

Practical guide

for the design of cropping systems less reliant on pesticides

Application in polyculture/mixed farming systems

Support sheets – Rapid programme



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«développement agricole et rural»



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List of abbreviations

The forms in this list are marked by the ^a sign in the text.

CMP	Crop management plan
COMIFER	Comité Français pour le développement de la Fertilisation Raisonnée (French committee for the development of rationalised fertilisation)
CS	Cropping system
CT	Conservation tillage
F	Farm
IC	Intercrop period
K	Potassium
N	Nitrogen
OM	Organic matter
P	Phosphorous
RSA	Revue Suisse Agricole (Swiss Journal of Agriculture)
TFI	Treatment Frequency Index

Programme summary

Step 1: Diagnosis of the initial situation
1.a. Overall performance of the farm
Objectives : → Understanding the overall objectives of the farmer for his farm → Understanding the farm's assets and constraints → Identifying the CS ^a of the farm and which should be improved first <i>Production of a diagnosis of the farm (Support sheet S1)</i>
1.b. Description of the cropping system to be improved
Objectives : → Characterise the CS ^a (crop sequence, CMPs ^a) and soil types → Become acquainted with the farmer's objectives and issues with the CS ^a <i>Description of the crop sequence (Support sheet S2B)</i> <i>Rapid description of the CMPs + comprehensive description of the CMPs for one or two crops (Support sheet S2A)</i>
1.c. Evaluation of the initial cropping system
Objectives : → Evaluate the CS ^a based on a list of pre-established indicators, making it possible to later compare the performance of these to proposed alternative systems <i>Rapid characterisation of the CS^a (Support sheet S2B)</i>
Step 2: Co-design of alternative cropping systems
Objectives : → Identify with the farmer those agronomic levers already used in the current CS ^a at the rotation scale → Identify supplementary levers which could be interesting to use, according to the objectives
2.a. Considering the rotation
<i>Identify those levers used at the rotation scale in the current CS^a</i> <i>Suggest supplementary levers for implementation (Support sheet S3)</i>
2.b. Considering the CMP
<i>Identification of levers for implementation at the CMP^a scale in the current CS^a</i> <i>Suggest supplementary levers for implementation (Support sheet S4)</i> <i>Rapid description new CS^a constructed (Support sheet S2B)</i>
Step 3: Evaluating alternative cropping systems compared with the initial cropping system
Objectives : → Evaluate the performances of alternative CS ^a compared with the initial CS ^a <i>Qualitative evaluation of the performances of constructed CS^a compared to the farmer's current CS^a according to selected indicators (Support sheet S5)</i>
Step 4: Discussion of results
Objectives : → Discuss the introduction of alternative systems suggested for the farm

Support sheet S1 :

Summary diagram for the diagnosis of the farm (Step 1a)

Date :

Farm :

Priority tasks	Farmer's priorities	Milieu (soil/climate)																		
Workforce	<table border="1"> <thead> <tr> <th colspan="2">Crop sequences</th> </tr> </thead> <tbody> <tr> <td>Crop sequence 1</td> <td>Crop sequence 2</td> </tr> <tr> <td>% on F:</td> <td>% on F:</td> </tr> <tr> <td>Crops:</td> <td>Crops:</td> </tr> <tr> <td>Most common planting method: ploughing/SCT/direct sowing</td> <td>Most common planting method: ploughing/SCT/direct sowing</td> </tr> <tr> <td>Crop sequence 3</td> <td>Crop sequence 4</td> </tr> <tr> <td>% on F:</td> <td>% on F:</td> </tr> <tr> <td>Crops:</td> <td>Crops:</td> </tr> <tr> <td>Most common planting method: ploughing/SCT/direct sowing</td> <td>Most common planting method: ploughing/SCT/direct sowing</td> </tr> </tbody> </table>	Crop sequences		Crop sequence 1	Crop sequence 2	% on F:	% on F:	Crops:	Crops:	Most common planting method: ploughing/SCT/direct sowing	Most common planting method: ploughing/SCT/direct sowing	Crop sequence 3	Crop sequence 4	% on F:	% on F:	Crops:	Crops:	Most common planting method: ploughing/SCT/direct sowing	Most common planting method: ploughing/SCT/direct sowing	Local issues
Crop sequences																				
Crop sequence 1	Crop sequence 2																			
% on F:	% on F:																			
Crops:	Crops:																			
Most common planting method: ploughing/SCT/direct sowing	Most common planting method: ploughing/SCT/direct sowing																			
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% on F:	% on F:																			
Crops:	Crops:																			
Most common planting method: ploughing/SCT/direct sowing	Most common planting method: ploughing/SCT/direct sowing																			
Equipment/material		Crop enemies																		
Location of fields	Production system	Technical-economic environment																		

(According to Capillon, Vogrincic et al.)
 The diagram should be completed by highlighting the assets and constraints of the farm for each of the criteria above. A list of questions is supplied in Help sheet H1 for completing the table.

