4 Quantification of the themes: parameters and target values

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4.1 Introduction

In paragraph 2.3.2, the parameters were introduced that are used in the VEGINECO project. In this chapter, the reasons why these parameters are chosen are discussed for each theme. In addition, target values for each parameter are given. Target values between countries are not always identical because of the different systems (for system-specific target values) or different conditions. In paragraph 2.3.2, the requirements of parameters and target values were already discussed.

4.2 Quality production

The theme 'Quality production' examiness quality and quantity of production. The potential for yield (weight unit per surface area unit) and quality (percentage of produce in quality classes) are very site-specific (pedologic and climatic conditions). Moreover, quantity and quality of different crops is not comparable. Therefore, indexes were developed to indicate to what extent quality and quantity (site or region specific) can be compared to Good Agricultural Practices (GAP). Quantity and quality, according to GAP, is established per region or site. The parameters 'Quality of Produce' (QLP) and 'Quantity of Produce' (QNP) are used:

QNP = achieved marketable quantity / site or region specific quantity according to GAP
QLP = achieved quantity of desired quality/ site or region specific quantity of desired quality

Each partner established their own values for the quantity and quality of yield (QNP, QLP), according to the Good Agricultural Practice yields and quality in their regions (Table 4.1).
Special attention to quality has to be given to harmful nutrient levels in vegetables. Especially nitrate content in leafy vegetables is important because nitrate can be converted to nitrite, which is in certain amounts toxic to humans, especially to young children. This is why the parameter 'Nitrate content in crops' (NCONT) is included in the VEGINECO project. The target value of NCONT is derived form EU-legislation and is set at 2 500 ppm. For Switzerland, the target value is based on national legislation, which indicates a target value of 3 500 ppm. The parameter is used only in leafy vegetables.

No attention was paid to pesticide residues on produce because integrated crop protection strategies are expected to keep pesticide use sufficiently below harmful levels.
In addition, pesticides are carefully selected, those with the lowest impact on humans and the environment.

4.3 Farm continuity

A farming system needs to be economically viable and manageable to be sustainable. In addition, the labour needed on the farm should correspond with labour available in the region.
The parameter 'Net Surplus' (NS) evaluates most of these economic aspects: the inputs and outputs are all priced and the difference between the outputs and inputs should be positive. In vegetable farming systems, labour is the highest cost. Costs for crop protection and fertilisation are relatively low.

Labour for growing crops can be divided into four categories: seeding and planting, weed control and crop nursing, and harvest and post processing. Within a given system and level of mechanisation, the labour is the most variable factor depending on the crops, weather and the success of the mechanical, physical and chemical weed control. Therefore, a parameter Hours Hand Weeding (HHW) is used in the Netherlands and Spain. As it strongly influences the labour needs, it is part of the theme 'Farm Continuity'.

4.4 Sustainable use of resources

The objective in this theme is to preserve natural resources by sound use of these resources. The theme can be divided in two parts: preservation of the soil as internal infinite but vulnerable resource, and the efficient use of non-renewable external resources such as water and energy.

Most of the attention in the theme is placed on the sustainable use of soil reserves. The specific objective of this part is to keep the soil reserves at agronomically desirable levels, which do not damage the ecology.

Parameters to quantify nutrient reserves are established for phosphate (P_2O_5) and potash (K_2O): the Phosphate Available Reserves (PAR) and Potash Available Reserves (KAR). These soil fertility reserves should be kept at agronomically desirable and environmentally acceptable levels. Therefore a target range is determined.
The reserve levels are soil, location and applied analytical technique specific (Table 4.2). When reserve levels are not within the limits, fertilisation should be changed (see PAB and KAB, Chapter 4.5). For nitrogen, no parameter is established to quantify the reserves because nitrogen reserves fluctuate dramatically during the year and between years. In addition, for micronutrients, no parameters are established as they are for most crops not limited.

