





# User manual

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## Contents

1.	Ove	rview	۷	. 3
2.	Lice	nce		. 6
3.	Soft	ware	installation	. 7
4.	Wel	come	e page	. 8
5.	Para	mete	ers	. 9
5	.1.	Acti	vities	. 9
5	.2.	Cult	ivars	10
5	.3.	Task	<s< td=""><td>11</td></s<>	11
5	.4.	Fam	ilies of treatment products	12
5	.5.	Trea	ntment products	13
5	.6.	Labo	our	14
5	.7.	Cost	ts	15
6.	Farn	n		16
6	.1.	Sele	ction of the farm studied	16
6	.2.	Farm	n features	17
7.	Scer	nario		18
7	.1.	Sele	ction of the scenario studied	19
7	.2.	Labo	our supply	20
7	.3.	Labo	our demand out-of-blocks	22
7	.4.	Fixe	d costs	23
7	.5.	Bloc	k	24
	7.5.2	1.	Features	25
	7.5.2	2.	Sales	26
	7.5.3	3.	Treatments	27
	7.5.4	4.	Labour demand	28
	7.5.5	5.	Variable costs	29
7	.6.	Resu	ılts	30
	7.6.2	1.	Treatment Frequency Index	31
	7.6.2	2.	Labour balance	32
	7.6.3	3.	Costs per task	35
	7.6.4	4.	Economic results	36
8.	Save	<b>.</b>		39
9.	Ехро	ort		40

Appendix A. List of variables and equations included in CoHort	
A.1. Index list	
A.2. Unit definition	
A.3. Colour codes of variables	
A.4. Input variables 'Parameters'	
A.5. Input variables 'Scenario'	
A.6. Intermediate calculations variables (invisible in the software)	
A.7. Results variables	
A.7.1. Economic results	
A.7.2. Output variables for 'Costs per operation'	
A.7.3. Output variables for 'TFI results'	
A.7.4. Labour balance results	

#### 1. Overview

The CoHort software is an executable program available in French and English and freely downloadable on your computer. It was created and tested as part of Solène Pissonnier's PhD thesis, conducted jointly within the Plantes et Systèmes de Culture Horticoles (PSH, Inra-Avignon) and UMR Innovation (CIRAD/Inra/SupAgro) research units, and funded by the ANR Sustain'Apple project. Based on an analysis of the practices and strategies of apple producers in two French cooperatives (Pissonnier et al., 2016), CoHort aims to support horticultural producers in their reflections regarding the technical, economic and environmental evolution of their farms and practices (Pissonnier et al., 2017). It can also be used by researchers to design innovative configurations of horticultural systems, particularly in the context of agro-ecological transition (Pissonnier et al., 2019), or in the context of initial and professional training.

CoHort is part of **a strategic support approach** conducted by an adviser with an individual producer or a group of producers. The approach is based on the design and simulation of different scenarios, each representing a possible evolution of the case studied. CoHort calculates the performance of the simulated scenario at the environmental (TFI - Treatment Frequency Index), labour (monthly supplydemand balance) and economic (gross and net margins) levels. Analysing scenario outputs and comparing scenarios allow producers to better evaluate *ex-ante* the advantages and disadvantages of each configuration that is explored. This brain-storming support may eventually lead to a decision, which may include maintaining the *status quo* if the changes envisaged do not prove to be relevant with regard to the producer's objectives.

CoHort represents the farm by breaking it down into three components (Figure 1):

(i) farming activities to be modelled, which will be described precisely in terms of crop blocks, cropping practices per block and labour required;

(ii) farming activities for which only labour requirements will be taken into account;

(iii) off-farm activities that are also time consuming<sup>1</sup>.

CoHort includes three modules (see sections 5, 6 & 7). The first one, called 'Parameters', allows users to create their own lists of names **in their own language**<sup>2</sup> regarding:

- . farming and off-farm activities;
- . cultivars per crop;
- . crop operations;
- . treatment product families and individual products;
- . labour categories;
- . expenses (fixed and variable).

These lists are generally specific to an intervention area and will be used with all cases studied in that area. They are completed by the software user as new items are encountered.

The second module, called 'Farm', allows the user to create a farm and briefly describe its cropping pattern and livestock.

<sup>&</sup>lt;sup>1</sup> Off-farm activities correspond to non-farming tasks conducted by farmers and their families either on or out of the farm.

<sup>&</sup>lt;sup>2</sup> Only the fixed titles of CoHort are necessarily in French and English.

The third module, called 'Scenario', allows the creation and characterisation of each scenario related to the farm under study. For this, a set of pages must be filled in concerning the farm's:

(i) labour resources;

(ii) labour requirements of the non-modelled part of the farm;

(iii) fixed costs.

Then, after further breaking down the modelled part of the farm into crop blocks, the following information must be entered for each block:

a. surface area, crop cultivated on it, cultivar concerned and yield;

b. selling prices of the productions;

c. related farming practices and labour monthly labour requirements;

d. treatments carried out;

e. variable costs.

The results calculated include the TFI per block and over the entire farm, monthly labour balance, costs per task and block, gross margins per block and total, and net margin on the modelled part of the farm. All variables and equations used in CoHort are described in Appendix A.

Scenarios can be very diverse, ranging from changes in practices requiring investments, such as the use of nets in orchards or the introduction of new cultivars more resistant to fungal diseases (Pissonnier et al., 2017), to the redesign of the entire production system, such as the introduction of a sheep herd in a specialised apple farm (Pissonnier et al., 2019).

Figure 1. CoHort conceptual model



#### For more information :

Pissonnier S., Lavigne C., Toubon J.-F., Le Gal P.-Y., 2016. Factors driving growers' selection and implementation of an apple crop protection strategy at the farm level. *Crop Protection* 88, 109-117. http://dx.doi.org/10.1016/j.cropro.2016.06.007

Pissonnier S., Lavigne C., Le Gal P.-Y., 2017. A simulation tool to support the design of crop management strategies in fruit tree farms. Application to the reduction of pesticide use. *Computers and Electronics in Agriculture* 142(A), 260–272. <u>http://dx.doi.org/10.1016/j.compag.2017.09.002</u>

Pissonnier, S., Dufils, A., Le Gal, P.-Y., 2019. A methodology for redesigning agroecological radical production systems at the farm level. *Agricultural Systems* 173, 161–171. https://doi.org/10.1016/j.agsy.2019.02.018

## 2. Licence

CoHort is freely available at the following link:

https://www6.paca.inrae.fr/psh/Modeles-et-logiciels/Cohort

It is available to professionals working in the horticultural sector, including agricultural consultants, under a BSD-3-Clause license.

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## 3. Software installation

Download the archive by clicking on the link above, open the archive and run the setup.exe file. A subdirectory called CoHort 2019 is then created in your Programs directory.

A second subdirectory called CoHort is also created in your 'My Documents' directory. It stores a set of information related to your own use of the software (e.g., parameter values).

You can finally create your own CoHort directory to store the \*.csv files resulting from the export of each scenario you wish to keep.

#### 4. Welcome page

The Welcome page allows you to select the working language (English or French) by clicking on the two dedicated buttons at the top right of the screen.

Then click on 'Démarrer' (if French has been selected) or 'Start' (if English has been selected) to go into the software.



Once in the program, the screen displays a grey banner with the three modules 'Parameters', 'Farm' and 'Scenario' which allow access to all of CoHort's functions (see screen shot on the following page). In addition, the 'Save' and 'Export' functions are activated when a new farm or scenario is created, or when a change is made in farms and scenarios which already have been created.

This banner appears on every CoHort screen. The scroll-down menus of each module can be displayed by clicking on their names at any time.

## 5. Parameters

When using CoHort for the first time, **the values of the Parameters variables have to be entered first**, as they will then be used in the two other modules through various choice lists. These values can be enriched throughout the use of the software when new occurrences are encountered while characterising new farms and scenarios.