Support sheet S2A :

Detailed description of the management of the principal crops in the current CS (Step 1b)

Date :

Farm :

	Principal crop 1		Principal crop 2	
CROP				
MANAGEMENT	'Typical' management	Variability in practices and causes	'Typical' management	Variability in practices and causes
MANAGEMENT OF FALLOW PERIOD				
Shredding of residues (yes/no)				
Chemical weeding				
TFI or costs (€/£)				
Tillage				
Ploughing (yes/no)				
Superficial cultivation (type and number of passages)				
Sowing of intermediate crop				
Species sown				
SOWING				
Sowing date (early/average/late)				
Number of varieties				
Type of varieties (susceptible/low susceptibility)				
Sowing density (low/average/high)				
Spacing of rows (narrow/average/wide)				
Seed treatment (yes/no)				

Support sheet S2A :

Detailed description of the management of the principal crops in the current CS (Step 1b)

	Principal crop 1		Principal crop 2	
CROP				
MANAGEMENT	'Typical' management	Variability in practices and causes	'Typical' management	Variability in practices and causes
FERTILISATION				
Mineral fertilisation				
Mineral nitrogen inputs (kg of nitrogen/ha)				
Number of inputs				
Organic fertilisation				
Organic fertilisation				
Organic nitrogen inputs (kg of nitrogen/ha)				
CROP PROTECTION				
Herbicides				
TFI/costs (€/£) or number of passages				
Fungicides				
TFI/costs (€/£) or number of passages				
Insecticides				
TFI/costs (€/£) or number of passages				
Others (molluscicides, regulators, etc.)				
TFI/costs (€/£) or number of passages				
Mechanical control				
Hoe/harrow/rotary hoe – number of passages				
Biological control				
Control method (Trichogramma, Contans, etc.)				
IRRIGATION				
Quantity of water added (m ³ /ha)				
HARVEST				
Yield (q/ha)				

Support sheet S2B :

Simplified description of the CS (Step 1b and 1c)

Date :

Farm :

Farmer's objectives and constraints :

Current CS	Crop 1	Crop 2	Crop 3	Crop 4	Crop 5	Crop 6
CROP						
Ploughing (yes/no)						
Tillage during fallow period (number of passages)						
Sowing date (early/average/late) and density (low/average/high)						
Choice of variety (susceptible/low susceptibility)						
TFI (if available) or number of pas- sages for chemical protection						
Operational costs for pesticides (€/£)						
Mechanical weeding (yes/no)						
Total dose of nitrogen input (units of nitrogen)						
Yield (q/ha)						

Support sheet S2B :

Simplified description of the CS (Step 1b and 1c)

Alternative CS 1	Crop 1	Crop 2	Crop 3	Crop 4	Crop 5	Crop 6
CROP						
Ploughing (yes/no)						
Tillage during fallow period (number of passages)						
Sowing date (early/average/late) and density (low/average/high)						
Choice of variety (susceptible/low susceptibility)						
TFI (if available) or number of pas- sages for chemical protection						
Operational costs for pesticides (€/£)						
Mechanical weeding (yes/no)						
Total dose of nitrogen input (units of nitrogen)						
Yield (q/ha)						

Alternative CS 2	Crop 1	Crop 2	Crop 3	Crop 4	Crop 5	Crop 6
CROP						
Ploughing (yes/no)						
Tillage during fallow period (number of passages)						
Sowing date (early/average/late) and density (low/average/high)						
Choice of variety (susceptible/low susceptibility)						
TFI (if available) or number of pas- sages for chemical protection						
Operational costs for pesticides (€/£)						
Mechanical weeding (yes/no)						
Total dose of nitrogen input (units of nitrogen)						
Yield (q/ha)						

Support sheet S3 :

Introduction of alternative technical solutions available for crop protection at the rotation scale (Step 2a)

Date :

Farm :

The objective of this table is to make it possible to rapidly see which practices have already been implemented by the farmer in his current CS and those which could be used in alternative CS.

