Pathways to phase-out contentious inputs from organic agriculture in Europe

Deliverable 6.1: Version 1.1

Targeted design of user-centric scenarios for organic production systems phasing out contentious inputs

Versions

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Indhold

List of Figures

List of Tables

1. Summary

Contentious inputs in organic farming are unwanted inputs, but allowed by the Commission Regulation (EC) No 889/2008. Such inputs include among others non-organically fertilizers, soil conditioners, pesticides, feed stuff, and feed additives. In order to select suitable alternatives, and secondly, which alternatives are best, the consequences of substitution must be evaluated in terms of feasibility, sustainability, and environmental impact. As a first step, scenarios constructions aimed at these assessments have been carried out in Deliverable6.1. 22 scenarios were identified together with 37 case farms. These scenario alternatives were congruently specified at product level and examples were found in the relevant partner countries together with WP 2 task 2.1. where case farms are selected to elaborate on user centric aspects of implementing alternatives to the identified issues of concern. The list of scenarios will be used in cooperation with Task 2.1 to design the questions to be proposed for the case farms.

2. Introduction

Contentious inputs in organic farming are undesired inputs, but allowed by the Commission Regulation (EC) No 889/2008, where in the annex I, II, V, VI, and IX it is specifically mentioned, which fertilizers and soil conditioners, pesticides -plant protection products, feed materials, feed additives, and ingredients off agricultural origin which have not been produced organically.

Contentious inputs in organic farming have been grouped according to the theme area in which they will be investigated by the Organic Plus consortium. The three themes are 1) Plant; 2) Livestock; and 3) Soil. Within these themes, specific issues have been identified which have been discussed extensively and are cause for concern, as they are not in line with the organic principles (IFOAM guidelines) and might influence the marketing of organic products. The market is the driving force behind the vigorous development of the volume of organic agricultures, in terms of area, farm numbers and amount of produce.

In order to select possible alternatives, and secondly, which alternatives are best, the consequences of change need to be evaluated. Of course, the economic consequences are important, although the principal character of allowance of the alternative, can be the decisive factor for getting a premium, which eliminates the "normal" economic mechanisms. Consequences can also be in the form of environmental aspects such as climate impact, eutrophication, energy consumption or toxicity. In addition, there can be consequences in terms of the feasibility at the operational level (operations efficiency and ease, labour input, etc.).

Often changes in the EC are obstructed by individual country interests, where certain countries can be afraid that specific changes will decrease competitiveness of their national products. The independent, scientific based evaluation done by EGTOP (Expert group for technical advice on organic production), with no commercial interest, will have to evaluate the multinational process of avoiding contentious inputs.

3. Methodology

3.1 Targeted scenarios design

WP6 will employ a number of assessments at different levels, namely feasibility (T6.2) and sustainability (T6.4) at the farm level, whereas environmental impact (T6.3) will be assessed by using life cycle assessment (LCA) at product level. Necessary scenario construction and information gathering for these multiple assessments will be coordinated, as much as possible, especially with WP2, to avoid redundant information and efforts. In order to achieve this, alternative scenarios were identified (T6.1). Deliverables 3.1, 4.1 and 5.1 present a status quo of the situation in the partner

countries, comprising the three main areas that Organic Plus is concerned with; plant, livestock and soil. On basis of these deliverables, the identified alternatives are marked in a schematic overview (Figure 1).

These alternatives were congruently specified at product level and examples were found in the relevant partner countries. This was done in cooperation with WP 2 task 2.1. where case farms are selected to elaborate on user centric aspects of implementing alternatives to the identified issues of concern. This will be done in a participatory manner. The definitive list of scenarios defined here (Table 1) will be used in cooperation with Task 2.1 to design the questions to be proposed for the case farms.

Table 1. Identified scenarios and case farms to be assessed according to T6.2, T6.3, and T6.4.

Senarie	Country	Number of case farms	WP	Action Area			Product	Input to be minimised	Alternatives
				Plant	Livestock	Soil			
1	Germany/DK	2	3	Horticultural appel			apple	S	resistant varieties
2	Turkey/Spain/ Greece	3	3	outdoor cultivation of olive/tomatoe/egg plant			olives/tomatoe/eggplant	S, Cu, mineral oil	resistant varieties
3	Germany/France	2	3	Agriculture/potatoes			Potatoe	Cu	Seed tube dressings eg. Phosphonate and chitosan, resistant varieties, foliar application of probiotic
4	UK	1	3	Agriculture/potatoes			Potatoes	Cu	Growing practice e.g. removal of foliage at first sight of blight
5	Spain/Germany	1	3	Nursery/greenhouse crops			tomatoes	Cu	potassium hydrogen carbonate, sulphur,
6	DK	1	3	Agriculture			Potatoes	Cu	pre sprouting, resistant varieties, defoliate
7	Germany	1	3	Agriculture and nursery				Mineral oils	Vegetable oils, Integrated pest management,
8	Italy/Turkey	2	3	Citrus			orange	Cu, S	Less copper, less sulphur, other plant based fungicides
9	UK/Norway	2	4		cows, pigs, poultry, lambs		meat/milk	Antibiotics	Plant based inflammatory, immune stimulants, anti-infectives, tannins
10	Italy	1	4		Cheese production		milk	Antibiotics	Plant based anti flammatory
11	Germany	1	4		Barn		meat/milk	Conv. Straw	Agroforestry supply chain products
12	DK	1	4		Pigs		meat	Antibiotics	herbs
13	Italy	3	4		cows, pigs, poultry		meat/milk	Antiparasitics	herbs /tannin
14	Norway/Poland	2	4		Barn animals		meat/milk	Conv. Straw	Bark as bedding
15	Spain, France, UK	3	5	Agriculture	Feed	agriculture and horticulture	plant /livestock products	manure/feed/medicine	Permaculture
16	DK	1	5	free land Tomato/strawberry		Soil cover	tomatoes, strawberry	Plastic	Photodegrable plastic from corn starch, crop covers, woven ground cover(Mypex)
17	Germany/ DK/ Norway	3	5	Cereals		fertilizer/mulch/marine waste	grain	Conventional manure	Digestat/recycled household waste/other annex I possibilities/fish waste etc.
18	UK	1	5	Planting/cutlings		Vegetable transplants	plants	Peat	Composted bark/wood, coir fibre, green waste compost, leaf mould, worm compost
19	Germany	1	5	Horticultural		Plant media	plants	Peat	Composted bark+wood, cori fibre peat, green waste compost, leaf mould, garden compost, worm compost, processing trees/waste fibre material in a extruder (ATB)
20	UK	1	5	Agriculture free land, Cabbage, carrot		Protected cropping (horticulture) -fertilizer	Tomatoes or other polytunnel crops	Animal manure	New cropping systems with innovative use of legumes and organic biogas digestate
21	Germany/ Denmark/Poland	3	5	Agriculture and horticulture		Fertilizer	Arable crops	Manure	New cropping systems with legumes and clover, household waste, organic biogas waste
22	UK	1	5			Field vegetables - weed control mulch	Vegetable crops	Plastic	Non fossil fuel derived biodegradable mulch
total		37							

Specifically, Table 1 shows the relationships with the LCA-reference scenarios outlined in the description of Milestone S4. In this way coordination of assessment of the scenarios, as for example the data/information collection in the LCA scenarios , can be achieved.

