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

Deliverable 5.1: Version 1.1

Current use of peat, plastic and fertiliser inputs in organic horticultural and arable crops across Europe

Versions

Version: 1.0 (September 2018) First version

Version: 1.1 (31 October 2018) Text updated with latest information.

Funding

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No [774340 — Organic-PLUS]

Project Details:

Programme: **H2020, SUSTAINABLE FOOD SECURITY – RESILIENT AND RESOURCE- EFFICIENT VALUE CHAINS**

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, Centre for Agroecology, Water and Resilience**

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

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Acknowledgements:

The authors of this report are very grateful for the kind assistance of many organic farmers and advisors, willing to share their knowledge and experiences. We also thank Joana Amador, Assumpció Antón, A. Bertuglia, Doris Blackhurst, Miguel de Cara, B. Cetinel, Glòria Colom, D. Dróżdż, MC García, M Kacprzak, Erica Montemayor and M. Mrowiec for valuable contributions.

Deliverable Details:

WP: 5 SOIL

Task(s): 5.1: Current use of contentious inputs

Deliverable Title: Current use of peat, plastic and fertiliser inputs in organic horticultural and arable crops across Europe

Lead beneficiary: NORSØK

Involved Partners: ABioDoc, CU, CUT, ESA, FORI, IFAPA, INRA, IRTA, MFAL, SA, SEGES, UNICT, UTH

Deadline for delivery: month 6, 31/10/2018

Date of delivery: 31/10/2018

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1. Summary with conclusions

The use of contentious inputs linked to plant protection, and the use of peat, plastic and fertilisers used in growing have been mapped in selected organically produced crops in 10 countries across Europe. This report refers the output of this mapping. It shows that organic production has not come very far to phase out peat or plastic. The consumption of these materials seems to be quite comparable to non-organic production systems.

The main utilisation of peat is for production of young plants (transplants). Most organic growers purchase plants e.g. for citrus, olives and grafted tomatoes and the growing media has usually a high content of peat. Vegetable transplants are also commonly produced by special growers. Peat is also used for casing layers for organic mushrooms, and as a potting media for aromatic plants.

For plastic, the use is extensive for mulching and to protect crops against frost, less often for insect protection. The use of plastic materials to attach young plants to sticks etc., and to protect grafting wounds in young trees, was also observed. While not big in volume, this use may contribute to micro-plastic waste. Plastic is also very common for solarisation and for tunnels and greenhouses, especially in southern countries. In northern countries, greenhouses are usually made of other materials than plastic. Further research within the Organic PLUS project will reveal farmers and growers who have worked with promising alternatives and develop these further.

For applied fertilisers, which in our context need to be approved for use in certified organic production, the application of commercial products seems to be higher in some countries, e.g. Greece, whereas other countries seem to use much less. This may be explained by economic conditions of the growers, cultural differences, by the extent of organic production and development of a market for such products, by the availability of national fertiliser companies and by other factors. Information about raw materials used to produce these fertilisers is commonly not readily available but may sometimes be found under information about the company's history. These website sections also reveal that fusions of fertiliser companies occur rapidly.

Many fertiliser products seem to be derived from residuals from sugar or starch production. Horn grid, meat and bone meal, blood meal and feather meals are well known organic fertilisers but were not so much observed in this study. Instead, we observed that animal hides are an important raw material for organic N fertilisers. Seaweed products are quite common, whereas fish-based products were only mentioned from UK. Non-organic manure (from conventional farms) is used in all countries, commonly as pelletised dry poultry manure.

2. Introduction

The use of contentious inputs linked to plant protection, and the use of peat, plastic and fertilisers used in growing have been mapped in selected crops in 10 countries participating in Organic-PLUS (Table 1). Information was received by asking experienced advisors and/or farm managers to fill in a table to describe the typical use of inputs for various crops, following the growing cycle from plant establishment to product harvest. In addition to peat, plastic and fertilisers the use of plant protection inputs was described, and we also asked for information about irrigation and working operations, to calculate input of energy. For Poland, the information was based on inputs recorded by a simple web survey from several producers. For UK, information was not compiled in crop tables. Instead, the largest organic growers' association, Soil Association (SA) interviewed several growers, and analysed the permissions to use restricted inputs that were given in one year. The information provided by SA is included in this report. All tables are compiled in a separate Annex (Katsoulas et al 2018), to be used both for the current report and for other deliverables from the Organic PLUS project. The output and analysis of plant protection inputs is summarised per country and discussed in an extensive report (Katsoulas & Løes 2018), where an introduction is also given about the extent of organic production and the organisation of organic certification including large private standard organisations in each country.

In this report, we will summarize the use of peat and plastic linked to growing of important organic crops, as well as the use of fertilisers, across crops and countries. For Germany, an additional analysis of the use of peat and plastic was conducted. This analysis is included here.

The crops were selected to be important organic crops in the respective country, and where we expected to find inputs that may be considered as contentious. For tomatoes, only greenhouse production was considered in all countries. The most extensive information was received for citrus, olives, potato and tomato. Altogether, we received information about 14 crops in 60 tables filled in with detailed information about the use of inputs during the growing period, in addition to information about 6 crops in UK (Table 1).

Table 1. Overview of crops and countries where information about contentious inputs was recorded. The numbers indicate how many informants have filled in a table of information for each crop. *The bottom line for UK show the main crops grown with the farmers being interviewed there.*

Crops/ Countries	Apple	Broccoli	Cabbage	Carrot	Cereals	Citrus	Cucumber	Eggplant	Lettuce	Olive	Potato	Pepper	Straw-berry	Tomato	**SUM**
Denmark	1	1			1						1		1	1	6
France				1				1	1	1	1			4	9
Germany			1		2						1			1	5
Greece	1	1				1				1	1			1	6
Italy						3				2	2			2	7
Norway	1			1							1		1	1	5
Poland							1				1		1	1	4
Spain						3				4				2	9
Turkey						1		1		1	1	1	1	1	7
SUM	**3**	**2**	**1**	**2**	**3**	**8**	**1**	**2**	**1**	**9**	**9**	**1**	**4**	**14**	**60**
UK	*2*	*2*	*2*	*2*					*1*				*1*		*8*

3. The use of peat in plant growing

Peat is used for several purposes in society, such as in growing media for producing transplants, in greenhouses and in green roofs (Caron et al., 2015). Further, peat is used in livestock production, as bedding material, as an additional compost substrate or to cover windrows of compost, and as a substrate for application in composting toilets. Peat may even be used as a food supplement, for therapeutic purposes (in baths), in aquariums and as oil binding substance. Peat as bedding material, especially for horses, lost its importance over the last 50 years but has recently achieved increased attention.
The volume of growing media for plants being sold in Europe has been estimated to about 37 million m^3 per year (Aleandri et al., 2015). Peat represents about 80% of this volume; about 30 million m^3 annually.

Peat is often used in mushroom production in the casing layers, where fungal mycelium proliferates. Casing layers are laid on top of other growing materials, which may also include peat but more often decomposing straw, manure, woodchips or other ingredients. More information about organic mushroom production, demonstrating a high diversity in produced species and growing materials, can be found here:
https://freshcapmushrooms.com/learn/understanding-mushrooms-substrates/
www.usda.gov/oce/forum/past_speeches/2016_Speeches/Ellor.pdf
www.cngfarming.org/mushroom_standards

EU regulations for organic production published in 2018 (EU 2018) will be implemented from January 1, 2021. These regulations, further referred to as EC 2018/848, will need detailed rules for implementation, including Annexes listing permitted inputs. The regulation 2018/848 mentions the term “peat” is only once, under Organic mushroom production, where it is stated that peat for mushroom substrates must not be chemically treated. This is identical to the regulation which is still used in practice, EC 889/2008 (EU 2008), where peat is also mentioned in Annex 1, Fertilisers and soil conditioners, as a permitted input restricted to horticulture (market gardening, floriculture, arboriculture, nursery). Regulations for organic production could well do more to restrict or eliminate peat use in organic production, to maintain the image of organic production as sustainable and environmentally sound.

In the Organic PLUS project, emphasis is on reducing peat used for growing media. Transplants are common in all horticultural production. Most organic growers of tree crops (apple, citrus, olive), many growers of strawberries and tomatoes and several vegetable producers purchase young plants, sometimes from abroad. Conventional plants are common for tree crops, and the plantations are converted after planting. For tomatoes and strawberries, certified organic plants are available, e.g. from the Netherlands: www.bannergreenhouses.com/organic-strawberries.php Below, information about peat use in the Organic PLUS countries is referred per country.

3.1 Denmark

In table-top strawberry production, peat is included in the soil mixture. Furthermore, for raising of horticultural transplants, peat is included in the growing media along with sand and organic fertilisers. Most transplants come from the Netherlands.

Peatlands are scarce in Denmark, and the extraction has diminished significantly over time. Whereas 336,000 m^3 were extracted in 2006, only 107,000 m^3 were extracted in 2017. Statistics on extraction of Danish resources are found in www.statistikbanken.dk/RST01 However, the peat use is still significant, and lots of peat is imported, especially from Eastern Europe.

3.2 France

Peat is used as growing media for purchased tomato plants, which are quite commonly used, except for varieties used for direct marketing ("market gardens"). One informant reports that 90-95% of the substrate used in growing media for transplants is peat, also when the growers make their own transplants. Peat is also used for transplants of lettuce.

3.3 Germany

From the information recorded in tables, peat use was reported in tomatoes, where purchased transplants are raised in growing media containing peat. The best way to avoid this is to produce own transplants. Then, growing media can be made from several ingredients, e.g. coconut products. One grower explained that he has successfully made his own growing media from various leafy materials. Leaves from wild plants are to be preferred if the growing media shall not be sterilised, to avoid in infection from pests following crop plants.

In Germany, private standard organisations are important, and most farmers are certified by Naturland, Bioland or Demeter. Private organisations may have stricter regulations than EU regulations, and Table 2 compares the regulation about peat in EU 889/2008 with the private standards. The amount of peat used as growing substrate is limited with all three associations, whereas the EU-regulation does not give a maximum amount. However, no standards have been developed for organically produced growing media. To assess the effect of such regulations on the actual peat use, it is relevant to explain that the area of land used for organic vegetable production accounts for about 9% of the total area in this sector, whereas the market share of organically produced vegetables accounts for about 7% (Destatis.de).

Table 2. Regulation of peat use in EC 889/2008 and the most important German organic growers' associations.

EC-889/2008	Naturland	Bioland	Demeter
Limited to horticulture (market gardening, floriculture, arboriculture, nursery)	Allowed share of peat in growing substrate: max 80% for growing of young plants; max. 50% for cultivation in pots (e.g. herbs).	Allowed share of peat in growing substrate: max 80% for growing of young plants; max. 50% for cultivation in pots (e.g. herbs).	Only allowed as a constituent for propagation beds and potting mixes. The proportion of peat is to be

			kept as low as possible and may not exceed 75%.

Since 2015, between 8 and 9.5 million m³ of growing media and potting soil containing peat are produced each year in Germany. 51-56% of this volume is used in professional horticulture. About 5.5 million m³ of black peat are extracted from German peat bogs annually, whereas 2.7 million m³ of white peat is imported, mainly from Baltic countries. About 80% of the German peat production occurs in Lower Saxony, where the federal government has an aim of maintaining and regenerating marshlands, by reducing the current peat extraction by 25%. A forum for peat replacement has been established, with 70 experts acting as an actors' platform to exchange experiences and support the development of peat replacement substrates.