Table 4.1 Target values for quantity and quality of production for integrated and organic systems (Spain integrated target values for ES INT3)

cntry	system	crop	cultivation method	target yield kg ha^{-1}	target quality[1] % class 1
ES	INT	artichoke		15 000	75
ES	ORG	artichoke		13 000	75
NL	INT	barley	spring	6 900	100
NL	ORG	barley	spring	5 500	100
NL	INT	Brussels sprouts	mid-early	20 000	100
NL	INT	Brussels sprouts	late	14 000	100
NL	ORG	Brussels sprouts	mid-early	12 000	50
NL	ORG	Brussels sprouts	late	12 000	50
CH	INT+ORG	carrot		46 200	70
CH	INT+ORG	cauliflower	late spring	17 350	70
CH	INT+ORG	cauliflower	summer	17 350	70
ES	INT	cauliflower		21 600	80
ES	ORG	cauliflower		19 200	80
I	INT	cauliflower		25 000	85
NL	INT	cauliflower	summer	33 000	90
NL	INT	cauliflower	autumn early	33 000	90
NL	INT	cauliflower	winter	17 000	80
NL	INT	celeriac		57 000	100
I	INT	celery		55 000	90
ES	INT	fennel		21 000	100
ES	ORG	fennel		19 000	100
I	ORG	fennel		20 000	70
NL	INT	fennel	early planted	17 000	85
NL	INT	fennel	autumn sown	20 000	85
NL	ORG	fennel	early	16 000	85
NL	ORG	fennel	autumn	20 000	85
ES	INT	green bean		10000	90
ES	ORG	green bean		8 000	90
I	INT	green bean		8 000	90
I	ORG	green bean		7 000	90
CH	INT+ORG	leek		40 400	70
CH	INT+ORG	head lettuce	late spring	24 000	70
CH	INT+ORG	head lettuce	summer	24 000	70
I	INT	lettuce	autumn	28 000	100
I	INT	lettuce	summer	32 000	100
I	ORG	lettuce	autumn	25 000	100
I	ORG	lettuce	summer	28 000	100
NL	INT	iceberg lettuce	early	37 000	100
NL	INT	iceberg lettuce	early autumn	33 000	100
NL	ORG	iceberg lettuce	early summer	27 000	50
NL	ORG	iceberg lettuce	early autumn	23 000	50
I	INT	melon		30 000	85
I	ORG	melon		30 000	80
CH	INT+ORG	onion		40 600	70
ES	INT	onion		80 000	100
ES	ORG	onion		75 000	100
ES	INT	potato		42 000	100
ES	ORG	potato		38 000	100
NL	INT	potato	early	33 000	100
NL	INT	potato		56 000	100
NL	ORG	potato	early	32 000	100
I	INT	spinach		14 000	90
I	INT	strawberry		30 000	80
I	ORG	strawberry		18 000	90
I	INT	sugar beet		50 000	16
I	INT	tomato		55 000	5
ES	INT	watermelon		72 000	90
ES	ORG	watermelon		70 000	90
I	INT	wheat		8 000	80
NL	INT	wheat	winter	9 000	-
NL	ORG	wheat	spring	6 000	100

[1] quality expressed as percentage quality 1 (as a described quality class) or precentage of the net product quantity acceptable product for the processing of bulk product (celeriac, potatoes, barley, wheat)

Organic matter is important in many ways including its contribution to soil fertility, soil structure and soil health. However, the optimum organic matter content is not known. Therefore, the target is set to keep present organic matter content at the same level. To reach this target, organic matter decomposition has to be compensated with the input of an equal amount of effective organic matter. The parameter 'Organic Matter Annual Balance' (OMAB) is used to quantify this. The target value is set at one. When the organic matter content is considered too low or too high, OMAB should be respectively larger or smaller than one.

The 'Energy Input' (ENIN) determines the value of the energy expended in farming tasks and in the manufacturing of all additional products that are used such as fertilisers, machinery, tubes, pesticides, and so on. Most of this energy is obtained from non-renewable resources and therefore, ENIN presents another factor concerning the sustainability of the farming system. As this parameter was developed during the project, it was not used in the testing and improvement process. Water use and soil health were not assessed in the parameters.