In no case is the objective to introduce all these levers in the CS: according to the objectives and the constraints of the farmer, the task is to find a combination of practices to limit the pest pressure he is faced with.

Lever available	Implementation in current CS		Implementation in alternative CS 1		Implementation in alternative CS 2	
	Rotation :		Rotation :		Rotation :	
	Probably yes	Probably no	Probably yes	Probably no	Probably yes	Probably no
Diversify families and species in the rotation to break the disease cycle, taking into account the time period before the return of crops and the possible precedents						
Diversify families and species in the rotation to break the pest cycle in relation to animal pests, taking into account the time period before the return of crops and the possible precedents						
Diversify families and species in the crop sequence to 'despecialise' weed flora						
Introduce a long fallow period one year in three to allow tillage						

(According to P. Viaux)

Support sheet S4 :

Introduction of alternative technical solutions available for crop protection at the CMP scale (Step 2b)

Date :

Farm :

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The objective of this table is to make it possible to rapidly see which practices have already been implemented by the farmer in his current CS and those which could be used in alternative CS^a. **In no case is the objective to introduce all these levers in the CS :** according to the objectives and the constraints of the farmer, the task is to find a combination of practices to limit the pest pressure he is faced with.

Lever available	Effects on			Crop :					
				Implementation in current CS		Implementation in alternative CS 1		Implementation in alternative CS 2	
				Reminder of Rotation :		Reminder of Rotation :		Reminder of Rotation :	
				Probably yes	Probably no	Probably yes	Probably no	Probably yes	Probably no
Shredding of crop residues		X	X						
Destruction of volunteers and host weeds	X	X	X						
Use of uncontaminated seed		X							
Choice of resistant/tolerant varieties		X	X						
Choice of competitive varieties (according to their phenological characteristics)	X								
Limiting contamination through equipment	X	X							
Tillage (alternating superficial cultivation and ploughing) in association with the rotation (burying seeds and sources of inoculum)	X	X	X						
Stale seed beds: to exhaust seed bank	X		X						
Shredding of borders	X								
Shifting sowing date	X	X	X						
Increasing sowing density, reducing spacing of rows	X	X	X						
Reducing sowing density	X	X	X						
Combination of species and varieties	X	X	X						
Adjusting nitrogen inputs to the production needs of the crop to encourage its development	X	X	X						
Mechanical weeding	X		X						
Biological control		X	X						
Landscape management		X	X						

In red, those levers which can have an antagonistic effects between pest categories.

Support sheet S5 :

Simplified evaluation of the performance of alternative cropping systems compared with the current cropping system (Step 3)

Date :

Farm :

The indicators below have been chosen in order to conduct a very rapid evaluation, comparing CS^a on various criteria: environment through TFI, economy through yield, costs and direct margin, energy through the quantity of nitrogen inputs and the social aspect through the number of passages in the field.

These tables should be completed based on the description of CS^a made in support sheet S2A. The task is to translate the changing trends in the indicators, comparing crop by crop and then overall, the current and alternative CS^a.

If new crops are introduced, compare only those found in the two CS^a, then judge the overall change in the indicators by estimating the value of the indicators for new crops.

For TFI, see if there is an overall reduction in the number of passages through the introduction of alternative practices compared to the current CS^a.

For costs, estimate the variations due to changes in pesticide and fertiliser consumption. The margin can then be calculated in relation to the changes forecast in costs and yield.

The number of passages in the fallow period records the tillage conducted (stubble cleaning, stale seed beds, etc.).

Indicator	Alternative CS 1 :						Average for the CS
	Crop 1	Crop 2	Crop 3	Crop 4	Crop 5	Crop 6	
TFI							
Yield (t/ha)							
Costs (€/£)							
Direct margin (€/£)							
Nitrogen input							
Number of passages in fallow period							
Number of passages for mechanical weeding							

Indicator	Alternative CS 2 :						Average for the CS
	Crop 1	Crop 2	Crop 3	Crop 4	Crop 5	Crop 6	
TFI							
Yield (t/ha)							
Costs (€/£)							
Direct margin (€/£)							
Nitrogen input							
Number of passages in fallow period							
Number of passages for mechanical weeding							



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