The German Garden Industry Association - Industrieverband Garten (IVG) supports the development of peat free growing media and provides statistics about the annual peat use. The current proportion of peat in growing media is 94%, and in potting soil 72% (Figure 1). Ingredients used to replace peat are bark, wood fibres, coconut products, green waste compost and xylitol (possibly added to protect against microbial growth).
The available annual amounts of substrates which may be used to replace peat in Germany are estimated to maximum 500,000 m³ of compost, 230,000 m³ of bark humus, 120,000 m³ of wood fibres/wood, 50,000 m³ of coconut materials, in total 900,000 m³. This is not a significant amount, as compared with the large quantities required.

Further, alternatives to peat possess some problems. Plants may be infected with fungal disease from wood fibre, and straw and other non-organic materials contain pesticide residues. A majority of German consumers are willing to pay a higher price for peat-free growing media.

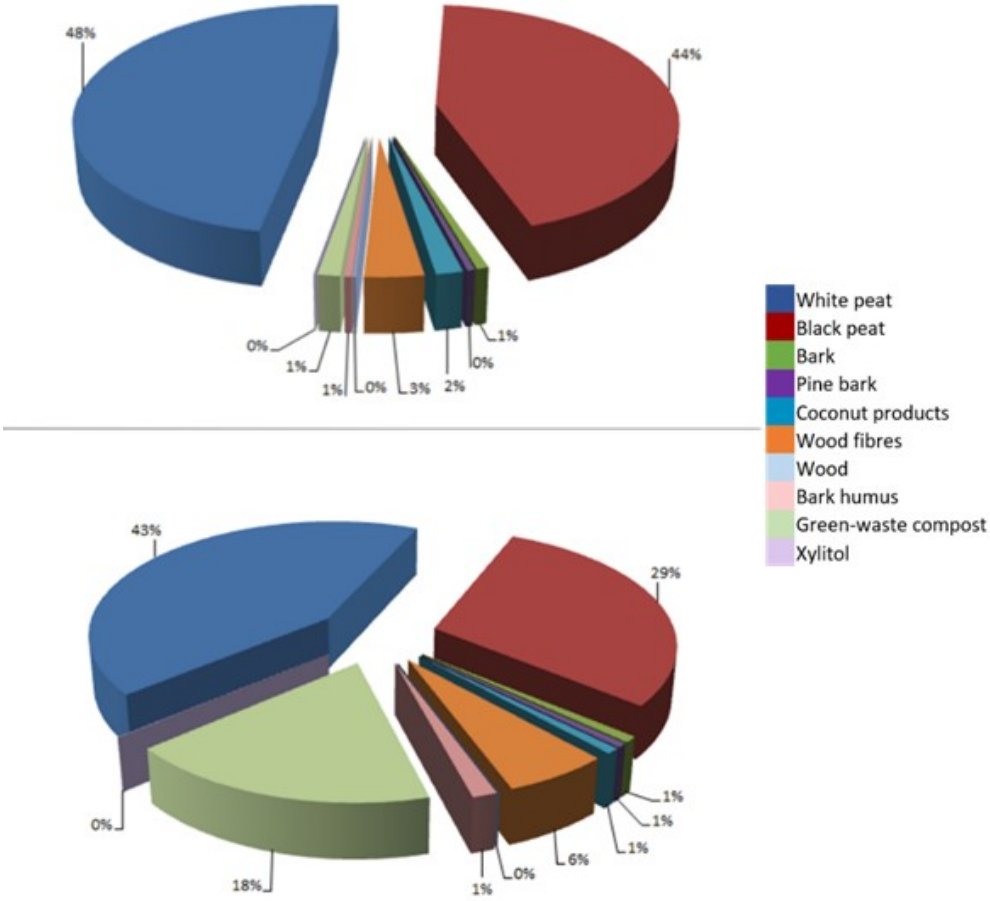

Figure 1. Ingredients used to produce growing media and potting soil.

Table 3 gives an overview of growing media comprising peat and or other materials as well as the respective brand names and manufacturers or sales organisations.

Table 3. Examples of growing media with and without peat, brand name and manufacturers/sales organisations (source aid.de)

Example of peat growing media, "peat" in this case means raised bog peat		
Brand name	**Composition**	**Manufacturer/Sales organisation**
Gepac Baltic Torfsubstrat	slightly to moderately decomposed peat	Einheitserde Werkverband
TKS 1 Instant	strongly and slightly to moderately decomposed peat	Floragard Vertriebs GmbH
Klasmann Substrat 2	slightly to moderately decomposed peat	Klasmann-Deilmann
Klasmann TS 1	slightly to moderately decomposed peat	Klasmann-Deilmann
Examples of peat-clay substrates		
Brand name	**Composition**	**Manufacturer/Sales organisation**
Brill PRO Classic	80% slightly to moderately decomposed peat, 20% strongly decomposed peat, 75 L clay/m³	Gebr. Brill Substrate GmbH & Co. KG
Einheitserde Classic	slightly to moderately decomposed peat, 30 Vol.-% natural clay	Einheitserde Werkverband
Einheitserde Special	slightly to moderately decomposed peat, 10-20 Vol.-% natural clay	Einheitserde Werkverband
Floragard Anzuchtsubstrat	slightly to moderately decomposed peat, Bentonite	Floragard Vertriebs GmbH
Fruhstorfer Erde Typ T	slightly to moderately decomposed peat, Bark humus, Vulcanic clay	Hawita-Gruppe GmbH
Klasmann Tonsubstrat	50% slightly to moderately decomposed peat, 50% strongly decomposed peat, 40 kg Vulcanic clay/m³	Klasmann-Deilmann
Examples for container substrates for nursery stocks		
Brand name	**Composition**	**Manufacturer/Sales organisation**
Gepac Containersubstrat grob	45% slightly to moderately decomposed peat, 20% Bark humus, 30% Wood fibres, 5% Natural clay	Einheitserde Werkverband
Fruhstorfer Erde Containersubstrat	slightly to moderately decomposed peat, Rize husks, Coconut fibres, Vulcanic clay	Hawita-Gruppe GmbH
Klasmann Containersubstrat 1	slightly to moderately decomposed peat, strongly decomposed clay, Peat fibres, Wood fibres	Klasmann-Deilmann
Examples for "Bio" substrates - containing only organic fertilizers		
Brand name	**Composition**	**Manufacturer/Sales organisation**

Einheitserde Bio Topfsubstrat	slightly to moderately decomposed peat, Substrate compost, Natural clay	Einheitserde Werkverband
Gepac Bio Presstopfsubstrat	slightly to moderately decomposed peat, strongly decomposed peat, Substrate compost	Einheitserde Werkverband
Floragard Bio-Topferde	slightly to moderately decomposed peat, strongly decomposed peat, Coconut fibres, Compost, Perlite	Floragard Vertriebs GmbH
Floragard Bio-Presstopferde	slightly to moderately decomposed peat, strongly decomposed peat, Compost	Floragard Vertriebs GmbH
Klasmann Bio Kräutersubstrat	slightly to moderately decomposed peat, strongly decomposed peat, Green-waste compost, Coconut fibres	Klasmann-Deilmann
Klasmann Bio Topfsubstrat	slightly to moderately decomposed peat, strongly decomposed peat, 20% Green-waste compost	Klasmann-Deilmann
Examples for potting soils poor in peat or free of peat		
Brand name	**Composition**	**Manufacturer/Sales organisation**
frux Öko-Blumenerde	30% Bark humus, 30% Wood fibres (organic produced), 30% Clay, 10% Green-waste compost	Einheitserde Werkverband
Florabelle Bio-Blumenerde	With high amount of Green-waste compost	Klasmann-Deilmann
Floragard Torffreie Blumenerde	Xylitol, bark humus, Coconut fibres	Floragard Vertriebs GmbH
Gärtnererde Exclusiv	Bark humus, Compost, Peat, Clay	Stender AG

3.4 Greece

No informant mentioned peat. However, for transplants, peat is most likely used in growing media.

3.5 Italy

No informant mentioned peat for olive, potato and citrus crops. However, in citrus one exception might occur in nurseries with the purpose of seed germination of rootstocks. It is not used as integral growing media, but in mixtures with soil in a range of 10% to 20% of the total.

For tomatoes, peat is generally used in nurseries as growing media of seedlings for transplants.

3.6 Norway

Most organic tomatoes in Norway are grown in bags where peat comprises a significant proportion of the growing media. About 150 m^3 of peat is used per ha and year (15 litres per m^2). Peat is also used in strawberries grown in restricted growing media, but so far this production is not managed organically in Norway. Peat is used in growing media for young apple trees and tomato plants.

Despite the restriction to only use peat for nurseries and marketable pots, the national certification body (Debio) explained in a telephone interview that in practice, no control is made of the peat content in growing media sold for organic growing, or about the actual use of that growing media. Norway has a significant resource of peat and extracts about 100000 tons annually (600000-700000 m^3). Peat is used for roofs, toilets, bedding, and growing media (about 25%). Statistics available at www.ngu.no/upload/Publikasjoner/Rapporter/2016/Mineralressurser_i_Norge_2015.pdf

3.7 Poland

Peat may be used to mix with compost to make a growing media for cucumbers grown in tunnels. Otherwise the use of peat was not mentioned, but tomato producers in Poland purchase transplants, like growers in other countries. Hence, peat is most likely used to raise transplants in Poland as well.

3.8 Spain

Peat is used as growing media for purchased tomato plants, which are quite commonly used, along with transplants of many other crops. Informants for olive and citrus did not mention the use of peat in nurseries of young plants of these crops. However, many nurseries use peat as an ingredient in growing media. Nurseries for production of aromatic plants in containers also use imported peat (from Germany) to raise young plants.

Regarding the importance of peat in pot plant production, a study of nurseries in Catalonia revealed the 63% of the production used peat-based substrates (Marfà et al., 2008). The association APTYS (http://www.aptys.org/aptys.html) gathers significant manufacturers of growing media in Spain. They promote a study on the use of peat, coco fibres and perlite in growing media in Spain, to be completed in 2019.

3.9 Turkey

As mentioned for many other countries, the most significant use of peat is linked to the production of transplants. One informant mentioned that a mixture of sheep manure, soil and perlite could replace peat-containing growing media to raise young trees of olives.

Photo: Farmer in Turkey being interviewed about applied inputs.

3.10 UK

While the EU Organic Regulation limits the use of peat to horticulture the Soil Association (SA) standards further restrict the use of peat (standard 4.7.4). Similar to German growers certified by private standards, SA-licensees may only use peat in growing media for young plants (propagating media) and should use alternatives to peat where possible. Ideally these should be from sustainable UK produced materials. However, we are not aware of farmers using peat in the UK for anything other than for propagation. Our research focused on specialist propagators where we talked to 3 of the 5 main ones in the UK, growers, and compost manufacturers. For growers we were not able to get definitive data on the proportion using peat. Broadly speaking most of the larger growers will be using peat while amongst smaller growers practice is more mixed.

