta.xml default value from	CLIMAISJ_sta.xml default value from
	codecaltemp	option to activate the variable of the cumule in unitary $(1 - 10, 2 - 90)$ option to activate the use of crop temperature for phasic development calculation (1 =	code 1/2	CLIMAISJ_sta.xml default value from	CLIMAISJ_sta.xml default value from
		empirical relation, 2 =energy balance)		CLIMAISJ_sta.xml	CLIMAISJ_sta.xml
	codeclichange	option to activate climate change (1 = no, 2 =yes)	code 1/2	default value from CLIMAISJ_sta.xml	default value from CLIMAISJ_sta.xml
	codeetp	option for the method of calculating PET (1 = forced Penman, 2 = calculated Penman, 3= Shuttleworth & Wallace, 4 = Priestley & Taylor)	code 1/2/3/4	default value from CLIMAISJ_sta.xml	default value from CLIMAISJ_sta.xml
	codemet	option of calculation of net radiation (1 = Brunt's method, 2 = Cellier's method)	code 1/2	default value from CLIMAISJ_sta.xml	default value from CLIMAISJ_sta.xml
	coefdevil	multiplier coefficient of the exterior radiation to compute PET inside of a greenhouse	SD	default value from CLIMAISJ_sta.xml	default value from CLIMAISJ_sta.xml
	coefrnet	coefficient of calculation of the net radiation under greenhouse	SD	default value from CLIMAISJ sta.xml	default value from CLIMAISJ sta.xml
	corecTrosee	temperature to substract to Tmin to estimate dew point temperature (in case of missing air humidity data)	degreeC	default value from CLIMAISJ sta.xml	default value from CLIMAISJ sta.xml
	cvent	parameter of the climate calculation under the shelter	SD	default value from CLIMAISJ sta.xml	default value from CLIMAISJ sta.xml
	gradtn	thermal gradient in altitude for minimal temperatures	degreeC.m-1	default value from CLIMAISJ sta.xml	default value from CLIMAISJ sta.xml
	gradtninv	thermal gradient in altitude for minimal temperatures under the inversion level	degreeC.m-1	default value from	default value from
	gradtx	thermal gradient in altitude for maximal temperatures	degreeC.m-1	CLIMAISJ_sta.xml default value from	CLIMAISJ_sta.xml default value from
	latitude	latitude of the site	degree	CLIMAISJ_sta.xml +	CLIMAISJ_sta.xml +
	NH3ref	NH ₃ concentration in the atmosphere	µg.m-3	default value from CLIMAISJ_sta.xml	default value from CLIMAISJ_sta.xml
	ombragetx	change in air temperature in the northern hillslope of mountains (activated if codadret=2)	degreeC	default value from CLIMAISJ sta.xml	default value from CLIMAISJ_sta.xml
	patm	atmospheric pressure	mbar	+	default value from CLIMAISJ_sta.xml
	phiv0	parameter allowing the calculation of the climate under shelter	SD	default value from CLIMAISJ_sta.xml	default value from CLIMAISJ_sta.xml
	ra	aerodynamic resistance (used in volatilization module when we use ETP approach)	s.m-1	default value from CLIMAISJ sta.xml	default value from CLIMAISJ sta.xml
	zr	reference height of meteorological data measurement	m	+	default value from
Plant and soil inicialization file (*_ini.xml)	beginningstage	initialization parameter for the development stage of the main crop. Several choices are possible: SNU: bare soil PLT: sowing or planting (annuals) LEV: emergence or budding DOR: beginning of dormancy (woody plants) AMF: maximum acceleration of leaf growth, end of juvenile phase DRP: onset of filling of harvested organs LAX: maximum leaf area index, end of leaf growth	(-)	default= PLT	CLIMAISI sta.xml default= PLT
	1.0	SEN: beginning of net senescence (LAInet option)		la facilita da C	4.6.1. 1. 1
	lai0	initial leaf area index	m2.m-2	default value from mais_ini.xml	default value from mais_ini.xml
	masec0	initial aerial biomass	t.ha-1	default value from mais_ini.xml	default value from mais_ini.xml
	zrac0	initial depth of root apex of the crop	cm	default value from mais_ini.xml	default value from mais_ini.xml
	magrain0	initial grain dry weight	g.m-2	default value from mais_ini.xml	default value from mais_ini.xml
	QNplante0	initial N amount in the plant	kg.ha-1	default value from mais_ini.xml	default value from mais_ini.xml
	resperenne0	initial reserve of biomass	t.ha-1	default value from	default value from
	densinitial	initial root density in each of the five soil layers	cm.cm-3	mais_ini.xml default value from	mais_ini.xml default value from
	Hinit	initial gravimetric water content of each soil layer (/fine earth)	% w	mais_ini.xml default value from	mais_ini.xml default value from
	NO3init	initial amount of NO3-N in each of the soil layers (/fine earth)	kg.ha-1	mais_ini.xml default value from	mais_ini.xml default value from
			Ĭ	mais_ini.xml	mais_ini.xml

	NH4init	initial amount of NH4-N in each of the soil layers	kg.ha-1	default value from mais_ini.xml	default value from mais_ini.xml
Run file (USM.xml)	usm finit	name of the USM name of the initialization file	SD SD	default='agentN' name of plant and	default='agentN' name of plant and
(00.0.0.0.0)			SD SD	soil inicialization file (*_ini.xml)	name of plant and soil inicialization file (*_ini.xml) name of weather
	fstation	name of the weather station file		name of weather station file (*_sta.xml)	station file (*_sta.xml)
	nomsol	name of the soil in the sols.xml file	SD	'sol nom' parameter from soil parameters	'sol nom' parameter from soil parameters
	datedebut	day of the beginning of the simulation	julian.d	(sols.xml) file +	(sols.xml) file +
	datefin fclim1	day of the end of simulation name of the first climate file	julian.d SD	+ name of first	+ name of first
				weather file *.XXX where the XXX are the 3 last digits of the year	weather file *.XXX where the XXX are the 3 last digits of the year
	fclim2	name of the last climate file	SD	name of the last weather file *.XXX where the XXX are the 3 last digits of	name of the last weather file *.XXX where the XXX are the 3 last digits of
	culturean	number of calendar years involved in the crop cycle $(1 = 1 \text{ year e.g. for spring crops}, 0 = \text{two}$	code 1/0	the year +	the year +
	codesimul	years, e.g. for winter crops) Type of LAI simulation : 0 = culture (LAI calculated by the model), 1 = feuille (LAI forced)	code 0/1	default=0	default=0
	flai	name of the LAI forcing file (null if none)	SD	default=null	default=null
	fplt	name of the plant file for main plant and if intercropping for associated plant	SD	name of plant parameters (*_plt.xml) file	name of plant parameters (*_plt.xml) file
	ftec	name of the technical file for main plant and if intercropping for associated plant	SD	name of crop management (* tec.xml) file	name of crop management (* tec.xml) file
	nbplantes	number of simulated plants (sole crop=1; intercropping=2)	SD	default=1	default=1
	abso(n)	OUTPUTS N uptake rate by the crop	kg.ha-1.d-1	no need to have	no need to have
	age_prairie	age of the forage crop since sowing	year	this information no need to have	this information no need to have
	airg(n)	daily amount of irrigation water	mm.d-1	this information no need to have	this information no need to have
	albedolai	albedo of the crop including soil and vegetation	SD	this information no need to have	this information no need to have
				this information	this information
	allocfruit	allocation ratio of assimilates to the fruits	0-1	no need to have this information	no need to have this information
	ammomes	amount of NH4-N in soil over the depth "profines"	kg.ha-l	no need to have this information	no need to have this information
	amptcultmat	mean daily temperature range (tcult) during the reproductive phase (stages lax - rec)	degreeC	no need to have this information	no need to have this information
	anit(n)	daily amount of fertiliser-N added to crop	kg.ha-1.d-1	no need to have	no need to have
	anit_engrais(n)	Daily nitrogen provided by fertiliser	kgN.ha-1 j-1	this information no need to have	this information no need to have
	abso(n)	N uptake rate by the crop	kg.ha-1.d-1	this information no need to have	this information no need to have
	age_prairie	age of the forage crop since sowing	year	this information no need to have	this information no need to have
	airg(n)	daily amount of irrigation water	mm.d-1	this information no need to have	this information no need to have
				this information	this information
	albedolai	albedo of the crop including soil and vegetation	SD	no need to have this information	no need to have this information
	anoxmoy	index of anoxia over the root depth	0-1	no need to have this information	no need to have this information
	AZamm(1)	amount of NH4-N in the soil layer 1	kg.ha-l	+	no need to have this information
	AZamm(2)	amount of NH4-N in the soil layer 2	kg.ha-1	+	no need to have this information
	AZamm(3)	amount of NH4-N in the soil layer 3	kg.ha-l	+	no need to have this information
	AZamm(4)	amount of NH4-N in the soil layer 4	kg.ha-l	+	no need to have
	AZamm(5)	amount of NH4-N in the soil layer 5	kg.ha-1	+	this information no need to have
	azlesd	daily amount of NO3-N leached in mole drains	kg.ha-1.d-1	no need to have	this information no need to have
	AZnit(1)	amount of NO3-N in the soil layer 1	kg.ha-1	this information	this information no need to have
	AZnit(2)	amount of NO3-N in the soil layer 2	kg.ha-l	+	this information no need to have
					this information
	AZnit(3)	amount of NO3-N in the soil layer 3	kg.ha-1	+	no need to have this information
	AZnit(4)	amount of NO3-N in the soil layer 4	kg.ha-1	+	no need to have this information
	AZnit(5)	amount of NO3-N in the soil layer 5	kg.ha-1	+	no need to have this information
	azomes	amount of NO3-N in soil over the depth "profmes"	kg.ha-l	no need to have this information	no need to have this information
	bouchon	index showing if the shrinkage slots are opened (0) or closed (1)	0/1	no need to have	no need to have
	Cb	amount of C in the microbial biomass decomposing organic residues mixed with soil	kg.ha-l	this information +	this information no need to have
	Cbmulch	amount of C in the microbial biomass decomposing organic residues at soil surface (mulch)	kg.ha-l	+	this information no need to have
	cdemande	cumulative amount of N needed by the plant (plant needs)	kg.ha-1	+	this information +
	cEdirect	Total Evaporation (water evaporated by the soil + intercepted by leaves and mulch) integrated over the cropping season	mm	+	+
	cEdirecttout	Total Evaporation (water evaporated by the soil + intercepted by leaves and mulch) integrated	mm	+	no need to have
	cep	over the simulation period cumulative transpiration over the cropping season	mm	+	this information no need to have
	ces	cumulative evaporation over the cropping season	mm	+	this information no need to have
		cumulative evaporation over the simulation period	mm	+	this information no need to have
	cestout		1	1	this information
			mm	+	
	cet	cumulative evapotranspiration over the cropping season	mm	+	no need to have this information
	cet cet_from_lev	cumulative evapotranspiration over the cropping season cumulative evapotranspiration over the cropping season (from emergence or budbreak)	mm	+	no need to have this information no need to have this information
	cet	cumulative evapotranspiration over the cropping season		+ + no need to have this information	no need to have this information no need to have
	cet cet_from_lev	cumulative evapotranspiration over the cropping season cumulative evapotranspiration over the cropping season (from emergence or budbreak)	mm	+ no need to have	no need to have this information no need to have this information no need to have

shareafrait	number of filling grains or size fruits	m-2	no need to have	no need to have
chargefruit	number of filling grains or ripe fruits		this information	this information
Chuma	amount of active C in humified organic matter	kg.ha-1	no need to have this information	no need to have this information
Chumi	amount of inert C in humified organic matter	kg.ha-1	no need to have this information	no need to have this information
Chumt	amount of C in humified organic matter (active + inert fractions)	kg.ha-1	no need to have this information	no need to have this information
cintermulch	cumulative amount of rain intercepted by the mulch	mm	no need to have this information	no need to have this information
cinterpluie	cumulative amount of rain intercepted by the leaves	mm	no need to have this information	no need to have this information
Cmulch	amount of C in the whole plant mulch	kg.ha-1	no need to have this information	no need to have this information
Cmulchdec	amount of C in the decomposable mulch	kg.ha-l	no need to have	no need to have
Cmulchnd	amount of C in the non decomposable mulch	kg.ha-1	this information no need to have	this information no need to have
CNgrain	N concentration in fruits	% dry weight	this information +	this information no need to have
Cnondec(1)	amount of C in the undecomposable mulch made of residues of type 1	kg.ha-1	no need to have	this information no need to have
Cnondec(10)	amount of C in the undecomposable mulch made of residues of type 10	kg.ha-l	this information no need to have	this information no need to have
Cnondec(2)	amount of C in the undecomposable mulch made of residues of type 2	kg.ha-l	this information no need to have	this information no need to have
Cnondec(3)	amount of C in the undecomposable mulch made of residues of type 3	kg.ha-1	this information no need to have	this information no need to have
Cnondec(4)	amount of C in the undecomposable mulch made of residues of type 4	kg.ha-1	this information no need to have	this information no need to have
Cnondec(5)	amount of C in the undecomposable mulch made of residues of type 5	kg.ha-1	this information no need to have	this information no need to have
Cnondec(6)	amount of C in the undecomposable mulch made of residues of type 5 amount of C in the undecomposable mulch made of residues of type 6	kg.ha-1	this information no need to have	this information no need to have
			this information	this information
Cnondec(7)	amount of C in the undecomposable mulch made of residues of type 7	kg.ha-1	no need to have this information	no need to have this information
Cnondec(8)	amount of C in the undecomposable mulch made of residues of type 8	kg.ha-1	no need to have this information	no need to have this information
Cnondec(9)	amount of C in the undecomposable mulch made of residues of type 9	kg.ha-l	no need to have this information	no need to have this information
CNplante	N concentration in the aboveground plant	% dry weight	+	no need to have this information
co2(n)	atmospheric CO2 content above 330 ppm	ppm	no need to have this information	no need to have this information
CO2hum	daily amount of CO2-C emitted due to the mineralisation of soil humus	kg.ha-1.d-1	no need to have this information	no need to have this information
CO2res	daily amount of CO2-C emitted due to the mineralisation of organic residues	kg.ha-1.d-1	no need to have this information	no need to have this information
CO2sol	daily amount of CO2-C emitted due to soil mineralisation (humus and organic residues)	kg.ha-1.d-1	no need to have this information	no need to have this information
codebbch_output	code of the bbch stage (see plant file)	0-99	no need to have this information	no need to have this information
concNO3les	nitrate concentration in drained water	mg NO3.1-1	+	+
concNO3sol(1)	nitrate concentration in soil layer 1	mg NO3.1-1	+	no need to have this information
concNO3sol(2)	nitrate concentration in soil layer 2	mg NO3.1-1	+	no need to have this information
concNO3sol(3)	nitrate concentration in soil layer 3	mg NO3.1-1	+	no need to have this information
concNO3sol(4)	nitrate concentration in soil layer 4	mg NO3.1-1	+	no need to have this information
concNO3sol(5)	nitrate concentration in soil layer 5	mg NO3.1-1	+	no need to have this information
condenit	ratio of actual to potential denitrifying rate	0-1	no need to have this information	no need to have this information
couvermulch	cover ratio of mulch	0-1	no need to have this information	no need to have this information
cpluie	cumulative amount of rain over the simulation period	mm	no need to have this information	no need to have this information
cprecip	cumulative water supply over the cropping season	mm	+	no need to have this information
cpreciptout	cumulative water supply over the simulation period	mm	+	no need to have
Cr	amount of C in organic residues mixed with soil	kg.ha-l	no need to have	this information no need to have
Crac	amount of C in roots at harvest	kg.ha-1	this information no need to have	this information no need to have
Cresiduprofil(1)	amount of C in residues over the soil depth "profhum" in the residue type 1	kg.ha-1	this information no need to have	this information no need to have
Cresiduprofil(10)	amount of C in residues over the soil depth "profhum" in the residue type 10	kg.ha-1	this information no need to have	this information no need to have
Cresiduprofil(2)	amount of C in residues over the soil depth "profhum" in the residue type 2	kg.ha-1	this information no need to have	this information no need to have
Cresiduprofil(3)	amount of C in residues over the soil depth "profhum" in the residue type 3	kg.ha-1	this information no need to have	this information no need to have
Cresiduprofil(4)	amount of C in residues over the soil depth "profhum" in the residue type 4	kg.ha-1	this information no need to have	this information no need to have
Cresiduprofil(5)	amount of C in residues over the soil depth "profhum" in the residue type 5	kg.ha-1	this information no need to have	this information no need to have
Cresiduprofil(6)	amount of C in residues over the soil depth "profilum" in the residue type 5 amount of C in residues over the soil depth "profilum" in the residue type 6		this information no need to have	this information no need to have
	amount of C in residues over the soil depth "profhum" in the residue type 6 amount of C in residues over the soil depth "profhum" in the residue type 7	kg.ha-l	this information	this information
Cresiduprofil(7)		kg.ha-l	no need to have this information	no need to have this information
Cresiduprofil(8)	amount of C in residues over the soil depth "profhum" in the residue type 8	kg.ha-1	no need to have this information	no need to have this information
Cresiduprofil(9)	amount of C in residues over the soil depth "profhum" in the residue type 9	kg.ha-1	no need to have this information	no need to have this information
crg	cumulative global radiation over the cropping season	MJ.m-2	no need to have this information	no need to have this information
crgtout	cumulative global radiation over the simulation period	MJ.m-2	no need to have this information	no need to have this information
ctairtout	cumulative air temperature (tair) over the simulation period	degreeC	no need to have this information	no need to have this information
ctcult	cumulative crop temperature (tcult) over the cropping season	degreeC	no need to have this information	no need to have this information
ctculttout		degreeC	no need to have	no need to have this information
	cumulative crop temperature (tcult) over the simulation period			
ctetptout	cumulative crop temperature (tcut) over the simulation period cumulative potential evapotranspiration (pet) over the simulation period	mm	this information +	no need to have
		mm degreeC	+ no need to have	no need to have this information no need to have
ctetptout	cumulative potential evapotranspiration (pet) over the simulation period		+ no need to have this information no need to have	no need to have this information no need to have this information no need to have
ctetplout ctmoy	cumulative potential evapotranspiration (pet) over the simulation period cumulative air temperature over the cropping season	degreeC	+ no need to have this information	no need to have this information no need to have this information

cum_et0_from_lev	cumulative maximum evapotranspiration over the cropping season from germination or	mm	no need to have	no need to have
	budbreak (eop+eos)		this information	this information
cum_immob	cumulative amount of N immobilised by the microbial biomass decomposing residues	kg.ha-1	no need to have this information	no need to have this information
cumIracz	cumulative length of active roots per soil surface	cm.cm-2	no need to have this information	no need to have this information
cumraint	cumulative intercepted radiation	MJ.m-2	no need to have this information	no need to have this information
cumrg	cumulative global radiation during the stage sowing-harvest	Mj.m-2	no need to have this information	no need to have this information
cumvminh	daily amount of N mineralised from humus	kg.ha-1.d-1	no need to have this information	no need to have this information
cumvminr	daily amount of N mineralised from organic residues	kg.ha-1.d-1	no need to have this information	no need to have this information
da(1)	bulk density of the layer 1 (recalculated by the model if codeDSTtass is 1)	g.cm-3	no need to have this information	no need to have this information