As indicated in the general presentation, the 'Parameters' module has seven pages that must be filled in.

#### 5.1. Activities

Four types of pre-determined activities are proposed: crop (crop names: apple, pear, apricot, etc.), livestock (name of the domestic species, specifying their production if necessary: dairy cattle, beef cattle, meat sheep, etc.), other farming activity, and off-farm activity.

The user first chooses the type of activity and then enters a new name in the 'Activity name' field. Then he/she clicks on "Add" and the value is entered in the corresponding table.

It is possible to "Modify" and "Delete" the occurrences already entered. The user first clicks on the selected occurrence, which is highlighted. By clicking on "Modify", the occurrence appears in the "Activity name" where it can be modified and added. By clicking on "Delete", it disappears.

These three buttons "Add", "Modify" and "Delete" are found on all of the screens of the software.



### 5.2. Cultivars

A set of cultivars can be entered for each crop entered on the previous page. The user starts by choosing a crop from the list constructed in 5.1. The selected crop is displayed with the cultivar names already entered. Then he/she enters the name of a new cultivar in the dedicated field.

CoHort 2019 [V1.0]	via I Sava Evnot	(ultari) saide tar 's page printider	n, I or provide it pairs or	
	Save Export			
Parameters				
Cultivar names per cro	p			
	Crop selection :	Cultivar name :		
	Apple		Add	
	Сгор	Cultivar	▲ Modify	
	Apple	Elvina		
	Apple	Gala	Delete	
	Apple	Golden		
	Apple	Pink Lady		
			and the second second	
			-	

### 5.3. Tasks

The names of tasks that require labour, equipment and inputs are entered on this page according to their nature: crop, livestock, other. The names already entered appear in the three dedicated tables. To enter a new name, the user first selects the kind of task, then enters the name itself in the 'Task name' field.

CoHort 2019 [V1.0]					
Parameters   Farm Scenario	Save Export				
Parameters Names of tasks using labou	r, equipment and inputs				
	Crop task All tasks Conservation Fertilisation Harvest Irrigation Net setting Observations Orchard plantation Protection treatment	E Kind Task	id Modify of task :	Delete	
	Fruning Livestock task Feeding Grazing Milking Veterinary care	Oth	er task Maintenance		

## 5.4. Families of treatment products

In order to facilitate data entry and analysis, it is possible to work with treatment product families and/or with individual products themselves in CoHort.

The 'Treatment product families' page allows the user to enter these family names, which are then used to define, if necessary, the product names per family (section 5.5), and to calculate the Treatment Frequency Indexes (section 7.6.1).

Warning! Only the product families included in the TFI calculation are concerned by this table.

CoHort 2019 [V1.0]				
Parameters Farm Scenario	Save Export			
Parameters				
Names of treatment produc	cts families			
	Name of the treatment product family :			
			Add	
	Family of the treatment product		Modify	
	All products			
	Biocontrol products		Delete	
	Fungicide			
	Insecticide			
	Thinning			
		-		

#### 5.5. Treatment products

CoHort allows all of the treatment products per family used in the working area of the software user to be listed. Each new product is defined by entering its commercial name and its unit cost.

**Warning!** If the user wishes to be able to work only on the product families, **he/she must also enter their names here a second time** so that he/she can choose them when defining the treatments by block in the 'Product choice' field (section 7.5.3). The unit cost entered is then an average cost **per treatment** calculated on all of the products belonging to the family considered, as well as the associated dose entered in section 7.5.3. Another solution is to enter a cost per hectare **per treatment** with an associated dose of 1.

**Warning!** The cost per unit does not refer to a monetary unit, nor to a volume unit. This choice is deliberate as it gives the software greater flexibility in terms of context of use. It is systematically applied for all of the quantitative variables requiring a unit encountered in CoHort.

On the other hand, it supposes that the user is consistent at all points of the software for the same object. For example, the cost calculation of a treatment product consists in multiplying the dose used on a crop block by the block surface, then by its unit cost. If the cost of the treatment is expressed in  $\epsilon$ /ha, the surface area of the blocks (entered in section 7.5.1) should be in ha, the unit cost (entered in section 5.5) in  $\epsilon$ /liter, and the dose (entered in section 7.5.3) in liter/ha.

If many units are used according to the products and productions listed, **it may be useful to report in a separate file the different units used** according to the products and productions, i.e., area, input volume, production weight, currency.

Warning! Only products whose use is included in the TFI calculation are concerned by this table.

CoHort 2019 [V1.0]	net de Tatar l'ansamble	e des produits de	traitement par famili	ie utilitalis darr	
Parameters   Farm Scenario	Save Export				
Parameters					
raranecers					
Names of treatment product	ts				
	Selection of product family	Product name :	Cost per unit ·		
	Insecticide		0	Add	
	Family of the treatment product	Treatment product	Cost per unit	Modify	
	Insecticide	Calvoso	188.35	Delete	
	Insecticide	Insecticide	0	Delete	
	Insecticide	Suprême	137,43		
	-				

#### 5.6. Labour

This page allows the categories of labour that can be found on farms in the user's area to be defined. Each category is defined by its name and unit cost.

The choice was made to consider this cost as constant for a category of labour in a given context, and thus to integrate it in the 'Parameters' module. The user can nevertheless adjust the amounts by creating new categories corresponding to the real cases encountered. The example provided below takes into account two possible situations: the one where the farm head and the family workforce are paid, with the salaries being charged to expenses, and the one where they are not (payment on the net margin).

**Warning**! As in the previous case, **the time unit is not predefined** and must therefore be chosen and maintained throughout the software by the user. In the case of working time, it can be, for example, hour, day or month. **This choice then applies to all categories of labour** and may require intermediate calculations to be made outside the software to go from a unit mentioned by the producer to the one taken into account in the application.

For example, if seasonal labour is paid by the hour and permanent labor is paid by the month, the hourly cost of the latter must be recalculated to have the same unit as the former.

CoHort 2019 [V1.0]	re par exemple l'heure, la journale i	sole mails. En chois c'applique al	tre à toutes les catilgories	
arameters   Farm Scenario	Save Export			
Parameters				
Names of labour categor	у			
	Name of the labour category :	Cost per unit :		
		0	Add	
	Labour category	Cost per unit	Madify	
	Family with salary	13	wedny	
	Family without salary	0	Delete	
	Farm head with salary	13		
	Farm head without salary	0		
	Permanent staff	15	the second s	
	Temporary staff	13		
			-	

## 5.7. Costs

Four types of costs are predefined in CoHort: fixed, variable for crops, variable for livestock, and other variable costs. The user enters the names of the cost items that he/she will need in scenarios by first choosing the nature of the cost from among these four types, and then by entering the name of the cost item. This name is then entered in the list corresponding to the type of cost chosen.

CoHort 2019 [V1.0]	Labolitant					
Parameters   Farm Scenario	Save Export					
Parameters Names of costs (including o	depreciation)					
	Kind of cost :		Name of cost :			
	Other	▼.			Add	
	Fixed cost All Equipment depreciation Financial costs Insurances Internet Maintenance Office equiment Rents Social security	× H	Variable crop cost Contactor Irrigation Mineral fertiliser Net Organic fertiliser Seeds Young orchards	×	Modify Delete	
	Variable livestock cost Feeds Veterinary costs	×	Other variable cost Fuel / lubricant Packaging	×		

#### 6. Farm

*Nota bene*: the example used to illustrate the manual is a fictional farm.

## 6.1. Selection of the farm studied

Whether real or virtual, each new farm with which the user has to work must first be created. To do this, enter the farm name in the dedicated field. The "Create" and "Rename" buttons are then activated. By clicking on the "Create" button, the name is entered in the list below with the date that the farm was created.