Three major organic propagators of vegetable transplants were interviewed in August 2018. All three companies use peat in organic production. The total annual volumes of peat used by each over the last year is as follows:

- Licensee A used 420 m^3. They grow about 50-60,000 brassica trays a year and estimate to supply around 15-20% of UK organic brassicas.
- Licensee B used 1480 m^3. They supply major growers with a wide range of crops and estimate to supply around 20% of the market for their crops.
- Licensee C used 1200 m^3. They grow about 10% organic and 90% non-organic transplants, so over all they use 12,000 m^3. They propagate 68 million lettuces, 16 million celery/celeriac, and 1.7 million strawberries annually.

Four grower licensees were interviewed about peat use. Two of these did not undertake any propagation and recommended contacting their suppliers (multiple in the UK, and one in the Netherlands). One medium sized grower of 28 ha top fruit (apples etc.), soft fruit and vegetables did undertake their own propagation using a Klassman module compound with 50% peat content. Their estimated annual peat use is 3.36 m^3. One grower interviewed did not use any peat.

Two manufacturers of compost, both licensed by SA were interviewed. One manufactures only 100% peat-free compost and does not supply any major growers. This licensee indicated that *'major growers probably use Klassman*'. The other manufacturer reported that the peat content in their products was around 90%, with estimated peat sales at 315 t/year. However, this company works with a major water company to source peat that has been filtrated/dredged that would get dumped otherwise. They only sell to growers of small-medium size and do not supply any major growers.

The peat used by the licensees interviewed was reported to come from Germany, Siberia, and Cumbria (UK). Reasons cited for peat use across interviewed licensees were largely concerned with the unsuitability of alternatives to peat for blocking purposes and for nutrient uptake. Some comments from our informants:

- "*Peat is essential for propagation*"
- "*There's nothing quite like peat. Various alternatives are not as good. If you can't produce a good plant in a module you won't produce a good crop*"
- "*Use of unsuitable alternatives caused a major organic herb company to go out of business*"
- "*It's the main media source compatible with blocking machinery*"
- "*Lettuce propagation relies on peat pressed blocks*"
- "*I trialled a coir-based compound but had a problem with nutrition. Alternatives need to be able to absorb nutrients, and allow that nutrients to be slowly available to the plant*"
- "*We are looking at coir alternatives for strawberry propagation. Pros are that it's free draining. Cons are that it's expensive*"

The Organic Growers Alliance also carried out a survey in 2015/16 looking at growing media. In response to the question "If you use a peat-based substrate, please tell us why you don't use reclaimed peat or non-peat based substrates. Please tick all reasons that apply", 27% of respondents (n= 15) had not found a cost-effective alternative, and 100% stated that the quality of alternatives was not good enough.

4. The use of plastic for mulching of soil, and otherwise linked to the growing

Whereas peat is at least mentioned in current and future EU regulations with a restriction, the word plastic is not used in EU regulations. In this respect, EU regulations are much less strict than other international standards. Standards in Canada and USA are quite concerned about plastics, e.g. in Canada (GOC 2018), it is not permitted to use plastic polymers for pelletizing of seeds and USDA standards (ECFR 2018) specify that plastic pellets may not be used as animal feed. Further, the standards refer to biodegradable plastic, which makes it relevant here to describe the difference between **bioplastic** and **biodegradable** plastics. Bioplastics refers to materials made from renewable sources, such as maize which is often genetically engineered, which is converted to lactic acid by fermentation. Lactic acid is the most common source of making plastics from renewable ingredients. Biodegradable plastic is often (partly) made from non-renewable materials. Degradation may be increased by addition of chemicals. Oxygen, UV light, moisture and heat increases degradation. Whether such materials can be completely compostable is intensively discussed. Polylactide acid (PLA) and polyhydroxyalkanoate (PHA) are two types of bioplastic which looks and behaves like polyethylene and polypropylene (made from petroleum). Both are completely compostable, but demand agricultural land to source their raw materials. In organic standards in Canada and USA, PAH is accepted whereas PAL is not. This is because the microbial synthesis used to make PHA is seen as a natural process, whereas the chemical synthesis of PLA is not. USDA standards specifically permit (non-degradable, traditional) plastic mulches for weed regulation, but demands that they are removed by the end of the growing period.

The USDA standards further define the word biodegradable, as being subject to biological decomposition into simpler biochemical or chemical components. Further, biodegradable biobased mulch film is defined as a synthetic mulch film that meets the following criteria: (1) Meets the compostability specifications of one of the following standards: ASTM D6400, ASTM D6868, EN 13432, EN 14995, or ISO 17088 (all incorporated by reference; see §205.3) (2) Demonstrates at least 90% biodegradation absolute or relative to microcrystalline cellulose in less than two years, in soil, according to one of the following test methods: ISO 17556 or ASTM D5988 (both incorporated by reference; see §205.3); and (3) Must be biobased with content determined using ASTM D6866 (incorporated by reference; see §205.3). Canadian standards require that non-degradable and semi-degradable materials shall not be incorporated into the soil or left in the field to decompose. Use of PVC as plastic mulch or row cover is prohibited. Biodegradable mulches must be 100% derived from bio-based sources, no petroleum sources, and plant sources and modifying microorganisms may not be from genetically engineered sources. Formulas or ingredients in biodegradable mulches, especially resins, shall be listed in one out of two regulation tables listing permitted inputs to soil amendment and plant production. The product shall not be chemically modified during manufacturing. As for other molecules which are subject to biological degradation in soil, an unsolved question about degradable plastics is whether they are completely converted to CO_2, H_2O and microbial biomass within a «reasonable» time frame, without forming harmful residues or by-products. Further, for the proportion which is possibly integrated in microbial biomass, a relevant

question to ask is whether this microbial biomass is somehow different from other microbial biomass, which might have effects for soil ecology.

Hence, by 2018, biodegradable plastics are in practice banned in certified organic farming in USA and Canada. The Biodegradable Plastics Institute (non-profit organization established in USA in 1999; www.bpiworld.org/) works to allow such use.

Whereas the organic movement in Europe has not yet done much to reduce plastic use in organic growing, other stakeholders have worked hard on this issue. A new European standard, "Plastics - Biodegradable mulch films for use in agriculture and horticulture - Requirements and test methods" (EN17033) was published in January 2018, and the former standard EN 13655 has been revised to cover mulch films that have to be recovered after use, demanding a thickness > 25 µm. The certification system "OK Biodegradable soil" was used as a basis for EN17033. This system demands that 90% of the mass is converted to CO_2 within 24 months in a soil biodegradation test.

Since the use of plastic is not yet regulated in the organic growing certified by the EU, we have in the subsequent text not distinguished between the use of bioplastic and petroleum-derived plastic. Some private standards, e.g. Soil Association (SA) has some requirements (see section 4.10). Plastic is extensively used in horticultural production, for crop protection, to attach crops to poles etc. during growth, for water application (e.g. non-reusable water tubes lasting only for one season), for wrapping of products and as a soil covering mulch. Below, information about plastic use in the Organic PLUS countries is referred per country.

4.1 Denmark

No plastic mulch is used in apple orchards since this would increase the risk of damage from mice and voles. Some growers have invested in plastic roofs for weather protection; costly, but efficient. In broccoli, a mesh (plastic net, fleece) is used to protect early planted crop against frost. In potatoes, plastic is used to cover early potatoes against frost. This plastic may be used 1-3 times before it is discarded. Early potatoes comprise only about 1% of organic potato area in Denmark. About 5% of organic strawberry growers use black plastic for soil cover, to protect against weeds. In tomato growing, the soil is covered by plastic foil in the areas between the double rows of tomato. This foil is used only once, and not recycled. The reason for using plastic is to avoid germination of tomato seeds present in the soil from former growing periods, which could cause infection by tomato mosaic virus.

4.2 France

In carrots, insect nets are made by plastic. In lettuce, the soil is always covered with plastic. Plastic is also used for sheltering e.g. in early and late season. In lettuce, the soil is always covered with plastic, and a part of the production is done under plastic shelter.
In potatoes, small areas may be covered with plastic to support early yields. In aubergine, the soil is often covered by woven tarpaulin, sometime by plastic and rarely no cover is used. Most of the production is as protected growing (non-heated tunnel). In tomato growing, the soil is

covered by woven tarpaulin, which remains for about 10 years, or by plastic film (20 µm), sometimes degradable plastic is used. Some farmers do not use plastic and cover with plant mulch (straw). Between 60% and 90% of the area is covered. Further, the houses or "multichapelles" (combined rows of greenhouses) used for growing tomatoes are usually made by plastic. Plastic is also used for division of greenhouses ("blankets"). Their lifespan is 3-10 years, dependent on local conditions, bleaching against sunlight, use of sulphur etc.

4.3 Germany

Plastic use was reported in tomatoes, where its use was not frequent. One grower described using plastic mulch for tomato, cucumber, eggplant, pepper and zucchini. In open field, mesh nets are used in cabbage.

Plastic foil mulch protects the crops against weeds and frost and increases the availability of local products in early season. As was shown for peat, Naturland, Bioland and Demeter have somewhat stricter regulations than EC 889/208, and suggest using degradable foil instead of plastic mulch for plant protection. Naturland states that the use of PVC is prohibited, whereas polyethylene (PE) and polypropylene (PP) is allowed if removed after use. Recyclable materials should be chosen. Bioland has the equal regulation here, but additionally states that a maximum of 5% of the open area used for growing vegetables may be covered at any one time by mulch foil, mulch fleece or mulch paper. Operations with less than 4 ha of area for vegetables may mulch up to 0.2 ha. Demeter states that the use of industrial mulch materials is allowed with restrictions.
There is no data on the amount of plastic foil or degradable foil which is used each year. Waste disposal companies have arrangements for farmers to dispose their plastic waste. However, there is no obligation for farmers to document the amount of plastic foil they use or discard.
Biodegradable plastic materials from maize and potato starch have been available in Germany for several years. In a statement in 2016, the Bavarian State Ministry of Agriculture and Forestry concluded that a mandatory use of biodegradable plastics was not yet to be recommended, since these materials have substantial weaknesses for practical use. The degradation is either too slow or too fast and does not occur completely. The material decays into small pieces which remain in the field.
Plastic mulch is most commonly used in asparagus, cucumbers, pumpkins and zucchini. All these crops comprise a minor proportion of the total vegetable area (Figure 1). In small-scale, intensive vegetable and fruit production, plastic foil is also used with strawberries and lettuce. With all crops only plant rows are covered (80-100 cm of soil is covered; less than 45% of the cultivated area). To estimate the use of plastic mulch in German vegetables, we may assume that the 45% of the area of asparagus, cucumbers, pumpkins and zucchini is covered by mulch foil. This implies that about 10500 ha of asparagus, 2000 ha of pumpkins, 500 ha of zucchini and 70 ha of cucumbers is covered, in total about 13000 ha per year.

If we assume that the proportion of various vegetables is the same within organic growing as shown in general, plastic mulch is used on about 1200 ha of organically grown vegetables in Germany.