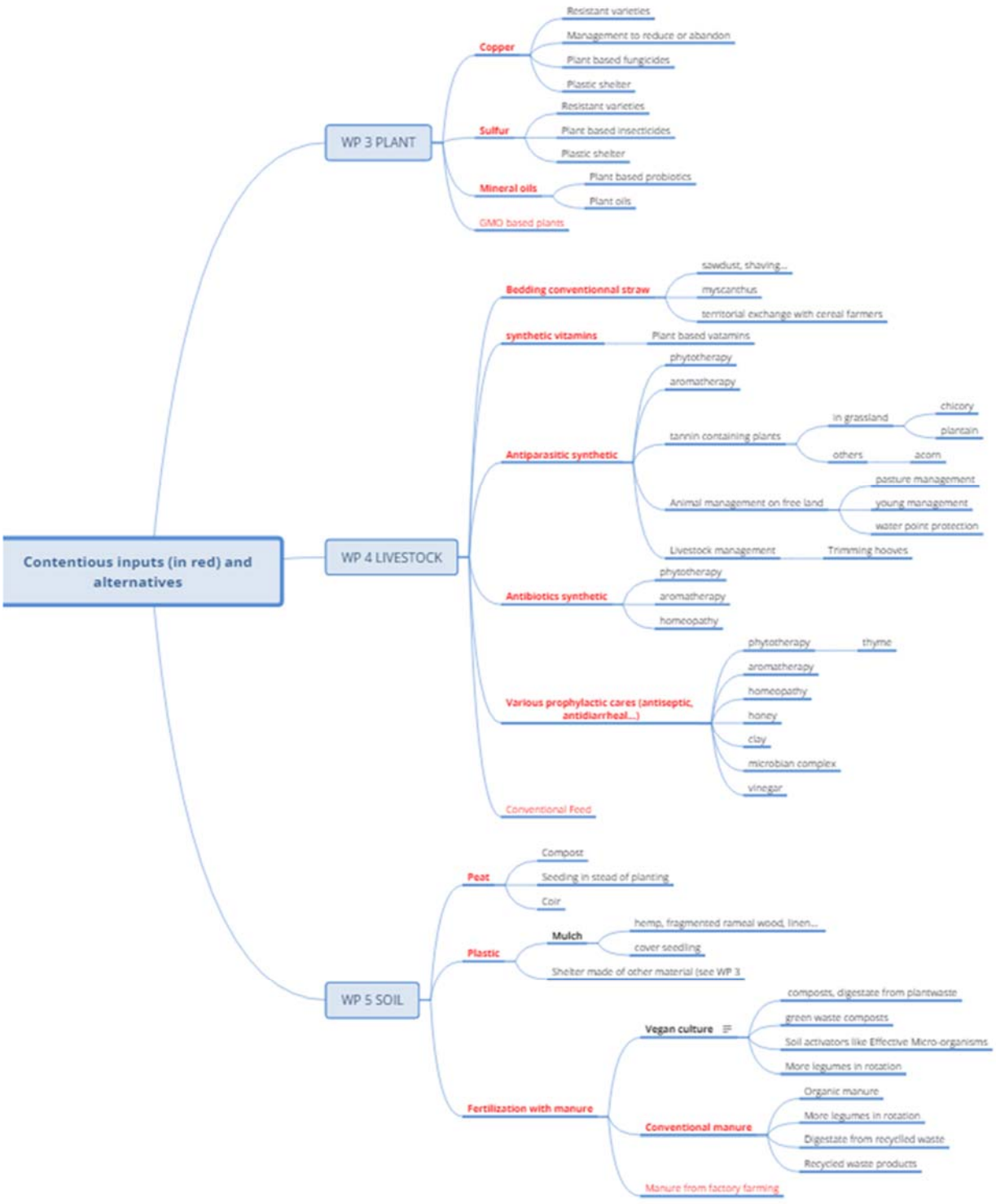

Figure 1. Contentious inputs in organic farming to be investigated in Organic plus (in bold red) and annotation of the alternatives.

3.2 Feasibility (T6.2)

A feasibility study is defined as an evaluation or analysis of the impact of a proposed method as compared to current methods or practises (e.g. Gael & Ellen, 2015; Sørensen et al., 2005). In this case, the feasibility of alternative scenarios involves assessing the functional, operational capability, and economic viability of specific operations processes/methods based on obtained information about system performance before and after the implementation of alternative production methods substituting contentious inputs. The feasibility analysis will include sensitivity analyses ranking and quantifying important influential factors as well as descriptive advantages and disadvantages of both the current situation and the proposed alternative situation.

A key objective of a feasibility study is to support decision-makers (here farmers) in determining whether or not to implement a specific alternative production method. The feasibility study is partly based on basic production data collected for also the sustainability and LCA assessments, and partly on supplemental data concerning specifically operations data for usage scenarios. The feasibility study will include advantages and disadvantages of both the current production methods and the proposed productions methods. For example, cost comparisons will involve estimating incremental costs as the difference between costs of current methods of operation and cost of implementing and operating new methods.

3.3 Environmental impact (T6.3)

The environmental impact will be analysed using the LCA method, as defined by ISO 14040 (2006) and ISO 14044 (2006) and described in MS4 (e.g. Nemecek, 2015). Key steps involve definition of goal and scope, quantifying and analysis of a life cycle inventory (LCI), where all material and energy input and output within the defined system boundary are collected, life cycle impact assessment (LCIA), classifying and explaining the main impact categories, and finally interpretation and displaying the results. It will be an attributional assessment approach assessing a "snapshot" of the system at a specific point in time and considering best available technologies. Product related information for specific reference scenarios included in Table 1 will be collected as part of T6.3. For this, questionnaires have been designed and distributed among partners of the organic plus consortium. Two examples of such questionnaires can be seen in appendix B.

The goal of the LCA study is to quantify the environmental impacts associated with organic crop and livestock production from cradle to farm-gate. This will include all steps from raw material manufacturing to transport to the slaughterhouse or processing plant (in regards to livestock) or transport to storage (in terms of crops). The collected information will serve to detect hotspots – or where the majority of environmental impacts are occurring in the system. This material could help researchers optimize the process and decision makers and authorities decide between different alternatives.

The functional unit is a measure of the function of the studied system and it provides a reference to which the inputs and outputs can be related. Since we are establishing reference scenarios, we are

not particularly interested in final impacts for the yield produced. Therefore, we will use reference flows as the functional unit or unit of analysis. This is usually one hectare for crops and animal head for livestock production. Nevertheless, these reference flows can be easily translated to yield or kilograms of food product. For peat and plastic, kilograms will be used as the reference flow.

3.4 Sustainability (T6.4)

The sustainability will be analysed using the international recognized method called RISE (De Olde et al., 2016; Berbec et al., 2018) (Response Inducing Sustainability Evaluation). With the RISE method, certified analysts make a whole farm assessment, using ten themes and 50 indicators to estimate the performance of the farm. There have been made more than 2000 RISE analysis the past 15 years all around the world. The sustainability performance is visualised in a polygon (Figure 3) with relative scores, giving an overview of the positive performance (green), the critical performance that can be improved (yellow), and the problematic performance (red) that is threatening the sustainability. The scores are based on computation according to scientific documented methodology for the indicators (e.g. biodiversity, organic matter in the soil, farm net income, animal welfare). The method is carefully described in manuals, and the software is available (www.hafl.bfh.ch/en/research-consulting-services/agricultural-science/sustainability-and-ecosystems/sustainability-assessment/rise.html.

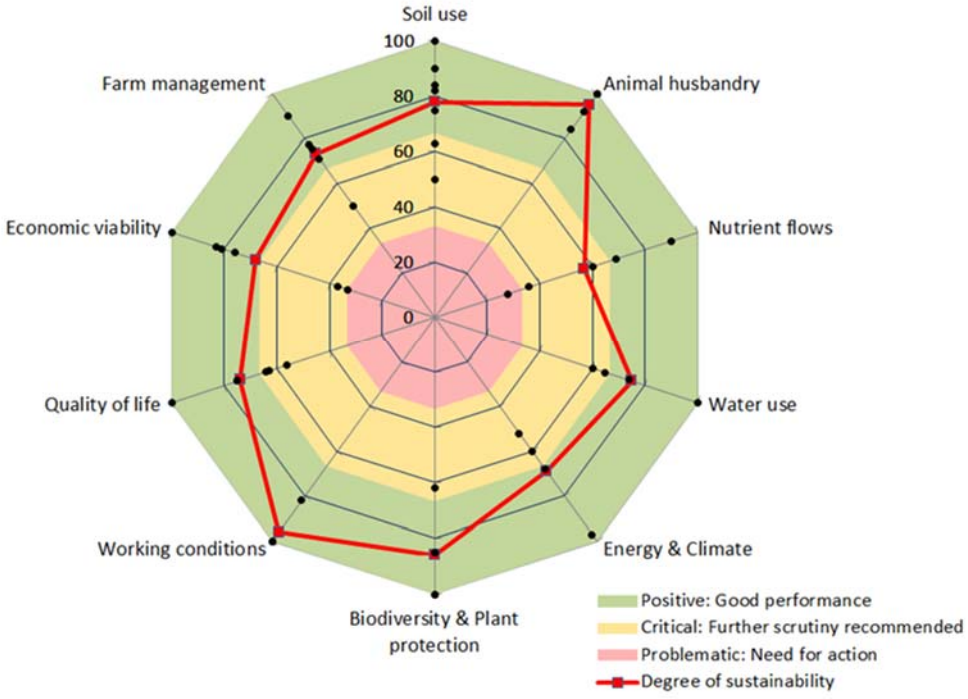

Figure 2. Example polygon with scores for a specific farm performance. The black dots are the individual indicator scores, which are all absolute scores, transformed to relative values. The relative values are related to regional yields, and legislations.