To rename a farm that already has been created, simply select it from the list and type the new name in the dedicated field, then click on the "Rename" button.

To work on a farm, whether newly created or renamed, click on the "Open" button. The name of the farm and its creation date are then displayed at the top of the page. These two pieces of information will then appear on all pages related to the farm.

It is possible to delete a created farm by selecting it from the list and clicking on the "Delete" button. This action, as well as opening a created farm, triggers a message alerting the user to the risk of data loss.

	Display of the the date it			
CoHort 2019 [V1.0]	on & "supplicitation of	sa data da critation (	Picture days and	
Farm selection Select a farm already saved or create a new one	Farm Date	: Gachet : 02/07/2020	Scenario Date	-
Farm r Creativ Farm	name : on date : 25/03/2021 Arbo	Cr Rer Date ^ Or 24/03/2020	eate ame ame	
	chet	02/07/2020 Ren	nove	

## 6.2. Farm features

This page gathers information that is not used in the subsequent calculations, but that allows the user to keep a brief description of the farm studied, to which he/she can return during the course of the work to verify certain entries related to the scenarios: total surface area, permanent labour force, initial cropping pattern and livestock, marketing mode.

The values in the upper box are to be entered with the keyboard, while the choices of crop and livestock activities are made from the lists defined in the 'Parameters' module.

CoHort 2019 [V1.0] Parameters Farm So Farm featur	cenario   Save Export	Farm : Gachet Date : 02/07/202	Scenario : O Date :	
Data entered with keyboard	Last name of the farm head : Gachet First name of the farm head : Florence Number of permanent workers : 1	Farm location : Ventenac Farm specialization : Pomme Marketing channel : Perlim	Total cultivated area of the farm : 11 Specialized cultivated area of the farm : 8 Kind of technical support : Cooperative advisor	Data entered with keyboard
	Apple 0 Crop Area Apple 8 Apricot 1 Pear 2 Sele	Add Suckling ex Modify Livestock Delge	g ewe 50	

### 7. Scenario

The 'Scenario' tab provides access to the scenario 'Selection', and to its characterisation with regard to 'Labour supply', 'Labour demand outside blocks' and 'Fixed costs', and to the 'Block' and 'Results' submenus.

CoHort 2019 [V1.0]	Jous menus bioc en	. neoundio .					
Parameters   Farm	Scenario   Save Export						
Farm sele	Selection Labour supply	Ctrl+I Ctrl+E	Farm Date	: Gachet : 02/07/2020		Scenario : Date :	
Select a farm alre	Labour demand out-of-bloc Fixed costs Block	Ctrl+S					
	Result	•					
		Creation date :			Create		
		Creation date :	25/03/2021		Rename		
		Farm EA Arbo		Date  24/03/2020	Open		
		🖻 Gachet		02/07/2020	Remove		
				_			
				<b>.</b>			

*Nota bene*: the scenario used to illustrate the manual is fictious.

#### 7.1. Selection of the scenario studied

Each farm can be the subject of an infinite number of scenarios. To create a scenario, go to the "Scenario name" field and type in the name you have chosen. The two buttons "Create" and "Rename" are activated. By clicking on "Create", the scenario name is entered in the list below.

To rename an already created scenario, click on the scenario name which is then highlighted, then type the new name in the dedicated field and click on the "Rename" button which has been activated. A message appears asking you to confirm the procedure. If the procedure is confirmed, the new name will appear in the list of created scenarios.

To work on a scenario, you must open it by clicking on its name in the list (it is then highlighted) and then clicking on the "Open" button. Its name is then displayed on the top left of the page. It will appear in all the following pages corresponding to the characterisation and the results of the calculations specific to this scenario. This display allows the user to make sure that he/she is on the desired scenario.

A scenario can be deleted using the same procedure, but by clicking on the "Delete" button instead of "Open". In both cases, warning messages appear on the screen to prevent the unintentional loss of entered data.

		Display of th date it	ne selected scenario and the was created in CoHort
CoHort 2019 [V1.0]	it alors dans is lots de-	advaries crists.	
Parameters   Farm Scenario   Save Export			
Scenario selection	Farm Date	: Gachet : 02/07/2020	Scenario : Gachet 1 Date : 17/12/2019
Select a scenario already saved or create a new	one		
Sce	nario name :	Create	
Cre	ation date : 25/03/2021	Rename	
Sc	enario Gachet 3 Gachet 2	Date Copen 17/12/2019 17/12/2019 Remove	
	Gachet 1	17/12/2019	
		*	

#### This selection stage is necessary before moving to the next stages (7.2 to 7.6).

## 7.2. Labour supply

The labour balance calculated by CoHort requires the user to first list the resources available on the farm. This description is done person by person, by attaching each person to one of the labour categories defined in 'Parameters'. For each person, the user provides the amount of working time available per month, employing the time unit used to define the unit labour costs (section 5.6). Once the person is created, times are entered directly in the cells of the table.

**Warning! Seasonal labour is a special case** when it appears in a scenario. It is not included in the calculation of the labour supply-demand balance (section 7.6.2), which only concerns the farm's permanent labour force. However, it is taken into account in the labour requirements of the modelled part of the farm (section 7.5.4) in order to include its cost in the calculation of variable costs and then gross and net margins. To enter these requirements, the following steps must be taken:

(i) Enter this seasonal labour category in the 'Parameters' module (section 5.6);

(ii) Enter it as a person in section 7.2 'Labour supply' by setting the available time to zero over the 12 months (see example below);

(iii) If necessary, select this category and this person in the characterisation of labour demand by block by specifying the task and the amount of time required (section 7.5.4).

The monthly values are entered directly into the cells of the table as in a spreadsheet. When the first value is entered, the software asks if the user wishes it to be duplicated for the 12 months of the year. This procedure speeds up data input. However, each monthly value can be modified by clicking directly on the cell.

The "Modify" button only affects the category and the name of the person already entered.

The "Delete" button deletes the person and his/her values.

The "Clear all" button clears the whole table (persons and values).

oHort 2019 [V1.0] meters   Farm Scenaric	Save Export												
onthly working availab	ilities of permanen	t labour (sea	asonal la	Fa Da abour n	rm ate nay be	: Ga : 02 mentior	ichet /07/2020 ned with	out any	<sup>,</sup> availabil	Scenario Date ity)	: Ga : 17	achet 1 /12/2019	
election of permanent labour Family without salary	r: Worker	name :								Add	Modify	Delete	Clear a
Kind of labour	Involved worker	January	February	March	April	May	June	July	August	September	October	November	December
Family without salary	Pierre	50	50	0	0	0	0	0	0	0	0	50	50
Farm head without salary	Florence	160	160	160	160	160	160	160	160	160	160	160	160
Permanent staff	François	160	160	160	160	160	160	160	160	160	160	160	160
Temporary staff	Temporary staff	0	0	0	0	0	0	0	0	0	0	0	0

#### 7.3. Labour demand of non modelled activities

Labour is the only resource for which a balance sheet is made at the farm level and not only on the modelled part (section 7.6.2). To do so, the user must enter here the aggregated monthly labour requirements (all persons and labour categories combined) for each non-modelled activity.

These activities are chosen among those defined in the 'Parameters' module: farming (crop, livestock, other) and off-farm.