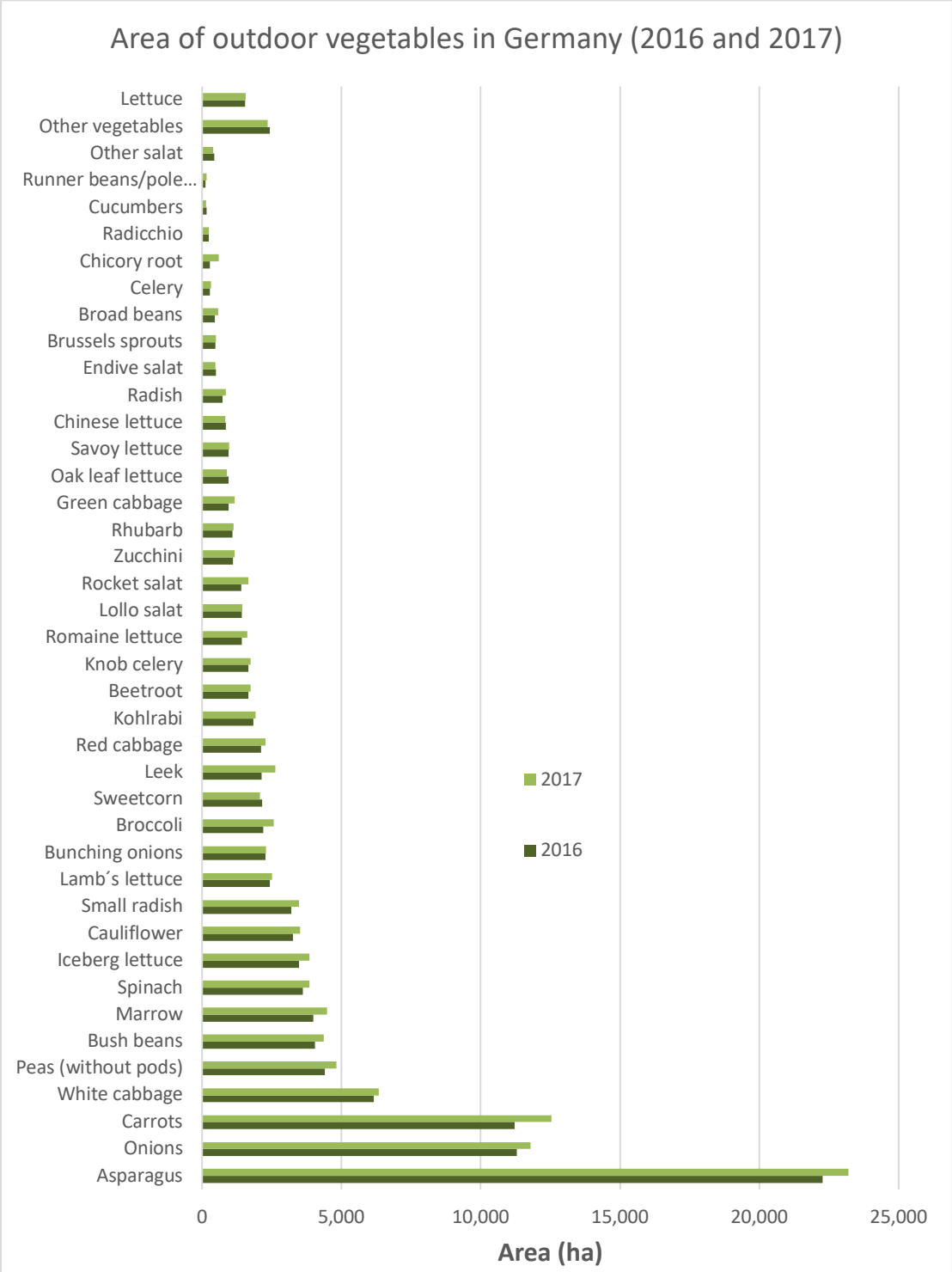

Figure 2. Area used for vegetables in Germany. Source: https://de.statista.com/statistik/daten/studie/29314/umfrage/anbauflaeche-ausgewaehlter-gemuesearten-in-deutschland/ (in German).

4.4 Greece

White-and-black plastic is used to mulch the soil in broccoli in open field and in greenhouse growing crops. Polyethylene is used as greenhouse covering and is changed every three to four years.

4.5 Italy

Plastic use is mainly reported in tomatoes. White-and-black plastic is used for soil mulching in the greenhouses and changed between each cultivation period. Plastic is also used as greenhouse coverings. The transparent plastic film (with EVA 12%) is changed every two years. Plastic for mulching of soil is never used in citrus groves. The only mentioned use of plastic is for wrapping around the trunks of citrus plants for the first 3-4 years.

4.6 Norway

Woven plastic has been tested as a ground cover in apples, but caused problems with mice, water voles (*Arvicola amphibius*) and ants. Fibre nets (meshes) made from plastic are used for early cultivars of carrot and potato. In strawberries, black polyethylene 0.05 µm is used for soil mulching up to two seasons. Thicker degradable plastic (30-40 µm) may also be used, against weeds. Mesh (fleece) is used to protect against frost. Insect nets have been tested but reduce pollination and make damage to plants. In tomato, growing bags are made of plastic, and plastic is also used to cover the ground under the bags. Trials have been made with degradable bags. In Norway, greenhouses for tomato are not made of polyethylene plastic (PP) but from glass or rigid plastic. Tunnels for berries are made from PP.

4.7 Poland

Plastic is used for tunnels to grow tomato and cucumber, and also for materials to attach the plants such as strings. Plastic is not used as soil mulch in tomatoes, but may be used for cucumber. Plastic foil is used by some growers for mulching of soil in strawberries; however, mulching with straw is more common (3-5 cm cover, using 4-5 tons of straw per ha). If this straw is derived from non-organic production, it may also be a contentious input. Fibre cloth may be used to protect against frost in strawberries, g.e. Pegas Agro 19 g/m^2 for early season and 23 g/m^2 for autumn-winter season.

4.8 Spain

Plastic as a soil cover, or geotextiles, may be used in new plantations of citrus, however with mixed experience. Citrus plants are not available as a certified organic product, and the plantation is converted two years after planting. Plastic to cover soil was also mentioned in olives, to avoid water runoff. Greenhouses for tomato are usually made from plastic. Transparent plastic (polyethylene) for solarisation (to control weeds and disinfect topsoil) is used by most tomato growers, as well as plastic mulch to control weeds, but not so frequently. Materials used for attaching plants to roofs etc. such as strings and clips, are often made from plastic. For trees which are grafted, plastic may be used to protect the wound.

4.9 Turkey

In strawberries, the whole area is usually covered by plastic mulch. Small-scale growers may use straw.

4.10 UK

The Soil Association (SA) has some standards to regulate the use of plastic in organic farming which resembles the American standards cited above. Plastic mulches are permitted but must be made only from polyethylene, polypropylene or other polycarbonates (standard 4.10.3). Plastic waste must be recycled or disposed of appropriately (standard 4.5.37) and must not be burnt (standard 4.5.38). For any structures that require plastic covering, such as polytunnels, the plastic covering must be based on polyethylene, polypropylene or other polycarbonates (standard 4.5.39).
It is estimated that the majority of SA horticulture licensees use significant quantities of plastic in their operations. Plastic has become an essential component of modern agriculture systems and processes. In many cases, suitable alternatives do not exist in sufficient quantities on the market, or where they do exist would place the licensee at a significant competitive or cost disadvantage. It is predicted that plastic use in farming will receive increasing public and private attention in the UK in the near future. Public awareness of plastic pollution is at an all-time high, and there is significant NGO and political activity in this space in 2018.
Two grower licensees and one propagator licensee provided information on plastic use. The main uses of plastic cited were:

Plastic mulch
Two interviewed growers use photodegradable plastic mulch made from corn starch:

- One grower stated it photodegrades in sunlight in to water and CO_2. They cover around 80 ha a year. They use it for leeks, sweet potato & courgettes as a tool to make weeds germinate.
- Another grower stated they use 100% compostable starch film from Belgium or the Netherlands. It gets composted and totally disappears. They use around 120,000 m^2/year for all vegetable crops such as spinach and onions (not root vegetables). It is a standardised system and they raise all modules through film.

Two interviewed growers use clear plastic that is recycled:

- One grower stated all early crops are covered in clear plastic. This is either re-used or recycled in to garden furniture.
- One grower stated they use plastic as crop cover for carrots. They grow 146 ha of organic carrots per year.

Irrigation tape
One grower talked about irrigation tapes laid under films – stating "*that's probably the worst bit*". These are very thin plastic tape with little drippers. These are single use as they would leak if reused. They use about 120 km per year and send it off for recycling.

Woven ground cover

One grower said strawberries and soft fruit are grown through Mypex – a woven ground cover, which they re-use probably 2-3 times. It lasts for about ten years. This is very low grade recycled plastic that is not left in the soil.

Plastic module trays

One grower said trays are reusable and have a life of 10 years or more. They only send them to landfill when broken.

Crop Covers

Fleece and mesh are used by most growers to a greater or lesser extent. Fleece is becoming less common as it rarely lasts more than one year, while good quality mesh will last for as much as 10 seasons. As new pests (for instance leek moth) reach the UK, growers are covering an increasing number of crops with mesh.

5. The use of commercial fertilisers

The analysis of fertiliser use was conducted with the aim of revealing the types, rather than the amounts, of fertilisers being applied for important crops in various countries. Some compound fertiliser products include calcium. Other application of calcium was considered as liming and is not further referred here. Applications of micronutrients has not been described here, because this constitutes a special field within fertilisation.
However, one should be aware that application of copper for fertilisation is permitted and may occur on leaves, e.g. of fruit trees. The primary reason for its use, however, may be the need for copper as a plant protection agent. This may be a challenge if copper application limits for plant protection are reduced in regulations and standards.
Even if green manure is not a commercial fertiliser, its use has been referred when it was described by our informants.

In some countries (Italy, Norway, Poland), public websites are available where all fertilisers approved for use in certified organic growing in that country are shown. We have provided links to these websites.

Interesting differences were found between countries. Whereas in some countries, e.g. Denmark, Germany, Norway, Poland and Turkey, only a few commercial organic fertilisers were mentioned, other countries, especially Greece but also Italy and Spain, described a broader use of many different fertilisation products. A tick (x) in a table below does not indicate that all types of fertilisers are used in this crop, but that these types of fertilisers were mentioned as relevant for this crop.
When commercial names of fertilisers were mentioned, internet searches were made to reveal the raw materials used to produce them. However, in several cases this information was not available. Plant based products seem to be more common than animal-derived, and vinasse from the production of sugars seems to be an important raw material for several plant-based fertilisers. Seaweed products were frequently mentioned, especially in southern countries, whereas fertiliser derived from fish was only mentioned from UK. Whether the animal manure applied was from certified organic production or not, was not always mentioned.

5.1 Denmark

In Denmark, the fertilisation is based on manure and slurry, sometimes from none-organic farms (Table 4). The amount of other commercial inputs listed by the informants was quite restricted, and mainly comprised vinasse (residual product from the production of sugar) and protamylasse (residual product from the production of potato starch). Especially the use of protamylasse from non-organic potatoes is questioned, because conventional potatoes are heavily treated with pesticides and residues are likely to remain in the fertilizer product. Some mineral fertilisers are used when deficiencies indicate a significant need. One product made from animal materials (bone meal and pig bristles) was mentioned, and compost from urban waste is used in apples and cereals. The Danish company DAKA produces fertilisers for organic growing with the label “Øgro”; www.daka.dk/dk/daka/ogro/oegro-produktoversigt/

Approved fertilisers for organic growing are published (in Danish) in a regularly updated Exel file maintained by SEGES, found at:
www.landbrugsinfo.dk/Oekologi/Planteavl/Goedskning/Sider/oe_17_3694_opdateret-version-vaerktoej-til-valg-goedninger.aspx

Table 4. Fertilisation products mentioned by informants in Denmark for relevant crops grown organically. O indicates slurry or manure from certified organic animals, whereas NO indicates slurry or manure from not certified organic animals.