da(2)	bulk density of the layer 2 (recalculated by the model if codeDSTtass is 1)	g.cm-3	no need to have this information	no need to have this information
day_after_sowing	days after sowing or planting	day	no need to have this information	no need to have this information
day_cut	cut day	julian day	no need to have this information	no need to have this information
deltai(n)	daily increase in green leaf index per soil surface	m2.m-2.d-1	no need to have this information	no need to have this information
deltaz	rate of deepening of the root front	cm.d-1	no need to have this information	no need to have this information
demande	daily amount of N need of the plant	kg.ha-1.d-1	no need to have	no need to have
densite	actual sowing density	plants.m-2	this information no need to have	this information no need to have
densiteequiv	equivalent plant density for the understorey crop	plants.m-2	this information no need to have	this information no need to have
dfol	"within the shape" leaf density	m2.m-3	this information no need to have	this information no need to have
diftemplintercoupe	mean difference between crop and air temperatures during the vegetative phase (emergence -	degreeC	this information no need to have	this information no need to have
diftemp2intercoupe	maximum LAI) mean difference between crop and air temperatures during the reproductive phase (maximum	degreeC	this information no need to have	this information no need to have
ditags	LAI - maturity) daily growth rate of the plantlets	t.ha-1.d-1	this information no need to have	this information no need to have
ditaisen	daily change in the senescent leaf area index	m2.m-2.d-1	this information no need to have	this information no need to have
ditarsen ditarns(n)	daily change in the senescent tear area index daily growth rate of the plant	m2.m-2.d-1 t.ha-1.d-1	this information no need to have	this information no need to have
			this information	this information
dltamsen	daily senescence rate of the plant	t.ha-1.d-1	no need to have this information	no need to have this information
dltaremobil	daily amount of perennial reserves remobilised	t.ha-1.d-1	no need to have this information	no need to have this information
dltmsrac_plante	pour sorties ArchiSTICS: biomasse journaliere allouee aux racines en g	mi¾²sol	no need to have this information	no need to have this information
drain	daily amount of water drained at the base of the soil profile	mm.d-1	no need to have this information	no need to have this information
drain_from_lev	cumulative amount of water drained at the base of the soil profile during the crop cycle(emergence or budbreak-harvest)	mm	no need to have this information	no need to have this information
drain_from_plt	cumulative amount of water drained at the base of the soil profile during the crop cycle (planting-harvest)	mm	+	no need to have this information
drat	cumulative amount of water drained at the base of the soil profile during the simulation period	mm	+	no need to have this information
drlsenmortalle	root biomass corresponding to dead tillers	t.ha-1.d-1	no need to have this information	no need to have this information
drisenmortalle dtj(n)	root biomass corresponding to dead tillers thermal time for root growth	t.ha-1.d-1 degreeC.d	this information no need to have	this information no need to have
			this information no need to have this information no need to have	this information no need to have this information no need to have
dtj(n)	thermal time for root growth	degreeC.d	this information no need to have this information no need to have this information no need to have	this information no need to have this information no need to have this information no need to have
dtj(n) dureehumec	thermal time for root growth number of hours which are "wet" (rainy days or days when tcult < dew point)	degreeC.d	this information no need to have this information no need to have this information no need to have this information no need to have	this information no need to have this information no need to have this information no need to have this information no need to have
dtj(n) dureehumec dureeRH	thermal time for root growth number of hours which are "wet" (rainy days or days when tcult < dew point) number of night hours during which relative humidity exceeds a 90% threshold	degreeC.d hour hour	this information no need to have this information no need to have this information no need to have this information no need to have this information no need to have	this information no need to have this information no need to have this information no need to have this information no need to have this information no need to have
dtj(n) dureehumec dureeRH durvie(n)	thermal time for root growth number of hours which are "wet" (rainy days or days when tcult < dew point) number of night hours during which relative humidity exceeds a 90% threshold actual life span of the leaf surface	degreeC.d hour hour degreeC	this information no need to have this information no need to have	this information no need to have this information no need to have
dtj(n) dureehumec dureeRH durvie(n) eai	thermal time for root growth number of hours which are "wet" (rainy days or days when tcult < dew point) number of night hours during which relative humidity exceeds a 90% threshold actual life span of the leaf surface equilvalent leaf area for ear	degreeC.d hour hour degreeC m2.m-2	this information no need to have this information no need to have	this information no need to have this information no need to have
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dij(n) dureehumec dureeRH durvie(n) eai ebmax ebmax_gr	thermal time for root growth number of hours which are "wet" (rainy days or days when tcult < dew point) number of night hours during which relative humidity exceeds a 90% threshold actual life span of the leaf surface equilvalent leaf area for ear maximum value of radiation use efficiency Maximum radiation use efficiency during the vegetative stage (AMF-DRP)	degreeC.d hour hour degreeC m2.m-2 cg.MJ-1 g MJ-1	this information no need to have this information	this information no need to have this information
di(n) dureehumec dureeRH durvie(n) eai ebmax ebmax_gr Edirect	thermal time for root growth number of hours which are "wet" (rainy days or days when tcult < dew point) number of night hours during which relative humidity exceeds a 90% threshold actual life span of the leaf surface equilvalent leaf area for ear maximum value of radiation use efficiency Maximum radiation use efficiency during the vegetative stage (AMF-DRP) daily amount of water evaporated by the soil + intercepted by leaves and mulch	degreeC.d hour hour degreeC m2.m-2 cg.MJ-1 g MJ-1 mm.d-1	this information no need to have this information	this information no need to have this information
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dij(n) dureehumec dureeRH durvie(n) eai ebmax ebmax_gr Edirect efda efdensite efdensite efdensite efNrac_mean em_N2O em_N2Oden emd emden eo eop eos ep ep_rec_recal(1) epc_recal(2)	thermal time for root growth number of hours which are "wet" (rainy days or days when tcult < dew point) number of night hours during which relative humidity exceeds a 90% threshold actual life span of the leaf surface equilvalent leaf area for ear maximum value of radiation use efficiency Maximum radiation use efficiency during the vegetative stage (AMF-DRP) daily amount of water evaporated by the soil + intercepted by leaves and mulch reduction factor on root growth due to physical constraint (through bulk density) density factor on root growth reduction factor on root growth reduction factor on root growth rate due to mineral N concentration daily amount of N2O-N emitted from soil daily amount of N2O-N emitted from soil by denitrification daily amount of N2O-N emitted from soil by nitrification daily amount of water directly evaporated after leaves interception intermediary variable for the computation of evapotranspiration daily maximum transpiration flux daily maximum transpiration flux thickness of the soil layer 1 (recalculated by the model if codeDSTtass is 1)	degreeC.d hour hour degreeC m2.m-2 cg.MJ-1 g MJ-1 mm.d-1 0-1 0-1 0-1 0-1 0-1 kg.ha-1.d-1 kg.ha-1.d-1 kg.ha-1.d-1 kg.ha-1.d-1 mm.d-1 mm.d-1 mm.d-1 mm.d-1 mm.d-1 cm	this information no need to have this information have this have this ha	this information no need to have this information have this have the have this have the have the have this hav
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et	daily evapotranspiration (esol + ep)	mm.d-1	no need to have	no need to have
et0	daily maximun evapotranspiration flux (transpiration + soil evaporation)	mm	this information no need to have	this information no need to have
etm	daily maximum evapotranspiration (esol + eop)	mm.d-1	this information no need to have	this information no need to have
	'daily potential evapotranspiration (corr + cop)	mm.d-1	this information no need to have	this information no need to have
etpp(n)			this information	this information
exces(1)	amount of water in the macroporosity of the layer 1	mm	no need to have this information	no need to have this information
exces(2)	amount of water in the macroporosity of the layer 2	mm	no need to have this information	no need to have this information
exces(3)	amount of water in the macroporosity of the layer 3	mm	no need to have this information	no need to have this information
exces(4)	amount of water in the macroporosity of the layer 4	mm	no need to have this information	no need to have this information
exces(5)	amount of water in the macroporosity of the layer 5	mm	no need to have this information	no need to have this information
exobiom	reduction factor on biomass growth due to water excess	0-1	no need to have this information	no need to have this information
exofac	waterlogging index	0-1	no need to have	no need to have
exofac1moy	mean value of the waterlogging index during the vegetative stage (emergence - fruit	0-1	this information no need to have	this information no need to have
exofac2moy	establishment) mean value of the waterlogging index during the reproductive stage (fruit establishment -	0-1	this information no need to have	this information no need to have
exolai	maturity) reduction factor on leaf growth due to water excess	0-1	this information no need to have	this information no need to have
fapar	proportion of the radiation intercepted	0-1	this information no need to have	this information no need to have
fco2	specie-dependant CO2 effect on radiation use efficiency	SD	this information no need to have	this information no need to have
fco2s		SD	this information no need to have	this information no need to have
	specie-dependant CO2 effect onstomate closure		this information	this information
fgelflo	reduction factor on the number of fruits due to frost	0-1	no need to have this information	no need to have this information
fixmaxvar	maximal rate of BNF (symbiotic fixation)	kg.ha-1.d-1	no need to have this information	no need to have this information
fixpot	potential rate of BNF (symbiotic fixation)	kg.ha-1.d-1	no need to have this information	no need to have this information
fixreel	actual rate of BNF (symbiotic fixation)	kg.ha-1.d-1	no need to have this information	no need to have this information
flurac	daily amount of N taken up by the plant when N uptake is limited by the plant capacity absorption	kg.ha-1.d-1	no need to have this information	no need to have this information
flusol	daily amount of N taken up by the plant when N uptake is limited by the transfer from soil to	kg.ha-1.d-1	no need to have	no need to have
fpari	root radiation effect on conversion efficiency	g.MJ-1	this information no need to have	this information no need to have
fpari_gr	radiation factor on the calculation of conversion efficiency	g MJ-1	this information no need to have	this information no need to have
fpft	daily sink capacity of fruits	g.m-2.d-1	this information no need to have	this information no need to have
fpv(n)	daily sink capacity of growing leaves	g.m-2.d-1	this information no need to have	this information no need to have
			this information	this information
FsNH3	daily amount of NH3-N emitted from soil by volatilisation	micro g.m-2.d-1	no need to have this information	no need to have this information
fstressgel	reduction factor on leaf growth due to frost	0-1	no need to have this information	no need to have this information
ftemp	reduction factor on biomass growth due to temperature-related epsibmax	0-1	no need to have this information	no need to have this information
fxa	reduction factor on BNF (symbiotic fixation) due to soil anoxia	0-1	no need to have this information	no need to have this information
fxn	reduction factor on BNF (symbiotic fixation) due to mineral N concentration	0-1	no need to have this information	no need to have this information
fxt	reduction factor on BNF (symbiotic fixation) due to soil temperature	0-1	no need to have this information	no need to have this information
fxw	reduction factor on BNF (symbiotic fixation) due to soil water content	0-1	no need to have	no need to have this information
gell	proportion of leaves damaged by frost before amf stage (end of juvenile phase)	0-1	this information no need to have	no need to have
gel1_percent	proportion of leaves damaged by frost before amf stage (end of juvenile phase)	%	this information no need to have	this information no need to have
gel2	proportion of leaves damaged by frost after amf stage (end of juvenile phase)	0-1	this information no need to have	this information no need to have
gel2_percent	proportion of leaves damaged by frost after amf stage (end of juvenile phase)	%	this information no need to have	this information no need to have
gel3	proportion of flowers or fruits damaged by frost	0-1	this information no need to have	this information no need to have
		%	this information no need to have	this information no need to have
gel3_percent	proportion of flowers or fruits damaged by frost		this information	this information
H2Orec H2Orec_percent	water content of harvested organs water content of harvested organs	0-1 % fresh weight	+ +	+ +
hauteur	height of canopy	m	+	no need to have this information
Hmax	maximum height of water table between drains	cm	no need to have this information	no need to have this information
Нпарре	height of water table affecting plant growth	cm	no need to have this information	no need to have this information
Hpb	minimum depth of perched water table	cm	no need to have	no need to have
Hph	maximum depth of perched water table	cm	this information no need to have	this information no need to have
HR(1)	water content of the soil layer 1	% dry weight	this information +	this information +
HR(2) HR(3)	water content of the soil layer 2 water content of the soil layer 3	% dry weight % dry weight	+ +	+ +
HR(4) HR(5)	water content of the soil layer 4 water content of the soil layer 5	% dry weight % dry weight	+ +	+ +
HR_vol_1_10	water content of the layer 1-10 cm	mm	+	+
HR_vol_1_30 HR_vol_121_150	water content of the layer 1-30 cm (table) water content of the layer 121-150 cm (table)	mm mm	+ +	+ +
HR_vol_151_180 HR_vol_31_60	water content of the layer 151-180 cm (table) water content of the layer 31-60 cm (table)	mm mm	+ +	+ +
HR_vol_61_90 HR_vol_91_120	water content of the layer 61-90 cm (table) water content of the layer 91-120 cm (table)	mm	+ +	+ +
huile	oil content of harvested organs	mm 0-1	+ +	+
huile_percent humair	oil content of harvested organs air moisture content	% fresh weight 0-1	+ no need to have	+ no need to have
humair_percent	air moisture content	% saturation	this information no need to have	this information no need to have
humidite	air moisture content in the canopy	0-1	this information no need to have	this information no need to have
	air moisture content in the canopy	% saturation	this information no need to have	this information no need to have
humidite_percent				

NorwallNorwallNorwallNorwallNorwallNorwallNorwallNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallControlControlControlControlControlNorwallCo	huming man	reduction factor or not month due to coll writer contact (mean value over the not multi-	0.1	no need to have	no need to have
Introdo not due yournee notanon diagente and yournee yournee of	humirac_mean	reduction factor on root growth due to soil water content (mean value over the root profile)	0-1	no need to have this information	no need to have this information
InductorInductorInductorInductorInductorInductorInductorAnd ensure and ensure	hur(10)_vol	soil water content in the soil at 10 cm	cm/cm	+	
InstructMarket startingMarketMarketMarketMarketChartAndreadMarketMarketMarketMarketMarketChartMarketMarketMarketMarketMarketMarketChartMarket<	iamfs	date of amf stage (maximum acceleration of leaf growth, end of juvenile phase)	julian day		no need to have
InstructMatem	idebdess	date of onset of water dynamics in harvested organs	julian day	no need to have	no need to have
Deponly day of Big refuence laysjuringbig herebig hereBisnerday deriges to notionaryjuringbis herebis hereBisnerday derige to notionarybis herebis herebis hereBisnerd	idebdorms	date of entry into dormancy	julian day		
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BoxMode Quantany Mini Angel A	iflos	date of flowering	julian day		
InterJourd any	igers	date of germination	julian day		
INDApple of participants and a set of participant and particip	ilans	date of lan stage (leaf index nil)	julian day	no need to have	no need to have
IPPSDefinitionDe	ilaxs	date of lax stage (leaf index maximum)	julian day		
InstructureInstructur	ilevs	date of emergence	iulian dav		
memorydes of end of an AgramJaho deBillion de<		-		this information	this information
nethodandrahmin persons are how drie hype?and al.and al.an				this information	this information
add_xnd?add_bly present is for som if hype 1and 1add will be add will b	imontaisons	date of start of stem elongation	julian day		
Index <th< td=""><td>infil_recal(1)</td><td>infiltrability parameter at the base of the layer 1</td><td>mm.d-1</td><td></td><td></td></th<>	infil_recal(1)	infiltrability parameter at the base of the layer 1	mm.d-1		
Indexand the section by Seq 4and 1and 1and 1000and 1000IndexSeq 500Seq 500 </td <td>infil_recal(2)</td> <td>infiltrability parameter at the base of the layer 2</td> <td>mm.d-1</td> <td>no need to have</td> <td>no need to have</td>	infil_recal(2)	infiltrability parameter at the base of the layer 2	mm.d-1	no need to have	no need to have
edit (Strok)unitability preserve at the based of larger 4mm.64mm.64operation based in based in based of larger 4ind (Strok)strong numera at the based of larger 4strong numera at l	infil_recal(3)	infiltrability parameter at the base of the layer 3	mm.d-1	no need to have	no need to have
IndexIndication interval factors of a log of a lo	infil_recal(4)	infiltrability parameter at the base of the layer 4	mm.d-1		
Inmany and and and and and and 	infil recal(5)	infiltrability parameter at the base of the layer 5	mm d-1		
Inclusters industanceencige NM dating dec at (or. day regulative place characters in attainant Lol000					this information
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Interprese infraryaverage NM during the ords can encredence patient LA to nutative)b 2 cmas not base cm is noted to have method to the present serverb 2 cmas noted to have method to the present serverb 2 cmas noted to have method to the present serverb 2 cmas noted to have method to the present serverb 2 cmas noted to have method to the present serverInnin or 1method to the present server	innlmoy	average NNI during the vegetative stage	0-2	no need to have	no need to have
Indiageevenge/NA ange far appealacits sugle6.3mit and le kermeade hereIndiarelation fact or a for gravel due to NA (image deficuscy)inmits 10.1000 ker0.0000 kerInstancerelation fact or a for gravel due to NA (image deficuscy)inmits 10.1000 ker0.0000 kerInstancediago assista sufficing laves dualimage due to NA (image deficuscy)inmits 10.1000 ker0.0000 kerInstancediago assista sufficing laves dualimage due to NA (image deficuscy)image due to NA (image deficuscy)0.1000 ker0.1000 ker0.1000 kerInstandadiago assista sufficing laves dualimage due to NA (image deficuscy)image due to NA (image deficuscy)0.1000 ker0.1000 ker </td <td>inn2intercoupe</td> <td>average NNI during the cut (cut crop reproductive phase: maximum LAI to maturity)</td> <td>0-2</td> <td>no need to have</td> <td>no need to have</td>	inn2intercoupe	average NNI during the cut (cut crop reproductive phase: maximum LAI to maturity)	0-2	no need to have	no need to have
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Image: set of the	innlai	reduction factor on leaf growth due to NNI (nitrogen deficiency)	innmin to 1		