As before, the monthly values are entered directly into the cells of the table.

onthly work demands of non-	modelled activities			Farm Date		Gachet 02/07/20			Scenari Date				
ype d'activité :	Selectio	n of activit	ty:										
Off-fram activity	•				•				Add	Modify	Delete	Clear	al
Farming activity	January	February	March	April	May	June	July	August	September	October	November	December	-
Apricot	25	25	0	10	10	50	50	0	0	0	0	0	
Pear	50	50	10	20	20	0	0	0	100	0	0	0	
Sucking ewe	UC	50	00	100	50	50	50	00	00	50	50	00	
Off-farming activity	January	February	March	April	May	June	July	August	September	October	November	December	
Bed and Breakfast	0	0	0	10	20	30	50	50	30	10	0	0	
Coop administrator	8	8	8	8	8	8	8	8	8	8	8	8	
rarm sale	U	0	U		U	20	20	20	20	20	U	U	

#### 7.4. Fixed costs

CoHort makes it possible to include the fixed costs, i.e., those that cannot be attributed to a particular activity or production (e.g., depreciation of equipment used in several activities, financial costs, etc.) in the calculation of the economic results **regarding the modelled part of the farm**. The net margin generated by this part can thus be estimated in addition to the gross margin, which only integrates the variable costs (section 7.6.4).

To do this, the user selects the cost items that concern the farm studied from those listed in the 'Parameters' module ('Selection of fixed cost'), and then enters for each selected item (i) its cost per unit area (the one that will be used for block size) and (ii) the proportion of this cost assigned to the modelled part of the farm.

CoHort 2019 [V1.0]				
Parameters Farm Scenario	Save Export			
		Farm : Gachet Date : 02/07/202	Sce 0 Dat	
Fixed costs per area unit				
	Selection of fixed cost :	Cost per area unit :	Share :	
		• 0	100 %	Add
	Fixed cost	Cost per area unit	Share 🔺	Modify
	Equipment depreciation	50	70	
	Financial costs	5	70	Delete
	Social security	20	70	
	Water/Gas/Electricity	5	70	Clear all
			-	

## 7.5. Block

The definition and characterisation of the blocks concern **only the modelled part of the farm**, which they constitute.

The "Block" submenu gathers together the following information for each block: its characterisation, sales of its production, phytosanitary treatments carried out, tasks conducted and associated labour requirements, and the variable costs related to them.

CoHort 2019 [V1.0]										X
Parameters   Farm S	cenario   Save Export									
	Selection	Ctrl+I		Farm		Gachet		Scenario	Gachet 1	
Scenario s	Labour supply	Ctrl+E		Date		02/07/2020		Date		
	Labour demand out-of-blocks	Ctrl+B								
Select a scenario	Fixed costs	Ctrl+S								
	Block	•	Features	Ctrl+T						
	Result	•	Sales	Ctrl+L						
			I reatments	Ctrl+D			Contract			
		Creation dat	Variable cost	s Ctrl+G			Create			
		sreation dat	26/03/20	121			Rename			
			20,03,20							
		Scenario			Da	te 🔺	Open			
		Gachet 3			17,	/12/2019				
		Gachet 1			17,	(12/2019	Remove			
						_				
						_				
and the second										
						-				

#### 7.5.1. Features

The user first defines the blocks that constitute the modelled part of the farm. Each block corresponds to a physical plot or a set of identically managed plots. It may be tempting to multiply blocks, or even to "stick" to the plot reality of the farm, but this mechanically increases the amount of data to be entered. The user must therefore work with the producer to find a compromise based on the data and time available to carry out the simulations, and on the configuration of the scenarios envisaged.

A block is defined by its name, the crop selected among those listed in 'Parameters' (5.1), the cultivar linked to the chosen crop (5.2), its area and its yield. These last two variables must be consistent in terms of units with those used elsewhere in the software since CoHort does not predefine any units.

**Warning!** If the user wishes to change the name of a block when he/she already has entered a certain amount of data describing it in the following pages, all of these data will be lost. A message warns of this risk. It is therefore preferable to stick to the names defined at this stage.

**Warning!** The yields entered are those corresponding to the practices described in the following pages (treatments, labour and variable charges). In general, they are not derived from cultivation models but from expert references or estimates (producers, technicians, researchers, etc.). The user must therefore consider the possible consequences of these changes on the yields entered each time these practices are modified, in order to maintain the overall consistency of the scenario.

oHort 2019 [V1.0]	technicisme, character	on styll & shares multiple	they be used and the set	Publications shall do	
meters   Farm Scen	ario   Save Export				
		Farm : G	achet	Scenario : Gachet	
		Date : 02	2/07/2020		
efinition of the bloc	ks making up the modelled pa	rt on the farm			
					Statement of the local division of the local
Block name :	Crop selection :	Cultivar selection :	Area :	Yield :	
	Pear	<ul> <li>Comice</li> </ul>	• 0	0	Add
Block	Сгор	Cultivar	Area	Yield	Modify
1	Apple	Golden	3,8	45	
2	Apple	Pink Lady	4,2	35	Delete
3	Apricot	Roussillon	1	10	
4	Pear	Comice	2	15	Clear al
					-
					-
					-
					-

#### 7.5.2. Sales

Each block's production can be sold at different prices depending on its quality. The user therefore specifies here (i) the selling price per unit of volume and (ii) the proportion of the production sold at this unit price.

**Warning!** When opening this page and the following ones, all of the fields are empty. If blocks have already been created and information entered, simply select them by making the list appear in the "Block Name" field. The values corresponding to the selected block name, and only these, will then appear in the table below.

		Farm : Date :	Gachet Scena 02/07/2020 Date	rio : Gachet 1 : 17/12/2019
e prices of crop pro	oduction per block and marke	eting channel		
ck selection :	Crop : Apple	Cultivar : Golden	Sale price per unit : 0	Share : 0 % Ad
ock	Сгор	Cultivar	Sale price per unit	Share 🔺 Mod
1	Apple	Golden Golden	100 350	20 80 Del
				Clea

#### 7.5.3. Treatments

The description of the phytosanitary treatments carried out on each block constitutes one of the essential components of CoHort, which initially was designed to reproduce treatment strategies on a farm scale.

Each phytosanitary intervention (i) is positioned in a block, (ii) is linked to a crop operation, (iii) belongs to a product family, (iv) is made up of a product, (v) which can be applied several times a year (number of treatments), (vi) at a dose whose unit of volume must correspond to that of the unit price defined in the 'Parameters' module (5.5) and whose unit of area must correspond to that of the blocks (7.5.1).

In order to calculate the only environmental indicator contained in CoHort, namely the TFI, the user enters the % TFI corresponding to each treatment. If the producer has applied the approved dose for the use of the product on the crop in question, this proportion is equal to 100. A dose that is x% lower (e.g., for herbicides) or an application area that is x% smaller reduces this proportion by the same amount (e.g., a half-dose or half the area results in a % TFI of 50).

If the user does not wish to go down to the product but only to the product family, he/she must enter the names of the families in the list of products defined in 5.5. so that they appear in the "Product choice" field. The number of treatments then corresponds to the number of applications of the family in question, regardless of the products used. See 5.5 for the values to be entered for the unit cost and the dose corresponding to each family.

The calculation of the TFI is done at a minimum by block and by product family (7.6.1).

**Warning!** When the user works only by product family, **it is preferable to respect the spelling of the family name** as entered in 5.4.

**Warning!** Only products and product families whose use is included in the TFI calculation are concerned by this table.

Hort 2019 [V1.0]	Scenario Save Export						
eatments per blo	ock included in the cald	ulation of the Treatr	Farm : G Date : 0 nent Frequency Index (	iachet 2/07/2020 TFI)	Scenario Date	: Gachet 1 : 17/12/2019	
ock selection :	Task selection :	Family selection :	Product selection :	Number of treatments :			
[	▼ Protection	<ul> <li>Insecticide</li> </ul>	▼ Calypso	• 0	0	0 %	Add
lock	Task	Product family	Product used	Treatments per year	Dose	% TEL	Madif
1	Protection treatment	Fungicide	Chorus	4	0.45	100	Modify
1	Protection treatment	Insecticide	Calvpso	2	0.25	100	Delete
1	Weeding	Herbicide	Fusilade	1	0,64	100	
							Clear a

#### 7.5.4. Labour demand

Labour requirements are entered (i) by block, (ii) by task, then (iii) by category of labour and (iv) by person concerned within that category.