	Farmyard manure	Chicken manure	Alfalfa pellets	Vinasse, protamylasse	Patentkali	Kieserite	Mn sulphate	Bone meal " ØGRO"	Compost from urban waste
Apple		x, O or NO		x					x
Broccoli	x			x		x			
Cereals	After clover ley, often no fertilisers. x: slurry, often NO* Max 50 kg NH4-N/ha from external source.			x	x*		x*	x	x
Potato	x: slurry, O or NO			x	x				
Strawberries	x: NO pig slurry 80 kg N/ha in planting year, sometimes also after harvest 30 kg N/ha								
Tomato	x: O cow manure, composted with grass cuts and wood chips		x						

* sprayed if needed

5.2 France

Advisors comment that tomato plants would benefit from more fertilisation. The system which comes most close to conventional tomato production is liquid fertilisation, where beet vinasse and/or seaweed fertilizers are used (Table 5), and excess liquid recycled.
For potatoes, fertiliser application may be reduced if the pre-crop is a green manure.
For lettuce, excess N is often a problem and soil mineralisation of N is often enough for the crop's need.
The most important commercial fertilisers used for tomato in France are Bochevo and Vegor from the French producer Huon fertilisants organiques, and DCM EcoMix from the Belgian fertiliser company DCM. Bochevo is composted manure from cattle, horses and poultry, enriched with marine-derived calcium. VEGOR 70 consists mainly of lignocellulosic plant meal enriched with farm manure, composted at 70 °C. DCM offers several Ecomixes with different proportions of N, P and K. More information is available at www.ets-huon.com/fr/9-etablissements-huon/fertilisants.html and https://dcm-info.com/en/products/fertilisers

In France, there is no public list available for approved fertilisers.

Table 5. Fertilisation products mentioned by informants in France for relevant crops grown organically

Product/Crop	Cattle manure	Green manure	Fertilizer pellets	Dehydrated manure pellets	Feather flour	Pork silk	Blood meal	Beet vinasse	Mineral potassium fertiliser, patentkali	Complete organic fertiliser, e.g. 6 3 12	Natural phosphate	Seaweed fertilizer
Carrot	x*		x									
Eggplant												
Lettuce (different types)		x										
Olive										x#		
Potato	x*											
Tomato	x+		x	x	x	x	x	x	x	x	x	x

* preferably composted

+ sometimes composted

in spring

5.3 Germany

German organic farmers seem to purchase small amounts of fertiliser inputs, except for tomatoes (Table 6). Maltaflor is derived from roots and shoots of malting barley, and is produced in Germany by Maltaflor Düngemittel, which was acquired by the Dutch company Culterra in 2015. Florapell is made by Biofa company, from sheep's wool.

Table 6. Fertilisation products mentioned by informants in Germany for relevant crops grown organically.

	Animal manure (own farm)	Non-organic manure	Com-posted manure	Horn meal	Maltaflor	Florapell	Sulphur	Phosphorus
Cabbage			x	x				
Cereals	x	x					x	
Potato	x							x
Tomato			x	x	x	x		

In Germany, lists of approved fertilisers (and other permitted inputs) are published by the private research institute for organic farming, FIBL (Forschungsinstitut für biologischen Landbau on the website www.betriebsmittelliste.de/de/bml-startseite.html. Naturland and Demeter have their own lists which are somewhat stricter. These lists are available at www.naturland.de/images/Erzeuger/Service/Antraege_Listen/BML_Naturland_Verbandsliste_2018.pdf and www.demeter.de/sites/default/files/richtlinien/richtlinien_betriebsmittelliste.pdf .

5.4 Greece

All crops described in Greece use imported fertilisers (Table 7), commonly from Italy where there is a big industry producing fertilisers from various organic and mineral materials. Usually, solid fertilisers are used for preparing the soil before planting and liquid fertilisers are for application on the canopy during growth.

The Greek Ministry of Agriculture Development and Food (www.minagric.gr) maintains a register of fertiliser manufacturers, and a register of fertilisers for non-organic and organic use. This information is available (in Greek) at: www.minagric.gr/index.php/el/for-farmer-2/crop-production/lipasmata/278-mitroa. A registration to the register of fertiliser manufacturers must be requested by the manufacturer before placing the fertiliser on the market, communicating the object of their activity and specifying, in addition to the personal data, the data necessary to allow monitoring of the preparation and trade, such as the production sites and the categories of fertilisers to be registered, as described in: www.minagric.gr/index.php/el/for-farmer-2/crop-production/lipasmata/282-edypadikailogitika and www.minagric.gr/index.php/el/for-farmer-2/crop-production/lipasmata/928-nomothesialipasmaton

Table 7. Fertilisation products mentioned by informants in Greece for relevant crops grown organically.

Product/ Crop	Poly-sulphate, or K-Mg sulphate	Bioilsa	Chicken manure	Animal manure	Dualspore activator	Betabio full	Azomin	Top-N	Potassio biologico	Agrimartin Fe biologico	Femvigor	Axion-N	Macrocystis	Copper sulphate	Plant extracts on leaves: nettle, seaweed
Apple			x											x	
Broccoli	x	x	x			x	x								
Citrus			x											x	
Potato										x	x	x	x		
Olive	x			x											x
Tomato	x				x	x	x	x	x						

Before planting:

POLYSULPHATE: Polysulphate is the commercial product name of fertilisers derived from polyhalite bedrock. The chemical formula is $K_2Ca_2Mg(SO_4)_4 \cdot 2H_2O$; hence this mineral fertiliser contains 48% SO_3, 14% K_2O, 6% MgO and 17% CaO. Polyhalite is extracted from below the North Sea in UK and is a solid product. Further information is available at www.polysulphate.com/introducing-polysulphate/

BIOILSA: Bioilsa is a solid N fertiliser made from hydrolysis of animal hides, approved for use in certified organic growing and applied before planting. The ILSA company, established in Italy in 1956, has worked with utilisation of nitrogen in collagen derived from animal hides since the beginning. The product "Agrogel", gelatine for agricultural use, is the basic product of ILSA. Products are solid and offered as powder, microgranules and macrogranules. ILSA also offers several liquid products. The company has three production facilities, two in Italy (Arzignano by Vicenza and Molfetta by Bari, and one in Brazil (Porto Alegre). Further information is available at www.ilsagroup.com/en/prodotti/prodotto/93/bioilsa.htm

Chicken manure may be e.g. NEOGEN, 65% organic matter, 10% humic acids, 20-30% humidity, no further info about fertiliser contents is available.

DUALSPORE ACTIVATOR from www.msbiotech.net/prodotti/activator/ Activator consists of an organic base of highly humified vegetable origin. According to product information, 50% is peat. The product further consists of selected microbial strains, which are aimed to rebalance the soil microflora, especially in case of soil damaged by sterilizations and/or chemical treatments. The product has 25% of dry matter as organic C, 7% of DM as humic and fulvic C, 12% as organic N and a CN ratio of 20.8. The content of rhizosphere bacteria is 1 x103 CFU/g, and the salinity 65 dS/m.

AGRIMARTIN Fe BIOLOGICO: Derived from composted sheep manure, this solid product is made by the Spanish company Fertesa-Agrimartin. Further information available at: www.agrimartin.com/_en/catalogo.swf

Greek company of organomineral fertilisers: www.bhp.gr/en/products-en/organic-products.html
FEMVIGOR is a fertiliser complex, no further info about fertiliser contents is available.
Axion-N Link www.agrola.gr is a nitrogen powder which contains amino acids from hydrolysis of animal proteins. Composition: Total organic nitrogen (N) 14%, Dry matter 95%, Organic carbon (C) 40%, Total proteins 87.5%.

During growth:
BETABIO FULL: This is a liquid fertiliser, produced in Italy by ED&F Man Liquid Products from residues of molasses (side product from sugar) and other plant-based ingredients, such as phytates from seeds and dried fruit as a source of P. The standard product BETABIO contains 2.5% total N (all organic), 5% K_2O and 28% organic matter, whereas Betabio full contains 3%N, 4%P and 3% K. Further information is available at http://edfman.it/images/pdfs/organic-biostimulants-EN/Betabio-Full.pdf
AZOMIN: This is a liquid N fertiliser, derived from animal tissues, with 5% total N, where the most (4%) is organic N. It also contains 10% organic C of biological origin. The producing (Italian) company is CIFO. CIFO and ILSA cooperate closely under the brand of Biolchim. Further information is available at: www.cifo.it/prodotto/agricoltura-professionale/prodotti-ap/organici-e-organo-minerali/liquidi/concime-organico-azomin/?frc=225
Potassio biologico, K-BIO, NPK 3-5-10 (15C org.)
Further info: http://k-adriatica.it/www.k-adriatica.it/b2bipad.k-fert.it/psadr3/source3/Documenti/Schede%20tecniche/030510%23D%23Technical%20sheet%23en.pdf

5.5 Italy

Commercial fertilisers for organic farming are available from many domestic companies, such as SGS Consorzio and Serbios, where various types of liquid organic N, e.g. Nifert, Protamix, Kappabios, Dominus are produced from hides, vegetable materials and additional minerals (Table 8). In citrus plantations, especially while trees are young, faba beans are grown between tree rows as a green manure.

The Italian Ministry of Agricultural, Food and Forestry Policies (MIPAAF) maintains a register of fertiliser manufacturers, and a register of fertilisers for non-organic and organic use. This information is available (in Italian) at www.sian.it/vismiko/jsp/indexConsultazione.do. A registration to the register of fertiliser manufacturers must be requested by the manufacturer before placing the fertiliser on the market, communicating the object of their activity and specifying, in addition to the personal data, the data necessary to allow monitoring of the preparation and trade, such as the production sites and the categories of fertilisers to be registered.

Table 8. Fertilisation products mentioned by informants in Italy for relevant crops grown organically.

	Cattle manure	Vinasse products, e.g. Kappabios (it: borlanda)	Organic N fertiliser, e.g. Nifert, Protamix, Dominus	Amino acids, foliar spray	K sulphate
Citrus	x	x	x	x	x
Olives	x			x	
Potato			x		x
Tomato			x	x	x

5.6 Norway

The most common commercial fertiliser product is dried poultry manure from non-organic farms (Table 9), which comes from two fertiliser companies and is marketed as “Marihøne” (lady beetle) or “Grønn FK” (green FK). Both products may be enriched with non-organic meat and bone meal. During growth, a solid leaf fertiliser may be applied, such as PHC Organic Plant Feed, made from sugar cane molasses (vinasse). PHC (Plant Health Cure) is a Dutch company. Pioner Complete 6-1-3 organic fertiliser is used in strawberries. Pioner is produced by the international chemical company Azelis, from plant materials.

Table 9. Fertilisation products mentioned by informants in Norway for relevant crops grown organically.