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largeurmno need to have this information this infor	laisen(n)	leaf area index of senescent leaves (table)	m2.m-2		
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LRACH(5) root length density in soil layer 5 cm.m-3 no need to have this information Iracsentot cumulative length of senescent roots cm root.cm -2 soil no need to have this information no need to have this information mabois biomass removed by pruning tha-1 no need to have this information no need to have this information maenfruit biomass of harvested organ envelops tha-1 + + mafeuil mafeuil quality laye Dr matter of leaves kg.ln-1 + + mafeuilloweh biomass of lalen leaves tha-1 + + mafeuilloweh biomass of fallen leaves tha-1 + + mafeuilloweh biomass of fallen leaves tha-1 + + mafeuilloweh biomass of graene leaves tha-1 + + mafeuilloweh biomass of graene leaves tha-1 + + mafeuilloweh biomass of graene leaves tha-1 + + mafeuilloweh biomass of harvested organs tha-1 + + maffuit kg_bh	LRACH(4)	root length density in soil layer 4	cm.cm-3	no need to have	no need to have
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Index Instrument Instrument Instrument Instrument Instrument makes biomass of harvested organ envelops tha-1 no need to have this information mafeuil biomass of harvested organ envelops tha-1 + + mafeuil biomass of harvested organ envelops tha-1 + + mafeuil biomass of laves tha-1 + + mafeuil biomass of yellow laves tha-1 + + mafeuilgame biomass of yellow laves tha-1 + + mafeuilgame biomass of green leaves tha-1 + + mafeuilware biomass of green leaves tha-1 + + mafeuilware biomass of green leaves tha-1 + + mafeuilware biomass of green leaves tha-1 + + mafrait abvoeground fresh matter tha-1 + + mafrait abvoeground fresh matter tha-1 + + mafruit <td></td> <td></td> <td></td> <td>this information</td> <td>this information</td>				this information	this information
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	mafeuil mafeuil, <u>kg</u> ha mafeuiljaune mafeuillombe mafeuilverte	biomass of leaves Dry matter of leaves biomass of yellow leaves biomass of fallen leaves biomass of green leaves biomass of green leaves	kg.ha-l t.ha-l t.ha-l t.ha-l	+ + + +	+ + +
	mafeuil mafeuiljaune mafeuiljaune mafeuilverte mafrais mafrais	biomass of leaves Dry matter of leaves biomass of yellow leaves biomass of fallen leaves biomass of green leaves aboveground fresh matter biomass of harvested organs	kg.ha-1 t.ha-1 t.ha-1 t.ha-1 t.ha-1 t.ha-1 t.ha-1	+ + + + +	+ + + + +

masec_kg_ha masec mx av cut				
	Aboveground dry matter Aboveground dry matter before cut(for cut crops, for others = masec(n))	kg.ha-1 t.ha-1	+	+
masecneo	biomass of newly-formed organs	t.ha-1	+	+
masectot	dry matter	t.ha-l	+	+ +
masecveg matigestruc	biomass of vegetative organs biomass of stems (only structural parts)	t.ha-1 t.ha-1	+	+
matigestruc_kg_ha	Dry matter of stems (only structural parts)	kg.ha-l	+	+
matuber mortalle	biomass of harvested organs, tuber weight only calculated for sugarbeet daily number of dying tillers	t.ha-1 d-1	+	+
mortmasec	cumulative biomass of dead tillers	t.ha-1	+	+
Monuneate	biomass of reserves corresponding to dead tillers cumulative amount of harvested biomass	t.ha-1.d-1	+ +	+
MSexporte msjaune	Senescent dry matter	t.ha-1 t.ha-1	+	+
msneojaune	newly-formed senescent dry matter	t.ha-1	+	+
msrac(n) msrec_fou	biomass of roots Dry matter of harvested organs for forages	t.ha-1 t.ha-1	+ +	+
MSrecycle	cumulative amount of biomass returned to soil (unexported at harvest + fallen leaves)	t.ha-1	+	+
msresjaune N_mineralisation	senescent residual dry matter cumulative amount of N mineralized from humus and organic residues	t.ha-1 kg.ha-1	+	+
N_volatilisation	cumulative amount of N volatilised from fertilizer and organic residues	kg.ha-1	+	+
Nb	daily amount of N in the microbial biomass decomposing organic residues mixed with soil	kg.ha-1	no need to have this information	no need to have this information
nbfeuille	number of leaves on main stem	SD	no need to have	no need to have
			this information	this information
nbinflo_recal	number of inflorescences	SD	no need to have this information	no need to have this information
nbj0remp	number of shrivelling days	d	no need to have	no need to have
nbjechaudage	number of shrivelling days between lax and rec	d	this information no need to have	this information no need to have
			this information	this information
nbjgel	number of frosting days active on the plant	d	no need to have this information	no need to have this information
nbjpourdecirecolte	number of days until harvest is launched when it is postponed by the "harvest decision" option	d	no need to have	no need to have
nbjpourdecisemis	number of days until sowing is launched when it is postponed by the "sowing decision" option	d	this information no need to have	this information no need to have
			this information	this information
Nbmulch	cumulative N in microbial biomass decomposing the decomposable mulch	kg.ha-1	no need to have	no need to have
NCbio	n/c ratio of biomass decomposing organic residues	SD	this information no need to have	this information no need to have
			this information	this information
Ndenit	daily denitrification rate in soil (if option "denitrification" is activated)	kg.ha-1.d-1	no need to have this information	no need to have this information
Nexporte	cumulative amount of N removed by crop harvests	kg.ha-l	no need to have	no need to have
nfruit(1)	number of fruits in box 1	SD	this information no need to have	this information no need to have
			this information	this information
nfruit(2)	number of fruits in box 2	SD	no need to have this information	no need to have this information
nfruit(3)	number of fruits in box 3	SD	no need to have	no need to have
nfruit(4)	number of fruits in box 4	SD	this information no need to have	this information no need to have
mun(4)	number of nurshi box 4		this information	this information
nfruit(5)	number of fruits in box 5	SD	no need to have this information	no need to have this information
nfruit(nboite)	number of fruits in last box	SD	no need to have	no need to have
nfruit(nboite-1)	number of fruits in last but one box	SD	this information no need to have	this information no need to have
man(none-1)	number of nurshin last but one box	46	this information	this information
nfruitnou	number of set fruits	fruits.m-2	no need to have this information	no need to have this information
Nhuma	amount of N in active soil organic matter	kg.ha-l	no need to have	no need to have
NIL		he he 1	this information	this information no need to have
Nhumi	amount of N in inert soil organic matter	kg.ha-1	no need to have this information	this information
Nhumt	amount of N in humus soil organic matter (active + inert fractions)	kg.ha-1	no need to have this information	no need to have this information
nitetcult(n)	number of iterations to calculate tcult	SD	no need to have	no need to have
			this information	this information
nitrifj	daily nitrification rate in soil (if option "nitrification" is activated)	kg.ha-1	no need to have this information	no need to have this information
Nmineral_from_lev	cumulative amount of N mineralized during the crop cycle (emergence or budbreak-harvest)	kg.ha-1	+	no need to have
Nmineral_from_plt	cumulative amount of N mineralized during the crop cycle (sowing-harvest)	kg.ha-1	+	this information no need to have
				this information
Nmulchdec	amount of N in the decomposable mulch	kg.ha-1	+	no need to have this information
Nmulchnd	amount of N in the non decomposable mulch	kg.ha-1	+	no need to have
Nnondec(1)	amount of N in the undecomposable mulch derived from residues type 1	kg.ha-1	+	this information no need to have
				this information
Nnondec(10)	amount of N in the undecomposable mulch derived from residues type 10	kg.ha-1	+	no need to have this information
Nnondec(2)	amount of N in the undecomposable mulch derived from residues type 2	kg.ha-1	+	no need to have
Nnondec(3)	amount of N in the undecomposable mulch derived from residues type 3	kg.ha-1	+	this information no need to have
				this information
Nnondec(4)	amount of N in the undecomposable mulch derived from residues type 4	kg.ha-1	+	no need to have this information
Nnondec(5)	amount of N in the undecomposable mulch derived from residues type 5	kg.ha-1	+	no need to have
Nnondec(6)	amount of N in the undecomposable mulch derived from residues type 6	kg.ha-1	+	this information no need to have
				this information
Nnondec(7)	amount of N in the undecomposable mulch derived from residues type 7	kg.ha-1	+	no need to have this information
Nnondec(8)	amount of N in the undecomposable mulch derived from residues type 8	kg.ha-1	+	no need to have
Nnondec(9)	amount of N in the undecomposable mulch derived from residues type 9	kg.ha-1	+	this information no need to have
				this information
nodn	reduction factor on nodulation establishment (potential BNF) due to mineral N stress	0/1	+	no need to have this information
Norgeng	daily amount of N immobilized from fertiliser	kg.ha-1.d-1	+	no need to have
Nr	amount of N in the decomposing organic residues mixed with soil			this information no need to have
	amount of 14 in the decomposing organic residues inixed with soli	kg.ha-1	+	this information
Nrac	amount of N in roots at harvest	kg.ha-1	+	no need to have this information
Nrecycle	cumulative amount of N returned to soil (unexported at harvest + fallen leaves)	kg.ha-1	+	no need to have
				this information no need to have
	amount of N in maiduae arouthe call double (and 0			
Nresiduprofil(1)	amount of N in residues over the soil depth (profhum) derived from residues type 1	kg.ha-1	+	this information
	amount of N in residues over the soil depth (profhum) derived from residues type 1 amount of N in residues over the soil depth (profhum) derived from residues type 10	kg.ha-l kg.ha-l	+ +	this information no need to have
Nresiduprofil(1)				this information

Nresiduprofil(3)	amount of N in residues over the soil depth (profhum) derived from residues type 3	kg.ha-1	+	no need to have this information
Nresiduprofil(4)	amount of N in residues over the soil depth (profhum) derived from residues type 4	kg.ha-1	+	no need to have this information
Nresiduprofil(5)	amount of N in residues over the soil depth (profhum) derived from residues type 5	kg.ha-1	+	no need to have
Nresiduprofil(6)	amount of N in residues over the soil depth (profhum) derived from residues type 6	kg.ha-1	+	this information no need to have
Nresiduprofil(7)	amount of N in residues over the soil depth (profhum) derived from residues type 7	kg.ha-1	+	this information no need to have
				this information
Nresiduprofil(8)	amount of N in residues over the soil depth (profhum) derived from residues type 8	kg.ha-1	+	no need to have this information
Nresiduprofil(9)	amount of N in residues over the soil depth (profhum) derived from residues type 9	kg.ha-l	+	no need to have this information
Ntousresidusprofil	amount of N in all organic residues over soil depth (profhum)	kg.ha-1	+	no need to have
numcoupe	cut number	SD	no need to have	this information no need to have
numcult	crop season number	SD	this information no need to have	this information no need to have
Nvolat_from_lev	cumulative amount of N volatilised during the crop cycle(emergence or budbreak-harvest)	kg.ha-1	this information	this information no need to have
			т	this information
Nvolat_from_plt	cumulative amount of N volatilised during the crop cycle (planting-harvest)	kg.ha-1	+	no need to have this information
Nvoleng	daily amount of N volatilised from fertiliser	kg.ha-1.d-1	no need to have this information	no need to have this information
offrenod	daily amount of N fixed symbiotically (BNF)	kg.ha-1.d-1	no need to have	no need to have
p1000grain	1000 grains weight	g	this information +	this information +
pdsfruit(1) pdsfruit(2)	weight of fruits in box 1 weight of fruits in box 2	g.m-2 g.m-2	+ +	+ +
pdsfruit(3)	weight of fruits in box 3	g.m-2 g.m-2	+	+
pdsfruit(4) pdsfruit(5)	weight of fruits in box 4 weight of fruits in box 5	g.m-2 g.m-2	+ +	+ +
pdsfruit(nboite)	weight of fruits in last box	g.m-2	+	+
pdsfruit(nboite-1) pdsfruitfrais	weight of fruits in last but one box weight of fresh fruits	g.m-2 g.m-2	+ +	+ +
penfruit	ratio of fruit envelops to plant biomass	0-1	no need to have this information	no need to have this information
pfeuil(n)	ratio of leaves to plant biomass	0-1	no need to have	no need to have
pfeuiljaune	ratio of yellow leaves to plant biomass	0-1	this information no need to have	this information no need to have
pfeuilverte(n)	ratio of green leaves to non-senescent plant biomass	0-1	this information no need to have	this information no need to have
			this information	this information
phoi	photoperiod	hour	no need to have this information	no need to have this information
pHvol	pH of soil surface as affected by organic residues application (slurry)	SD	no need to have this information	no need to have this information
pousfruit	number of fruits transferred from one box to the next	SD	no need to have	no need to have
poussracmoy	mean reduction factor on the root growth due to soil constraints (option "true density")	0-1	this information no need to have	this information no need to have
precip	daily amount of water added to soil (precipitation + irrigation)	mm.d-1	this information no need to have	this information no need to have
			this information	this information
precipjN	daily amount of mineral N added to soil due to precipitation	kg.ha-1.d-1	no need to have this information	no need to have this information
precipN	cumulative amount of mineral N added to soil due to precipitation	kg.ha-1	no need to have	no need to have
preserve	proportion of reserve in total plant biomass	0-1	this information no need to have	this information no need to have
	proportion of reserve in total plant biomass average depth of water absorption by plant	0-1 cm	this information no need to have this information no need to have	this information no need to have this information no need to have
preserve			this information no need to have this information	this information no need to have this information
preserve profexteau profextN	average depth of water absorption by plant average depth of N absorption by plant	cm cm	this information no need to have this information no need to have this information no need to have this information	this information no need to have this information no need to have this information no need to have this information
preserve profexteau profextN profnappe	average depth of water absorption by plant average depth of N absorption by plant depth of water table	cm cm cm	this information no need to have this information no need to have this information no need to have this information no need to have this information	this information no need to have this information no need to have this information no need to have this information no need to have this information
preserve profexteau profextN	average depth of water absorption by plant average depth of N absorption by plant depth of water table predawn leaf water potential	cm cm cm MPa	this information no need to have this information no need to have this information no need to have this information no need to have	this information no need to have this information no need to have this information no need to have this information no need to have
preserve profexteau profextN profnappe	average depth of water absorption by plant average depth of N absorption by plant depth of water table	cm cm cm	this information no need to have this information no need to have this information no need to have this information no need to have this information no need to have	this information no need to have this information
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QNplante	amount of N taken up by the plant	kg.ha-l	+	no need to have
QNplante_mx_av_cut	Amount of nitrogen taken up by the plant before $cut(for cut crops, for others = Qnplante(n))$	kgN.ha-	no need to have	this information no need to have
QNplantetombe	cumulative amount of N added to soil by fallen leaves due to senescence	kg.ha-1	this information no need to have	this information no need to have
			this information	this information
QNprimed	cumulative amount of N mineralised by priming effect	kg.ha-l	no need to have this information	no need to have this information
QNrac	cumulative amount of N added to soil by dead roots	kg.ha-l	no need to have this information	no need to have this information
QNresorg	cumulative amount of organic exogenous N added to soil	kg.ha-1	no need to have this information	no need to have this information
QNressuite	cumulative amount of N added to soil by aerial residues at harvest	kg.ha-1	no need to have this information	no need to have this information
QNrogne	cumulative amount of N added to soil by fallen leaves due to trimming	kg.ha-1	no need to have this information	no need to have this information
QNvoleng	cumulative amount of N volatilised from fertiliser	kg.ha-1	no need to have this information	no need to have this information
QNvolorg	cumulative amount of N volatilised from organic inputs	kg.ha-l	no need to have this information	no need to have this information
Qressuite	biomass of residues from the previous crop returned to soil at harvest	t.ha-l	+	no need to have this information
Qressuite_tot	amount of total harvest residues (aerials + roots)	t.ha-1	no need to have	no need to have
ra_recal	aerodynamic resistance between the canopy and the reference level zr	s.m-1	this information no need to have	this information no need to have
raint	photosynthetic active radiation intercepted by the canopy	MJ.m-2	this information no need to have	this information no need to have
ras	aerodynamic resistance between the soil and the canopy	s.m-1	this information no need to have	this information no need to have
Ratm	atmospheric radiation	MJ.m-2	this information no need to have	this information no need to have
rc	resistance of canopy	s.m-1	this information no need to have	this information no need to have
rdif	ratio of diffuse radiation to global radiation	0-1	this information no need to have	this information no need to have
	daily amount of biomass remobilized for growth	kg.ha-1.d-1	this information	this information
remobilj		-	no need to have this information	no need to have this information
remontee	capillary uptake from the base of the soil profile	mm.d-1	no need to have this information	no need to have this information
rendementsec resmes	dry biomass of harvested organs amount of soil water integrated on the measurement depth	t.ha-1 mm	+ no need to have	+ no need to have
resperenne	biomass of perennial reserves which can be remobilized	t.ha-l	this information no need to have	this information no need to have
resrac	soil water reserve in the root zone	mm	this information no need to have	this information no need to have
rfpi	reduction factor on plant development due to photoperiod	0-1	this information no need to have	this information no need to have
rfvi	reduction factor on plant development due to vernalization	0-1	this information no need to have	this information no need to have
			this information	this information
rlj	rate of root length growth	m.d-1	no need to have this information	no need to have this information
rltot	total root length (accounting for senescent roots)	cm.cm-2	no need to have this information	no need to have this information
rmaxi	maximum water reserve used	mm	no need to have this information	no need to have this information
met	net radiation	MJ.m-2	no need to have this information	no need to have this information
metS	net radiation at the soil surface	MJ.m-2	no need to have this information	no need to have this information
rombre	fraction of the total radiation in the shade	0-1	no need to have this information	no need to have this information
rsoleil	fraction of the total radiation in the full sun	0-1	no need to have this information	no need to have this information
RsurRU	fraction of plant available water over the soil profile	0-1	no need to have this information	no need to have this information
RsurRUrac	fraction of plant available water over the root profile	0-1	no need to have this information	no need to have this information
RU	maximum plant available water content over the soil profile	mm	no need to have	no need to have
ruissel	daily amount of water in total runoff (surface + overflow)	mm.d-1	this information no need to have	this information no need to have
ruisselsurf	daily amount of water in runoff at soil surface	mm.d-1	this information no need to have	this information no need to have
ruisselt	cumulative amount of water in total runoff (surface + overflow)	mm	this information no need to have	this information no need to have