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4. Scenarios

4.1 Scenario examples

For each of the stipulated scenarios described in Table 1, specific case farms will be located. These case farms are located in the respective countries where alternatives for the contentious inputs have been in use and experience from using these alternatives have been gained. How the case farms use the alternatives or combinations of alternatives will be described in depth, before collecting the specific data necessary for making the various assessments outlined in Section 3. The following describes examples of in depth scenario description listing general information about the case, identification of measures to replace the contentious input in question, and importantly specification of data and information required or the feasibility, LCA, and sustainability assessments. The current example scenarios/case farms include alternative for Copper in Denmark in potatoes, lamb/meat and alternatives for antibiotics in Norway, olive production without copper in Turkey, citrus production without copper in Turkey, eggplant production without copper in Turkey, vegetable production without livestock manure in Germany, transplant production without peat in the UK, vegetable production without plastic mulch in the UK, vegetable production without livestock manure in the UK, and greenhouse tomatoes production without animal manure in the UK.

5. Annex

5.1 Annex A. Scenario examples

5.1.1 Potato

Table A1. Scenario on potato growing in Denmark

Scenario: Potatoes, DK	Contentious input: Cu	General information: Scenario without copper in temperate climate zone, 800 mm rainfall/y. Yield level in organic potatoes for consumption = 20-25 tons/ha (less than half of conventional yields with chemical protection) Price (wholesale) organic potato = 300 €/t; price conventional potato = 160 €/t Identification of specific actions taken to prevent Phytophthora without Cu: • Pre-sprouting of the tubers (Phytophthora usually emerges in July, so earlier growth gives higher yield) • Select size of tubers (relative large= older, older tubers tend to start making tubers earlier in the season) • Select resistant varieties • Plant fewer tubers per ha, as open space makes wind drying possible • Fertilize optimally, as better-nourished plants have better resistance against Phytophthora.
Data and information needed for **sustainability** and **feasibility** evaluation	Case farm practice and information to be collected in interviews or other types of interventions	Example data and information to be collected: • Direct costs for prevention (work hours, diesel) • Indirect costs for prevention (depreciation machines, risk, higher plant-tuber price) • Yield levels and potato quality (size, dm.), taste • Extra materials and resources (fertilizer, biological control) • Extra mental work load, complexity, specialist knowledge All alternatives can be found on one case farm
Data and information needed for **LCA**	Data at product level to be collected by questionnaire	See IRTA (MS4)

5.1.2 Lamb

Table A2. Scenario on lamb production in Norway

Scenario: Lamb/meat, Norway	Contentious input: Antibiotics and anthelminthics	General information: Scenario with no use of anthelminthics in temperate climate zone, 800 mm rainfall/y. Production level of organic lamb meat per year = 35-40 kg/ewe (hereof, 6 kg meat from ewe) With a demand for cultivated land varying from 0,12 to 0,20 ha per ewe, the production level per ha will vary from 211 to 292 kg/ha Price organic lamb = 4.1 €/kg including 0.3 €/kg premium price – excluding subsidies Identification of specific actions taken to prevent antibiotics and anthelminthics: • Increased indoor spacing/animal • Careful planning of grazing on cultivated land; not more often than each xx year • Changing the location of salt feeding stations on permanent pastures
Data and information needed for **sustainability** and **feasibility** evaluation	Case farm practice and facts to be collected in interviews or other types of interventions	Example data and information: • Direct costs for prevention (working hours) • Indirect costs for prevention (risk) • Meat yield levels and quality (=EUROP) (over years) • Extra materials and resources (ever considered to use woody plants, tannin extracts) • Extra mental work load, complexity, specialist knowledge
Data and information needed for **LCA**	Data at product level to be collected by way questionnaire	See IRTA (MS4)

5.1.3 Olive

Table A3. Olive production in Turkey

Scenario: Olive, TR	Contentious input: Cu	General information: Scenario without copper in temperate climate zone, 800 mm rainfall/y. Yield level in organic olive for consumption =35_50 kilograms/tree (less than half of conventional yields with chemical protection) Price (wholesale) organic olive = 1230-1950 Euros, price conventional olive = 833_1330€/t (It depends on the variety and size) Identification of specific actions taken to prevent Olive Leaf Scab (OLS) *Spilocaea olaegina* without Cu. • Cultural measures (constitution of the orchard on windy, less humidity area, pruning the trees for better air circulation) Fertilise according to the lab test results) • Select resistant varieties (needs to be investigated) • Combating the disease with the help of alternative substances (We are investigating alternative chemicals, biologic agents etc. in the O+ project in Turkey) • Fertilize optimally, as better-nourished plants have better resistance against OLS
Data and information needed for **sustainability** and **feasibility** evaluation	Case farm practice and facts to be collected in interviews or other types of interventions	Example data and information: • Direct costs for prevention (work hours, diesel), 60 Euro/10000 square meter/ 1 season (Cu fungicide), 85-100 Euros diesel for 10000squremeter/1 season, 50-60 Euros for labor costs/1 season for OLS disease prevention. • Indirect costs for prevention (depreciation machines, risk, yearly changing olive oil and oil fruit prices) • Yield levels and oil and olive fruit quality (size, dm.), taste (Olive fly induced damages can affect quality and yield this is another risk) • Extra materials and resources (fertilizer, biological control) • Extra mental work load, complexity, specialist knowledge

		All alternatives can be found on one case farm We have got an olive orchard, all scenarios are available for it. We are planning to conduct an experiment for OLS on this olive orchard.
Data and information needed for **LCA**	Data at product level to be collected by way questionnaire	See IRTA (MS4)

5.1.4 Citrus

Table A4. Citrus production in Turkey

Scenario: **Citrus, TR**	Contentious input: Cu	General information: Scenario without copper in temperate climate zone, 800 mm rainfall/y. Yield level in organic mandarin for consumption = 100 kilograms/tree Price (wholesale) organic mandarin = 1250-2000 Euros, price conventional mandarin = 900_1400€/t Identification of specific actions Turkey has no action in O+ for citrus: • Cultural measures (constitution of the orchard on windy, less humidity area, pruning the trees for better air circulation) • Fertilization optimally according to the lab test results
Data and information needed for **sustainability** and **feasibility** evaluation	Case farm practice and facts to be collected in interviews or other types of interventions	Example data and information: • Direct costs for prevention (work hours, diesel), 60 Euro/10000 square meter/ 1 season (Cu fungicide), 85-100 Euros diesel for 10000squremeter/1 season, 50-60 Euros for labour costs/1 season for prevention of disease • Indirect costs for prevention (depreciation machines, risk, yearly changing olive oil and oil fruit prices) • Yield levels and fruit quality (size, dm.), taste (Olive fly induced damages can affect quality and yield this is another risk) • Extra materials and resources (compost, K source as wood ash, biological control)

		• Extra mental work load, complexity, specialist knowledge

5.1.5 Eggplant

Table A5. Eggplant production in Turkey

Scenario Eggplant, TR	Contentious input: Cu	General information: Scenario without copper in temperate climate zone, 800 mm rainfall/y. Yield level in organic eggplant for consumption = 4000 kilograms /10000squaremeter Price (wholesale) organic eggplant = 450-1200 Euros/Ton, price conventional eggplant= 300-830 €/t (It depends on the variety and size) Identification of specific actionstaken to prevent eggplant early blight(EEB) *Alternatia solani* withoutCu. • Cultural measures (constitution of the orchard on windy, less humidity area, Fertilise according to the lab test results) • Select resistant varieties (needs to be investigated in Turkey for O+ project we will work on this issue) • Combating the disease with the help of alternative substances (needs to be investigated) • Fertilize optimally, as better-nourished plants have better resistance against EEB • Different, alternative mulching techniques may be investigated because A. solani is a soil borne pathogen.
Data and information needed for **sustainability** and **feasibility** evaluation	Case farm practice and facts to be collected in interviews or other types of interventions	Example data and information: • Direct costs for prevention for A.solani(work hours, diesel), 80 Euro/10000 square meter/ 1 season (Cu fungicide), 30-50Euros diesel for 10000squremeter/1 season, 70-100 Euros for labor costs/1 season for EEB disease prevention • Indirect costs for prevention (depreciation machines, risk, yearly changing prices) • Extra materials and resources (fertilizer, biological control) • Extra mental work load, complexity, specialist knowledge All alternatives can be found on one case farm We are collecting local eggplant seeds for testing against to *A. solani*

Data and information needed for **LCA**	Data at product level to be collected by way questionnaire	See IRTA (MS4)

5.1.6 Vegetable/cabbage

Table A6. Vegetable production in Germany

Scenario cabbage, Germany	Contentious input: external animal derived fertilisers (conventional animal manure, horn grit etc.)	<u>General information:</u> Scenario with substitution of external animal derived fertilisers on an arable farm with field vegetable cultivation (white head cabbage) on a large scale (as opposed to horticulture with many crops and greenhouse cultivation); temperate climate zone 700 mm rainfall/y. N need (target): 160 – 220 kg/ha Yield level in organic cabbage production = 35-50 tons/ha (for autumn harvest/storage cabbage) Price (wholesale) organic cabbage = ??; price conventional potato = 160 €/t <u>Identification of specific actions</u> taken to substitute conventional animal derived fertilisers • Use of clover grass silage (internal fertiliser) • Use of biogas residues from house hold waste (combine both fertilisers? Fast availability of N for biogas residues, slower but continuous for silage) • Fertilize optimally, use software like N-Expert ect. For a more targeted fertilisation • Maybe addition of K_2SO_4 needed
Needed for Sustainability and feasibility evaluation	Case farm practice and information to be collected in interview	Direct costs for production of silage (work hours, diesel) • Indirect costs for prevention (depreciation machines, risk especially for using biogas residues from household waste, higher cabbage price). • Yield levels and cabbage quality (size, dm.), taste • Extra materials and resources (fertilizer, biological control, maybe some pests are attracted by the new fertilisers) • Extra mental work load, complexity, specialist knowledge.