4.5 Clean environment nutrients

In this theme, the important objective is to minimise nutrient emissions from the system. Most important nutrient emission routes in agriculture are leaching to groundwater

Table 4.2 Target values for Phosphate and Potash Available Reserves (PAR, KAR)

	Phosphate Available Reserves (PAR) Target value	Extraction method	Potash Available Reserves (KAR) Target value	Extraction method
Netherlands	20-30 mg P_2O_5 l^{-1} dry soil	P_2O_5-H_2O	20-29 mg K_2O 100 g^{-1} dry soil	K_2O-count (K_2O -Cl)
Italy	35-40 mg P_2O_5 kg^{-1} dry soil	P_2O_5-Olsen	144-216 mg K_2O kg^{-1} dry soil	K_2O -NH_4-ac
Spain	35-40 mg P kg^{-1} dry soil	P-Olsen	150-300 mg K kg^{-1} dry soil	K-NH_4-ac
Switzerland	4-8 mg P kg^{-1} dry soil	P-H_2O	20-40 mg K kg^{-1} dry soil	K-H_2O
	40-80 mg P kg^{-1} dry soil	P-NH_4-ac-EDTA	120-200 mg K kg^{-1} dry soil	K-NH_4-ac-EDTA

and surface water, and ammonia emissions to the air. Ammonia emissions in vegetable farming are not very important, so no parameter is set for this emission route. Emissions to ground and surface water are important and therefore, those need to be quantified. Emission of phosphate and potash are not directly related to agronomic activities because these nutrients are immobile. In addition, emission of potash is politically less important. For that reason, direct emission quantification is focused on nitrogen only. However, as emission measurements are expensive, time-consuming and have to be carried out by skilled people, these measurements are not very suitable for farming systems research. Therefore, they are not carried out and an additional parameter indicating emission has been defined: 'Nitrogen Available Reserve' (NAR). This determines the quantity of the mineral nitrogen in the soil at the start of the leaching season. The target value for NAR was set at 70 kg ha^{-1}. Switzerland used a target of 75 kg ha^{-1}. As the soil of the INT1 in Italy is very sandy, the target value for this system was lowered to 45 kg ha^{-1}.

To quantify phosphate and potash emissions, nutrient balances are used. With the aid of nutrient balances, information about possible losses related to inputs and outputs of nutrients can be represented in a simple way. Parameters containing balances are set for phosphate and potash: 'Phosphate Annual Balance' (PAB) and 'Potash Annual Balance' (KAB). For nitrogen, no annual balance parameter is set because emission and efficiency of use can be quantified with NAR. The target values for the PAB and KAB were set at one when the soil reserves of phosphate and potash (PAR, KAR) are within the target limits. When the soil reserves are too high, the balance values of PAB and KAB should be lower than one. This means that the input of nutrients is lower than the output. When soil reserves are too low, balance values should be larger than one to repair the nutrient deficit. The Netherlands accounts for unavoidable losses of 20 kg ha^{-1} for phosphate and 40 kg ha^{-1} for potash.

4.6 Clean environment pesticides

The use of pesticides is currently often quantified as the number of treatments, as kilograms of active ingredients (PESTAS) or as a relative number, expressing the ratio used dose/recommended full field dose. These parameters only quantify use and production technique. As pesticide input in kilograms of active ingredients is easy to assess and is often used in target levels for policy and label use, PESTAS is used as testing parameters in the VEGINECO project.

Active ingredients such as mineral oil, copper or sulphur, with lower environmental effects and higher concentrations in their formulations, are usually applied in a much higher dose per hectare than the synthetic pesticides. Therefore, mineral compounds usually make PESTAS much higher than synthetic active ingredients. Biological pesticides, whose concentration is measured in International Units, are difficult to be quantified by PESTAS. Therefore, the parameter PESTAS-Synth was established to quantify the input of synthetic active ingredients and the parameter PESTAS-copper to quantify the input of copper compounds. Copper compounds can have a remarkable effect on flora and fauna and on environment. As the ecological and environmental danger of sulphur is limited and in biological pesticides often not known, no parameters are set for these inputs.

Pesticide input gives no detailed information on how and to what extent pesticides are dispersed in the environment and what damage they do there on non-target biota (Figure 4.1). To quantify the emission to the (a-biotic) environment independently, PPO developed a concept called Environment Exposure to Pesticides (EEP). EEP is quantified by taking into account the active ingredient's physical

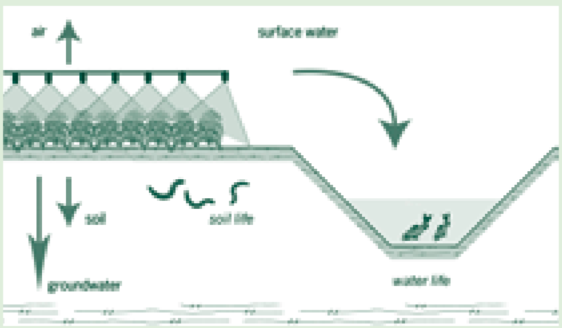

Figure 4.1 Main emission routes and main ecological effects of pesticide use

properties (DT50, soil half life; VP, Vapour pressure and Kom, bonding to organic matter) and the amount used (See intermezzo).