runoff_from_lev	cumulative amount of water in runoff (surface + overflow) during the crop cycle (emergence	mm	this information no need to have	this information no need to have
runoff_from_plt	or budbreak-harvest) cumulative amount of water in runoff (surface + overflow) during the crop cycle (sowing-	mm	this information no need to have	this information no need to have
RUrac	maximum plant available water content over the root profile	mm	this information no need to have	this information no need to have
saturation	amount of water in the soil macroporosity	mm	this information no need to have	this information no need to have
			this information	this information
senfac	reduction factor on leaf life span due to water stress (increasing senescence rate)	0-1	no need to have this information	no need to have this information
sla	specific leaf area	cm2.g-1	no need to have this information	no need to have this information
SoilAvW	amount of plant available water in soil over the depth "profimes"	mm	no need to have this information	no need to have this information
SoilN	amount of mineral N in soil over the depth "profmes"	kg.ha-l	no need to have this information	no need to have this information
SoilNM	amount of NO3-N in soil over the depth "profmesN"	kg.ha-l	no need to have this information	no need to have this information
SoilWatM	amount of plant available water in soil over the depth "profmesW"	mm	no need to have this information	no need to have this information
som_HUR	cumulative water content of the soil microporosity	mm	no need to have this information	no need to have this information
som_sat	cumulative amount of water in the soil macroporosity	mm	no need to have	no need to have
somcour	cumulative units of development (upvt) between two stages	degreeC.d	this information no need to have	this information no need to have
somcourdrp	cumulative units of development (upvt) between two reproductive stages	degreeC.d	this information no need to have	this information no need to have
somcourfauche	sum of temperature beetwen 2 cuts of forage crop	degreeC.d	this information no need to have	this information no need to have
somcourmont	cumulative units of development from the start of vernalisation	degreeC.d	this information no need to have	this information no need to have
somdiftcultair	cumulative temperature difference (tcult-tair) during the simulation period	degreeC	this information no need to have	this information no need to have
somemp	sum of temperatures (expressed in Q10 = sum (2.0 ** (udevair ou udevcult / 10.))	degreeC.d	this information no need to have	this information no need to have
			this information	this information
somudevair	sum of air temperature (udevair) from sowing to harvest	degreeC	no need to have this information	no need to have this information

somudevcult	sum of crop temperature (udevcult) from sowing to harvest	degreeC	no need to have	no need to have
somupvtsem	sum of development units (upvt) from sowing to harvest	degreeC	this information no need to have	this information no need to have
		SD	this information no need to have	this information no need to have
sourcepuits	source to sink ratio of assimilates in the plant		this information	this information
spfruit	reduction factor on the fruits number due to trophic stress	0-1	no need to have this information	no need to have this information
splai	source to sink ratio of assimilates in the leaves	SD	no need to have this information	no need to have this information
stemflow	daily amount of water runoff along the stem	mm.d-1	no need to have this information	no need to have this information
strlintercoupe	average stomatal water stress index during the vegetative phase (emergence - maximum LAI) of forage crops	0-1	no need to have this information	no need to have this information
str2intercoupe	average stomatal water stress index during the reproductive phase (maximum LAI - maturity) of forage crops	0-1	no need to have this information	no need to have this information
stulintercoupe	average turgescence water stress index during the vegetative phase (emergence - maximum LAI) of forage crops	0-1	no need to have this information	no need to have this information
stu2intercoupe	average turgescence water stress index during the reproductive phase (maximum LAI - maturity) of forage crops	0-1	no need to have this information	no need to have this information
sucre sucre_percent	sugar content of harvested organs sugar content of harvested organs	0-1 % fresh weight	+ +	+++
surf(ao)	fraction of the soil surface in the shade	0-1	no need to have this information	no need to have this information
surf(as)	fraction of the soil surface in the sun	0-1	no need to have	no need to have
swfac	stomatic water stress index	0-1	this information no need to have	this information no need to have
swfac1moy	average stomatic water stress index over the vegetative stage	0-1	this information no need to have	this information no need to have
swfac2moy	average stomatic water stress index over the reproductive stage	0-1	this information no need to have	this information no need to have
tairveille	mean air temperature at the previous day	degreeC	this information no need to have	this information no need to have
tauxcouv(n)	cover rate of the canopy	SD	this information no need to have	this information no need to have
tcult	crop surface temperature (daily average)	degreeC	this information no need to have	this information no need to have
tcult_tairveille	difference between canopy temperature and air temperature	degreeC	this information no need to have	this information no need to have
			this information	this information
tcultmax	crop surface temperature (daily maximum)	degreeC	no need to have this information	no need to have this information
tcultmin	crop surface temperature (daily minimum)	degreeC	no need to have this information	no need to have this information
tempeff	efficient temperature for growth	degreeC	no need to have this information	no need to have this information
tetp(n)	efficient potential evapotranspiration (entered or calculated)	mm.d-1	no need to have this information	no need to have this information
tetstomate	threshold of soil water content limiting transpiration and photosynthesis	% vol	no need to have this information	no need to have this information
teturg	threshold of soil water content limiting the growth of leaves (in surface area)	% vol	no need to have this information	no need to have this information
tmax(n)	maximum active temperature of atmosphere	degreeC	no need to have this information	no need to have this information
tmaxext(n)	maximum temperature of external atmosphere	degreeC	no need to have this information	no need to have this information
tmin(n)	minimum active temperature of atmosphere	degreeC	no need to have this information	no need to have this information
tminext(n)	minimum temperature of external atmsphere	degreeC	no need to have	no need to have
tmoy(n)	mean active temperature of atmosphere	degreeC	this information no need to have	this information no need to have
tmoyext(n)	mean temperature of external atmosphere	degreeC	this information no need to have	this information no need to have
			this information	
tmoyIpltJuin	mean temperature from sowing or planting (iplt stage) until June 30	degreeC	no need to have	this information no need to have
tmoyIpltJuin tmoyIpltSept	mean temperature from sowing or planting (iplt stage) until June 30 mean temperature from sowing or planting (iplt stage) until September 30	degreeC degreeC		
		degreeC	no need to have this information	no need to have this information
tmoyIpltSept	mean temperature from sowing or planting (iplt stage) until September 30		no need to have this information no need to have this information	no need to have this information no need to have this information
tmoyIpltSept tncultmat tnhc	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus	degreeC degreeC d	no need to have this information no need to have this information no need to have this information no need to have this information	no need to have this information no need to have this information no need to have this information no need to have this information
tmoylpllSept tncultmat tnhc tnrc	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues	degreeC degreeC d d	no need to have this information no need to have this information no need to have this information no need to have this information	no need to have this information no need to have this information no need to have this information no need to have this information
tmoyIpltSept tncultmat tnhc tnrc totapN	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers	degreeC degreeC d d kg.ha-1	no need to have this information no need to have	no need to have this information no need to have this information no need to have this information no need to have this information no need to have this information
tmoyIpltSept tncultmat tnhc tnrc totapN totapNres	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers	degreeC degreeC d d kg.ha-1 kg.ha-1	no need to have this information no need to have	no need to have this information no need to have this information
tmoyIpItSept tncultmat tnhc tnrc totapN totapNres totir	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation)	degreeC degreeC d kg.ha-1 kg.ha-1 mm	no need to have this information no need to have this information	no need to have this information no need to have this information
tmoyIpIISept tncultmat tnhc tnrc totapN totapNres totir totir tpm(n)	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air	degreeC degreeC d kg.ha-1 kg.ha-1 mm hPa	no need to have this information no need to have this information	no need to have this information no need to have this information
tmoyIpItSept tncultmat tnhc tnrc totapN totapNres totir tpm(n) trg(n)	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air active radiation (entered or calculated)	degreeC degreeC d kg.ha-1 kg.ha-1 mm hPa MJ.m-2	no need to have this information no need to have this information	no need to have this information no need to have this information
tmoyIpIISept tncultmat tnhc tnrc totapN totapNres totir totir tpm(n)	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air active radiation (entered or calculated) exterior radiation	degreeC degreeC d d kg.ha-1 mm hPa MJ.m-2 MJ.m-2	no need to have this information no need to have this information	no need to have this information no need to have this information
tmoyIpItSept tncultmat tnhc tnrc totapN totapNres totir tpm(n) trg(n)	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air active radiation (entered or calculated)	degreeC degreeC d kg.ha-1 kg.ha-1 mm hPa MJ.m-2	no need to have this information no need to have	no need to have this information no need to have
tmoyIpltSept tncultmat tnhc tnrc totapN totapNres totir tpm(n) trgext(n)	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air active radiation (entered or calculated) exterior radiation	degreeC degreeC d d kg.ha-1 mm hPa MJ.m-2 MJ.m-2	no need to have this information no need to have	no need to have this information no need to have
tmoyIpItSept tncultmat tnhc tnrc totapN totapNres totir tpm(n) trgext(n) trr(n)	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air active radiation (entered or calculated) exterior radiation daily rainfall	degreeC degreeC d kg.ha-1 kg.ha-1 mm hPa MJ.m-2 mm.d-1	no need to have this information no need to have	no need to have this information no need to have
tmoyIpItSept tncultmat tnhc tnrc totapN totapNres totir tpm(n) trgext(n) trr(n) TS(1)	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air active radiation (entered or calculated) exterior radiation daily rainfall mean soil temperature (in layer 1)	degreeC degreeC d kg.ha-1 kg.ha-1 mm hPa MJ.m-2 MJ.m-2 mm.d-1 degreeC	no need to have this information no need to have	no need to have this information no need to have
tmoyIpItSept tncultmat tnhc tnrc totapN totapNres totir tpm(n) trg(n) trr(n) TS(1) TS(2)	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air active radiation (entered or calculated) exterior radiation daily rainfall mean soil temperature (in layer 1) mean soil temperature (in layer 2)	degreeC degreeC d d kg.ha-1 kg.ha-1 mm hPa MJ.m-2 MJ.m-2 MJ.m-2 degreeC degreeC	no need to have this information no need to have	no need to have this information no need to have this information
tmoyIpItSept tncultmat tnhc tnrc totapN totapNres totir tpm(n) trgext(n) trr(n) TS(1) TS(2) TS(3)	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of compute (precipitation + irrigation) water vapour pressure in air active radiation (entered or calculated) exterior radiation daily rainfall mean soil temperature (in layer 1) mean soil temperature (in layer 3)	degreeC degreeC d kg.ha-1 kg.ha-1 mm hPa MJ.m-2 MJ.m-2 MJ.m-2 mm.d-1 degreeC degreeC degreeC	no need to have this information no need to have	no need to have this information no need to have
tmoyIpItSept tncultmat tnhc tnrc totapN totapNres totir tpm(n) trgext(n) trr(n) TS(1) TS(2) TS(3) TS(4)	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air active radiation (entered or calculated) exterior radiation daily rainfall mean soil temperature (in layer 1) mean soil temperature (in layer 3) mean soil temperature (in layer 4)	degreeC degreeC d d kg.ha-1 kg.ha-1 mm hPa MJ.m-2 MJ.m-2 MJ.m-2 mm.d-1 degreeC degreeC degreeC	no need to have this information no need to have this information have this have this information have this have the have this have this have the have the have this have the have the have the have this have the have	no need to have this information no need to have this information
tmoyIpIISept tncultmat tnhc tnrc totapN totapNres totir trg(n) trgext(n) trr(n) TS(1) TS(2) TS(3) TS(4) TS(5)	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air active radiation (entered or calculated) exterior radiation daily rainfall mean soil temperature (in layer 1) mean soil temperature (in layer 3) mean soil temperature (in layer 5)	degreeC degreeC d d kg.ha-1 kg.ha-1 mm hPa MJ.m-2 MJ.m-2 mm.d-1 degreeC degreeC degreeC degreeC degreeC	no need to have this information no need to have this information	no need to have this information no need to have this information
tmoyIpItSept tncultmat tnhc tnrc totapN totapNres totir tpm(n) trgext(n) trr(n) TS(1) TS(2) TS(3) TS(4) TS(5) tsol(10)	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air active radiation (entered or calculated) exterior radiation daily rainfall mean soil temperature (in layer 1) mean soil temperature (in layer 3) mean soil temperature (in layer 5) temperature in the soil at 10 cm	degreeC degreeC d d kg.ha-1 kg.ha-1 mm hPa MJ.m-2 MJ.m-2 MJ.m-2 MJ.m-2 degreeC degreeC degreeC degreeC degreeC degreeC degreeC	no need to have this information no need to have this information	no need to have this information no need to have this information
tmoyIpItSept tncultmat tnhc tnrc totapN totapNres totir tpm(n) trgext(n) trr(a) TS(1) TS(2) TS(3) TS(4) TS(5) tsol(10) turfac	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of cumulative amount of mineral N added by organic fertilisers exterior radiation daily rainfall mean soil temperature (in layer 1) <td>degreeC degreeC d d kg.ha-1 kg.ha-1 mm hPa MJ.m-2 MJ.m-2 MJ.m-2 mm.d-1 degreeC degreeC degreeC degreeC degreeS 0-1</td> <td>no need to have this information no need to have this information</td> <td>no need to have this information no need to have this information</td>	degreeC degreeC d d kg.ha-1 kg.ha-1 mm hPa MJ.m-2 MJ.m-2 MJ.m-2 mm.d-1 degreeC degreeC degreeC degreeC degreeS 0-1	no need to have this information no need to have this information	no need to have this information no need to have this information
tmoyIpItSept tncultmat tnhc tnrc totapN totapNres totir tpm(n) trg(n) trg(n) TS(1) TS(2) TS(3) TS(4) TS(5) tsol(10) turfac turfac Imoy	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of calculated) exterior radiation daily rainfall mean soil temperature (in layer 1) mean soil temperature (in layer 3) mean soil temperature (in la	degreeC degreeC d d kg.ha-1 kg.ha-1 mm hPa MJ.m-2 MJ.m-2 MJ.m-2 MJ.m-2 degreeC degreeC degreeC degreeC degrees 0-1 0-1	no need to have this information no need to have this information	no need to have this information no need to have this information
tmoyIpItSept tncultmat tnhc tnrc totapN totapNres totir tpm(n) trgext(n) trr(n) TS(1) TS(2) TS(3) TS(4) TS(5) tsol(10) turfac turfacImoy turfacImoy turfac2moy	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air active radiation daily rainfall mean soil temperature (in layer 1) mean soil temperatu	degreeC d d kg.ha-1 kg.ha-1 mm hPa MJ.m-2 MJ.m-2 mm.d-1 degreeC degreeC degreeC degreeS 0-1 0-1	no need to have this information no need to have this information	no need to have this information no need to have this information
tmoyIpItSept tncultmat tnhc tarc totapN totapNres totir tpm(n) trgext(n) trr(n) TS(1) TS(2) TS(3) TS(4) TS(5) tsol(10) turfac turfacImoy turfacImoy turfac2moy tustress tvent(n)	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air active radiation (entered or calculated) exterior radiation daily rainfall mean soil temperature (in layer 1) mean soil temperature (in layer 2) mean soil temperature (in layer 3) mean soil temperature (in layer 5) temperature in the soil at 10 cm turgescence water stress index during the vegetative stage average turgescence water stress index during the reproductive stage reduction factor on leaf growth due to the effective water stress (= min(turfac,innlai)) mean adily wind speed at 2 m high above soil	degreeC d d kg.ha-1 kg.ha-1 mm hPa MJ.m-2 MJ.m-2 degreeC degreeC degreeC degreeC degreeS 0-1 0-1 0-1 0-1 ns-1	no need to have this information no need to have this information	no need to have this information no need to have this information
tmoyIpIISept tnculunat tnhc tnrc totapN totapNres totir trg(n) trgext(n) trr(n) TS(1) TS(2) TS(3) TS(4) TS(5) tsol(10) turfac turfacImoy turfacImoy turfac2moy tvent(n) udevair	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by organic fertilisers and organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air active radiation (entered or calculated) exterior radiation daily rainfall mean soil temperature (in layer 1) mean soil temperature (in layer 3) mean soil temperature (in layer 5) temperature in the soil at 10 cm turgescence water stress index during the vegetative stage average turgescence water stress index during the vegetative stage reduction factor on leaf growth due to the effective water stress (= min(turfac,innlai)) mean adily wind speed at 2 m high above soil effective temperature for crop development, computed with tair	degreeC d d kg.ha-1 kg.ha-1 mm hPa MJ.m-2 mm.d-1 degreeC degreeC	no need to have this information no need to have this information	no need to have this information no need to have this information
tmoyIpItSept tncultmat tnhc tnrc totapN totapNres totir tym(n) trgext(n) trr(n) TS(1) TS(2) TS(3) TS(4) TS(5) tsol(10) turfac turfac2moy tustress tvent(n)	mean temperature from sowing or planting (iplt stage) until September 30 average of minimum crop temperatures (tcultmin) between the stages lax and rec cumulative "normalized" time for the mineralisation of humus cumulative "normalized" time for the mineralisation of organic residues cumulative amount of mineral N added by mineral fertilisers and organic fertilisers cumulative amount of mineral N added by organic fertilisers cumulative amount of water inputs (precipitation + irrigation) water vapour pressure in air active radiation (entered or calculated) exterior radiation daily rainfall mean soil temperature (in layer 1) mean soil temperature (in layer 2) mean soil temperature (in layer 3) mean soil temperature (in layer 5) temperature in the soil at 10 cm turgescence water stress index during the vegetative stage average turgescence water stress index during the reproductive stage reduction factor on leaf growth due to the effective water stress (= min(turfac,innlai)) mean adily wind speed at 2 m high above soil	degreeC d d kg.ha-1 kg.ha-1 mm hPa MJ.m-2 MJ.m-2 degreeC degreeC degreeC degreeC degreeS 0-1 0-1 0-1 0-1 ns-1	no need to have this information no need to have this information	no need to have this information no need to have this information

upvt(n)	development unit	degreeC.d	no need to have this information	no need to have this information
vitmoy	mean canopy growth rate	g.m-2.d-1	no need to have this information	no need to have this information
xmlch1	thickness of the dry layer created by evaporation from the soil and mulch	cm	no need to have this information	no need to have this information
zrac	maximum depth reached by root system	cm	no need to have this information	no need to have this information

WOFOST DETAILED INPUT/OUTPUT

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	VARIABLE	DESCRIPTION INPUTS	UNIT	In Optimal?	In Minimal?