		At least for silage, there are case farms, for the biogas residues, so far, there are only case farms for residues from organic biogas production (normally digestate from slurry and clover grass), but not from household waste, here only data from our research trial.
Needed for LCA	Data at product level to be collected in questionnaire	See IRTA (MS4)

5.1.7 Transplant

Table A7. Transplant production in UK

Scenario: Organic transplant production, UK	Contentious input: peat	General information: Scenario without peat using a 100% peat-free growing media. Specialised commercial greenhouse production (e.g. Delfland) And On-farm production in propagation greenhouse Identification of specific actions to replace peat: • **System redesign** greater use of direct sowing or use of bare-root transplants, crop protection • Use of on-farm plant based growing media e.g. wood compost (including agroforestry sources), bark, leaf and crop and plant waste, loam based growing media based on farm soil, crops grown specifically to make compost • Use of waste inputs (bio-economy material in growing media, e.g. coir, green waste compost, wood waste) blended in on-farm • Commercial blended product using the above
Data and information needed for **sustainability** and **feasibility** evaluation	Case farm practice and facts to be collected in interviews or other types of interventions	Example data and information: • Direct costs of alternatives (work hours, diesel,…) • Indirect costs of alternatives (depreciation machines, risk, higher prices,…) • Yield levels and product quality (e.g. size, shape, taste) • Extra materials and resources (e.g. seeds, machinery biological control) • Extra management time, complexity, specialist knowledge

		All alternatives cannot be found on one case farm, and we expect it to be found on up to 5.
Data and information needed for **LCA**	Data at product level to be collected by way questionnaire	See IRTA (MS4)

5.1.8 Vegetable/plastic mulch

Table A8. Vegetable production in UK

Scenario: Organic field vegetable production, UK	Contentious input: fossil-fuel derived plastic mulch	General information: Scenario without fossil-fuel derived plastic mulch. On-farm use of alternative mulch materials Identification of specific actions to replace peat • **System redesign** with better land management, more precise weeding (robots), state seeds, precision farming with fixed beds, cover crops, roller-crimper method and direct seeding technology • Use of on-farm plant derived mulches like straw, plant waste, wood waste • Commercial non-fossile fuel derived plastic
Data and information needed for **sustainability** and **feasibility** evaluation	Case farm practice and facts to be collected in interviews or other types of interventions	Example data and information: • Direct costs of alternatives (work hours, diesel,…) • Indirect costs of alternatives (depreciation machines, risk, higher prices,…) • Yield levels and product quality (e.g. size, shape, taste) • Extra materials and resources (e.g. seeds, machinery biological control) • Extra management time, complexity, specialist knowledge All alternatives cannot be found on one case farm, and we expect it to be found on up to 5.
Data and information needed for **LCA**	Data at product level to be collected	See IRTA (MS4)

	by way questionnaire	

5.1.9 Vegetables/animal manure substitution

Table A9. Vegetable production in UK

Scenario: Organic field vegetables, UK	Contentious input: animal manure from conventional and organic sources	General information: Scenario without animal manure in temperate climate zone, 600 mm rainfall/y. Yield level in organic vegetable rotation = 20-25 tons/ha Price (wholesale) organic potato = 300 €/t; price conventional potato = 160 €/t Identification of specific actions to replace any animal manure source (stock-free or vegan organic production - Farm yard manure FYM, bone and blood-meal: • **System redesign** e.g. with different rotation (different crops) and greater use of fertility building crops, mulches and winter green manures, intercropping, agroforestry • Greater use of on-farm plant based fertility products (compost teas, comfrey liquid) • Greater use of green waste inputs (bio-economy fertiliser) • Greater use of commercial organic fertilisers from certified organic sources (bought in products, bio-stimulants) • Greater use of approved mineral derived fertilisers like rock-phosphate
Data and information needed for **sustainability** and **feasibility** evaluation	Case farm practice and facts to be collected in interviews or other types of interventions	Example data and information: • Direct costs of alternatives (work hours, diesel,…) • Indirect costs of alternatives (depreciation machines, risk, higher prices,…) • Yield levels and product quality (e.g. size, shape, taste) • Extra materials and resources (e.g. seeds, machinery biological control) • Extra management time, complexity, specialist knowledge All alternatives cannot be found on one case farm, and we expect it to be found on up to 5.

Data and information needed for **LCA**	Data at product level to be collected by way questionnaire	See IRTA (MS4)

5.1.10 Tomato/animal manure substitution

Table A10. Tomato production in UK

Scenario: Organic greenhouse tomato dominated rotation, UK	Contentious input: animal manure from conventional and organic sources	General information: Scenario without animal manure in temperate climate zone, protected cropping in heated or un-heated greenhouse Yield level in organic vegetable rotation = 20-25 tons/ha Price (wholesale) organic potato = 300 €/t; price conventional potato = 160 €/t Identification of specific actions to replace any animal manure source (stock-free or vegan organic production). Farm yard manure FYM, bone and blood-meal • **System redesign** e.g. with different rotation (different crops) and greater use of fertility building crops, mulches and winter green manures, intercropping • Greater use of on-farm plant based fertility products (compost teas, comfrey liquid) including liquid fertiliser like AD digestate • Greater of green waste inputs (bio-economy fertiliser) • Greater use of commercial organic fertilisers from certified organic sources (bought in products, bio-stimulants) • Greater use of approved mineral derived fertilisers like rock-phosphate
Data and information needed for **sustainability** and **feasibility** evaluation	Case farm practice and facts to be collected in interviews or other types of interventions	Example data and information: • Direct costs of alternatives (work hours, diesel,…) • Indirect costs of alternatives (depreciation machines, risk, higher prices,…) • Yield levels and product quality (e.g. size, shape, taste) • Extra materials and resources (e.g. seeds, machinery biological control) • Extra management time, complexity, specialist knowledge

		All alternatives cannot be found on one case farm, and we expect it to be found on up to 5. (Lucia's PhD)
Data and information needed for **LCA**	Data at product level to be collected by way questionnaire	See IRTA (MS4)

5.1.11 Cow

Table A11. Dairy cow in Italy

Scenario Cow/milk, Italy	Contentious input: Antibiotics	General information: Scenario with no use of antibiotics to control mastitis in temperate climate zone, 800 mm rainfall/y. Production level of dairy cow milk per year = 6500 Kg /cow Price organic cow milk = 45 euro/100 kg of milk Milk losses of about 9% in case of parasitosis Identification of specific actions taken to reduce antibiotics especially for mastitis treatments. Use of essential oils from plants showing antibacterial properties able to express antibacterial properties against pathogens isolated form mammary glands of cows with clinical mastitis. • Improved management strategies of dry period and milking • Use of phytotherapy (e.g. oregano, carvacrol, thymol, and trans-cinnamaldehyde) remedies for mastitis control during dry period and milking • Use alternative bedding materials (woody chips enriched with biochar)
Data and information	Case farm practice and	Example data and information:

needed for **sustainability** and **feasibility** evaluation	facts to be collected in interviews or other types of interventions	• Direct costs for prevention (cost for each cow treatment, working hours,) • Milk yield and milk quality (gross composition) • Extra materials and resources (alternative bedding materials) • Extra mental work load, complexity, specialist knowledge
Data and information needed for **LCA**	Data at product level to be collected by way questionnaire	See IRTA (MS4)