	Animal manure	Composted manure	Dry poultry manure	Vinasse products	Grass cuttings from between rows	Liquid fertiliser with N and K	Supplementing fertiliser, plant-derived
Apple	x	x	x		x	X	
Carrot	x	x	x	x			
Potato	x	x	x	x			
Strawberry	x		x	x			x
Tomato	x		x	x			

A list of inputs (in Norwegian: “driftsmiddel”), including fertilisers approved for use in organic production by the Norwegian Food Safety Authority (NFSA) is available in Norwegian here: https://debio.no/driftsmiddelregisteret/#gjodsel-og-jordforbedringsmidler
A registration in this database is voluntarily, and it is the responsibility of the individual producer or distributor of any input to apply with NFSA for an approval for use in certified organic production.

5.7 Poland

The use of commercial fertiliser products specialised for organic growing seems to be quite modest in Poland (Table 10). Although, there is a number of various commercially available fertilizers for organic agriculture permitted for use. The list of those fertilizers is issued by the State Research Institute – the Institute of Soil Science and Plant Cultivation and is available on line http://iung.pl/images/pdf/Wykaz_ekologia.pdf (updated, 2018). Most producers rely on

manure and compost made from manure, supplied with mineral fertilisers. Several mineral fertilisers were mentioned. Only one commercial product designed for use in organic growing was mentioned, Florovit, made by the Polish company GRUPA INCO. Florovit Agro Bionawoz is a liquid fertiliser certified for use in organic production, contains free amino acids and betaines and is claimed to be of vegetable origin. A solid product, Florovit AGRO Kompost granulowany contains "humus" (or possibly, composted organic material). More information is available at:
www.florovit.pl/eng/pro/produkty/strona/1?data%5BFilter%5D%5Bterms%5D%5Bflorovit-nawozy-pro%5D=31

Table 10. Fertilisation products mentioned by informants in Poland for relevant crops grown organically. O indicates slurry or manure from certified organic animals, whereas NO indicates slurry or manure from not certified organic animals.

	Farmyard manure (dairy cow, poultry)	Composted manure	Mineral fertilisers	K sulphate	Phosphate	Mg fertiliser	Maccerated nettles (*Urtica dioca*)	Green fertilisers (lupin, lucerne etc.)	Florovit
Cucumber	x			x	x	x		x	
Potato	x	x	x	x	x				
Strawberries	x, O or NO	x, O or NO		x					
Tomato			x	x	x		x	x*	x

*composted

5.8 Spain

For tomato, it is common to incorporate manure and other organic materials into the soil of the polyethylene covered greenhouses every 3-4 years. It is most common to use only liquid fertilisers (Table 11). Plant debris from tomato may be buried with plant residues from Brassica between rows in summer, as a means of biofumigation, which will also release nutrients.
Application of seaweed extract was mentioned by several informants, especially in citrus, e.g. Göemar extract which is made in France, from laminaria seaweed.
Solorganic Plus is made by the Spanish company Inagroagricola. Information about raw materials was not revealed. Other mentioned products were not identifiable by internet search.

Table 11. Fertilisation products mentioned by informants in Spain for relevant crops grown organically.

Product/ Crop	Plant debris	Manure, possibly composted	Liquid organic fertiliser	Composted sheep manure	Mulched grass cuttings	Organic N fertiliser pellets	Seaweed extract	Potassium sulphate	Mg sulphate	Solorganic Plus 1.3%N, 4.2%K	Organicum 14-1-1	Fertiliza complex 2-0-10	Fox 20 Organic phosphorus
Citrus		x	x	x	x*		x	x	x		x	x	x
Olive		x				x		x					
Tomato	x	x	x					x	x	x			

* NB irrigation water contains nitrate

Fertilisers approved for use in organic production can be found at the Intereco website (http://interecoweb.com/insumos-certificados/). INTERECO is a Spanish association that gathers the public monitoring authorites in organic production. They are in charge of the certification process of inputs in organic production. In addition, for each autonomous community there are technical rules that allow to specify local issues. As for other countries, the main regulatory framework is the European Regulation 834/2007, article 12 (and Annex 1), European regulation 889/2008, article 3 and the Regulation EU 354/214 (changes in the Annexes).

5.9 Turkey

Whereas in Greece, the organic growing seems to be quite commercialised, with several fertiliser inputs, in Turkey very few commercial inputs were listed (Table 12). This is mainly because the farms are usually small-scale, and the farmers cannot afford to purchase these products. Interestingly, this was the only country where compost tea and commercially available vermicompost was mentioned, for several crops. It is also interesting to note that medical and aromatic plants and residues from commercial crops are used to mix with farmyard manure to prepare composts for fertilisation.

In addition to several small-scale farms, there is a contracting system between 5-6 big organic product export companies of Turkey and organic family farmers. Further, the TATUTA farms of BUGDAY Association and some permaculture farms are also found. The data described here mainly covers the Aegean region, where organic farming started around 1990. The farmers in this region are usually authorized by MFAL control and certification bodies and Family organic farms of Izmir province.
In Turkey, there is no public list available for approved fertilisers.

Table 12. Fertilisation products mentioned by informants in Turkey for relevant crops grown organically.

	Compost made from plants + farmyard manure	Composted animal manure	Commercially available vermicompost	Compost tea	K-fertilizer	Green manure, vetches or vetch + barley
Citrus	x					
Olives		x				
Potato	x		x	x	x	
Strawberry		x		x		x
Tomato	x	x	x	x	x	x

5.10 UK

The use of mineral fertilisers and supplementary nutrients is restricted under Soil Association standards (standard 4.8.3). With approval, licensees may use the supplementary nutrients listed below to treat severe deficiencies:

- sulphur and trace elements
- basic slag (containing calcium phosphate)
- meat, blood, bone, hoof and horn meals, but only in propagating compost
- wool shoddy, only when not in direct contact with the crop
- fish meals, provided they are free from non-permitted substances and only in protected cropping, propagating composts or for perennial crops
- calcium chloride, only for bitter pit in apples
- industrial lime from sugar production.

Soil Association Certification Ltd (SACL) approves the application of supplementary nutrients case by case, and data has been provided on the permissions received between August 2017 and August 2018. From 143 permissions, the vast majority was about using copper for plant protection, or ferric phosphate against slugs. Three permissions were given for use of basic slag, one for anaerobic digestate to grass silage, two for fish-based fertiliser (NuGro 8-7-7), five for various potassium fertilisers, six for general fertilisers (Organic Natural 2.0, PHC 9-2-2, Dunns natural, Better Grass Extra) and 11 for high N fertilisers.

Two interviewees commented their use of commercial fertilisers, such as rock phosphate which has *"kind of died out. It's not soluble so you won't find it in liquid form. Used a small amount of it. Half a ton, 14/15 years ago. Use it every time plant trees in orchard. Still got half of it left. Don't know if makes a lot of difference. Will depend on the soil, whereabouts in the country you are. Any soil deficient in phosphorous. Lucky in Herefordshire as the soil is marvellous. Phosphorous is associated with perennial crops with big rooting systems. Fen land soils lack certain minerals*." Another interviewee uses rock phosphate for phytoplant growth.

Fertiliser companies Law and ILEX are both based in UK and offer a range of products approved for use in organic growing. Informants consider them to be a very potent compound, and a

very simple way of applying nutrients. The products are plant-based, but the company websites do not contain further information about the origin of the raw materials. Pelleted dry chicken manure is available as a commercial product, e.g. labelled Greenvale Plant Food (formerly, Rooster). Manure from animals which are not certified as organic, is essential for organic growers. Horse muck from local stables is a popular product among organic farmers. Green waste compost and anaerobic digestate are also used.

In UK, certifying bodies publish lists of permitted fertilisers. For Organic Farmers and Growers, it is found here: http://ofgorganic.org/approved-input/?app-in-category%5B%5D=358&term=&company_id For the Soil Association, here: https://www.soilassociation.org/media/13706/fertiliser.pdf . However, this mainly covers the products that have been approved specifically. Other products may be allowable for use, growers can ask and the certifying bodies will look at the ingredients to assess that product. New products keep coming on the market and it is quite a job to keep up with it all.

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

Annex to deliverables D3.1 and D5.1: Version 1.1

Tables describing the use of various inputs during organic growing of important horticultural and arable crops across Europe.

Versions

Version: 1.0 (September 2018) First version

Version: 1.1 (31 October 2018) Text updated with latest information.

Funding

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No [774340 — Organic-PLUS]

Project Details:

Programme: **H2020, SUSTAINABLE FOOD SECURITY – RESILIENT AND RESOURCE- EFFICIENT VALUE CHAINS**

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**

Lead authors:

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Deliverable Details

WP3 PLANT and WP5 SOIL

Task 3.1 and Task 5.1

Table of Contents

1. Summary

This Annex presents the results of the survey carried out in the frame of Tasks 3.1. and Task 5.1. A common table/questionnaire for both tasks was used in order to map the use of contentious inputs linked to plant protection (mainly Cu, S and mineral oils), and the use of peat, plastic and fertilisers used in growing, in 10 countries participating in Organic-PLUS (Denmark, France, Germany, Greece, Italy, Norway, Poland, Spain, Turkey and UK).
The survey was carried out mainly by interviewing one to three experienced advisors per crop, asking them to fill in a table describing a typical organic production of the relevant crop, emphasising the use of various inputs. An accompanying letter was used along with the questionnaire to explain the aim of this work, as presented below:

Organic Agriculture: Mapping the use of inputs in specific crops
This is a survey among … (e.g. fill in: advisors within extension service…/standard organisation/other «expert»), carried out as an activity linked to the project «Organic PLUS»: Pathways to phase-out contentious inputs from organic agriculture in Europe. Contact: (name of person making the phone call and/or sending the e-mail).
Within the work package ***«Plant»,*** *we are especially interested in the use of copper, minearal oil and sulphur as plant protection measures. If possible, we also like to record other plant protection measures such as commercial beneficial organisms. Further, we are interested in whether growers and advisors are discussing, or if you have proposals for, alternatives for copper, paraffin oil and sulphur.*
With the work package ***«Soil»,*** *we are mapping the use of plastics, especially for soil mulching, and further the use of peat in growing media, and animal-derived fertilisers such as manure from non-organic farms, meat and bone meal products and similar animal-derived materials. Also for these materials (plastic, peat and fertilisers) we aim at mapping the typical use in some important crops. Further, we like to know if growers and/or advisors have proposals or ideas for better solutions.*
Please fill in the table below as detailed as you can, for the crop(s) that we have agreed about (possibly specify these crops, or list them in the table!) based on your general knowledge. We want to get information about at least 3-5 important crops, where a majority of the decribed growing inputs are used. In the project, we have an emphasis on aubergine, potatoes, tomatoes, citrus, and olives. If these crops are grown in your coutry, they are of special relevance to map. For other countries, look for crops using the most of inputs.
The mapping will be conducted in Denmark, France, Germany, Greece, possibly Italy, Norway, Poland, Spain, Turkey and United Kingdom. A report describing the results will be produced, and we will be pleased to send it to you.
Thanks a lot for your kind and very valuable assistance!
Here follows an example for organic growing of strawberries in Norway. Thereafter, an empty table for you to fill in. Please copy it if you fill in for more crops.
On behalf of the Organic PLUS project, NAME and CONTACT DETAILS for the contact person in COUNTRY

For Poland, the information was based on inputs recorded by a simple web survey from several producers. For UK, information was not compiled in crop tables. Instead, the largest organic growers' association, Soil Association (SA) interviewed several growers, and analysed the permissions to use restricted inputs that were given in one year. The information provided by SA is also included in this report. The collected raw material is presented in in the following sections. Note that the names of the experts, consultants and growers interviewed are not presented to allow anonymity for the data given.