Weather file	CABO weather file *.XXX where the XXX are the 3 last digits of the year	name of the CABO weather file	(-)	+	+
	Station name	header with the name of the meteorological station	(-)	default=agentN where the N is the agent number	default=agentN where the N is the agent number
	Year Author	header with the year header with the name of the file creator	(-)	+ default=agentN where the N is the agent number	+ default=agentN where the N is the agent number
	Source	header with the source data provider	(-)	default=agentN where the N is the agent number	default=agentN where the N is the agent number
	WCCDESCRIPTION	the WCC-variable 'WCCDESCRIPTION' with the description of the weather station (this description must be exactly the same (including spaces) for different files of the same weather station, otherwise WCC will not recognize these files as belonging to the same station)	(-)	default=agentN where the N is the agent number	default=agentN where the N is the agent number
	WCCFORMAT	the WCC-variable 'WCCFORMAT' with an indication for the weather format. WCCFORMAT=2 indicates daily weather data (CABO-format)	(-)	default=2	default=2
	WCCYEARNR LONG	the WCC-variable 'WCCYEARNR' that gives the year longitude of the station	(y) (decimal degree)	+ +	+ +
	LAT ALT	latitude of the station altitude of the station	(decimal degree) (m)	+ +	+
	А	the A coefficient for the Ängström formula	(-)	+	default=-0.18
	B 1 st column	the B coefficients for the Ängström formula station number	(-)	+ default=1	default=-0.55 default=1
	2 nd column	year	(y)	+	+
	3 rd column 4 th column	day number irradiation	(day of year) (kJ·m ⁻² ·d ⁻¹)	+ +	+ +
	5 th column	minimum temperature	(°C)	+	+
	6 th column 7 th column	early morning vapor pressure	(°C) (kPa)	+ +	+ +
	8th column	mean wind speed at 2 m above ground	(m·s ⁻¹)	+	+
Soil file	9 th column soil file *.new	precipitation name of the .new soil file	(mm·d ⁻¹) (-)	+ +	+ +
	SOLNAM	description of the soil	(-)	default=SoilN where the N is the agent number	default value from *.new file
	SMTAB SMW	volumetric soil moisture content as function of pF soil moisture content at wilting point	([log (cm); cm ³ cm ⁻³]) (cm ³ cm ⁻³)	+ +	default value from *.new file default value from *.new file
	SMFCF	soil moisture content at field capacity	(cm ³ cm ³)	+	default value from *.new file
	SM0 CRAIRC	soil moisture content at saturation critical soil air content for aeration	(cm ³ cm ³) (cm ³ cm ³)	+ +	default value from *.new file default value from *.new file
	CONTAB	10-log hydraulic conductivity as function of pF	([log (cm); log (cm/day)])	+	default value from *.new file
	K0 SOPE	hydraulic conductivity of saturated soil	(cm d ⁻¹)	+ +	default value from *.new file
	SOPE KSUB	maximum percolation rate root zone maximum percolation rate subsoil	(cm d ⁻¹) (cm d ⁻¹)	+ +	default value from *.new file default value from *.new file
	SPADS	1st topsoil seepage parameter deep seedbed	(-)	+	default value from *.new file
	SPODS SPASS	2nd topsoil seepage parameter deep seedbed 1st topsoil seepage parameter shallow seedbed	(-)	+ +	default value from *.new file default value from *.new file
	SPOSS DEFLIM	2nd topsoil seepage parameter shallow seedbed required moisture deficit deep seedbed	(-) (-)	+ +	default value from *.new file default value from *.new file
		BAR301.CAB – spring barley (EU) FBE0801.CAB – Faba bano (Vicia faba) (EU) MAG202.CAB – Maize (Southern DE & Northern FR) MAG203.CAB – Maize (Contral FR & Northern IT) MAG204.CAB – Maize (Contral FR & Northern IT) MAG204.CAB – Maize (Routhern FR, Northern IT, ES & PT) MAG205.CAB – Maize (Routhern FR, Northern IT, Southern ES) POT701.CAB – potato (DK, Southern IT, Southern ES) POT701.CAB – potato (Southern FR, Northern IT) POT702.CAB – potato (Southern FR, Southern FR, Southern FR, Southern IT, Southern ES) RAP1001.CAB – ontato (Southern FR, R, Southern FR, Southern IT, Southern ES) RAP1002.CAB – winter oilseed rape (EU without Southern FR, Southern IT, Southern ES) RAP1002.CAB – winter oilseed rape (EU without Southern FR, Southern IT, RAP1003.CAB – winter oilseed rape (EU without Southern FR, Southern IT, RAP1003.CAB – winter oilseed rape (EU without Southern FR, Southern IT, RAP1003.CAB – winter oilseed rape (EU without Southern FR, Southern IT, RAP1004.CAB – oilseed rape (EU without Southern FR) SOY0901.CAB – solybean (Central FR) SOY0902.CAB – solybean (Central FR) SOY0903.CAB – solybean (Central FR) SOY0904.CAB – solybean (Central FR) SOY0904.CAB – solybean (Central FR) SOY0905.CAB – solybean (Central FR, NL, BE, LU, UK, IE, DK) SUG0602.CAB – sugar beet (Southern FR, Northern and Central T, ES, PT) SUG0603.CAB – solybean (Central FR, Southern T) SUG0603.CAB – solybean (Central FR, Southern T) SUG0603.CAB – solybean (Central AT, ES, PT) SUG0603.CAB – solybean (Central AT, ES, PT) SUG0603.CAB – solybean (Central AT, ES, CR) WWH101.CAB – winter wheat (Conthern ES, Southern T) SUG0604.CAB – solyar beet (R) SUN101.CAB – winter wheat (Central and southern UK, NL, NCH) WWH102.CAB – winter wheat (Central AT, ES, CR) WWH103.CAB – winter wheat (Central AT, SOUTHER, Southern AE, Southern DE) WWH103.CAB – winter wheat (central AT, SOUTHER, SOUT			default value from *.cab file
	CRPNAM TBASEM	lower threshold temperature for emergence	(-) (°C)	default value from *.cab file default value from *.cab file	default value from *.cab file
	TEFFMX TSUMEM	maximum effective temperature for emergence temperature sum from sowing to emergence	(°C) (°C d)	default value from *.cab file default value from *.cab file	default value from *.cab file default value from *.cab file
	IDSL	indicates whether pre-anthesis development depends on temp. (=0), daylength (=1), or both (=2)	(-)	default value from *.cab file	default value from *.cab file
	DLO DLC	optimum daylength for development critical daylength (lower threshold)	(h) (h)	default value from *.cab file default value from *.cab file	default value from *.cab file default value from *.cab file
	TSUM1	temperature sum from emergence to anthesis	(°C d)	default value from *.cab file	default value from *.cab file
	TSUM2 DTSMTB	temperature sum from anthesis to maturity daily increase in temperature sum as function of average temperature	(°C d) ([°C ; °C d])	default value from *.cab file default value from *.cab file	default value from *.cab file default value from *.cab file
	DVSI	initial DVS	(-)	default value from *.cab file	default value from *.cab file
	DVSEND TDWI	development stage at harvest (= 2.0 at maturity) initial total crop dry weight	(-) (kg ha ⁻¹)	default value from *.cab file default value from *.cab file	default value from *.cab file default value from *.cab file
	LAIEM	leaf area index at emergence	(ha ha ⁻¹)	default value from *.cab file	default value from *.cab file
	RGRLAI SLATB	maximum relative increase in LAI specific leaf area as a function of DVS	(ha ha ⁻¹ d ⁻¹) ([-; ha kg ⁻¹])	default value from *.cab file default value from *.cab file	default value from *.cab file default value from *.cab file
	SPA	specific pod area	(ha kg ⁻¹)	default value from *.cab file	default value from *.cab file
	SSATB SPAN	specific stem area as function of DVS life span of leaves growing at 35 Celsius	([-; ha kg ⁻¹]) (d)	default value from *.cab file default value from *.cab file	default value from *.cab file default value from *.cab file
	TBASE	lower threshold temperature for aging of leaves	(°C)	default value from *.cab file	default value from *.cab file
	KDIFTB EFFTB	extinction coefficient for diffuse visible light as function of DVS light-use efficiency for single leaf as function of daily mean temperature	([-; -]) ([°C; kg ha ⁻¹ h ⁻¹ j ⁻¹ m ² s])	default value from *.cab file default value from *.cab file	default value from *.cab file default value from *.cab file
	AMAXTB	maximum leaf CO2 assimilation as function of DVS	([-;;-])	default value from *.cab file	default value from *.cab file
	TMPFTB TMNFTB	reduction factor of AMAX as function of average temperature reduction factor of gross assimilation rate as function of low minimum temperature	([°C; -]) ([°C; -])	default value from *.cab file default value from *.cab file	default value from *.cab file default value from *.cab file
	CVL	efficiency of conversion into leaves	([⁻ C; -]) (kg kg ⁻¹)	default value from *.cab file	default value from *.cab file
L	CVO	efficiency of conversion into storage organs	(kg kg ⁻¹)	default value from *.cab file	default value from *.cab file

		-			
	CVR	efficiency of conversion into roots	(kg kg ⁻¹)	default value from *.cab file	default value from *.cab file
	CVS	efficiency of conversion into stems	(kg kg ⁻¹)	default value from *.cab file	default value from *.cab file
	Q10	relative increase in respiration rate per 10 Celsius temperature increase	(-)	default value from *.cab file	default value from *.cab file default value from *.cab file
	RML RMO	relative maintenance respiration rate leaves relative maintenance respiration rate storage organs	(kg CH ₂ O kg ⁻¹ d ⁻¹) (kg CH ₂ O kg ⁻¹ d ⁻¹)	default value from *.cab file default value from *.cab file	default value from *.cab file
	RMR	relative maintenance respiration rate roots	(kg CH ₂ O kg ⁻¹ d ⁻¹)	default value from *.cab file	default value from *.cab file
	RMS	relative maintenance respiration rate stems	$(kg CH_2O kg^{-1} d^{-1})$	default value from *.cab file	default value from *.cab file
	RFSETB	reduction factor for senescence as function of DVS	([-; -])	default value from *.cab file	default value from *.cab file
	FRTB	fraction of total dry matter to roots as a function of DVS	([-; kg kg ⁻¹])	default value from *.cab file	default value from *.cab file
	FLTB	fraction of above-ground dry matter to leaves as a function of DVS	([-; kg kg ⁻¹])	default value from *.cab file	default value from *.cab file
	FSTB	fraction of above-ground dry matter to stems as a function of DVS	([-; kg kg ⁻¹])	default value from *.cab file	default value from *.cab file
	FOTB PERDL	fraction of above-ground dry matter to storage organs as a function of DVS maximum relative death rate of leaves due to water stress	([-; kg kg ⁻¹]) (-)	default value from *.cab file default value from *.cab file	default value from *.cab file default value from *.cab file
	RDRRTB	relative death rate of reaves due to water stress	([-; kg kg ⁻¹ d ⁻¹])	default value from *.cab file	default value from *.cab file
	RDRSTB	relative death rate of stems as a function of DVS	$([-; kg kg^{-1} d^{-1}])$	default value from *.cab file	default value from *.cab file
	CFET	correction factor transpiration rate	(-)	default value from *.cab file	default value from *.cab file
	DEPNR	crop group number for soil water depletion	(-)	default value from *.cab file	default value from *.cab file
	IAIRDU	air ducts in roots present (=1) or not (=0)	(-)	default value from *.cab file	default value from *.cab file
	RDI	initial rooting depth	(cm)	default value from *.cab file default value from *.cab file	default value from *.cab file
	RRI RDMCR	maximum daily increase in rooting depth maximum rooting depth	(cm d ⁻¹) (cm)	default value from *.cab file	default value from *.cab file default value from *.cab file
	NMINSO	minimum concentrations of N in storage organs	(kg kg ⁻¹)	default value from *.cab file	default value from *.cab file
	NMINVE	minimum concentrations of N in vegetative organs	(kg kg ⁻¹)	default value from *.cab file	default value from *.cab file
	NMAXSO	maximum concentrations of N in storage organs	(kg kg ⁻¹)	default value from *.cab file	default value from *.cab file
	NMAXVE	maximum concentrations of N in vegetative organs	(kg kg ⁻¹)	default value from *.cab file	default value from *.cab file
	PMINSO	minimum concentrations of P in storage organs	(kg kg ⁻¹)	default value from *.cab file	default value from *.cab file
	PMINVE	minimum concentrations of P in vegetative organs	(kg kg ⁻¹)	default value from *.cab file	default value from *.cab file
	PMAXSO PMAXVE	maximum concentrations of P in storage organs	(kg kg ⁻¹)	default value from *.cab file	default value from *.cab file default value from *.cab file
	KMINSO	maximum concentrations of P in vegetative organs minimum concentrations of K in storage organs	(kg kg ⁻¹) (kg kg ⁻¹)	default value from *.cab file default value from *.cab file	default value from *.cab file default value from *.cab file
	KMINVE	minimum concentrations of K in storage organs	(kg kg ⁻¹)	default value from *.cab file	default value from *.cab file
	KMAXSO	maximum concentrations of K in storage organs	(kg kg ⁻¹)	default value from *.cab file	default value from *.cab file
	KMAXVE	maximum concentrations of K in vegetative organs	(kg kg ⁻¹)	default value from *.cab file	default value from *.cab file
	YZERO	maximum amount vegetative organs at zero yield	(kg ha ⁻¹)	default value from *.cab file	default value from *.cab file
TD: 01	NFIX	fraction of N-uptake from biological fixation	(kg kg ⁻¹)	default value from *.cab file	default value from *.cab file
Timer file	RUNNAM	run name (max. 6 characters, between quotes).	(-)	default='WCC' default=2	default='WCC'
	IWEATH CLFILE	format of weather: 0 (WOFOST-monthly), 1 (WOFOST-climate), or 2 (CABO). file name of weather station.	(-)	default=2 name of CABO weather file	default=2 name of CABO weather file
	CLITE	The name of weather station.	(7)	*.XXX	*.XXX
				where the XXX are the 3 last digits	where the XXX are the 3 last digits
				of the year	of the year
	ISYR	first year for which crop growth is simulated.	(y)	+	'Year' variable from weather file
	INYEAR	number of years to simulate crop growth.	(-)	default=1	default=1
	IRNDAT	option for the use/selection of rainfall data: 0 (generates statistics with varying total monthly rainfall and number of rainy days), 1 (distributes monthly rainfall over given number of days), 2 (reads rainfall data out of separate	(-)	default=3	default=3
		file) or 3 (rainfall as it occurs in weather file). See Chapter 4 about the input of rainfall to learn more about this			
		option).			