5.1.12 Sheep

Table A12. Dairy sheep production in Italy

Scenario Sheep/milk, Italy	Contentious input: Antiparasitics	<u>General information:</u> Scenario with no use of antiparisitics to control helminths in temperate climate zone, 800 mm rainfall/y. Production level of dairy sheep milk per year = 300 kg /sheep Price organic sheep milk = 120 euro/100 kg of milk Milk losses between 19 and 44% in case of parasitosis <u>Identification of specific actions</u> taken reduce antiparisitics, especially anti-helminth treatments: • Use of condensed tannins as natural strategies to deworm flocks; e.g. Terminalia arjuna bark tannins. Other possibilities: aqueous or ethanolic extracts of Fumaria parviflora (alkaloids and tannins); Calotropis procera powder (calotropin); Cucurbita maxima (pumpkin, cucurbitin) • Increased indoor spacing/animal • Grazing managements:

		○ Mixed or alternate grazing with other host spacing ○ Change of pastures between seasons ○ Grazing forage crops that contain condensed tannins or antiparasitic compounds in general • Use of products on the pasture to reduce pasture parasite charge
Data and information needed for **sustainability** and **feasibility** evaluation	Case farm practice and facts to be collected in interviews or other types of interventions	Example data and information: • Direct costs for prevention (cost for each sheep treatment, working hours,) • Milk yield and milk quality (gross composition) • Extra mental work load, complexity, specialist knowledge
Data and information needed for **LCA**	Data at product level to be collected by way questionnaire	See IRTA (MS4), data needed for modelling, no need for specification here

5.2 Annex B. LCA – Questionnaire

5.2.1 Questionnaire for Potatoes from France

Organic-PLUS

Questionnaire for Potatoes from France

WP6, Milestone 4

Version 1.0, 5 December, 2018

Versions

Version: 1.0 (December 2018) Draft written by Assumpció Antón (Task Leader) and Erica Montemayor (Task participant)

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Project Details:

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Call topic: **SFS-08-2017, (RIA) Organic inputs – contentious inputs in organic farming**

Project Title: **Pathways to phase-out contentious inputs from organic agriculture in Europe**

Project Acronym: **Organic Plus**

Proposal Number: **774340-2**

Lead Partner: **Coventry University**

Time Frame: **01/05/2018 – 31/04/2022**

Authors:

Assumpció Antón, Erica Montemayor and all Organic-PLUS participants

Deliverable Details:

WP: 6 MODEL

Task(s): 6.3: Environmental Assessment, Milestone 4 (MS4)

Deliverable Title: D6.3 Environmental Assessment (results for MS4 will be used for D6.3)

Lead beneficiary: IRTA

Involved Partners: CU, UTH, INRA, UNIPD, AU, NORSØK, aBERu

Deadline for delivery: month 36, 30/06/2021

Date of delivery: 30/06/2021

Table of Contents

Overview & Instructions

Product: Potato from France

IRTA has prepared environmental questionnaires to be filled out by the corresponding dataset responsible (In your case potato cultivation). The questionnaires have been divided into several sections as Annexes. Below is a scheme showing the different sections where exact questionnaires will be found as annexe information for crop cultivation.

Instructions:

- As a potato grower, we request that you fill out Annexes A1, A2, A3, A4, A5, A6, A7, A8, A9, A10 and A11.
- If you do not use a greenhouse or nursery during potato cultivation, Annex A9 does not need to be filled out.
- If you do not use phytosanitary treatments (e.g. natural or chemical herbicides, insecticides, fungicides) nor plastic & packaging during cultivation, Annexes A10 and A11 do not need to be filled out.
- If you rotate other crops with the potato plants, you must fill out all of Annex A again (i.e. twice in total), but with information regarding the secondary crop (e.g., Legumes, cover crops, etc.).

Annex A: Crops

- A1. Crop General Information
- A2. Crop Geographical Data
- A3. Crop Data
- A4. Crop Management
- A5. Crop Labour operations
- A6. Crop Storage & Transport
- A7. Crop Waste Management
- A8. Crop Fertilizer Treatments
- A9. Crop Greenhouse & Nursery data (fill out if a greenhouse or nursery is used)
- A10. Crop Phytosanitary Treatment (fill out if used, including natural or chemical ones)
- A11. Crop Plastics & Packaging (fill out if any plastic for mulching, solarisation, packaging,… is used)
- A12. Crop Additional Information/Comments (use this page if you need to add any additional information)

Annex A: Crop Questionnaires

A1. Crop General Information

Please respond to the following questionnaire as specific and precise as possible.

Additional information may also be added which he/she considers relevant, and/or add more rows to the different tables if necessary. In cases where no data is available, average values will be applied.

If you rotate other crops with the potato plants, you must fill out all of Annex A again (i.e. twice in total), but with information regarding the secondary crop (e.g., Legumes, cover crops, etc.).

If you have any questions or concerns please contact: erica.montemayor@irta.cat or assumpcio.anton@irta.cat

Black boxes: To be filled out by the IRTA team

Name of participant(s) filling out this questionnaire	
Contact details of participant(s)	
Corresponding year/s of reference data	
Date that this questionnaire was completed	
Name of crop under study	
Name of the farm[1]	
Name of the plot owner[1]	
Name and surname of the person in charge of the plot[1]	
Phone number[1]	
E-mail[1]	

Indicate with an "X" if the following data is in regards to the principal crop or the secondary crop.

	Principal crop
	Secondary crop

Annual crop production per hectare		Unit	

Other comments/Data[2]:

[1] Data will be kept confidential within this project on a need-to-know basis.

[2] If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex A12: Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

A2. Crop Geographical Data

Farm location	
Geographical coordinates	
Agroclimatic zone	
Water basin	

		Source of data (e.g. article, website, own data)
Precipitation, l/m^2		
Evapotranspiration, l/m^2		

Soil Data

		Source of data (e.g. article, website, own data)
Soil Texture		
Soil Structure		
Root depth (m)		
Clay content, 0-30cm soil (%)		
Sand content, 0-30cm soil (%)		
Lime content, 0-30cm soil (%)		
Organic material content,0-30cm soil (%)		
pH soil (0-30cm soil)		
Nitrogen content in planting soil, kg/ha		
Plot slope (%)		
Length of plot (m)		
Green borders "buffer zone", yes/no, dimensions		

Size of plot (ha)		

Note: If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex A12: Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

A3. Crop

Common Name				
Variety				
Growth cycle, indicate with an X		temporary		permanent
If the crop is permanent, how old is the crop?				
Date for planting				
Date for harvesting				
Date previous crop was harvested				
Quantity of seeds or cuttings used (kg/ha)				
Plantation density (plants/ha)				
Dry material yield (kg/ha)				
Fresh material yield (kg/ha)				

Other data / Comments*

* If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex A12: Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

A4. Crop Management

Irrigation

Type (e.g. drip recirculation, open drip, flood irrigation…)	
Consumption of irrigation water (L/m^2)	

	Canal	River	Well	Rain	Other, specify
Water origin (%)					

Type of energy used for irrigation (if applicable)	
Consumption of energy (kWh/m^2)	

		Source of data (e.g. Article, website, own data)
Nitrogen content in rainwater (kg NO_3 /m^3)		

Solarization

	Yes/No	System? Materials?
Solarization		

Water consumed (m^3/m^2)	
Amount of plastic used (kg/m^2)	

Energy

Electricity Consumption (kWh/m^2/year)		

Other data / Comments*

* If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex A12: Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

A5. Crop Labour operations

Work on soil (yes/no)	
Type (conventional, reduced tillage, no tillage, ...)	
Other, specify	

Machinery

		Source of data (e.g. article, website, own data)
Tractor potential (hp)		

Model of implement or manual machinery, **see Annex E for examples**	Agricultural operation (purpose)	Number of times (n) operation was carried out in area (n/area)	Diesel consumption (L/ha/año)	Potencial (kW)	Operating time (h/ha/yr)

Source of data (e.g. Article, website, own data)	

Pruning

Pruning Method (manual or mechanical)	
Quantity of organic waste obtained (kg)	
Type of machinery used for pruning	
Total time of labour	
Specify where is the organic waste deposited (e.g. Left on the ground as green manure, collected for compost/feed, burned, etc)	

Note: If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex A12: Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

A6. Crop Storage & Transport

Storage

Refrigerated storage (days)	
Refrigerated storage (temperature, ºC)	
Non-refrigerated storage (days)	

Processes on the farm	Water consumption (m^3/ kg of product)	Energy consumption (kWh/kg product)	Observations
Drying			
Washing			
Silage			
Others, specify			

Transport of product to storage facility or processing facility

Type of vehicle and trailer	Destination	Load (kg /journey)	Distance (km)

Other data / Comments*

* If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex A12: Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

A7. Crop Waste Management

	Total	Plastic	Glass	Cardboard	Organic
Generated waste (kg/ha)					

Type of waste treatment	Quantity treated, kg/ha	Percentage going to treatment (%)	Distance to treatment plant (km)	Mode of transport	If lorries are used, specify emission standard (e.g. EUR 1 - 6)
Landfill					
Compost					
Incineration					
Recycling					
Incorporation into the soil					
Other, specify					

Other data / Comments*

* If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex A12: Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

A8. Crop Fertilizer Treatments

Organic Fertilizer

Type of fertilizer including the animal and type (e.g. Pig/cow manure/purines/digestate, etc)	Mode of application (Hose, broad sprayer, surface deposition, injection…)	Date of application	Total dose applied (kg or m^3/m^2)	Origen (e.g. Name of country or own farm)	Distance from origen to plot land

Mineral Fertilizers

Name	Mode of application	Date of application	Total dose applied (specify, kg/m^2)	Origen (e.g. Name of country or own farm)	Distance from origen to plot land

Other data / Comments*

* If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex A12: Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

A9. Crop Greenhouse & Nursery data

If you have more than 1 type greenhouse/nursery that does not have the same characteristics as the one you listed below, please copy and insert (NOT paste) the entire "greenhouse data" section into this sheet to add it.