This concept fits into the strategy of integrated farming systems. In the development of these systems, the use of this instrument follows the strategy that aims at minimising any potential effect of pesticides on flora and fauna. Therefore, the exposure of the environment to pesticides (EEP) should be minimised. This should be accomplished by minimising the pesticide requirements of farming systems (Integrated Crop Protection) and

Intermezzo: Environments Exposure to Pesticides (EEP)

EEP calculates per pesticide application the potential pesticide emission to the compartments air, soil and groundwater. Calculation of this potential emission is based on the amount applied active ingredient and physical pesticide properties.

The EEP basic data are:

DT50 = half life time of pesticide in soil, a measure of the persistence in the soil

K_{om} = the partitioning coefficient of the pesticide over the dry matter and water fraction of the soil/organic matter fraction of the soil to organic matter

VP = vapour pressure; a measure for the volatilisation in Pascal

Derived from this basic data is:

F = the F value, a measure of the fraction of the active ingredient that leaches

$F = \exp(-[(A \times f_{om} \times \ln 2 \times K_{om}) / DT50 + (B \times \ln 2)/ DT50 + C])$

In which:

A = 392.5 l kg^{-1} $days^{-1}$; B = 68.38 days; C = 1.092 and f_{om} = 0.0146 (van der Zee en Boesten, 1991)

emission% = the translation of vapour pressure to the percentage of the active ingredient that volatilises

The emission percentages are:

> 10 mPa	95%
1 – 10 mPa	50%
0.1 – 1 mPa	15%
0.01 – 0.1 mPa	5%
< 0.01 mPa	1%

EEP calculation formulas for an application of one pesticide are given below. The $\sum_{1\text{-}n}$ refers to pesticides with more than one active ingredient. Then, the calculations should be done first per active ingredient and then added per parameter to make a total for the application.

EEP-air [kg ha^{-1}] = $\sum_{1\text{-}n}$ *(a.i. $input_m$ x $emission\%_m$ /100)*

In which:

a.i. $input_m$ = input of active ingredient m x active ingredient concentration of active ingredient m in a pesticide [kg ha^{-1}]

$emission\%_m$ = emission percentage of active ingredient *m* (see above)

EEP-groundwater [ppb] = $\sum_{1\text{-}n}$ *(a.i. $input_m$ * F_m / prec surplus)*

In which:

a.i. $input_m$ = input of active ingredient *m* x active ingredient concentration of active ingredient *m* in a pesticide [kg ha^{-1}]

F_m = F value of active ingredient m (see above)

prec surplus = precipitation surplus [m^3]

EEP-soil [kg days ha^{-1}] = $\sum_{1\text{-}n}$ *(a.i. $input_m$ x $DT50_m$ / ln2)*

In which:

a.i. $input_m$ = input of active ingredient *m* x active ingredient concentration of active ingredient *m* in a pesticide [kg ha^{-1}]

$DT50_m$ = soil half life of active ingredient *m*

EEP values per application can be summed per parameter to calculate EEP values on crop, field or farm level.

consequently, the careful selection of pesticides, while taking into account the extent to which the environment is exposed to pesticides. The approach of EEP, which is a basic preventative approach, is used as instrument in the VEGINECO project. Each year, a list was made of the highest scoring pesticides, then solutions were sought to prevent the use of these pesticides either by replacement with another pesticide or by changing the crop protection strategy.
Combining use, emission and effects on flora and fauna as one can establish the ecological risk of pesticide use. The environmental yardstick developed by CLM in the Netherlands is one of these approaches. The environmental yardstick calculates ecological risks for flora and fauna in water and soil. However, an overall comprehensive assessment of ecological risks is virtually impossible. Overall quantitative scores of 'ecosafety', therefore, may easily lead to unjustified classification of a pesticide as being safe. It is not said that additional ecological information is not useful. However, selection of pesticides only based on ecological effects may be misleading.