Monthly time is entered **by area unit**, based on the time unit defined for resources (see 7.2) and the area unit defined for blocks (7.5.1).

The comparison of these individualised needs with the individualised resources allows the calculation of balances per person within the farm for the part that is modelled (see 7.6.2).

			4			Date		)2/07/202			Date					
ontniy v ock selec	tion : K	ind of task :	, task and worke	tion :	Lal	bour select	ion :	Wo	rker select	ion :	Add		lodify	Delete		ar al
											Huu		iouny	Delete	Cic	
lock	Task	Labour	Involved worker	January	Februa	ry March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	1
1	Harvest	Temporany staf	Tomporany staff	0	10	10	0	0	0	0	0	40	40	0	0	
1	Protection tre	Farm head with	Florence	0	0	10	10	10	10	0	0	40	40	0	0	
1	Protection tre	Family without	Pierre	8	8	0	0	0	0	0	0	0	0	0	8	
1	Pruning	Temporary staf	Temporary staff	20	20	0	0	0	0	0	0	0	0	0	20	
1	Thinning	Permanent staf	François	0	0	0	0	0	16	0	0	0	0	0	0	
1	Weeding	Permanent staf	François	0	0	10	10	0	0	0	0	0	0	0	0	

#### 7.5.5. Variable costs

Variable costs are entered (i) by block, (ii) according to the nature of the task (crop, livestock, other) and (iii) the task itself. They are defined by (i) the nature of the cost and (ii) the name of the cost (5.7). The unit cost is given **per unit area** and is based on the monetary and area units previously used by the user.

**Warning!** Crop protection costs are not included in this page as they are calculated from the data entered in 7.5.3. The same applies to labour costs which are calculated from the data entered in section 7.5.4.

The costs entered here can be aggregated by task (e.g., total expenditure on fertilisers for the 'Fertilisation' task) or individualised (e.g., cost of fertiliser 1, cost of fertiliser 2, fuel, etc.), depending on the user's wishes. However, when this is the case, the user must define precisely in the cost names what he/she wants to appear in the choice lists (5.7). The calculation of the economic results stops at the 'Task' level (see 7.6.3).

CoHort 2019 [V1.0] ameters Farm Scena	rio   Save Export	de sufface atilat	es précédenceuré pa	e l'atilitational		
Amount of variable co	sts per area unit and 1	task for each block,	Farm : Gao Date : 02/ treatment products exo	chet S 07/2020 D	cenario : Gachet 1 late : 17/12/2019	9
Block selection :	Operation nature :	Task selection :	Kind of cost :	Selection of variable cost :	Amount per area unit :	
Block 1 1 1	Task Fertilisation Soil preparation Weeding		Variable cost Mineral fertiliser Contactor Contactor		Amount per area unit 20 10 20	Modify     Delete     Clear al

#### 7.6. Results

The 'Result' submenu of the 'Scenario' menu includes the calculation of the TFI, labour balances, costs per task and economic results.

	Selection		Ctrl+I		Farm	Gachet	Scenario	· Garbet 1	
lculation of TFI	Labour su Labour d Fixed cos Block	upply emand out-of-blo ts	Ctrl+E ocks Ctrl+B Ctrl+S		Date	: 02/07/2020	Date		
TFI per block	Result		•	✓ Treatment Fi	equency Index	Ctrl+Q			
		1	2	Costs per tas	k	Ctrl+U			
Crop		Apple	Apple	Economic re	sults	Ctrl+W			
Cultivar		Golden	Pink Lady	Roussillon	Comice				
TFI		7,0	14,0	4,0	2,0				
TFI per unit of produ	uction	0,16	0,40	0,40	0,13				
TFI per product far	nily								
All products		0,0	0,0	0,0	0,0				
<b>Biocontrol products</b>		0,0	0,0	0,0	0,0				
Conservation		0,0	0,0	0,0	0,0				
Fertilisers		0,0	0,0	0,0	0,0				
Fungicide		4,0	10,0	0,0	0,0				
Herbicide		1,0	0,0	0,0	0,0				
Insecticide		2,0	4,0	4,0	2,0				
Oils		0,0	0,0	0,0	0,0				
Others		0,0	0,0	0,0	0,0				
Thinning		0,0	0,0	0,0	0,0				

## 7.6.1. Treatment Frequency Index

The TFI is first calculated per block from the list of treatments entered in 7.5.3 (see equation in Appendix A). The total value obtained is then divided by the block production in order to get a simple evaluation of the efficiency of the treatments.

The total TFI is then broken down into the different product families defined in 5.4.

Finally, an average TFI for the farm is calculated by weighting the values per block by the area of the blocks.

				Farm Date	Gachet 02/07/202	Scenari Date	io : Gachet 1 : 17/12/2019	
culation of TFI per block	and on the fa	rm						
FI per block								
	1	2	3	4				
Crop	Apple	Apple	Apricot	Pear				
Cultivar	Golden	Pink Lady	Roussillon	Comice				
FI	7,0	14,0	4,0	2,0				
FI per unit of production	0,16	0,40	0,40	0,13				
FI per product family								
All products	0,0	0,0	0,0	0,0				
Biocontrol products	0,0	0,0	0,0	0,0				
Conservation	0,0	0,0	0,0	0,0				
ertilisers	0,0	0,0	0,0	0,0				
ungicide	4,0	10,0	0,0	0,0				
lerbicide	1,0	0,0	0,0	0,0				
nsecticide	2,0	4,0	4,0	2,0				
Dils	0,0	0,0	0,0	0,0				
Others	0,0	0,0	0,0	0,0				
hinning	0,0	0,0	0,0	0,0				

#### 7.6.2. Labour balance

CoHort calculates three types of monthly labour supply-demand balances in total number of time units (see equations in Appendix A). A positive value indicates an excess of labour (underemployment), a negative value a deficit requiring a correction (reduction of demand or employment of additional labour, permanent or seasonal) which can be the subject of a new scenario.

#### . By labour category

CoHort calculates the monthly labour balance by labour category **on the modelled part of the farm**, based on the requirements entered by crop block (section 7.5.4). The table shows all of the labour categories defined in 5.6, even if they were not used in the scenario studied.

neters   Farm Scenario	Save E	xport											
					Farm Date	: Gache : 02/07	et /2020		Scenar Date		Gachet 1 17/12/2019		
lculation of the balances	between	supply and	d demand	of work									
Monthly balance per kind of fac	our (model	ieu part)	Mor	thly balance	e per perman	ent staff (mo	delled part)		Monthly an	d annual ba	lance at farm	level	
/onthly balance :												-	_
	January	February	March	April	May	June	July	August	September	October	November	December	1
Family with salary	0	0	0	0	0	0	0	0	0	0	0	0	
Family without salary	-14	-14	0	0	0	0	0	0	0	0	50	-14	1
Farm head with salary	0	0	0	0	0	0	0	0	0	0	0	0	L
Farm head without salary	160	122	21	59	80	80	160	160	160	160	160	160	
Permanent staff	16	16	122	122	160	99	160	160	160	160	160	16	
fonthly demand :													
	January	February	March	April	May	June	July	August	September	October	November	December	
Family with salary	0	0	0	0	0	0	0	0	0	0	0	0	ſ
Family without salary	64	64	0	0	0	0	0	0	0	0	0	64	1
Farm head with salary	0	0	0	0	0	0	0	0	0	0	0	0	L
Farm head without salary	0	38	139	101	80	80	0	0	0	0	0	0	
Permanent staff	144	144	38	38	0	61	0	0	0	0	0	144	
Aonthly supply :													
	January	February	March	April	May	June	July	August	September	October	November	December	
Family with salary	0	0	0	0	0	0	0	0	0	0	0	0	ſ
Family without salary	50	50	0	0	0	0	0	0	0	0	50	50	
Farm head with salary	0	0	0	0	0	0	0	0	0	0	0	0	
Farm head without salary	160	160	160	160	160	160	160	160	160	160	160	160	1
Permanent staff	160	160	160	160	160	160	160	160	160	160	160	160	1
						0	0	0	0	0			

#### . By active worker

On the same basis as the preceding balance (modelled part of the farm), this balance sheet gives an individual view of the monthly workload.