		Other(s), specify:
Total greenhouse area covered (ha)		
Type: (parral, multitunnel, venlo, tunnel)		
Structure (steel/wood/concrete)		
Walls cover material (film, polyester plates, glass, ...)		
Roof cover material (film, polyester plates, glass, ...)		
Span number		
Nº bays per span		
Span width (m)		
Span length (m)		
Ridge height (m)		
Gutter height (m)		
Plastic Mulching, specify type of plastic/material		
Quantity of peat used (kg/plant)		
Screen (shading, thermal, ...)		
Specify screen material		
If heating is used, specify fuel type(s)		
Fuel Consumption, m^3 or kg per ha, specify units		
CO_2 enrichment, kWh per m^2		
Fogging system, kWh per m^2		
Fogging system, L per m^2		

* If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex A12: Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

A10. Crop Phytosanitary Treatment (Crop protection products)

Have you used phytosanitary treatments? If yes, fill in the following table.		Yes		No

Nº treatment, please specify commercial product [1]	Active ingredient	Plague / disease	Dosis (kg/ha)	Date of Application	Growth stage of crop
1)					
2)					
3)					
4)					
5)					
6)					
7)					
8)					
9)					
10)					
11)					
12)					

Please specify for each of previous treatments:	Machinery aplication (type) **See Annex D**	Method of application (Position and height of the nozzles, type of nozzle, etc.)	Drift control equipment (yes / no)
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			
9)			
10)			
11)			
12)			

[1]In case of commercial product or treatment with several active ingredients, please keep a row for each active ingredient.

A11. Crop Plastics & Packaging

Plastics

Any use of plastics while growing the crop? Do not focus on wrapping of products, but plastic used in growing such as soil mulching, plant cover, etc.

Type of material	Purpose	Estimate quantity used (kg/ha)

Other Packaging

Description characteristics type of packaging, paste photo if possible	Type of material	Dimensions	Dimension units
Bag			
Boxes			
Pellets			
Other, specify			

Other data / Comments*

* If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex A12: Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

A12. Crop Additional data / Comments

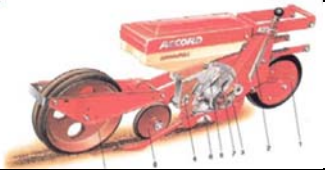
1. Annex D. PPP Application Machinery

(this is a general list of machinery, if you use a different one that those below please add it to the list)

Phytosanitary application machinery	Description		
(A) Manual sprayers or atomizers	These sprayers can vary widely in type and pressure capacity, are **usually backpacks** transported on the back by the operator, **or connected to a tank**, **mobile or static**, and have different lances or guns, for the application.		
(B) Suspended or bar sprayers	These sprayers have multiple nozzles spaced along the boom or bar attached to a large tank. They are used to spread liquid pesticides over large areas. T**he nozzles are directed towards the ground**.		
(C) Atomizers and similar	Atomizers are most often used in orchards, vineyards and some berry crops. Pneumatic and hydro-pneumatic machinery drive the drops **vertically towards the plant**.		
(D) Aerial application	**Airplanes and helicopters** can be used to continuously apply pesticides such as solids or liquids (including ultra low volume spray) over large areas. Helicopters are useful for treating isolated patches.		
(E) Granular applicators or incorporation into the soil	They are used to emit **granules** of pesticides on a complete field surface or in bands corresponding to rows of crops. Uses gravity or a positive measurement mechanism to regulate flow. Small, manually operated dispersion equipment (eg, rotary spreaders) can be used to treat smaller areas.		
(F) Pneumatic backpack sprayer with barrel	The basic principle of a **pneumatic cannon sprayer** is the atomization of a **liquid** sprayed with the help of **high air speed**. Typical horizontal spray ranges vary between 25-70m and vertical ranges between 20 and 30m depending on the intensity of the air assistance.		

Annex E. Labour Operations Machinery

Agricultural Machinery	**Description**		
1) Disc Harrow	Used for **primary tillage or to chop unwanted weeds or crop residues**. Composed of vertical discs that are driven into the ground. They produce breakage of the clods to **produce a leveled and settled ground surface**. It also allows the superficial burial of stubble.		
2) Mechanical Rake (tipping)	Rakes the ground using **metal elements (barbs or fingers) capable of continuously sweeping the forage**. Types include: Assembly on straight bars (horizontal and oblique windlass rakes). Radial mounting on a rotating shaft (sun rakes and vertical or gyroscopic reel rakes).		
3) Rototiller	They have a horizontal rotating shaft from which a set of angled **arms or hoes pulverize the ground**. The hoes are usually grouped by blocks or discs, with about 6 blades per disc. The assembly is located inside a protective cover leaving the ground more or less pulverized.		
4) Tiller	**Tills the surface of the soil using flexible arms**, at the end of which a grille is placed to displace the clods upwards or downwards. They usually include wheels to control the depth of work.		
5) Subsoiler/ Plow	Implement used for the **deep clearing (scarification**) of the agricultural lands, **below the arable layer**, **without turning the soil**, especially for **decompaction and facilitate aeration**, water infiltration and root penetration. The working depth of up to 45cm.		

6) Broadcast fertilizer	This machine **uniformly disperses solid mineral fertilizers (preferably granulated**). A central hopper equipped with **one or two outlets** in the **lower part with a stirring device** that **prevents** the **caking of the fertilizer** and facilitates uniform exit.		
7) Sower (monograin)	Creates **open furrows of constant depth**, and **deposits seeds (coarse grain or monograin)** in them, one by one. It is equipped with a hopper in each integrated sowing unit with the dispenser.		
8) Conditioning Mower	**Mows the forage at a certain height above the ground**, making a clean cut **that facilitates the regrowth of the grass**. Harvesting is carried out simultaneously with the conditioning operation. The cutting devices are located laterally with respect to the tractor, or on the front (front hitch).		
9) Seed drill	Creates **open grooves of constant depth**, and continuously **deposits seeds (Fine grain**) into them. The machine includes both the opening of the groove and the cover of the seeds (sowing boots). Has an adjustable sowing dose depending on the plant species considered.		

5.2.2 Questionnaire for Sheep from Norway

Organic-PLUS

Questionnaire for Sheep from Norway

WP6, Milestone 4

Version 1.0, 11 December, 2018

Versions

Version: 1.0 (December 2018) Draft written by Assumpció Antón (Task Leader) and Erica Montemayor (Task participant)

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Call topic: **SFS-08-2017, (RIA) Organic inputs – contentious inputs in organic farming**

Project Title: **Pathways to phase-out contentious inputs from organic agriculture in Europe**

Project Acronym: **Organic Plus**

Proposal Number: **774340-2**

Lead Partner: **Coventry University**

Time Frame: **01/05/2018 – 31/04/2022**

Authors:

Assumpció Antón, Erica Montemayor and all Organic-PLUS participants

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Task(s): 6.3: Environmental Assessment, Milestone 4

Deliverable Title: D6.3 Environmental Assessment (results from Milestone 4 will be used in D6.3)

Lead beneficiary: IRTA

Involved Partners: CU, UTH, INRA, UNIPD, AU, NORSØK, aBERu

Deadline for delivery: month 36, 30/06/2021

Date of delivery: 30/06/2021

Table of Contents

Overview & Instructions

Product: Sheep from Norway

IRTA has prepared environmental questionnaires to be filled out by the corresponding dataset responsible (In your case sheep rearing). The questionnaires have been divided into several sections as Annexes. Below is a scheme showing the different sections where exact questionnaires will be found as annexe information for crop cultivation.