	RAFILE	name of rainfall station	(-)	default=' <none>'</none>	default=' <none>'</none>
	ISYRR	(first) year of rainfall data to be used (if IRNDAT = 2). If IRNDAT \neq 2, then ISYRR = -	(-)	default=-999	default=-999
		Wageningen Environmental Research – WOFOST user manual - 2014 (update spring 2021) 61			
	INYRG	number of runs for which rainfall has to be generated (IRNDAT = 0), or distributed (IRNDAT = 1). If IRNDAT \neq	(-)	default=1	default=1
	in the	0 or 1, then INYRG = 1 (WOFOST does not accept 0!). This variable is also used for the number of rainfall years	0	definiti-1	domun-1
		(IRNDAT = 2).			
1	CRFILE	name of crop file	(-)	name of the .cab crop file	name of the .cab crop file
	ISTCHO	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day).	(-)	default=1	default=1
	ISTCHO IDEM	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0.	(-) (day of year)		
	ISTCHO IDEM IDSOW	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1.	(-) (day of year) (day of year)	default=1 default=1 +	default=1 default=1 +
	ISTCHO IDEM	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2.	(-) (day of year) (day of year) (day of year)	default=1	default=1
	ISTCHO IDEM IDSOW IDESOW	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1.	(-) (day of year) (day of year)	default=1 default=1 + default=100	default=1 default=1 + default=100
	ISTCHO IDEM IDSOW IDESOW IDLSOW IENCHO	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days).	(a) (day of year) (day of year) (day of year) (day of year) (day of year)	default=1 default=1 + default=100 default=140 default=2	default=1 default=1 + default=100 default=140 default=2
	ISTCHO IDEM IDESOW IDESOW IDLSOW IENCHO IDAYEN	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if IENCHO = 1 or 3.	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year)	default=1 default=1 + default=100 default=140 default=270 default=270	default=1 default=1 + default=100 default=140 default=2 default=270
	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDURMX	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if IENCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3.	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (da) of year)	default=1 default=1 + default=140 default=140 default=2 default=270 default=350	default=1 + default=10 default=100 default=140 default=270 default=270 default=350
	ISTCHO IDEM IDESOW IDESOW IDLSOW IENCHO IDAYEN	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if IENCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary), 1 (for whole system), 2 (for root zone), or 3 (for	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year)	default=1 default=1 + default=100 default=140 default=270 default=270	default=1 default=1 + default=100 default=140 default=2 default=270
	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDURMX IBAL	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if IENCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary), 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone).	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (d) (-)	default=1 default=1 + default=100 default=140 default=22 default=270 default=350 default=1	default=1 default=1 + default=100 default=20 default=270 default=270 default=350 default=1
	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDURMX	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day or year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. Ultimate day of farvest (day of year). Used if ISTCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary), 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (da) of year)	default=1 default=1 + default=140 default=140 default=2 default=270 default=350	default=1 + default=10 default=100 default=140 default=270 default=270 default=350
	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDURMX IBAL PRDEL	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if IENCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary), 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to these lines. No detailed output will be produced, if the interval is set at zero days.	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (-) (-)	default=1 default=1 + default=100 default=210 default=270 default=350 default=1 default=1	default=1 + default=10 default=100 default=270 default=350 default=1 default=1.0
	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDAYEN IDAYEN IDAYEN IDAYEN IBAL PRDEL CRPNAM	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of serving (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if IENCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary), 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days.	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (d) (-) (-)	default=1 default=1 + default=100 default=140 default=2 default=270 default=350 default=1.0 'CRPNAM' variable from crop file	default=1 default=1 + default=100 default=200 default=270 default=270 default=350 default=1.0 'CRPNAM' variable from crop file
	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if ISTCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary), 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provide. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of soil	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (d) (-) (-) (-)	default=1 default=1 + default=100 default=20 default=270 default=270 default=270 default=10 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file	default=1 + default=10 default=100 default=20 default=270 default=270 default=350 default=1 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file
	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDAYEN IDAYEN IDAYEN IDAYEN IBAL PRDEL CRPNAM	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of serving (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if IENCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary), 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days.	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (d) (-) (-)	default=1 default=1 + default=100 default=200 default=270 default=270 default=250 default=1 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file	default=1 + default=100 default=100 default=270 default=270 default=270 default=350 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file
	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of farvest (day of year). Used if ISTCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary), 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of crop description of soil description of soil description of soil	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (d) (-) (-) (-)	default=1 default=1 + default=100 default=270 default=270 default=270 default=2. default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from crop file 'WCCDESCRIPTION' variable from climate file	default=1 default=1 + default=100 default=200 default=270 default=270 default=300 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from crop file 'WCCDESCRIPTION' variable from climate file
	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM CLMNAM ISAY	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if ISTCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary). 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of rorp description of rainfall station start date of the water balance	(·) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (d) (·) (·) (·) (·) (·) (·) (·) (·) (·) (·	default=1 default=1 + default=100 default=200 default=270 default=270 default=20 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from crop file 'SOLNAM' variable from soil file default=1.0	default=1 default=1 + default=100 default=200 default=270 default=320 default=300 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file from climate file default=1 default=1 =
Site file	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM CLMNAM CLMNAM ISAY ISAY SOFILE	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 1. earliest of both days). ultimate go f arvest (day of year). Used if ISTCHO = 1. or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary). 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provide. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of roop description of soil description of soil description of rainfall station start date of the water balance name of sin file	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (d) (-) (-) (-) (-) (-) (-) (-) (-	default=1 default=1 + default=10 default=2 default=270 default=270 default=270 default=10 default=10 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from clinate file default='conec' default=1 mame of the new soil file	default=1 default=1 + default=100 default=20 default=270 default=270 default=270 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=-cnone>' default=1.0 inter file default=-cnone>'
Site file	ISTCHO IDEM IDSOW IDLSOW IENCHO IDAYEN IDURMX IBAL IBAL PRDEL CRPNAM SOLNAM CLMNAM RAINAM ISAY SOFILE IZT	options for start simulation: 0 (fixed emergence day,).1 (fixed sowing day) and 2 (variable sowing day). day of serving (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate sowing day (day of year). Used if ISTCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary), 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of soll description of roop description of roin of weather station start date of the water balance name of soil file ground water influence: 0 (no) or 1 (yes).	(·) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (-) (·) (·) (·) (·) (·) (·) (·) (·	default=1 default=1 + default=100 default=200 default=270 default=270 default=270 default=320 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from crop file 'SOLNAM' variable from soil file default=1.0 default=1.0 vwcCDESCRIPTION' variable from climate file default=1 name of the new soil file default=0	default=1 default=1 + default=100 default=270 default=270 default=270 default=350 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file from climate file default=cone>' default=1 name of the new soil file default=0
Site file	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM CLMNAM CLMNAM ISAY SOFILE IZT IFUNRN	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if ISTCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary), 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of ron for rainfall station start date of the water balance name of soil file ground water influence: 0 (no) or 1 (yes). non-infiltrating fraction of rain is function of storm size (1) or not (0).	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (d) (-) (-) (-) (-) (-) (-) (-) (-	default=1 default=1 + default=10 default=270 default=270 default=270 default=270 default=10 'CRPNAM' variable from crop file 'SOLNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=1 name of the .new soil file default=0	default=1 default=1 + default=100 default=200 default=270 default=270 default=270 default=300 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from crop file 'WCCDESCRIPTION' variable from climate file default=1 name of the .new soil file default=0
Site file	ISTCHO IDEM IDSOW IDLSOW IENCHO IDAYEN IDURMX IBAL IBAL PRDEL CRPNAM SOLNAM CLMNAM RAINAM ISAY SOFILE IZT	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of sowing (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 1. earliest of both days). ultimate day of farvest (day of year). Used if ISTCHO = 2. ultimate day of barvest (day of year). Used if ISTCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary). 1 (for whole system), 2 (for root zone), or 3 (for whole system) and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provide. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of roal description of soll description of soll description of soll description of soll description of soll description of soll growing period, (1) or albence growing were influence: 0 (no) or 1 (yes). non-infiltrating fraction of rain is function of storm size (1) or not (0).	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (d) (-) (-) (-) (-) (-) (-) (-) (-	default=1 default=1 + default=100 default=200 default=270 default=270 default=270 default=320 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from crop file 'SOLNAM' variable from soil file default=1.0 default=1.0 vwcCDESCRIPTION' variable from climate file default=1 name of the new soil file default=0	default=1 default=1 + default=100 default=200 default=270 default=320 default=350 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file /WCCDESCRIPTION' variable from climate file default=1 name of the new soil file default=0
Site file	ISTCHO IDEM IDSOW IDESOW IDLSOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM CLMNAM CLMNAM RAINAM ISAY SOFILE IZT IFUNRN IDRAIN	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if ISTCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary), 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of ron for rainfall station start date of the water balance name of soil file ground water influence: 0 (no) or 1 (yes). non-infiltrating fraction of rain is function of storm size (1) or not (0).	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (d) (-) (-) (-) (-) (-) (-) (-) (-	default=1 default=1 + default=10 default=10 default=22 default=270 default=350 default=10 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=1. default=1. default=1. default=1. default=0 default=0 default=0 default=0	default=1 default=1 + default=100 default=20 default=270 default=270 default=270 default=350 default=1 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from clinate file default=1 cone>: default=1 cone>: default=1 cone>: default=1 cone>: default=1 cone>: default=0 cone=1 cone=
Site file	ISTCHO IDEM IDSOW IDLSOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM CLMNAM ISAY SOFILE IZT IFUNRN IDRAIN SSMAX WAV	options for start simulation: 0 (fixed emergence day,), 1 (fixed sowing day) and 2 (variable sowing day). day of serving (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 1. earliest of both days). ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if IENCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary). 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output will be produced, if the interval is set at zero days. description of soil description of roop description of roop ground water influence: 0 (no) or 1 (yes). non-infiltrating fraction of rain is function of storm size (1) or not (0). presence (1) or absence (0) or d farians maxinuum surface storage capacity (cm water). initial amount of available soil water in	(·) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (d) (·) (·) (·) (·) (·) (·) (·) (·	default=1 default=1 + default=100 default=200 default=270 default=270 default=270 default=350 default=1 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file default=1 name of the .new soil file default=0 default=1 default=1 default=1 default=1 default=1 default=1 default=1 default=1 default=1 default=1 default=2 default=1 default=2 default=0 default=1 default=2 default=0 default=0 default=0 default=0 default=0 default=0 default=2 default=0 default=1 default=0 default=	default=1 default=1 + default=100 default=270 default=270 default=320 default=300 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file default=1.0 default=1.0 default=0 d
Site file	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM CLMNAM CLMNAM ISAY SOFILE IZT IFURN IDRAIN SSMAX WAV ZTI	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of soming (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if ISTCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary), 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of crop description of rainfall station start date of the water balance name of soil file ground water influence: 0 (no) or 1 (yes). non-infiltrating fraction of rain is function of storm size (1) or not (0). presence (1) or absence (0) of drains maximum surface storage capacity (cm water). initial amount of available soil water in the rootable soil (moisture content above permanent wilting point) (cm water).	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (d) (-) (-) (-) (-) (-) (-) (-) (-	default=1 default=1 + default=10 default=270 default=270 default=270 default=350 default=10 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=1 name of the .new soil file default=0 default=0 default=0 default=0 default=0 default=0 default=0 default=000000 default=20.000000	default=1 default=1 + default=100 default=270 default=270 default=270 default=320 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=1 name of the .new soil file default=0 default=
Site file	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM CLMNAM CLMNAM RAINAM ISAY SOFILE IZT IFUNRN IDRAIN SSMAX WAV ZTI DD	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of sowing (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 1. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (caritest of both days). ultimate day of harvest (day of year). Used if IENCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary). 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provide. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of roal description of soll description of soll description of solf file ground water influence: 0 (no) or 1 (yes). mame of soil file ground water inducence (0) of drains maximum surface storage capacity (cm water). initial anount of available soil water in the rootable soil ((-) (day of year) (-) (-) </td <td>default=1 default=1 + default=10 default=270 default=270 default=270 default=270 default=270 default=10 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=2 default=10N' variable from climate file default=10 default=0 default=0 default=0 default=20.00000 default=20.00000 default=20.00000</td> <td>default=1 default=1 + default=10 default=2 default=270 default=270 default=2 default=1 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=1 name of the .new soil file default=0 default=0 default=0 default=2 .000000 default=20.000000 default=999.000000 default=990.000000 default=900.000000 default=900.000000 default=900.000000 default=900.00000 default=900.00000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.00000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.00000 default=900.00000 default=900.000000 default=90</td>	default=1 default=1 + default=10 default=270 default=270 default=270 default=270 default=270 default=10 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=2 default=10N' variable from climate file default=10 default=0 default=0 default=0 default=20.00000 default=20.00000 default=20.00000	default=1 default=1 + default=10 default=2 default=270 default=270 default=2 default=1 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=1 name of the .new soil file default=0 default=0 default=0 default=2 .000000 default=20.000000 default=999.000000 default=990.000000 default=900.000000 default=900.000000 default=900.000000 default=900.00000 default=900.00000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.00000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.000000 default=900.00000 default=900.00000 default=900.000000 default=90
Site file	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM CLMNAM CLMNAM ISAY SOFILE IZT IFURN IDRAIN SSMAX WAV ZTI	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of serving (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate sowing day (day of year). Used if ISTCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary). 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of soil description of fainfall station start date of the water balance non-infiltrating fraction of rain is function of storm size (1) or not (0). presence (1) or alsence (0) of drains maximum murface storage capacity (cm water). initial amount of available soil water in the rootable soil (moisture content above permanent wilting point) (cm water). initial depth of the ground water t	(-) (day of year) (day of year) (day of year) (day of year) (day of year) (day of year) (d) (-) (-) (-) (-) (-) (-) (-) (-	default=1 default=1 + default=10 default=270 default=270 default=270 default=350 default=10 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=0 defau	default=1 default=1 + default=100 default=270 default=270 default=270 default=320 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=1 name of the .new soil file default=0 default=
Site file	ISTCHO IDEM IDSOW IDESOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM CLMNAM CLMNAM RAINAM ISAY SOFILE IZT IFUNRN IDRAIN SSMAX WAV ZTI DD	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of sowing (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 1. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (caritest of both days). ultimate day of harvest (day of year). Used if IENCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary). 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provide. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of roal description of soll description of soll description of solf file ground water influence: 0 (no) or 1 (yes). mame of soil file ground water inducence (0) of drains maximum surface storage capacity (cm water). initial anount of available soil water in the rootable soil ((-) (day of year) (-) (-) </td <td>default=1 default=1 + default=10 default=270 default=270 default=270 default=270 default=270 default=10 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=2 default=10N' variable from climate file default=10 default=0 default=0 default=0 default=20.00000 default=20.00000 default=20.00000</td> <td>default=1 default=1 default=1 default=10 default=2 default=270 default=270 default=2 default=1 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=1 name of the .new soil file default=1 default=0 default=0 default=0 default=2 .000000 default=20.000000 default=999.000000 default=909.000000 default=999.000000 default=999.000000 default=999.000000 default=999.000000 default=999.000000 default=999.000000 default=999.000000 default=999.000000 default=909.000000 defaul</td>	default=1 default=1 + default=10 default=270 default=270 default=270 default=270 default=270 default=10 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=2 default=10N' variable from climate file default=10 default=0 default=0 default=0 default=20.00000 default=20.00000 default=20.00000	default=1 default=1 default=1 default=10 default=2 default=270 default=270 default=2 default=1 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=1 name of the .new soil file default=1 default=0 default=0 default=0 default=2 .000000 default=20.000000 default=999.000000 default=909.000000 default=999.000000 default=999.000000 default=999.000000 default=999.000000 default=999.000000 default=999.000000 default=999.000000 default=999.000000 default=909.000000 defaul