This table includes the values calculated for seasonal labour already present in the previous table since this labour appears as both a category and a person (see 7.2).

					Farm Date	: Gach : 02/07	et 7/2020		Scenar Date		Gachet 1 17/12/2019		
lculation of the bala	ances between	supply and	d demand	of work									
Monthly balance per kind	d of labour (model	led part)	Mon	thly balance	per permane	ent staff (mo	delled part)		Monthly an	d annual ba	lance at farm	n level	
fonthly balance :													
	January	February	March	April	May	June	July	August	September	October	November	December	
Florence	160	122	21	59	80	80	160	160	160	160	160	160	
François	16	16	122	122	160	99	160	160	160	160	160	16	
Pierre	-14	-14	0	0	0	0	0	0	0	0	50	-14	
Temporary staff	-76	-76	0	0	0	-30	-30	0	-152	-278	-186	-76	
Nonthly demand :													
	January	February	March	April	May	June	July	August	September	October	November	December	-
Florence	0	38	139	101	80	80	0	0	0	0	0	0	
François	144	144	38	38	0	61	0	0	0	0	0	144	
Pierre	64	64	0	0	0	0	0	0	0	0	0	64	
Temporary staff	76	76	0	0	0	30	30	0	152	278	186	76	
fonthly supply :													- 19
Worker	January	February	March	April	May	June	July	August	September	October	November	December	
Pierre	50	50	0	0	0	0	0	0	0	0	50	50	
Florence	160	160	160	160	160	160	160	160	160	160	160	160	
François	160	160	160	160	160	160	160	160	160	160	160	160	
Temporary staff	0	0	0	0	0	0	0	0	0	0	0	0	

#### . On the whole farm

This balance sheet integrates the non-modelled activities of the farm (outside the blocks). It therefore aggregates all labour categories (including seasonal) and provides an overall assessment of the monthly and annual workload.

This balance sheet is useful to identify possible labour surpluses or deficits linked to the combination of the modelled part of the farm with other labour-generating activities. On this basis, a discussion can be initiated with the producer to modify one and/or the other of these two farm sub-components.

For example, a labour deficit can be absorbed by increasing the working time of the permanent workforce, by employing additional permanent staff, or by using seasonal labour on the non-modelled part of the farm. The latter solution may already be used in practice by the producer. However, it is not explicitly taken into account in the scenario since the labour demands of the non-modelled part are not divided between labour categories to simplify data collection and entry.

Monthly balance	per kind of la	bour (mode	lled part)	Mor	thly balance	e per perman	ent staff (mo	delled part)		Monthly and	d annual ba	lance at farm	level
Nhole farm balan	ce :												
lotal	171	January	February	March	April	May	June	July	August	September	October	November	December
	471	-47	-85	75	33	132	-9	112	192	-40	-46	126	28
Whole farm dema	ind :												
Total		January	February	March	April	May	June	July	August	September	October	November	December
	3569	417	455	245	287	188	329	208	128	360	366	244	342
emand on the m	odelled part :												
Total		January	February	March	April	May	June	July	August	September	October	November	December
	2103	284	322	177	139	80	171	30	0	152	278	186	284
upply of the who	le permanent	staff :											
Total		January	February	March	April	May	June	July	August	September	October	November	December
	4040	370	370	320	320	220	220	220	320	220	220	270	270

## 7.6.3. Costs per task

The costs per task are calculated per block and for the whole farm, in monetary units per unit area.

For each task, (i) treatment costs (section 7.5.3), (ii) labour costs (section 7.5.4), and (iii) variable costs (section 7.5.5) are summed together.

				Farm Date	: Gachet : 02/07/2	: 2020	Scenario Date	
culation of variabl	le costs per area ι	init for each	task (block a	and whole fan				
	Whole farm	1	2	3	4			
rop	-	Apple	Apple	Apricot	Pear			
ultivar	-	Golden	Pink Lady	Roussillon	Comice			
ask								
ertilisation	11	20	10	0	0			
larvest	799	1040	780	780	390			
rotection treatment	120	112	66	137	241			
runing	859	780	900	900	900			
oil preparation	3	10	0	0	0			
hinning	83	240	0	0	0			
Veeding	130	341	20	20	15			

#### 7.6.4. Economic results

The economic results are calculated per block, per crop and on the modelled part of the farm. They systematically include gross products and variable costs, plus fixed costs for the farm.

#### . By block

The presentation by block details the expenses by distinguishing between labour, the costs of phytosanitary treatments and the other variable costs. The gross margin is calculated by subtracting these three cost items from the gross product.

lesults per area unit for each	block	Mean gro	ss margin per are	a unit for each o	rop and variety	Results for	the modelled	part of the fram	
	1	2	3	4					
Crop	Apple	Apple	Apricot	Pear					
Cultivar	Golden	Pink Lady	Roussillon	Comice					
Results									
Gross product	6300	10500	2000	2250					
abour	2360	1680	1680	1290					
reatment products	133	66	137	241					
Other variable costs	50	30	20	15					
otal of variable costs	2543	1776	1837	1546					
Gross margin	3757	8724	163	704					

## . By crop and cultivar

Gross margin is only presented in these tables, by crop and cultivar. Calculations are made by area unit.

neters   F	Farm Scenario   Save Export	Farm Date	: Gachet : 02/07/2	2020	Scenario : Gachet 1 Date : 17/12/2019	
lculation o	of economic results per bloc	k and for the modelled part of the	fram			
Results per a	rea unit for each block	Mean gross margin per area unit for ea	ach crop and variet	ty	Results for the modelled part of the fra	n
Crop	Mean gross margin per area		Crop	Cultivar	Mean gross margin per area	
Apple	mean gross margin per area	6365	Apple	Gold	den	3757
Apricot		163	Apple	Pink L	ady	8724
Pear		704	Apricot	Roussil	lon	163
			Pear	Com	nice	704

#### . On the whole farm (modelled part only)

This table takes the same items as for each block and adds the fixed costs attributed to the modelled part of the farm (7.4), which makes it possible to calculate a net margin for this part. The calculations are made per unit area and in total once the area of each block is taken into account.

esults per area unit for e	ach block M	ean gross margin per are	a unit for each cro	op and variety	Results for the modelled part of the fram
	Per area unit	Total			
ross product		6776	74540		
abour		1844	20284		
eatment products		128	1403		
ther variable costs		33	366		
tal of variable costs		2005	22053		
oss margin		4772	52487		
ked costs		56	616		
et margin		4716	51871		

#### 8. Save

Any changes made to a farm or scenario can be saved by clicking on the "Save" button on the top banner. An additional box appears, where the "Save" button is only activated if changes have been made since the last save.

In addition, if the user wishes to duplicate the data of the farm or scenario, he/she places himself/herself in the fields "Farm name" or "Scenario name" respectively and types in the new name for this duplication. The "Duplicate" button is then activated and creates the new farm or scenario. This function is particularly useful to start from an existing scenario and then modify it, while keeping the original version of the scenario.

If changes have not been saved before leaving CoHort, a reminder message appears on the screen.