Instructions:

- As a lamb producer, we request that you fill out **mandatory** Annexes B1, B2, B3, B4, B5, B6, B7, B8, and B9.
- For the *optional* Annexes B10 – B16, please fill out only those that apply to your sheep rearing system (see comments in the list below).
- If you have data for **each growth stage** in the animals' life, please fill out the annexes that have distinct inputs **for each stage**, such as Annexes **B4, B9**, B12 *and B15* which may differ by growth stage (e.g. birth to weaning, replacement gimmer weaning to 1 year, weaned lamb for sale, replacement gimmer 1-2 years, ewe in production, where each may have different inputs like feed, water, electricity, etc…)

Annex B: Livestock

- **B1: General Information**
- **B2: Geographical Data**
- **B3: Livestock Data**
- **B4: Livestock Management**
- **B5: Fertilizers & Manure Management**
- **B6: Transport & Waste Management**
- **B7: Infrastructure Data**
- **B8. LS Waste Management**
- **B9. LS General Feed Information**
- *B10. LS Pasture grazing (fill out if livestock are fed partly or completely by grazing)*
- *B11. LS Compound Feed (fill out of any commercial feed was bought and used)*
- *B12. LS Feed Pre-mixtures (fill out of any pre-mixtures was bought and used/added to feed)*
- *B13. LS Feed mill operations & Transport (fill out if you have information regarding feed mill operations e.g. electricity, water. AND/OR if you have information regarding transport of feed from mill to the farm)*
- *B14. LS Biogas Plant Infrastructure (fill out if a biogas plant is used to digest organic waste)*
- *B15. LS Antibiotics / Livestock protection products / Alternatives (fill out if these are used)*
- *B16. LS Plastics & Packaging (fill out if any plastic or packaging is used only during rearing)*
- *B17. LS Additional Information/Comments (use this page if you need to add any additional information)*

Annex B: Livestock

B1. Livestock (LS) General Information

The participant is requested to respond to the following questionnaire as specific as possible, in order to carry out an accurate assessment. The client can also add additional information that s/he considers relevant, and/or add more rows to the different tables if necessary. In cases where no data is available, average values will be applied. Please keep in mind that ALL DATA MUST BE RECORDED AS THE AVERAGE QUANTITY PER HERD/FLOCK PER YEAR. If you have any questions or concerns please contact: erica.montemayor@irta.cat or assumpcio.anton@irta.cat

Black boxes: To be filled out by the IRTA team

Name of participant(s) filling out this questionnaire			
Contact information of participant(s)			
Corresponding years of reference data			
Date that this questionnaire is completed			
Name of livestock under study			
Name of the farm			
Name of the farm owner*			
Name of the person in charge of the survey*			
Phone number*			
E-mail*			
Total annual livestock production units*		Units	
Type of farming (e.g. Intensive, extensive, organic grassland)			
Type of husbandry (e.g. Housed/factory farms, open-field grassland)			

Other comments/Data**

* Data will be kept confidential within this project on a need-to-know basis.

** If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex B17: Livestock Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

B2. LS Geographical Data

Location	
Coordinates	
Agroclimatic zone	
Water basin	

		Source of data (e.g. Article, website, own data)
Precipitation (l/m^2)		
Evapotranspiration (l/m^2)		

Other data / Comments*

* If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex B17: Livestock Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

B3. Livestock Data

Common Name	
Breed	
Number of Animals at the beginning of the year	
Number of livestock at the time of surveying	
Average bodyweight on aquisition (kg)	
Average bodyweight when slaughtered (kg)	
Average Age of animals on acquisition (years)	
Average age when slaughtered (years)	
Expected lifespan of livestock (years)	
Mortality rate (number of natural deaths/month)	
Livestock density (animals/ha)	

Type(s) of product(s) obtained from livestock	Units	Production of each product per year	Quality rating of product(s)	Comments
	tons			
	tons			
	tons			
	tons			
	tons			
	tons			
	tons			

Note: If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex B17: Livestock Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

B4. Livestock Management

Feed

Please fill in "Annex C" for plant-based feed if you grow feed on your farm or if information is available to you.

Water

Average quantity of water withdrawn from source (L/year)	
Average quantity of water consumed out the amount withdrawn (L/year OR % of withdrawn water consumed)	
If only total quantity of water consumed is known (not a proportion of withdrawn), enter the quantity here (L/year)	

	Canal	River	Well	Rain	Other, specify
Estimate water origin (%)					

Type of energy used for cleaning or feeding water (if applicable, eg electricity)	
Consumption of energy (kWh/m^2)	

Bedding

Specify type(s) of bedding	Average quantity of bedding used (kg/ herd/ year)

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Note: If you have data for each growth stage in the animals' life, please fill out the annexes that have distinct inputs for each stage, such as this annex B4 which may differ by growth stage (e.g. birth to weaning, replacement gimmer weaning to 1 year, weaned lamb for sale, replacement gimmer 1-2 years, ewe in production, where each may have different inputs like feed, water, electricity, etc…)

Energy	
Electricity Consumption (kWh/year)	

Machinery/Equipment

		Source of data (e.g. Article, website, own data)
Tractor potential (hp)		

Make & Model of implement or manual machinery	Agricultural operation (purpose)	Number of times (n) operation was carried out in area (n/area)	Diesel consumption (L/ha/year)	Potencial (kW)	Operating time (h/ha/yr)

Source of data (e.g. Article, website, own data)	
Other, specify	

Other comments/Data*

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Note: If you have data for each growth stage in the animals' life, please fill out the annexes that have distinct inputs for each stage, such as this annex B4 which may differ by growth stage (e.g. birth to weaning, replacement gimmer weaning to 1 year, weaned lamb for sale, replacement gimmer 1-2 years, ewe in production, where each may have different inputs like feed, water, electricity, etc…)

B5. LS Fertilizer & Manure Management

Fertilizer added to land (In case of grazing and fertilization)

Type of fertilizer including the animal and type (e.g. Pig/cow/chicken AND manure/purines/digestate, etc)	Model of application (Hose, broad sprayer, surface deposition, injection…)	Date of application	Total dose applied (specify, kg or L/m^2)	Origin (e.g. Name of country or own farm)	Distance from origin to plot land

Exported Manure or Compost

Annual Fresh Manure exported (kg/herd/ year)	
Annual Compost Manure exported (kg/herd/year)	

Manure Management

Put an "X" next to all the types of manure management systems in case it is applied on your farm:

	Indicate with an "X" here the applicable systems	Estimated % of manure that is managed by applicable systems (if more than one, must add up to 100%)
Daily spread on land		
Dry lot		
Lagoon		
Liquid/slurry		
Pit storage		
Solid storage		
Pasture/range		
Digestion in biogas plant[a]		

[a]If manure is managed in a biogas plant, please fill in **Annex B12**. If not, please leave Annex B12 empty.

Note: If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex B17: Livestock Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

B6. LS Transport & Waste Management

Transport of livestock to slaughterhouse

Type of vehicle and trailer	Destination	Load (kg /journey)	Distance (km)

Waste Management

	Total	Plastic	Glass	Cardboard	Organic
Generated waste (kg/ha)					

Type of waste treatment	Quantity treated, kg/ha	Percentage going to treatment (%)	Distance to treatment plant (km)	Mode of transport	If lorries are used, specify emission standard if known (e.g. EUR 1 - 6)
Landfill					
Compost					
Incineration					
Recycling					
Incorporation into the soil					
Other, specify					

Other data / Comments*

* If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex B17: Livestock Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

B7. LS Infrastructure data*

*This questionnaire **must** be filled out by all participating farms, in addition to the tabs "livestock" and "Feed". The client can also add additional information that he/she considers relevant, and/or add more rows to the different tables if necessary. In cases where no data is available, average values will be applied. If you have any questions or concerns please contact: erica.montemayor@irta.cat or assumpcio.anton@irta.cat*

B7.1 Buildings

Total number of buildings used for husbandry	

Type/Purpose of building(s) (e.g. Barn, chicken coop, cow-shed, stable, hayloft, silo)

Building 1	
Building 2	
Building 3	
4)	
5)	
6)	
7)	
8)	
9)	
10)	