Ecological risks are not explicitly used in the testing and improving procedure in the VEGINECO systems. Focus is on prevention of emissions. Information on ecological risks is, however, in some cases taken into account as an additional criterion in pesticide selection.

Both PESTAS parameters and all EEP parameters are calculated on a system level. Therefore, they are very much dependant on the composition of the cropping plan. Target values are derived by defining reduction percentages on use and emissions in normal practice. The input/emission in normal practice is calculated from available or estimated inputs/emissions per crop. An average model of all practice applications (including product, dosage and type of application) has been described for every crop. The input and emission per crop has been calculated from this model. A model farm is set up with the same crop composition as the VEGINECO systems from the individual crops. The active ingredient input and emission on system level is calculated for this model farm. Reduction percentages for PESTAS-Synth are generally set at 50%. Reduction percentages for PESTAS-Cu and EEP-air and EEP-soil are set at 70%. For EEP-groundwater, EU-legislation is followed. The target level is set at 0.5 ppb, and therefore, no reduction percentage is set. Average practice inputs, reduction percentages and target levels for PESTAS and EEP-air and -soil are presented in Table 4.3.

Pesticide inputs in organic farming in the **Netherlands** have been very low or negligible in normal practice up until 2001. Therefore, target levels for input and emissions are set to zero. Copper is not allowed in Dutch organic farming and hardly used in integrated and conventional farming. Moreover, the risk of accumulation of copper is prevented. Therefore, the Dutch target for PESTAS-Cu is set to zero.

In **Italy**, the target in I INT2 is higher than in other systems because in comparison with I ORG synthetic products are used more and, in respect to the I INT1, there are more crops. The target for I ORG is considered as a reduction depending on the amount of active ingredient used in the same rotation in conventional farm practices. It is very difficult to fix a target for the organic farms because the number of farms is limited, and it is difficult to acquire data on the applications made.

Table 4.3 Pesticide inputs for the model farm following average practice, reduction percentages to be met, and target inputs and emissions. Target values for the Italian organic system are derived from conventional farming. Target values for the organic system in Spain are set at 10% of the integrated target values, except for PESTAS-Cu.

Country	System	PESTAS-Synth		PESTAS-Cu		EEP-air		EEP-groundwater		EEP-soil	
		kg ha^{-1}		kg ha^{-1}		kg ha^{-1}		ppb		kg days ha^{-1}	
General reduction percentage		50%		70%		70%		-		70%	
		av. pract.	target	av. pract.	target	av. pract.	target	av. pract.	target	av. pract.	target
Netherlands	INT1	11.9	5.9	0.00	0.00	1.51	0.45	6.23	0.50	801	240
	INT2	8.1	4.0	0.00	0.00	1.40	0.42	8.01	0.50	479	143
	ORG	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0	0
Italy	INT1	10.7	5.4	9.28	2.78	3.57	1.07	92.10	0.50	998	299
	INT2	6.2	3.1	4.77	1.43	1.17	0.35	16.00	0.50	432	129
	ORG	6.5	3.3	6.30	1.89	1.67	0.50	17.00	0.05	300	90
Spain	INT1	42.0	21.0	8.90	2.67	4.90	1.47	77.10	0.50	101	305
	INT2	13.4	6.7	2.90	0.88	2.00	0.60	50.10	0.50	610	183
	INT3	24.8	12.4	6.50	1.96	3.90	1.18	30.60	0.50	827	248
	ORG	24.8	1.2	6.50	0.98	3.90	0.12	30.60	0.05	827	25

Table 4.4 Swiss targets for pesticide input for a selection of crops

Crop	Dimension	Target	Applications for
lettuce	no. of treatments	≤ 4	pests and diseases
cauliflower / broccoli	no. of treatments	≤ 3	pests
leek	no. of treatments	≤ 7	weeds, pests and diseases
onion	no. of treatments	≤ 9	weeds, pests and diseases
carrot	no. of treatments	≤ 4	weeds, pests and diseases
all vegetables	kg ha^{-1} $year^{-1}$	≤ 4 pure copper	fungi of the Oomycetes e.g.