		Farm	: Gachet	Scenario	: Gachet 1
(Q C	oHort 2019 [V1.0]				
culation of economic resu					
	Recording				and the second sec
esults per area unit for each bloc	riccording				d part of the fram
	Save or duplicate the far	m and scenario d	ata		
Per					
ross product	Farm name :		Scenario name :		
abour	Gachet		Gachet 1		
ther variable costs	Date of creation :		Date of creation :		
otal of variable costs	02/07/2020	÷ 😨	17/12/2019	÷ 📷	
ross margin					
ixed costs					
	Save	Duplic	ate	Cancel	

### 9. Export

CoHort offers the possibility of exporting the values entered for all of the input and output variables of a scenario in the form of .csv files that can be recovered in a spreadsheet program such as Excel<sup>®</sup>.

By clicking on the "Export" button located on the top banner, the software proposes to save the work done in one of the directories on the user's hard disk. A subdirectory is then created where all of the files describing the scenario concerned are stored.

The user can then manage this data in a spreadsheet or word processor to produce graphs or tables, for example comparing different scenarios. These materials can then be used for discussions with the producer, illustrate analysis reports or be used in training sessions, for example.



# Appendix A. List of variables and equations included in CoHort

Nota-bene: Index and variable names are the same as used in the French version of the manual.

#### A.1. Index list

act = activity cult = crop i = block j = category of selling price for a given production chf = fixed cost chv = variable cost e = permanent staff fprod = family of treatment product for crop protection m = month p = practice prod = treatment product (synthetic and natural) for crop protection mo = category of labour var = cultivar

#### A.2. Unit definition

CoHort does not specify any unit in order to keep the calculations as flexible as possible. But in return the user must always use the same unit for all variables that depend on it. For example, a unit price given in euros per kg should be multiplied by a production quantity in kg/ha to obtain a gross product in euros per hectare.

Unit	Signification
UProd	Quantity unit per treatment product (I, kg, bag, etc.)
UM	Monetary unit (€, \$, £, etc.)
UP	Weight unit per production (kg, ton, bag, etc.)
UT	Time unit (h, day, month, etc.)

#### A.3. Colour codes of variables

#### The only 'Parameter' variable used in calculations is in red.

The input variables used in calculations are in black.

The variables corresponding to intermediate calculations between input variables and results are in bold brown in equations (see their calculation mode in the dedicated tables).

#### « Final » output variables are in bold black.

Output variables reused in other calculations are in bold blue.

*Nota bene* 1: in all tables, the variables are classified by alphabetic order.

Nota bene 2: the variables names used in the French version have been kept in the English one.

	A.4. Input variables 'Par	ameters'		
Variable	Definition	Unit	Object	Range
CuProd <sub>fprod,prod</sub>	Cost per unit of treatment product <i>prod</i> or family of product <i>fprod</i>	UM/UProd	Treatment product	[0 ; +∞[
Fam <sub>fprod</sub>	Name of the family of product <i>fprod</i>	Text	Treatment product	-
Nom <sub>fprod,prod</sub>	Name of the treatment product <i>prod</i> belonging to the family of product <i>fprod</i>	Text	Treatment product	-
Nom <sub>cult</sub>	Name of crop <i>cult</i>	Text	Crop	-
Nom <sub>act</sub>	Name of off-farm activity act	Text	Off-farm activities	-
Nom <sub>cult,var</sub>	Name of cultivar var per crop cult	Text	Crop	-
Nom <sub>p</sub>	Name of practices	Text	Practices	-
Nom <sub>mo</sub>	Name of labour category mo	Text	Labour	-
Nom <sub>ch</sub>	Name of fixed (chf) and variable (chv) cost	Text	Costs	-

#### Reminder:

- ✓ The "Parameters" variables are variables indicated by the user at the beginning of the simulation when he/her first starts. They take values reusable in a set of farms *via* selection lists in the scenarios definition. Most of them are text variables (names) whose values are found in the index of input variables, except for the variable CuProd<sub>fprod,prod</sub> reused in calculation.
- ✓ The user completes these lists as and when he/she encounters new values. The software automatically classifies these values from A to Z in these lists so that they can be more easily used in the choice menus linked to input variables.

	A.5. Input variables	s 'Scenario'		
Variable	Definition	Unit	Object	Range
	Proportion of the TFI retained	-	Block	[1;100]
	according to the applied dose of			
%IFT <sub>i.p.fprod.prod</sub>	the product <i>prod</i> per ha or the			
TAL	product family <i>fprod</i> for the			
	practice <i>p</i> on the block <i>i</i> (%)			
0/ D\/	Proportion of the production sold	-	Bloc	[1;100]
%PV <sub>i,j</sub>	at price PV <sub>i,j</sub>			
	Proportion of annual fixed costs	-	Exploitation	[1;100]
%CHF <sub>chf</sub>	chf allocated to the modelled part			
	of the farm			
ССИЕ	Annual amount of fixed cost chf	UM/ha/year	Farm	[0;+∞[
CCHF <sub>chf</sub>	per ha			
	Amount per hectare of variable	UM/ha	Block	[0;+∞[
CCHV <sub>i,p,chv</sub>	cost chv, for practice p other than			
	phytosanitary treatment on block i			
CuMO <sub>mo</sub>	Unit cost for labour category mo	UM/UT	Farm	[0;+∞[
	Labour demand for non-modelled	UT	Farm	[0;+∞[
	farming and off-farming activity			
DAct <sub>m,act</sub>	act selected in the 'Crop',			
	Livestock', 'Other' & 'off-farm'			
	activity lists for month m			
	Labour supply of permanent staff	UT	Farm	[0;+∞[
DispMO <sub>m,mo,e</sub>	e on the whole farm (modelled			
	and non-modelled) for month m			
	Labour demand per hectare for	UT/ha	Block	[0 ; +∞[
DT <sub>i</sub> , <sub>p,mo,e,m</sub>	practice p, category of labour mo			
	and permanent staff e on block i			
	Number of treatments of product	-	Block	[0 ; +∞[
NbTrt <sub>i,p,fprod, prod</sub>	prod and product family fprod for			
	practice <i>p</i> on block <i>i</i>			
	Name of block <i>i</i> characterised	Text	Block	-
Nom_Bloc <sub>i</sub>	within the modelled part of the			
	farm			
Nom_Culture <sub>i</sub>	Crop <i>cult</i> for block <i>i</i>	'Crop' list	Block	-
Nom	Name of permanent staff	Text	Farm	-
- c	e (including the farm head)			
Nom Variété,	Cultivar var for block i	'Cultivar per	Block	-
1		crop' list		
PV <sub>ii</sub>	Selling price of the production for	UM/UP	Block	[0;+∞[
<i>"</i>	category of price <i>j</i> on block <i>i</i>			10 ľ
	Quantity of product <i>prod</i> par ha or	UProd/ha	Block	[0;+∞[
Q <sub>i,p,fprod,prod</sub>	family of product <i>fprod</i> for			
	practice <i>p</i> on block <i>i</i>			[0] [
Kat <sub>i</sub>		UP/na	BIOCK	[U;+∞[
S <sub>i</sub>	Area of block i	ha	Block	[0;+∞[

	A.6. Intermed	liate calc	ulations va	riables (i	nvisible in the software)
Variable	Definition	Unit	Object	Range	Calculation
CQ <sub>i,p,fprod,prod</sub>	Cost of treatment product prod or of family of product fprod <sup>1</sup> for practice p on block i	UM/ha	Block	[0;+∞[	$Q_{i,p,fprod,prod} \times CuProd_{fprod,prod} \times NbTRT_{i,p,fprod,prod}$
IFT <sub>i,p,fprod,prod</sub>	TFI corresponding to the spreading of treatment product <i>prod</i> belonging to the family <i>fprod</i> for practice <i>p</i> on block <i>i</i>	-	Block	[0;+∞[	$NbTRT_{i,p,fprod,prod} \times \% IFT_{i,p,fprod,prod} \div 100$
IFT <sub>i,p,fprod</sub>	TFI corresponding to the spreading of the family of treatment product <i>fprod</i> for practice <i>p</i> on block <i>i</i>	-	Block	[0 ; +∞[	When products are informed: $\sum_{prod} IFT_{i,p,fprod,prod}$ When only the product familes are informed <sup>1</sup> : $NbTRT_{i,p,fprod,"} \times D_{i,p,fprod,"} \times InIFT_{i,p,fprod,"}$

<sup>1</sup> When the products are not mentioned and calculations are only made on the families of product, the *prod* index is equal to "".