Site file	ISTCHO IDEM IDESOW IDESOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM CLMNAM CLMNAM CLMNAM ISAY SOFILE IZT IFUNRN IDRAIN SSMAX WAV ZTI DD RDMSOL	options for start simulation: 0 (fixed emergence day), 1 (fixed sowing day) and 2 (variable sowing day). day of emergence (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. ultimate sowing day (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if ISTCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary), 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of crop description of roin frainfall station start date of the water balance name of soil file ground water influence: 0 (no) or 1 (yes). non-infiltrating fraction of rain is function of storm size (1) or not (0). presence (1) or absence (0) of drains maximum surface storage capacity (cm water). initial amount of available soil water in the rootable soil (moisture content above permanent wilting point) (cm water). initial amount of available soil water in the rootable soil (moisture content above permanent wilting point) (cm water). initial depth of the ground water table (cm). The value 999 is maximum initial depth of the ground water table. drainage depth (cm). maximum non-inifiltrating fraction of rainfall. Range: 0 - 1. basis supply of nitrogen by the unifertilized soil (N, kg/sh-1). Range: 0 - 100	(-) (day of year) (d) (-) <td>default=1 default=1 + default=10 default=140 default=270 default=250 default=10 default=10 default=270 default=280 default=10 ''CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from soil file 'WCCDESCRIPTION' variable from crop file default=1 name of the .new soil file default=0 default=0 default=0.000000 default=10.000000 default=0.000000 default=0.000000 default=0.000000</td> <td>default=1 default=1 default=1 default=10 default=2 default=270 default=270 default=320 default=1 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from clinate file default=1 name of the .new soil file default=1 default=0 default=10.000000 default=10.000000 default=10.000000</td>	default=1 default=1 + default=10 default=140 default=270 default=250 default=10 default=10 default=270 default=280 default=10 ''CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from soil file 'WCCDESCRIPTION' variable from crop file default=1 name of the .new soil file default=0 default=0 default=0.000000 default=10.000000 default=0.000000 default=0.000000 default=0.000000	default=1 default=1 default=1 default=10 default=2 default=270 default=270 default=320 default=1 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from clinate file default=1 name of the .new soil file default=1 default=0 default=10.000000 default=10.000000 default=10.000000
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Rerun file	ISTCHO IDEM IDESOW IDESOW IDESOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM CLMNAM CLMNAM CLMNAM ISAY SOFILE IZT IFUNRN IZT IFUNRN IDRAIN SSMAX WAV ZTI DD RDMSOL NOTINF NBASE NREC PBASE PRASE KREC SSI SMLIM RUNNAM IOPT2 IPRODL IOXWL TIMFIL STIFIL WORRER	options for start simulation: 0 (fixed emergence day,).1 (fixed sowing day) and 2 (variable sowing day). day of sowing (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (earliest of both days). ultimate day of harvest (day of year). Used if IENCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary). 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of soal description of soal description of weather station start date of the water balance name of soil file ground water influence: 0 (no) or 1 (yes). non-infiltrating fraction of rain is function of storm size (1) or not (0). presence (1) or absence (0) of drains maximum surface storage capacity (cm water). initial depth of the ground water table (cm). The value 999 is maximum initial depth of the ground water table. drainage depth (cm). maximum non-infiltrating fraction of rainfall. Range: 0 - 10. apparent phosphorus by the unfertilized soil (N, kg-ha-1). Range: 0 - 10. apparent phosphorus by the unfertilized soil (N, kg-ha-1). Range: 0 - 10. apparent phosphorus by the unfertilized soil (N, kg-ha-1). Range: 0 - 10. apparent phosphorus trecovery. Increase in uptake of N as fraction of applied N. Range: 0 - 1. basis supply of phosphorus by the unfertilized soil (N, kg-ha-1). Range: 0 - 10. apparent phosphorus trecovery. Increase in uptake of K as fraction of applied N. Ra	(-) (day of year) (da) (-) <td>default=1 default=1 + default=100 default=140 default=270 default=270 default=30 default=270 default=30 default=270 default=30 default=20 default=1.0 ''CCPNSCRERCRPTION' variable from crop file 'WCCDESCRIPTION' variable from soil file default=1 name of the .new soil file default=0 default=0 default=20000000 default=20000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=10.000000 default=0.000000 default=10.000000 default=2.50000 RUNOPT.DAT default=2 default=3 default=10 default=10</td> <td>default=1 default=1 + default=100 default=140 default=270 default=270 default=300 default=1.0 'CCPNAM' variable from crop file 'SOLNAM' variable from soil file default=1.0 'WCCDESCRPTION' variable row Core SCRPTION' variable default=0 default=0 default=0 default=0 default=0 default=0.000000 default=20.000000 default=0.000000 default=0.250000 default=0.250000 default=2.50000 RUNOPT.DAT default=2 default=2 default=2 default=2 </td>	default=1 default=1 + default=100 default=140 default=270 default=270 default=30 default=270 default=30 default=270 default=30 default=20 default=1.0 ''CCPNSCRERCRPTION' variable from crop file 'WCCDESCRIPTION' variable from soil file default=1 name of the .new soil file default=0 default=0 default=20000000 default=20000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=10.000000 default=0.000000 default=10.000000 default=2.50000 RUNOPT.DAT default=2 default=3 default=10 default=10	default=1 default=1 + default=100 default=140 default=270 default=270 default=300 default=1.0 'CCPNAM' variable from crop file 'SOLNAM' variable from soil file default=1.0 'WCCDESCRPTION' variable row Core SCRPTION' variable default=0 default=0 default=0 default=0 default=0 default=0.000000 default=20.000000 default=0.000000 default=0.250000 default=0.250000 default=2.50000 RUNOPT.DAT default=2 default=2 default=2 default=2
Rerun file	ISTCHO IDEM IDESOW IDESOW IDLSOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM CLMNAM CLMNAM CLMNAM CLMNAM ISAY SOFILE IZT IFUNRN IDAIN ISAY SOFILE ZT IFUNRN IDAIN DD RAINAM CLMNAM CLMNAM CLMNAM ISAY SSMAX WAV ZTI DD RDMSOL NOTINF NBASE NREC PBASE PREC KBASE KREC SSI SMLIM RUNNAM IOPT2 IPRODL INTEN INTEN SITFIL WORRER WORCUT	options for start simulation: 0 (fixed emergence day,).1 (fixed sowing day) and 2 (variable sowing day). day of sowing (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (carliest of both days). ultimate sowing day (day of year). Used if ISTCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary).1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of crop description of rainfall station start date of the water balance name of soil description of rainfall station start date of the water balance name of soil file ground water influence: 0 (no) or 1 (yes). mor-infiltrating fraction of rain is function of storm size (1) or not (0). presence (1) or a absence (0) of drains maximum surface storage capacity (cm water). initial admount of available soil water in the rotable soil (moisture content above permanent wilting point) (cm water). maximum rooting depth allowed by soil (cm). This is dictated by soil characteristics like profile depth and presence of you and water. (maximum) non-infiltrating fraction of rainfall. Range: 0 - 10. apparent phosphorus recovery. Increase in uptake of N as fraction of applied N. Range: 0 - 1. basic supply of phosphorus by the unfertilized soil (K, kg-ha-1). Range: 0 - 10. apparent phosphorus thy the unfertilized soil (K, kg-ha-1). Range: 0 - 10. apparent phosphorus recovery. Increase in uptake	(-) (day of year) (d) (-) </td <td>default=1 default=1 + default=100 default=100 default=200 default=270 default=250 default=200 default=200 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=0 default=0.000000 default=0.000000 default=120.000000 default=120.000000 default=0.000000 default=1.02.50000 H default=3 default=3 default=3 default=0.000000<td>default=1 default=1 default=1 default=10 default=10 default=270 default=270 default=30 default=30 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file default=1.0 'CRPNAM' variable from soil file 'WCCDESCRPTION' variable from climate file default=1 name of the .new soil file default=0 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.500000 default=0.500000 default=0.500000 default=2 default=2</td></td>	default=1 default=1 + default=100 default=100 default=200 default=270 default=250 default=200 default=200 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=0 default=0.000000 default=0.000000 default=120.000000 default=120.000000 default=0.000000 default=1.02.50000 H default=3 default=3 default=3 default=0.000000 <td>default=1 default=1 default=1 default=10 default=10 default=270 default=270 default=30 default=30 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file default=1.0 'CRPNAM' variable from soil file 'WCCDESCRPTION' variable from climate file default=1 name of the .new soil file default=0 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.500000 default=0.500000 default=0.500000 default=2 default=2</td>	default=1 default=1 default=1 default=10 default=10 default=270 default=270 default=30 default=30 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file default=1.0 'CRPNAM' variable from soil file 'WCCDESCRPTION' variable from climate file default=1 name of the .new soil file default=0 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.500000 default=0.500000 default=0.500000 default=2
Rerun file	ISTCHO IDEM IDESOW IDESOW IDESOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM CLMNAM CLMNAM CLMNAM ISAY SOFILE IZT IFUNRN IDRAIN SSMAX WAV ZTI DD RDMSOL NOTINF NBASE NREC PBASE PREC KBASE KREC SSI SMLIM RUNNAM IOPT2 IPRODL IOXWL TIMFIL STIFIL WORRER	options for start simulation: 0 (fixed emergence day,).1 (fixed sowing day) and 2 (variable sowing day). day of sowing (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (carliest of both days). ultimate day of harvest (day of year). Used if IENCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary). 1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of soall description of weather station description of weather station start date of the water balance mame of soil file ground water influence: 0 (no) or 1 (yes). non-infiltrating fraction of rain is function of storm size (1) or not (0). presence (1) or absence (0) of drains maximum surface storage capacity (cm water). initial amount of available soil water in the rootable soil (moisture content above permanent wilting point) (cm water). (maximum) non-infiltrating fraction of rain fall. Range: 0 - 1. basic supply of photsphorus by soil (cm). This is dictated by soil characteristics like profile depth and presence of yords. (Lengen by the unfertilized soil (K, kg-ha-1). Range: 0 - 10. apparent phosphorus recovery. Increase in uptake of K as fraction of applied P. Range: 0 - 1. basic supply of photassium by the unfertilized soil (K, kg-ha-1). Range: 0 - 10. apparent phosphorus recovery. Increase in uptake of K as fraction of applied P. Range: 0 - 1. basic supply of photass	(-) (day of year) (da) (-) <td>default=1 default=1 + default=100 default=140 default=270 default=270 default=30 default=270 default=30 default=280 default=270 default=30 default=1.0 'CCPNCAM' variable from crop file 'SOLNAM' variable from soil file default=1 name of the .new soil file default=0 default=0 default=0 default=2000000 default=20.000000 default=20.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=10.000000 default=10.000000 default=2.50000 RUNOPT.DAT default=2 default=3 default=0</td> <td>default=1 default=1 + default=100 default=140 default=270 default=270 default=300 default=1.0 'CCPNAM' variable from crop file 'SOLNAM' variable from soil file default=1.0 'WCCDESCRPTION' variable row Core SCRPTION' variable default=0 default=0 default=0 default=0 default=0 default=0.000000 default=20.000000 default=0.000000 default=0.250000 default=0.250000 default=2.50000 RUNOPT.DAT default=2 default=2 default=2 default=2 </td>	default=1 default=1 + default=100 default=140 default=270 default=270 default=30 default=270 default=30 default=280 default=270 default=30 default=1.0 'CCPNCAM' variable from crop file 'SOLNAM' variable from soil file default=1 name of the .new soil file default=0 default=0 default=0 default=2000000 default=20.000000 default=20.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=10.000000 default=10.000000 default=2.50000 RUNOPT.DAT default=2 default=3 default=0	default=1 default=1 + default=100 default=140 default=270 default=270 default=300 default=1.0 'CCPNAM' variable from crop file 'SOLNAM' variable from soil file default=1.0 'WCCDESCRPTION' variable row Core SCRPTION' variable default=0 default=0 default=0 default=0 default=0 default=0.000000 default=20.000000 default=0.000000 default=0.250000 default=0.250000 default=2.50000 RUNOPT.DAT default=2 default=2 default=2 default=2
Rerun file	ISTCHO IDEM IDESOW IDESOW IDLSOW IENCHO IDAYEN IDURMX IBAL PRDEL CRPNAM SOLNAM CLMNAM CLMNAM CLMNAM CLMNAM ISAY SOFILE IZT IFUNRN IDAIN ISAY SOFILE ZT IFUNRN IDAIN DD RAINAM CLMNAM CLMNAM CLMNAM ISAY SSMAX WAV ZTI DD RDMSOL NOTINF NBASE NREC PBASE PREC KBASE KREC SSI SMLIM RUNNAM IOPT2 IPRODL INTEN INTEN SITFIL WORRER WORCUT	options for start simulation: 0 (fixed emergence day,).1 (fixed sowing day) and 2 (variable sowing day). day of sowing (day of year). Used if ISTCHO = 0. day of sowing (day of year). Used if ISTCHO = 1. earliest possible day of sowing (day of year). Used if ISTCHO = 2. option to determine end of simulation: 1 (fixed end day), 2 (maturity, but not to exceed maximum duration), or 3 (carliest of both days). ultimate sowing day (day of year). Used if ISTCHO = 1 or 3. maximum number of days from emergence to end of simulation used if IENCHO = 2 or 3. option for output summary water balance: 0 (no summary).1 (for whole system), 2 (for root zone), or 3 (for whole system and root zone). output interval: one output line per time interval. Output lines for day of emergence, anthesis and the last day are always provided. If the output interval is longer than the growing period, the detailed output will be reduced to these three lines. No detailed output will be produced, if the interval is set at zero days. description of crop description of rainfall station start date of the water balance name of soil description of rainfall station start date of the water balance name of soil file ground water influence: 0 (no) or 1 (yes). mor-infiltrating fraction of rain is function of storm size (1) or not (0). presence (1) or a absence (0) of drains maximum surface storage capacity (cm water). initial admount of available soil water in the rotable soil (moisture content above permanent wilting point) (cm water). maximum rooting depth allowed by soil (cm). This is dictated by soil characteristics like profile depth and presence of you and water. (maximum) non-infiltrating fraction of rainfall. Range: 0 - 10. apparent phosphorus recovery. Increase in uptake of N as fraction of applied N. Range: 0 - 1. basic supply of phosphorus by the unfertilized soil (K, kg-ha-1). Range: 0 - 10. apparent phosphorus thy the unfertilized soil (K, kg-ha-1). Range: 0 - 10. apparent phosphorus recovery. Increase in uptake	(-) (day of year) (d) (-) </td <td>default=1 default=1 + default=100 default=100 default=200 default=270 default=250 default=200 default=200 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=0 default=0.000000 default=0.000000 default=120.000000 default=120.000000 default=0.000000 default=1.02.50000 H default=3 default=3 default=3 default=0.000000<td>default=1 default=1 default=1 default=10 default=10 default=270 default=270 default=30 default=30 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file default=1.0 'CRPNAM' variable from soil file 'WCCDESCRPTION' variable from climate file default=1 name of the .new soil file default=0 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.500000 default=0.500000 default=0.500000 default=2 default=2</td></td>	default=1 default=1 + default=100 default=100 default=200 default=270 default=250 default=200 default=200 default=1.0 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file 'WCCDESCRIPTION' variable from climate file default=0 default=0.000000 default=0.000000 default=120.000000 default=120.000000 default=0.000000 default=1.02.50000 H default=3 default=3 default=3 default=0.000000 <td>default=1 default=1 default=1 default=10 default=10 default=270 default=270 default=30 default=30 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file default=1.0 'CRPNAM' variable from soil file 'WCCDESCRPTION' variable from climate file default=1 name of the .new soil file default=0 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.500000 default=0.500000 default=0.500000 default=2 default=2</td>	default=1 default=1 default=1 default=10 default=10 default=270 default=270 default=30 default=30 'CRPNAM' variable from crop file 'SOLNAM' variable from soil file default=1.0 'CRPNAM' variable from soil file 'WCCDESCRPTION' variable from climate file default=1 name of the .new soil file default=0 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.000000 default=0.500000 default=0.500000 default=0.500000 default=2

FIXNAM	output filename for summary output of potential and water limited production (max 8 characters; no extension because WOFOST uses * WPS and * .PPS as extension). This is only used when running WOFOST in TERMINAL mode; WCC uses its own filename.	(-)	default='WCC'	default='WCC'
RQUIRD	long term means results. This is a summary file of the summary files of potential and water limited production: 0 (no), 1 (yes). In WCC, the summary is only shown when there are more than two years (because of calculating statistics) and the rerun option is used. File name of this summary file is FINNAM and the extension ".SUM.	(-)	default=0	default=0
rs	OUTPUTS Potential production			
	detailed output			
YEAR	daily results year of the simulation time step	(y)	no need to have this information	no need to have this informati
DAY	day of year of the simulation time step	(1-366)	no need to have this information	no need to have this informati
IDSEM DVS	number of days since emergence development stage of crop	(d) (-)	no need to have this information no need to have this information	no need to have this informati no need to have this informati
TSUM	thermal time since emergence	(°C d)	no need to have this information	no need to have this information
WLV WST	dry weight of living leaves dry weight of living stems	(kg ha ⁻¹)	no need to have this information no need to have this information	no need to have this informat no need to have this informat
WSO	dry weight of living storage organs	(kg ha ⁻¹) (kg ha)	no need to have this information	no need to have this informat
TAGP	total above ground production (dead and living plant organs)	(kg ha ⁻¹)	no need to have this information	no need to have this informat
LAI TRA	leaf area index (leaf area)/(soil area) transpiration rate	(ha ha ⁻¹) (mm d ⁻¹)	no need to have this information no need to have this information	no need to have this informat no need to have this informat
GASS	gross assimilation rate	(kg (CH ₂ O) ha ⁻¹ d ⁻¹)	no need to have this information	no need to have this informat
MRES	maintenance respiration rate	(kg (CH ₂ O) ha ⁻¹ d ⁻¹)	no need to have this information	no need to have this informat
DMI	rate of dry matter increase summary of detailed output	(kg ha ⁻¹ d ⁻¹)	no need to have this information	no need to have this informat
HALT	day number at harvest	(day of the year)	no need to have this information	no need to have this informat
ANTH	duration of pre-anthesis phase	(d)	no need to have this information	no need to have this information
TWRT TWLV	total dry weight of roots (dead and living) total dry weight of leaves (dead and living)	(kg ha ⁻¹) (kg ha ⁻¹)	no need to have this information no need to have this information	no need to have this informat no need to have this informat
TWST	total dry weight of stems (dead and living)	(kg ha ⁻¹)	no need to have this information	no need to have this informat
TWSO	total dry weight of storage organs (dead and living)	(kg ha ⁻¹)	no need to have this information	no need to have this information
TAGP HINDEX	total above ground production (dead + living) harvest index: weight of storage organs / weight of total above ground crop	(kg ha ⁻¹) (-)	no need to have this information no need to have this information	no need to have this informat no need to have this informat
TRANSP	total transpiration	(cm water)	no need to have this information	no need to have this informat
TRC GASST	transpiration coefficient rate total gross assimilation	(kg (water) / kg (dry matter)) (kg (CH ₂ O) ha ⁻¹)	no need to have this information no need to have this information	no need to have this informat no need to have this informat
MREST	total maintenance respiration	(kg (CH ₂ O) ha ⁻¹) (kg (CH ₂ O) ha ⁻¹)	no need to have this information	no need to have this informa
	summary output			
YR RUNNAM	simulation year, which always refers to the year when the simulation has started (e.g. sowing or emergence) name of the simulation run	(y) (name)	+ no need to have this information	+ no need to have this information
SOW	sowing date (in case of fixed emergence value is -99)	(day in year)	no need to have this information	no need to have this informa
EM	days between sowing and emergence (in case of fixed emergence value is 0)	(d)	no need to have this information	no need to have this info