2. Annex I-Tables used for data collection

2.1 Denmark's Annex I-Tables

Name and position/title/function of the person filling in: consultants	
Region to which the information applies: Denmark	
Crop	*Apples*
Propagation material	No organic plant material is available, so conventional is used. Varieties: Discovery, Red Aroma, Santana, Alkmene, Rubinstein, Topaz and Holsteiner cox.
Cultivation system	Organic apple-orchards can be very intensive with 2500-3000 trees/ha on M9 or they can be more extensive with 400 trees/ha on M7 or A2 and everything in between. A few growers are using a plastic-roof above the tree row to protect the trees from rain and thereby avoid fungus-diseases (scab).
Fertilisation	The level of nitrogen is kept rather low in organic apple trees in Denmark, to prevent fungus-diseases. There is added about 40 kg N/ha/year, but given in the tree-row. Often the fertiliser is dry chicken manure from conventional or organic farms. Some farmers also add dry vinasse as a potassium-fertiliser. Some farmers also add micronutrients, if their leaf-analysis are showing a deficiency. Often there is added compost to improve the soil, either from municipal waste or from mushroom-production (very little N) Some apple growers are also egg-producers using the orchard as a chicken-run. These orchards are often fertilized too much because of the chicken manure and they are experiencing more fungus-disease problems.
Crop protection	The main crop protection is the choice of robust varieties. Jonagold and Elstar are hardly grown organically in Denmark because of their disease-problems. There are two groups of organic apple-growers in Denmark. Those who owns and uses a mist-sprayer (50%), and those who do not spray at all. The first group is mainly spraying with sulphur. Depending on the rainfall in spring, they might spray up till 25 times during the season. But normally less. The doses is around 4-6 kg/ha before flowering and 2-4 kg/ha after flowering. Copper as a plant protection-agent is not allowed in Denmark. Copper-fertilizers are legal, and in some cases, if leaf-samples are showing a Copper-deficiency a Copper-spray at green tip is added. Both groups of growers are using pheromone dispersion against apple codling moths and others fruit moths. The spraying group will also if necessary use Neem against red apple aphid and pyrethrum against apple sawfly. The growers in the non-spraying group are putting up white sticking-plates against apple sawfly. Flower-strips are also popular to feed the natural enemies. No use of mineral oil.

Plastics:	No plastic-mulch is used, while the trees then are eaten by mice and voles. Plastic-roof is as mentioned, sometimes used. Until now mainly at an experimental level. It works very good, but is also a big investment.
Peat:	no
Yields and harvest method:	7-20 ton/ha in average depending on the cultivars, soil, irrigation, age of trees, season, spraying or no spraying. Lowest yield in the non-sprayed group. But then they often sell the discarded apples to juice- and cider-factories
Machinery	Soil preparation before planting: Harrowing, harrowing, harrowing, ploughing and harrowing (to wipe out perennial weed). Establishing of support-system (poles, wires etc) requires some machinery to put down the poles and to make the planting-holes. Every year (during the app. 15 years of cultivation) the apples are row-cultivated 3-5 times. The green stripes between the rows are cut 3- 5 times a year. The trees are pruned every year, some are using a machine for that, others are using electric hand-tools. I suggest all these operations will take about 300 hours/ha/year, but it will vary a lot with the season and the level of weeds.
Irrigation	Drip irrigation is often put up in the tree-rows, but not all orchards are having irrigation. Especially the trees and vigorous rootstocks (A2) can manage without irrigation. The consumption of water will vary with the year and the energy-consumption will vary with the type of pump etc.
Alternatives/comments	I think, that all Danish organic apple-growers are using all possibilities to avoid contentious inputs

Name and position/title/function of the person filling in: cabbage grower	
Region to which the information applies: Denmark	
Crop	*Broccoli as example*
Propagation material	Pathenon
Cultivation system	Broccoli is planted on rows, 60 cm between the rows and 25 cm between the pants (67000 plants/ha). The plants are bought in Holland, and sprouted in peat pots. The cultivation in the rotation should have at least 3 years between cabbage varieties because of fear for Club Root (Plasmodiophora brassicae). Often clovergrass is used in the rotation to build up fertility in the soil, but clovergrass before cabbage is not advisable. The cabbage is planted ongoing every week, to spread the harvest.
Fertilisation	Farmer uses vinasse (distillery residues) or protamylasse (from potatoes starch industry) as a complement to the farmyard manure he spreads on the field before ploughing and planting. Soil samples are taken regularly to check if potassium and phosphorous is ok, as well as the pH. Broccoli is fertilised with up to 200 kg N/ha, 30-40 kg P/ha, 150-250 kg K/ha, 20-30 kg Mg/ha and 30-40 kg S/ha.

	Kieserite is used as Magnesium fertilizer if Vinasse or protamylasse does not contain enough according to soil or leaf samples
Crop protection	No chemical plant protection. Against insects (cabbage root fly, cabbage white butterfly) , the planted cabbage is protected by insect net. If larvae still is a problem, Dipel is used. Against weeds, the crop is hoed two or three times, and hand weeded in between the plants.
Plastics:	For the earliest planted crop fibre cloth is used, to keep the lowest temperatures away. This is only for a small part of the area (1%)
Peat:	no
Yields and harvest method:	70% of the planted broccoli can be harvested and will yield about 350-500 g/plant. The Broccoli is cut by hand and collected on a rubber belt leading to an accompanying wagon.
Machinery	Ploughing and cultivating Egalisation Planting (fully automatic) Two times hoeing between the rows Hand weeding Tractor wagon for harvest
Irrigation	Irrigations starts when the net water evaporation is minus 20-25 mm. Normally there is irrigated 4 to 5 times a year with in average 30 mm/ha.
Alternatives/comments	Especially protamylasse is a problem, as it comes from the conventional potatoes industry. Potatoes is one of the most chemical using crops in Denmark, so residues will exist.

Name and position/title/function of the person filling in: tomato grower	
Region to which the information applies: Denmark	
Crop	*Greenhouse Tomatoes*
Propagation material	Four varieties, Solanum lycopersicum var. Cerasiforme, Gemini, , Roma, Sweet pea
Cultivation system	In greenhouse, every year, 3,2 ha. Planting in January, plant material from Holland, 33000 plants pr. ha. Picking from April-November. Every year compost is added to greenhouse and mixed with a cultivator. Planting with 60 cm between two rows, plastic covering of soil between the rows, where water is supplied. Also drip water system is active, using collected rainwater. Plastic was introduced to prevent tomatoes mosaic virus, which spreads from emerging weed tomatoes from previous years
Fertilisation	A compost is made at the farm using organic cow manure, woodchips from deciduous trees, and grass cut. The composting process is stimulated by adding effective microorganisms. Of this compost 800 kg of N/ha is used. In addition, alfalfa pellets are used for fertilization along the year, every week. In total 200 kg N/ha is used.

Crop protection	No chemical plant protection is used against insects or fungi. Against insects, different biological natural enemies are used to fight attacks, when attacks can be noticed. Attacks seen every year: Spider mites, leaf miners, aphids. Sometimes beetle larvae. Products bought from www.Bioplant.dk Weeds in the soil with no plastic are removed in the first months, later, when the tomatoes shade for the soil there is no problem anymore. Grey mould is cut away and buried.
Plastics:	All tomatoes grow in soil covered by plastic foil 007. Plastic is used only once (unfortunately), too much work to recycle.
Peat:	no
Yields and harvest method:	Yields are dependent on variety but around 40 kg per m^2. Tomatoes are picked by hand and boxes are pulled with a chain system to the end of the greenhouse.
Machinery	Compost handling machines for turning, spreading and cultivation, tractor driven. Special designed fertilizer pellets made of Alfalfa spreading by disk coulter
Irrigation	Two types of irrigation, underneath the plastic by pipes and drip water for each plant. In total, the water consumption is 5 l per m^2 per day. Water from rain fall is used in normal years this is sufficient.
Alternatives/comments	Alternatives for plastic have been called for but not found for a competing price. The virus attack has to be addressed, but when there is no danger, the plastic can be avoided. As for the grey mould and insect attacks, the co-workers are specifically trained to observe beginning attacks, to prevent the use of expensive biological control.

Name and position/title/function of the person filling in: Advisor ØRD, Advisor SEGES, consultant, advisor	
Region to which the information applies: Denmark	
Crop	*Potato for consumption*
Propagation material	Konsumption:Ditta,Sava,Solist, Inova Marabel ,Carolus Starch: Kuras, Sarpo, Mira, Magnat
Cultivation system	One or two years of cereals before potatos because this is best to prevent Rhizoctonia, if clover-grass preferable only annual ley.
Fertilisation	Oftest gødkes der med gylle økologisk/ikke økologisk. Usually slurry (better thatn manure) , of which the maximum amount allowed as conventional which is 50 kg NH_4^+ per ha. Fertilisation up to 110-130 kg NH_4^+ per ha. Too much N enhances Rhizoctonia. Slurry is analysed for N, P and K. Starch potatoes receive 140-150 kg NH_4^+ per ha. Soil analysis are taken. When Potassium and/or phosphorous is limited the farmers use Vinasse, protamylasse or patentkali.

Crop protection	No chemical plant protection against blight. Some farmers (250 ha) use bio-preparate Proradix (Pseudomonas spp) against Rhizoctonia.
Plastics:	For the early spring potatoes, plastic is used for covering against frost and increasing the temperatures. Early potatoes maybe only 1% of all potatoes. The plastic is used 1-3 times
Peat:	no
Yields and harvest method:	Yields between 100 – 400 hkg/ha Growers often say 200 hkg/ha. Starch potatoes have the last 4 years had an average yield of 225 (Δ175-450) hkg/ha, with 35,7% starch. The lowest amount in the years where blight (Phytophtora) comes early, and growth is terminated early.
Machinery	In Denmark there are many stones, so usually the potato field is first cleaned for stones (put into swath and dug down), but sometimes removed. Hereafter ploughing of the field, two weed harrowings, two ridgings, irrigation , and picking up the potatoes. For the operations we use standard time and energy consumption
Irrigation	Irrigations starts when the net water evaporation is minus 20-25 mm. Normally there is irrigated 4 to 5 times a year with in average 30 mm/ha.
Alternatives/comments	Blight is a problem and to prevent devastating attacks, potatoes are pre-germinated, with heat boost. The laying of the potato seedlings after 1st of May is not advised. Some farmers try and prevent blight by spraying probiotica.

Name and position/title/function of the person filling in: Advisor ØRD, Consultant SEGES	
Region to which the information applies: Denmark	
Crop	*Spring Barley*
Propagation material	Evergreen, Laurikke, Quench
Cultivation system	Is grown in rotation with other crops, such as peas, wheat, rye, oats or potatoes. Usually 50% grass-clover on dairy farms, and 25% grass-clover on arable farms
Fertilisation	Usually slurry is used, before ploughing or after. This can be pig og dairy slurry. The amount of Nitrogen supplied is dependent on the previous crop, after grass-clover, no fertilizer is supplied, as the Nitrogen from the clover is sufficient. Usually the 50 kg of NH_4^+ comes from conventional livestock farmers, or as waste products from bone meal, (ØGRO), Potatoes starch industry (protamylasse), or yeast production (Vinasse) The use of compost from town garbage waste is being promoted, after Anaerobe fermentation. 50 kg of NH_4^+/ha-year (Ammonium N) is the maximum allowed amount of conventional N in organic agriculture. When deficiencies are registered, Patentkali (25%K, 17%S, 6%Mg) or Manganese sulphate (32% Mn) are sprayed.
Crop protection	No chemical plant protection. Often variety mixtures are used to prevent especially fungi.