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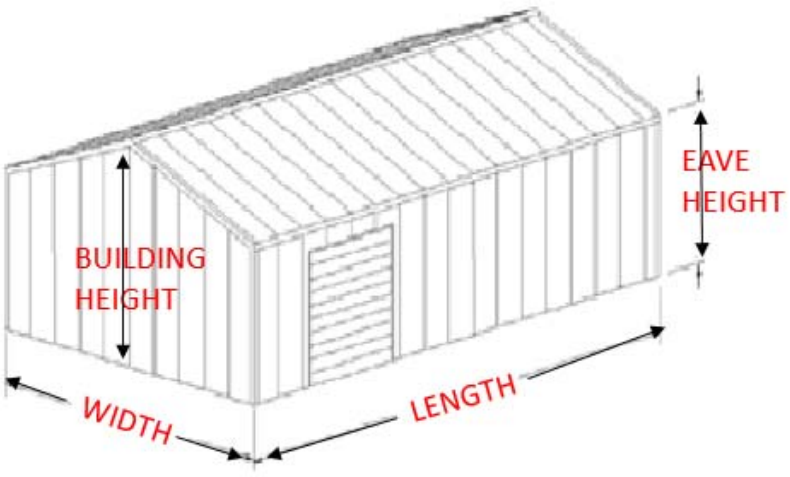
	Width (m)	Length (m)	Building Height (m)	Eave Height (m)
Building 1 dimensions (see picture below as reference)				
Building 2 dimensions (see picture below as reference)				
Building 3 dimensions (see picture below as reference)				
4)				
5)				
6)				
7)				
8)				
9)				
10)				



	Most common source:	Others
Heating, if applicable, specify all type(s) of energy used. If more than one type is used, write the most common source, and describe the others in "others" (e.g. Natural gas, electricity, propane LPG, etc)		
Average Consumption of energy for heating from each energy source (m^3 or Watts / year)		
Cooling systems, if applicable, specify all type(s) of energy used. If more than one type is used, write the most common source, and describe the others in "others" (e.g. Natural gas, electricity, propane LPG, etc)		
Average consumption of energy for cooling systems, for each energy source (m^3 or Watts / year)		

Materials

List the types of Materials used in each buildings' structure, separated by commas	
Building 1	
Building 2	
Building 3	
Building 4	
5)	
6)	
7)	
8)	
9)	

10)	

B7.2 Fences/Enclosures/Cages/Pens

Specify type of fences used (e.g. Metal chain-link, wood fence, woven wire fence, synthetic fence, electric fence, see pictures below as a reference)	Specify materials used in fences/enclosures	Width of enclosure (m or ha)	Length of enclosure (m or ha)





Metal (chain link/ barbed wire) Fence

Wooden Fence

Woven wire and wood Fence

Synthetic Fence

Electric Fence

Other data / Comments*

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B8. LS Waste Management

	Total	Plastic	Glass	Cardboard	Organic
Generated waste (kg/ha)					

Type of waste treatment	Quantity treated, kg/ha	Percentage going to treatment (%)	Distance to treatment plant (km)	Mode of transport	If lorries are used, specify emission standard (e.g. EUR 1 - 6)
Landfill					
Compost					
Incineration					
Recycling					
Incorporation into the soil					
Other, specify:					

Other data / Comments*

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B9. LS General Feed Information

Mark with an "X" all the types of feed that are used in your farm (i.e. you may mark more than one option, those that you mark indicate which questionnaire(s) you must fill out):

			Questionnaire to fill out:
1) Pasture grazing	☐	.....	B10: Pasture grazing
2) Compound Feed	☐	.....	B11: Compound Feed
3) Plant-based (crop) feed grown on-site	☐	.....	Annex C: Livestock Feed
4) Animal-based feed (e.g. fish meal)	☐	.....	B9. List types in table below, row (4)
5) Pre-mixture	☐	.....	B12: Feed Pre-mixtures

Of the types marked above, specify the feed material/ingredients given to the livestock and the quantities:

Type(s) of feed material (e.g. hay, grass, maize silage, soy, fish oils, etc)	Average quantity of feed used per year	Units	Origen of feed (e.g. Own farm, bought locally, imported)	Source of data (e.g. Article, website, own data)
1)		tonnes		
2)		tonnes		
3)		tonnes		
4)		tonnes		
5)		tonnes		

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Note: If you have data for each growth stage in the animals' life, please fill out the annexes that have distinct inputs for each stage, such as this annex B9 which may differ by growth stage (e.g. birth to weaning, replacement gimmer weaning to 1 year, weaned lamb for sale, replacement gimmer 1-2 years, ewe in production, where each may have different inputs like feed, water, electricity, etc…)

B10. LS Pasture grazing

Please fill out this annex if livestock are fed by pasture grazing.

Soil Data

		Source of data (e.g. article, website, own data)
Soil Texture		
Soil Structure		
Root depth (m)		
Clay content, 0-30cm soil (%)		
Sand content, 0-30cm soil (%)		
Lime content, 0-30cm soil (%)		
Organic material content, 0-30cm soil (%)		
pH soil (0-30cm soil)		
Nitrogen content in planting soil, kg/ha		
Plot slope (%)		
Length of plot (m)		
Size of plot (ha)		
% of farm area taken up by semi-natural habitats (e.g. hedges, trees, wild strips, river banks)		
Green borders "buffer zone" (m x m) if applicable		
Most common species of grass(es) on pasture		
% of the total dry matter intake (DMI) that is from pasture grazing		
% of land guaranteed to not be deforested for crops (i.e. % land guaranteed to stay as untouched forest/area)		
Biodiversity schemes (description of the different schemes (certified or not) in supply chain		

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B11. LS Compound Feed

If using a compound feed (commercial mixture of different feed materials), list all the ingredients that constitute the feed and write the percentage constitution of the total, where all ingredients should add up to 100%.

For example mixes could include: cereals such as maize, additives such as vitamin C, oils, animal fat, etc.

Ingredients in compound feed	Percentage of feed mix	Source of data (e.g. Article, website, own data)

Nutritional Analysis Data

(This section requires information regarding the nutritional analysis of the compound feed. Please fill this table out if information is available from the company supplying the feed. If data is not available, please leave this section blank and IRTA will use typical values)

Nutrient	Units	Quantity
Nitrogen	g/kg	
Phosphorus	g/kg	
Ash	g/kg	
Copper content	g/kg	
Zinc content	g/kg	
Gross Energy	MJ/kg	
Digestible energy fraction	% total gross energy	
Fossil carbon content		

Other data / Comments*

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B12. LS Feed Pre-mixtures

Ingredients of pre-mixture	Units	Quantity	Percentage of total pre-mixture

Other data / Comments*

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B13. LS Feed mill operations & Transport

Energy use

Activity data	Unit per tonne of feed out	Quantity	Source and method of measurement (if relevant)
Electricity use	kWh		
Gas use	MJ LHV		
Heat use	MJ LHV		
Other energy inputs (specify type)	MJ LHV		

Water use in feed mill (fill out if company-specific data is available)

Activity data	Unit per tonne of feed as fed	Quantity	Source and method of measurement
water consumption in the feed mill	m^3		

Outbound transport to livestock farm

Activity data	Unit	Quantity	Technology (EURO-class 1,2,3,4,5,6)	Utilisation Ratio	Source and method of measurement
Fuel use (type 1)	unit/tonne delivered feed (specify unit)				
Fuel use (type 2)	unit/tonne delivered feed (specify unit)				
Fuel use (type 3)	unit/tonne delivered feed (specify unit)				
Fuel use (type 4)	unit/tonne delivered feed (specify unit)				

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B14. LS Biogas Plant Infrastructure

	Type	Units	Quantity
Type & Quantity of animal manure (eg cow, chicken, pig, etc)		L / year	
Type(s) & Quantity of crop residues or energy crops added		L / year	
Solid, liquid slurry or both?			
Type of treatment (biogas, liquid/solid separation, dryed,…)			

	Units	Quantity
Total surface area taken up by biogas plant	ha	
Methane producing capacity (annual)	m3 / year	
Methane producing capacity (wasted)	m3 / year	
Energy production	kWh / year	
% exported energy	%	
Exported energy	kWh / year	
Surface area of effluent pond	ha	
Volume of effluent pond	m3	
Total surface area of composting area	ha	

Note: If you need more space to add additional data or comments than what is provided here, please print as many copies as needed of Annex B17: Livestock Additional comments/Data (If filling out on a computer, type on that page and add more pages if needed)

B15. LS Antibiotics / Livestock protection products / Alternatives

Have you used antibiotic or livestock protection products? Indicate with an X. If yes, fill in the following table.	Yes		No	

Name of commercial product	Active ingredient	Average dosis (mg/livestock unit or /kg of feed)	Number of times given to animals per year

Other data / Comments*

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B16. LS Plastics & Packaging

Plastics

Any use of plastics during the rearing of animals? (not including stages during or after slaughter)

Type of plastic	Purpose	Estimate quantity used (kg/ha)

Other Packaging

Description characteristics type of packaging, paste photo if possible

	Type of material	Dimensions	Dimension units
Bag			
Boxes			
Pellets			
Other, specify			

Other data / Comments*

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B17. Livestock Additional data / Comments