ANT	emergence date duration of pre-anthesis phase	(day in year) (d)	no need to have this information no need to have this information	no need to have this informat no need to have this informat
FLWR	day of flowering	(day in year)	no need to have this information	no need to have this informa
DUR HALT	duration of simulation period day number at harvest	(d) (day in year)	no need to have this information no need to have this information	no need to have this informat no need to have this informat
TWRT	total dry weight of roots (dead and living)	(kg ha ⁻¹)	+	no need to have this informat
TWLV	total dry weight of leaves (dead and living)	(kg ha ⁻¹)	+	no need to have this information
TWST TWSO	total dry weight of stems (dead and living) total dry weight of storage organs (dead and living)	(kg ha ⁻¹) (kg ha ⁻¹)	+ +	no need to have this informat
TAGP	total above ground production (dead and living plant organs)	(kg ha ⁻¹)	+	+ +
LAIM	maximum leaf area index	(ha ha-1)	no need to have this information	no need to have this information
HINDEX TRC	harvest index weight of storage organs / weight of total above ground crop transpiration coefficient rate	(-) (kg (water) / kg (dry matter))	no need to have this information no need to have this information	no need to have this informat no need to have this informat
GASST	total gross assimilation	(kg (CH ₂ O) ha ⁻¹)	no need to have this information	no need to have this informat
MREST	total maintenance respiration	(kg (CH ₂ O) ha ⁻¹)	no need to have this information	no need to have this information
TRANSP EVSOL	total transpiration total evaporation from soil surface	(cm water) (cm water)	no need to have this information no need to have this information	no need to have this informa no need to have this informa
11001	Water-limited crop production	(em water)	no need to neve this information	no need to have this informa
	detailed output daily results			
YEAR	year of the simulation time step	(y)	no need to have this information	no need to have this informa
DAY	day of year of the simulation time step	(1-366)	no need to have this information	no need to have this informa
WLV WST	dry weight of living leaves dry weight of living stems	(kg ha ⁻¹) (kg ha ⁻¹)	no need to have this information no need to have this information	no need to have this informa no need to have this informa
WSO	dry weight of living storage organs	(kg ha ⁻¹)	no need to have this information	no need to have this information
TAGP	total above ground production (dead and living plant organs) (only given when simulated without groundwater	(kg ha ⁻¹)	no need to have this information	no need to have this information
LAI	influence) leaf area index (leaf area)/(soil area)	(ha ha-1)	no need to have this information	no need to have this informa
RD	depth of actual root zone	(cm)	no need to have this information	no need to have this information
SM	soil moisture content in actual root zone available soil water in potential root zone (in and below actual root zone) (only given when simulated without	(cm ⁻³ (water) / (cm ⁻³ (soil))	no need to have this information	no need to have this information
RESRV	available soil water in potential root zone (in and below actual root zone) (only given when simulated without groundwater influence)	(cm water)	no need to have this information	no need to have this information
AVAIL	amount of water available in actual root zone (only given when simulated without groundwater influence)	(cm water)	no need to have this information	no need to have this information
RAIN TRA	total rainfall in the simulation period transpiration rate	(mm) (mm d ⁻¹)	no need to have this information no need to have this information	no need to have this informa no need to have this informa
EVA(P)	evaporation rate from soil or from water stored on soil surface	(mm d ⁻¹)	no need to have this information	no need to have this informa
SS	surface storage	(cm water)	no need to have this information	no need to have this information
ZT wet	depth of groundwater table days characterized by reduced crop growth due to oxygen shortage	(cm below soil surface) (d)	no need to have this information no need to have this information	no need to have this information no need to have this information information in the second s
dry	days characterized by reduced crop growth due to water shortage	(d)	no need to have this information	no need to have this information
HALT	summary of detailed output day number at harvest	(day of the year)	no need to have this information	no need to have this informa
ANTH	day number at narvest duration of pre-anthesis phase	(day of the year) (d)	no need to have this information	no need to have this information of the second seco
TWRT	total dry weight of roots (dead and living)	(kg ha ⁻¹)	no need to have this information	no need to have this information
TWLV TWST	total dry weight of leaves (dead and living) total dry weight of stems (dead and living)	(kg ha ⁻¹) (kg ha ⁻¹)	no need to have this information no need to have this information	no need to have this informa no need to have this informa
TWSO	total dry weight of storage organs (dead and living)	(kg ha ⁻¹)	no need to have this information	no need to have this information
TAGP	total above ground production (dead + living)	(kg ha-1)	no need to have this information	no need to have this information
HINDEX TRC	harvest index: weight of storage organs / weight of total above ground crop transpiration coefficient rate	(-) (kg (water) / kg (dry matter))	no need to have this information no need to have this information	no need to have this informa no need to have this informa
GASST	total gross assimilation	(kg (CH ₂ O) ha ⁻¹)	no need to have this information	no need to have this information
MREST wet	total maintenance respiration total number of days characterized by reduced crop growth due to oxygen shortage	(kg (CH ₂ O) ha ⁻¹) (d)	no need to have this information no need to have this information	no need to have this informa no need to have this informa
dry	total number of days characterized by reduced crop growth due to oxygen shortage total number of days characterized by reduced crop growth due to water shortage	(d) (d)	no need to have this information	no need to have this information no need to have this information information in the second s
init max root zone	initial water content (either for the maximum rooting zone or, when ground water influence is assumed, for the first 10 m)	(cm water)	no need to have this information	no need to have this informa
final max root zone	first 10 m)	(cm water)	no need to have this information	no need to have this information
change	difference between initial and the final water content (either for the maximum rooting zone or, when ground water influence is assumed, for the first 10 m)	(cm water)	no need to have this information	no need to have this information
	initial surface storage of water	(cm water)	no need to have this information	no need to have this information
init surf storage				
final surf storage	final surface storage of water	(cm water)	no need to have this information	no need to have this information
_	final surface storage of water difference between initial and the final surface storage of water irrigation (always 0, since there is no option for irrigation in WOFOST)	(cm water) (cm water) (cm water)	no need to have this information no need to have this information no need to have this information	no need to have this information need to have the have thave the have the have the have thave

evap water surface	evaporation (from the surface water)	(cm water)	no need to have this information	no need to have this information
rainfall	sum of yearly rainfall	(cm water)	no need to have this information	no need to have this information
evap soil surface	evaporation (from the soil surface)	(cm water)	no need to have this information	no need to have this information
transpiration	transpiration (by the crop) together: water loss to atmosphere)	(cm water)	no need to have this information	no need to have this information
to atmos	evaporation and transpiration together: water loss to atmosphere	(cm water)	no need to have this information	no need to have this information
surface runoff	runoff	(cm water)	no need to have this information	no need to have this information
lost to deep soil	percolation to the ground water and the water loss through the drains (when groundwater is present)	(cm water)	no need to have this information	no need to have this information
TOTAL INIT + IN	initial water content and the water that entered the system	(cm water)	no need to have this information	no need to have this information
TOTAL FINAL + OUT	the final water content and the water last entered the system	(cm water)	no need to have this information	no need to have this information
checksum	check the water balance	(cm water)	no need to have this information	no need to have this information
init water stock	initial water content in the root zone	(cm water)	no need to have this information	no need to have this information
final water stock	final water content in the root zone	(cm water)	no need to have this information	no need to have this information
infiltration	infiltration into the root zone (i.e. rainfall minus runoff)	(cm water)	no need to have this information	no need to have this information
evap soil surface	evaporation (from the soil)	(cm water)	no need to have this information	no need to have this information
added by root growth	increase in available water due to root growth	(cm water)	no need to have this information	no need to have this information
transpiration	transpiration (by the crop)	(cm water)	no need to have this information	no need to have this information
percolation	percolation to the ground water	(cm water)	no need to have this information	no need to have this information
TOTAL INIT + IN	initial water content and the water that entered the system	(cm water)	no need to have this information	no need to have this information
TOTAL FINAL + OUT	the final water content and the water lost	(cm water)	no need to have this information	no need to have this information
checksum	check the water balance	(cm water)	no need to have this information	no need to have this information
YEAR	summary output	(y)	±	+
RUNNAM	name of the simulation run	(y) (name)	+ no need to have this information	+ no need to have this information
SOW	sowing date (in case of fixed emergence value is -99)	(day in year)	no need to have this information	no need to have this information
EM	emergence date	(day in year)	no need to have this information	no need to have this information
DUR	duration of simulation period	(d)	no need to have this information	no need to have this information
TWLV	total dry weight of leaves (dead and living)	(kg ha ⁻¹)	+	no need to have this information
TWST	total dry weight of stems (dead and living)	(kg ha ⁻¹)	+	no need to have this information
TWSO	total dry weight of storage organs (dead and living)	(kg ha ⁻¹)	+	+
TAGP	total above ground production (dead and living plant organs)	(kg ha ⁻¹)	+	+
LAIM	maximum leaf area index	(ha ha ⁻¹)	no need to have this information	no need to have this information
HINDEX	harvest index weight of storage organs / weight of total above ground crop	(-)	no need to have this information	no need to have this information
TRC	transpiration coefficient rate	(kg (water) / kg (dry matter))	+	no need to have this information
RAINT				
	total rainfall in the simulation period	(cm water)	+	no need to have this information
DELWAT	difference between final and initial available water in the root zone	(cm water)	+ +	no need to have this information
DELWAT TRAT	difference between final and initial available water in the root zone total transpiration	(cm water) (cm water)	+	no need to have this information no need to have this information
DELWAT TRAT EVSOL	difference between final and initial available water in the root zone total transpiration total evaporation from soil surface	(cm water) (cm water) (cm water)	+ +	no need to have this information no need to have this information no need to have this information
DELWAT TRAT EVSOL LOSST	difference between final and initial available water in the root zone total transpiration total evaporation from soil surface total water percolated to deep soil, not available for plant growth	(cm water) (cm water) (cm water) (cm water)	+	no need to have this information no need to have this information no need to have this information no need to have this information
DELWAT TRAT EVSOL LOSST TSR	difference between final and initial available water in the root zone total transpiration total evaporation from soil surface total water percolated to deep soil, not available for plant growth total surface runoff during simulation period	(cm water) (cm water) (cm water) (cm water) (cm water)	+ + + +	no need to have this information no need to have this information
DELWAT TRAT EVSOL LOSST TSR RYLD	difference between final and initial available water in the root zone total transpiration total evaporation from soil surface total water percolated to deep soil, not available for plant growth total surface runoff during simulation period relative yield water-fimited yield / potential yield	(cm water) (cm water) (cm water) (cm water) (cm water) (cm water) (%)	+ + + + no need to have this information	no need to have this information no need to have this information
DELWAT TRAT EVSOL LOSST TSR	difference between final and initial available water in the root zone total transpiration total exportation from soil surface total water percolated to deep soil, not available for plant growth total surface runoff during simulation period relative yield water-limited yield / potential yield relative total above ground production water-limited production / potential production	(cm water) (cm water) (cm water) (cm water) (cm water)	+ + + +	no need to have this information no need to have this information
DELWAT TRAT EVSOL LOSST TSR RYLD	difference between final and initial available water in the root zone total transpiration total evaporation from soil surface total water percolated to deep soil, not available for plant growth total surface runoff during simulation period relative yield water-fimited yield / potential yield	(cm water) (cm water) (cm water) (cm water) (cm water) (cm water) (%)	+ + + + no need to have this information	no need to have this information no need to have this information
DELWAT TRAT EVSOL LOSST TSR RYLD RAGP	difference between final and initial available water in the root zone total transpiration total evaporation from soil surface total water percolated to deep soil, not available for plant growth total surface runoff during simulation period relative yield water-limited yield/ potential yield relative total above ground production water-limited production / potential production Nutrient-limited crop production	(cm water) (cm water) (cm water) (cm water) (cm water) (cm water) (%) (%)	+ + + + no need to have this information no need to have this information	no need to have this information no need to have this information
DELWAT TRAT EVSOL LOSST TSR RYLD RAGP Leaves Stems	difference between final and initial available water in the root zone total transpiration total transpiration total varporation from soil surface total water percolated to deep soil, not available for plant growth total surface runoff during simulation period relative yield water-limited yield / potential yield relative total above ground production water-limited production / potential production Nutrient-limited crop production total dry weight of leaves (dead and living) for potential production	(cm water) (cm water) (cm water) (cm water) (cm water) (%) (%) (%) (%)	+ + + + no need to have this information no need to have this information	no need to have this information no need to have this information
DELWAT TRAT EVSOL LOSST TSR RYLD RAGP Leaves	difference between final and initial available water in the root zone total transpiration total transpiration total avarpaction from soil surface total surface runoff during simulation period relative yield water-limited yield / potential yield relative total above ground production water-limited production / potential production Nutrient-limited crop production total dry weight of leaves (dead and living) for potential production total dry weight of stems (dead and living) for potential production	(cm water) (cm water) (cm water) (cm water) (cm water) (cm water) (%) (%) (%) (%)	+ + + no need to have this information no need to have this information + + no need to have this information	no need to have this information no need to have this information
DELWAT TRAT EVSOL LOSST TSR RYLD RAGP Leaves Stems Storage organ Ratio SO/straw Harvest index	difference between final and initial available water in the root zone total transpiration total evaporation from soil surface total water percolated to deep soil, not available for plant growth total avace runoff during simulation period relative yield water-limited yield / potential yield relative total above ground production water-limited production / potential production total dry weight of leaves (dead and living) for potential production total dry weight of storage organs (dead and living) for potential production total dry weight of storage organs (dead and living) for potential production harvest index: weight of storage organs (weight of total above ground crop for potential production	(cm water) (cm water) (cm water) (cm water) (cm water) (%) (%) (%) (kg ha ⁻¹) (kg ha ⁻¹) (kg ha ⁻¹) (-)	+ + + no need to have this information no need to have this information + + + +	no need to have this information no need to have this information
DELWAT TRAT EVSOL LOSST TSR RYLD RAGP Leaves Stems Storage organ Ratio SO/straw Harvest index Fertilizer N	difference between final and initial available water in the root zone total transpiration total vaporation from soil surface total water percolated to deep soil, not available for plant growth total surface runoff during simulation period relative vield water-limited yield / potential yield relative vield water-limited yield / potential yield relative total above ground production water-limited production / potential production Vutrient-limited crop production total dry weight of leaves (dead and living) for potential production total dry weight of stems (dead and living) for potential production total dry weight of stems (dead and living) for potential production total dry weight of stems (dead and living) for potential production total dry weight of stems (dead and living) for potential production total dry weight of stems (dead and living) for potential production total dry weight of stems (dead and living) for potential production Storage organ to straw ratio for potential production straw ratio for potential production Amount of N fertilizer needed to obtain production for potential production Amount of N fertilizer needed to obtain production	(cm water) (cm water) (cm water) (cm water) (cm water) (%) (%) (%) (%) (kg ha ⁻¹) (kg ha ⁻¹) (kg ha ⁻¹)	+ + + no need to have this information no need to have this information + + no need to have this information	no need to have this information no need to have this information
DELWAT TRAT EVSOL LOSST TSR RYLD RAGP Leaves Stems Storage organ Ratio SO/straw Harvest index Fertilizer N Fertilizer P	difference between final and initial available water in the root zone total transpiration total evaporation from soil surface total vaporation from soil surface total water percolated to deep soil, not available for plant growth total surface runoff during simulation period relative yield water-limited yield / potential yield relative total above ground production water-limited production / potential production Nutrient-limited crop production total dry weight of leaves (dead and living) for potential production total dry weight of storage organs (dead and living) for potential production total dry weight of storage organs (dead and living) for potential production Storage organ to straw artio for potential production harvest index: weight of storage organs / weight of total above ground crop for potential production Amount of N fertilizer needed to obtain production for potential production Amount of N fertilizer needed to obtain production for potential production	(cm water) (cm water) (cm water) (cm water) (cm water) (cm water) (%) (%) (%) (%) (%) (%) (kg ha ⁻¹) (kg ha ⁻¹) (·) (·) (kg ha ⁻¹) (kg ha ⁻¹)	+ + + no need to have this information no need to have this information + + + no need to have this information no need to have this information + + +	no need to have this information no need to have this information
DELWAT TRAT EVSOL LOSST TSR RYLD RAGP Leaves Stems Storage organ Ratio SO/straw Harvest index Fertilizer N Fertilizer P Fertilizer K	difference between final and initial available water in the root zone total transpiration total vaporation from soil surface total water percolated to deep soil, not available for plant growth total water curnoff during simulation period relative total above ground production water-limited production / potential production relative total above ground production water-limited crop production total dry weight of leaves (dead and living) for potential production total dry weight of storage organs (dead and living) for potential production total dry weight of storage organs (dead and living) for potential production total dry weight of storage organs (dead and living) for potential production total dry weight of storage organs (dead and living) for potential production harves tindes: weight of storage organs (weight of total above ground crop for potential production harves tindes: weight of storage organs (dead and living) for potential production Amount of N fertilizer needed to obtain production for potential production Amount of N fertilizer needed to obtain production for potential production Amount of N fertilizer needed to obtain production for potential production	(cm water) (cm water) (cm water) (cm water) (cm water) (cm water) (%) (%) (%) (%) (%) (%) (%) (%) (%) (%) (%) (%) (%) (%) (%) (%) (%) (kg ha ¹) (kg ha ¹) (kg ha ¹) (kg ha ¹)	+ + + no need to have this information no need to have this information + + + no need to have this information no need to have this information + + + + + + + + + + + + + + + + + + +	no need to have this information no need to have this information
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