In **Spain**, the target values for the organic system (ES ORG) have been set that reduce the targets considered for the equivalent integrated system (ES INT3) by 90%. The target for copper use in ES ORG has been limited to half the target value in ES INT3 because the Spanish regulation in the near future is not clear. The huge difference in emission and use between the different systems in Spain is remarkable. In addition, the different crops are rotated, and the important reasons for this must be pointed out:

- Differences in incidence of pests and diseases in different areas due to climatic conditions and different intensity of use.
- Different conditions for pesticides applications: Dosage is always done in concentration of pesticide per spray liquid. This means the used amount of pesticide depends on the wash used per hectare (mean in developed crops: 2 000 l ha^{-1} in ES INT1, 1 000 l ha^{-1} in ES INT2 and 1 500 l ha^{-1} in ES INT3 and ES ORG).

In contrast to the other partners, the pesticide input on Swiss farms is calculated as a crop-specific number of applications. This replaces the parameters PESTAS and EEP. From the Swiss perspective, active ingredients alone are of very limited use. Very active compounds such as the synthetic pyrethroids are used in very low amounts of active ingredients per hectare but, nevertheless, can have very serious side effects. The Swiss partner defines the pesticide inputs and the pesticide emissions by the number of applications because of the known or unknown negative side effects. The targets are crop-specific and based on the results from the survey on integrated VEGINECO pilot farms in Autumn 1997 and the Good Agricultural Practices (Lüthi, 1995).

In addition to applications with synthetic or non-synthetic 'natural' pesticides, applications also include *Bacillus thuringiensis,* sulphur and copper. For a comparison with the other countries, the input of active ingredients is presented and separated into input of synthetic or non-synthetic 'natural' pesticides excluding *Bacillus thuringiensis* compounds, and in input of copper and sulphur. According to the requirements for organic vegetable production in Switzerland, a copper input of 4 kg pure copper per hectare and year is the maximum allowed. This value was taken as Swiss copper target for organic and integrated farms. Table 4.4 presents the Swiss targets for a selection of most important crops in the VEGINECO project.

4.7 Nature and landscape

There is a common concern about the decline in value of natural resources and the landscape in agricultural areas. However, the different countries look at the farm nature within a framework in different ways. The Italian and Spanish main motivating factors for improvement and preservation of the farming environment is the increase in natural predators of pests, which is an agronomy-focused interest. In the Netherlands and Switzerland, the aim is to increase biodiversity. Other motives in all of the countries is increasing the attractiveness for the local community and improving the physical conditions (erosion, windbreak). In general, every country has the same set of motives to improve on farm nature, but with different priorities. In the Netherlands, Switzerland and Italy, there are subsidies for improvement or preservation of on farm nature. In Spain, the need to combine agronomic and recreational (landscape) functions is very high in areas located near large cities.

In the Netherlands, a methodology has been developed to quantify the potential quality of on farm nature. The historical, cultural and present landscape values play an important role in the layout of the farming environment in the Dutch point-of-view. Parameters have been developed to make the quantification possible. The results of the measures taken to improve the quality of the farming environment may take a long time to appear. This is the reason that the parameters are more focused on creating the conditions necessary to achieve the potential quality of nature for a specific farm (region).

A second set of parameters is also needed to estimate to when the potential quality has become the actual quality (scoring aspects of biodiversity). These secondary parameters are, of course, necessary to check the efficiency of the initial set of parameters. However, within the scope of the VEGINECO project, this second set of parameters was not possible to develop and test.

Nine parameters have been developed and divided into

Table 4.5 Parameters and target values for the evaluation of the quality of on farm nature values

Nature and landscape	
PWE Percentage of Woody Elements	Percentage at farm level (scale 1:5 000) = percentage at landscape level (scale 1:25 000). At the landscape level, the presence of larger woody elements in 250 x 250 meter squares is scored. At the farm level, the presence of individual trees in 50 x 50 meter squares is scored. For the landscape level, maps from 1970 are used. If rural development plans for the area differ from the actual landscape, target values may be adjusted
CoLE Connectivity Landscape Elements	Desired connectivity is reached if L ≥ ½N. N = Node: landscape element of sufficient size (>50 m^2) to provide shelter, food and the possibility for reproduction (depending on the species). L= Link: suitable habitat for movement of target species. A difference is made between woody links and herbal links.
CiLE Circuitry Landscape Elements	Desired circuitry is reached if the number of L ≥ N.
BTP Biotopes	50% of existing biotopes in the 6.25 km^2 surroundings of the farm must be present on the farm.
Environment	
BZI Buffer Zone Index	Length of buffer zones per length of ditches, waterways or woody elements between 1 and 2. For elements at the border of the farm, the index is 1, for internal elements the index is 2.
BZW Buffer Zone Width	The average width of the buffer zones = 4 meter. For the calculation of this parameter, buffer zones wider than 4 meter are fixed at 4 meter.
Agro-ecological layout	
EII Ecological Infrastructure Index	Percentage of the farm that is managed as a network of linear and non-linear biotopes for flora and fauna including buffer strips ≥ 5%.
FSI Field Size Index	Width of the fields < 125 meter. FSI =(A1 * (W1-125)/At) with A1 the area of the farm with fields wider than 125 meter, W1 the average width of that part of the farm and At the total area of the farm. Every 25 units correspond to a 10% shortfall
BTS Biotope Target Species	Number of target species present in a biotope. For each biotope, 20 target species are chosen. These 20 species can be divided into 4 groups that correspond to a specific stage in the succession of the vegetation.