		A.7.1. F	Conomic results		
Variable	Definition	Unit	Object	Range	Calculation
CA <sub>i</sub>	Gross product/ha for block i	UM/ha	Block	[0;+∞[	$\sum_{j} PV_{i,j} \times \% PV_{i,j} \times Rdt_i \div 100$
СА	Gross product/ha for the modelled part of the farm	UM/ha	Farm	[0;+∞[	$\sum_{i} (CA_i * S_i) \div \sum_{i} S_i$
<b>Ccond</b> <sub>i</sub>	Management cost /ha for block i	UM/ha	Block	[0;+∞[	$TotChV_i + Cprot_i + CMo_i$
ChF	Fixed costs/ha on the modelled part of the farm	UM/ha	Farm	[0;+∞[	$\sum_{chf} CChF_{chf} \times \% CHF_{chf} \div 100$
<b>CMo</b> <sub>i</sub>	Labour cost/ha for block <i>i</i>	UM/ha	Block	[0;+∞[	$\sum_{mo} (CuMO_{mo} \times \sum_{p} \sum_{m} DT_{i,p,mo,e,m})$
Cprod <sub>i</sub>	Cost of treatment products/ha for block <i>i</i>	UM/ha	Block	[0;+∞[	$\sum_{p} \sum_{f prod} \sum_{prod} CQ_{i,p,fprod,prod}$
MB <sub>i</sub>	Gross margin/ha for block i	UM/ha	Block	[0;+∞[	$CA_i - CCond_i$
<b>MB</b> <sub>cult</sub>	Average gross margin/ha for crop cult	UM/ha	Farm	[0;+∞[	$\sum_{cult} (\boldsymbol{MB}_i \times S_i) \div \sum_{cult} S_i$
MB <sub>var</sub>	Average gross margin/ha for cultivar var	UM/ha	Farm	[0;+∞[	$\sum_{var} (\boldsymbol{MB}_i \times S_i) \div \sum_{var} S_i$
МВ	Gross margin/ha on the modelled part of the farm	UM/ha	Farm	[0;+∞[	$\boldsymbol{MBTot} \div \sum_{i} S_i$
MBTot	Total gross margin on the modelled part of the farm	UM	Farm	[0;+∞[	$\sum_{i} (\boldsymbol{M}\boldsymbol{B}_{i} \times S_{i})$
MN	Net margin/ha on the modelled part of the farm	UM/ha	Farm	[0;+∞[	MB – ChF
MNTot	Total net margin on the modelled part of the farm	UM	Farm	[0;+∞[	$MN \times \sum_i S_i$
TotChV <sub>i</sub>	Total variable costs/ha for block i	UM/ha	Block	[0;+∞[	$\sum_{p} \sum_{chv} \text{CChV}_{i,p,chv}$

A.7.2. Output variables for 'Costs per operation'									
Variable	Definition	Unit	Object	Range	Calculation				
<b>CT</b> <sub><i>i</i>,<i>p</i></sub>	Cost/ha for practice <i>p</i> on block <i>i</i>	UM/ha	Practice + Block	[0;+∞[	$\left(\sum_{m}\sum_{mo} DT_{i,p,mo,e,m} \times CuMO_{mo}\right) + \sum_{prod} CQ_{i,p,fprod,prod} + \sum_{chv} CCHV_{i,p,chv}\right)$				
СТр	Cost/ha for practice <i>p</i>	UM/ha	Practice + Block	[0;+∞[	$\sum_{i} (CT_{i,p} \times S_i) \div \sum_{i} S_i$				

A.7.3. Output variables for 'TFI results'								
Variable	Definition	Unit	Object	Range	Calculation			
IFT <sub>i,fprod</sub>	TFI corresponding to the spreading of the family of product <i>fprod</i> on block <i>i</i>	-	Block	[0;+∞[	$\sum_{p} IFT_{i,p,fprod}$			
IFT <sub>i</sub>	Total TFI total of block i	-	Block	[0 ; +∞[	$\sum_{i} IFT_{i,p,fprod,prod}$			
IFT/UP <sub>i</sub>	TFI per weight unit of block i	-	Block	[0;+∞[	<b>IFT</b> <sub>i</sub> $\div$ (Rdt <sub>i</sub> $\times$ S <sub>i</sub> )			
IFTmoy	Average TFI for the scenario weighted by the area of each block	-	Farm	[0;+∞[	$\sum_{i} (IFT_i \times S_i) \div \sum_{i} S_i$			

A.7.4. Labour balance results								
Variable	Definition	Unit	Object	Range	Calculation			
BILMO	Annual labour balance	UT	Farm	[0;+∞[	Operm – DT			
BILMO <sub>m</sub>	Labour balance for month <i>m</i>	UT	Farm	[0 ; +∞[	$Operm_m - DT_m$			
BILMO <sub>m,e</sub>	Labour balance of permanent staff <i>e</i> for month <i>m</i> on the modelled part of the farm	UT	Farm	[0;+∞[	$DispMO_{m,mo,e} - DTMOD_{m,e}$			
BILMO <sub>m,mo</sub>	Labour balance of labour category <i>mo</i> for month <i>m</i> on the modelled part of the farm	UT	Farm (modelled part)	[0;+∞[	<b>Operm</b> <sub>m,mo</sub> – <b>DTMOD</b> <sub>m,mo</sub>			
DT <sub>m</sub>	Total demand of labour for month <i>m</i> on the whole farm	UT	Farm	[0 ; +∞[	$DTMOD_m + \sum_{act} DAct_{m,act}$			
DT	Total demand of labour on the whole farm	UT	Farm	[0 ; +∞[	$\sum_{m} DT_{m}$			
DTMOD <sub>m,e</sub>	Total demand of labour for permanent staff $e$ for month $m$ on the modelled part of the farm <sup>1</sup>	UT	Farm (modelled part)	[0 ; +∞[	$\sum_{i} (\sum_{p} DT_{i,p,mo,e,m} \times S_i)$			
DTMOD <sub>m,mo</sub>	Total demand of labour for labour category <i>mo</i> for month <i>m</i> on the modelled part of the farm <sup>1</sup>	UT	Farm (modelled part)	[0;+∞[	$\sum_{i} (\sum_{p} DT_{i,p,mo,e,m} \times S_i)$			
DTMOD <sub>m</sub>	Total demand of labour for month <i>m</i> on the modelled part of the farm	UT	Farm (modelled part)	[0 ; +∞[	$\sum_{mo} DTMOD_{m,mo}$			
Operm <sub>m,mo</sub>	Labour supply of labour category <i>mo</i> for month <i>m</i>	UT	Farm	[0;+∞[	$\sum_{e} DispMO_{m,mo,e}$			
<b>Operm</b> <sub>m</sub>	Total labour supply of permanent staff for month <i>m</i>	UT	Farm	[0;+∞[	$\sum_{mo} Operm_{m,mo}$			
Operm	Total labour supply of permanent staff	UT	Farm	[0;+∞[	$\sum_{m} Operm_{m}$			

<sup>1</sup> The two equations are identical and are based on the same  $DT_{i,p,mo,e,m}$ . But in one case sums are made by individual permanent staff, in the other by category of labour *mo*.