three categories: nature and landscape, environment, and agro-ecological layout (see Table 4.5). The parameters proposed for linking the farm to the landscape (PWE, CoLE, CiLE and BTP) have recently been developed and have yet to prove their suitability in different landscapes. PWE was developed to provide a guideline for how many woody elements on a farm reflect the landscape the farm is situated in. The same holds true for BTP. CoLE and CiLE were derived from landscape ecology where connectivity and circuitry are used to describe the functioning of networks (Forman & Godron, 1986). In this methodology, they are used to involve farms in creating corridors and connecting natural areas. The introduction of specific stepping-stones on the farm may improve the connectivity and circuitry of existing networks. Moreover, when new landscape elements are introduced on a farm, the positions have to be evaluated regarding the connectivity and circuitry in relation to existing networks.

BZI and BZW are based on pesticide drift reduction studies, which show that drift can be reduced to zero by using four-meter wide zones.

EII is the only parameter that was also used in the origi-

Table 4.6 Target values of on farm nature parameters for a selection of systems

	Parameter	Netherlands	Italy (I INT1)	Spain (ES INT2)	Switzerland
Nature and landscape					
1	Percentage of woody elements	30%	14%	44%	9%
2a	Connectivity woody elements	50%	25%	28%	33%
2b	Connectivity herbal elements	5%	25%	28%	33%
3a	Circuitry woody elements	100%	14%	20%	30%
3b	Circuitry herbal elements	100%	14%	20%	30%
4	Biotopes	3	2	3	4
Environment					
5a	Length of buffer zones/ length of ditches	1	1	x	1.48
5b	Length of buffer zones / length of woody elements	1	1	1	1.57
6a	Buffer zone width next to ditches	4	4 m	x	4
6b	Buffer zone width next to woody elements	4	4 m	4	4
Agro-ecological lay out					
7	Ecological infrastructure index	5%	5%	5%	5%
8	Field size index	<125 m	<125 m	<125 m	<125 m
9	Biotope for target species	-	-	-	-

nal prototyping methodology (Vereijken et al., 1998). FSI expresses the possibility for stabilising the agro-ecosystem for a specific farm. Expert judgement indicates that the optimal field size for natural predators of pests to reach the centre of the field is 125 meters (Booij; pers. comm.). BTS has so far only been developed for the management of dike grassland vegetation (Sprangers, 1999). Similar methods for other biotopes are now being developed.

For all parameters (except BTS), it is hypothesised that when the target values have been achieved, preconditions are present for a certain basic level of quality of the (agricultural) landscape. The ultimate desired quality depends largely on the management of the different elements. This can be evaluated with the BTS parameter.

Prototyping on farm nature management provides a tool to analyse and evaluate the achievements of nature management on a farm. This provides the farmer or researcher with clues how to improve the function and the quality of the nature on the farm and in the surrounding area. It is important to emphasize that the methodology presented evaluates if the conditions are present for a basic level of quality of the (agricultural) landscape. The achieved quality depends largely on the management of the different elements. Parameters for the evaluation of the latter will be developed in connection with the BTS parameter.

The target values for this theme are different for the partners, dependent on the nature values for the surroundings of the farms (Table 4.6). Only EI is included in the general circle diagram.

4.8 Summary

In Table 4.7, the parameters used in the VEGINECO project are summarised with a short definition and indication how the target value is established.