	Weed management when necessary with harrow, or hoe when seeded on 25 cm row. The latter is done when there is knowledge on high weed occurrence
Plastics:	no
Peat:	no
Yields and harvest method:	Yields between 20-65 hkg/ha highest yields on dairy farms, as they have high availability of Nitrogen in the soil and high carbon contents. Especially on clay soils the previous crop grass-clover N-value can have effect over more years, on sandy soils it wares out faster.
Machinery	Ploughing, cultivation, seeding and possible or cambridge rolling, harrowing or hoeing (2-3 times), harvest
Irrigation	On sandy soils normally 1-2 times 30 mm
Alternatives/comments	Very few growers try and avoid the conventional input of animal fertilizers, by moving green manure (grass) from one field to another. Organic manure or slurry can be hard ti find.

Name and position/title/function of the person filling in: consultants	
Region to which the information applies: Denmark	
Crop	*Strawberry*
Propagation material	Only one grower is producing his own young plants.A few growers use certified organic frigoplants from KGL Phalaenopsis & Breeding Aps, produced in The Netherlands. Most growers ask for derogation to plant conventional, imported frigoplants.The current major cultivars are Rumba, Honeoye, Sonata, Symphony, Salsa and Malwina
Cultivation system	Open air cultivation is still the main production system. Strawberries are often cultivated in a diverse crop rotation with grain and vegetables. Mechanically weeded. Some parts of the production is tabletop in glasshouses almost all year round. Other parts are grown in polyethylen tunnels (tall enough for standing upright in them), mainly for the early market. I do not know the percentage of each system.
Fertilisation	Some manure is used in the year of planting, maybe around 80 kg N/ha. Often there is added no extra fertilizers in the following two cropping years. Some farmers though, are adding pig slurry right after cutting the top, right after harvest in early august. The level is about 30 kg N/ha/year. Normally the manure is from conventional farms, as no organic manure can be found
Crop protection	Crop protection is mainly done by cultivating only robust cultivars and having a good crop-rotation. Normally the only crop-protection agent in organic strawberries in open air in Denmark is ferriphosphate against slugs. There is no normal level for that, it is strictly connected to the amount of rain. In case of Phytonemus pallidus, the farmers use biological control with natural enemies.

	Normally no fungicide sprays are used in strawberries in open air. No use of mineral oil.
Plastics:	Some (5%) growers are using black plastic-mulches to prevent weed.
Peat:	Normally no peat use in outdoor or tunnel production. In table-top production in greenhouses, peat is a main part of the pot-soil. They use about 5 liter/pot.. The one grower producing his own plants is using a peatmixture to root the runners.
Yields and harvest method:	8-12 ton/ha in average depending on the cultivar, soil, irrigation, year and harvest-method. Lowest yield in «Pick your self»-systems. In some fields and in some years, a yield about 20 T/ha is possible.
Machinery	Soil preparation before planting: Harrowing, harrowing, harrowing, plowing and harrowing (to wipe out perennial weed). Planting with a planting machine if in open field. In tunnels and in plastic mulch you plant by hand, but the plastic-covering is done by a machine. (bedopsætter og plastik-udlægger) Every year (during the three years of cultivation) the open-field strawberries are row-cultivated several times. Straw is spread out between the rows with a machine. The rows are cleaned with a machine (fingerhjul og radrenser) and the field is cleaned by hand 2-3 times. I suggest all these operations will take about 300 hours/ha/year, but it will vary a lot with the season and the level of weeds.
Irrigation	Irrigation is very relevant, and a standard in strawberry production. It is normal to use around 100 mm/year, In 2018 this was not enough. There is large difference in irrigation systems used.
Alternatives/comments	All Danish organic strawberry-growers are using a minimum of inputs.

2.2 France's Annex I-Tables

Name and position/title/function of the person filling in:	organic horticulture advisor, Association Bio Normandie
Region to which the information applies:	Normandie
Crop	*Tomato*
Propagation material	Round: Paola (Cindel to a lesser extent, Matina in population but rarer) Old: very many varieties. The classics: Beef Heart, Horned Andean, Black Crimea, Bern Pink, Pineapple, Green Zebra.
Cultivation system	Under shelters (simple plastic tunnels, the most common, or multi-chapels), on diversified market garden farms for direct sale. Rotation often quite "poor" on crops under shelter: 2 to 3 years for return of Solanaceae in the same greenhouse (2 families of greenhouse summer vegetables that occupy the majority of surfaces: cucurbitaceae and Solanaceae).
Fertilisation	Cattle manure in general and when it's possible (from neighboring farms), but often difficult to spread under a greenhouse (passage of a spreader is difficult, market gardeners not often equipped with small spreaders). So spreading by hand (but tedious!) or using fertilizer in commercial caps. If bovine manure: doses around 30-40 t / ha, but often approximate dosage. If fertilizer plugs: almost always insufficient doses (because high cost). And it shows (undernourished crops)! On the whole, I observe rather lack of fertilization (stunted plants), very rarely excesses.
Crop protection:	Overall, very few products used. On tomato, only copper. But most gardeners do not use it, and agree to have mildew (leaf stripping, etc.). Those who use it are reluctant to make repeated passes and do not necessarily protect their crops throughout the season. The diversified market gardeners who cultivate tomato generally do not seek very high yields (not the primary goal). Some errors are noted for lack of information: some treat after the rain (whereas copper = preventive use). Some use the maximum dose (4 to 6 kg / ha) in a single pass, whereas fractionation at 400 g / ha is recommended for the first passages (in the absence of disease).
Plastics	Tomato often on woven tarpaulin (which keep about 10 years). Otherwise, plant mulch (mulch straw).
Peat	It is used for the production of seedlings (potting soil). Either purchased seedlings or self-produced on the farm. Often a mix of both: purchase of the earliest early plants, and self-production of the second series implanted later, often old varieties.

Yields and harvest method	No measurements made locally! I would say : Old varieties: 4 to 7 kg / ha Round hybrid varieties: 8 to 12 kg / ha
Machinery	Fertilization Tillage (or not in "Market gardening on living soil") Laying tarpaulins (or mulching) Planting staking Cut Irrigation Possible treatments or foliar fertilizers (purines, etc.) Harvest lifting
Irrigation	No statistical data. Watering 1 to 3 times a week in general, drip, 1 to 2 hours each time.
Alternatives/comments	Many organic market gardeners do not use inputs! Often they are limited to fertilization. But in Market gardening on living soil (more and more frequent in market garden plants), often no fertilizer inputs, but only organic matter of plant origin. A priori much less diseases and pests because the balance is created through the biological activity of the soil. As for the use of copper, it is far from systematic (I think the majority of market gardeners do not use it, but that would be to confirm ...). Copper alternatives recommended or used by market gardeners: leaf stripping (for aeration), lithothamne dusting or ash (to dry), citrus essential oils (not practiced but sometimes recommended for drying effect, type Prev B2 products), horsetail purses, comfrey juice.

Name and position/title/function of the person filling in:	organic horticulture advisors, Chambre d'Agriculture du Rhône
Region to which the information applies:	Région Auvergne – Rhône-Alpes
Crop	*tomato*
Propagation material	Paola, Cindel, Cobra, Estiva, Maestria, Marutschka"Old" varieties: Beef Heart, Horned Andean, Bern Pink
Cultivation system	Tunnel shelter 8m (height 3.80m) mainly Rotation with other vegetables from the range (different leaf vegetables, zucchini - cucumber, other Solanaceae (sweet pepper - aubergine, new potato), cruciferous vegetables
Fertilisation	We find a little bit of everything - A fresh manure base (30 to 50 T / ha / year) or manure compost (20 to 25T / ha / year) - A supplement in basic manure with a commercially complete organic fertilizer type 6.3.12 (1 to 3 T / ha or 80 to 100 uN / ha) or only Nitrogen with feather flour or pork silk or blood meal at the same level of intake of Nitrogen. - Sometimes a complement K (potassium) and Mg

	(patenkali) or only K - Sometimes cover manure in solid (complete fertilizer or nitrogen fertilizer) at a rate of 30 to 50 u N / intake, 1 to 3 intakes - Some cases of liquid cover manure (beet vinasse)
Crop protection:	Fungal protection essentially based on copper: - Preventing copper sulphate (Bordelaise porridge at 5 kg / ha), 0 to 3 applications between planting and early harvest. - "Curative" if observation of symptoms (mildew, cladosporiosis, botrytis, alternaria) with copper hydroxide (Kocide 35 at 3.5 kg / ha or Nordox at 1.6 kg / ha), 0 to 4 applications - No use of paraffin oil - Sulfur only if powdery mildew symptoms, or in case of spider mite attack (Thiovit 7.5kg / ha) Very rare insecticidal protection (biological control by auxiliaries), use of Bacillus Thuringiensis against fruit moth (elicoverpa) and Tuta absoluta. In the latter case, when the attack is successful, 1 treatment is done every 7 to 14 days alternating strain kustaki and strain aizawai
Plastics	- Tunnel cover (PE 200µ) - Mulching with either PE 20µ or degradable plastic or Canvas above ground 130 g / m². Covered area of the order of 60 to 90%.
Peat	Yes for the production of plants. The vast majority of plants are bought by market gardeners from producers of specialized plants using commercial organic potting soil.
Yields and harvest method	Very variable but an average of 10 - 12 kg / m²
Machinery	Soil preparation Pose drip Mulching Planting trimming and trellising Harvests twice a week between late June and mid October.no references on time or energy consumption
Irrigation	From planting to final harvest : 4800 m3 / ha (about 220 l / plant)
Alternatives/comments	Few original practices in tomato under shelter at market gardeners. The ones that exist are: - Cultivation without plastic mulching, straw cover - Plastic mulching only on the cultivated strip and dwarf clover seedlings between strips - Copper: use of foliar fertilizer based on copper gluconate (low dose of copper) - Biological control against Tuta basoluta with predatory bug Macrolophus pigmaeus maintained during the winter on calendula at the foot of the tunnel arches. - Fertilization: In our systems we find more often problems of under-fertilization with crops that are hungry, because of infertile soils and fertilization only before planting.

Name and position/title/function of the person filling in:	organic horticulture advisor, Bio Centre
Region to which the information applies:	Centre - Val de Loire, France
Crop	*Aubergine (eggplant)*
Propagation material	between 5000m² and 6 ha, diversified market gardening, mainly for direct sale.
Cultivation system	Many varieties used: Falcon, Shakira, Black Beauty, Rosa Bianca, Clara...
Fertilisation	In majority: under cold tunnel (about 2.40 m height) More rarely: in the open field In rotation with all other greenhouse crops: spinach, lamb's lettuce, salad, Chinese cabbage, tomato, cucumber .... + green manures in some cases (sorghum for example)
Crop protection:	Fertilizers: composted manure (not from the farm), green waste compost (not from the farm), organic fertilizers in cork. Quantities brought are very variable. Composts origin : Organic farms if possible but there's few organic farms in this region…
Plastics	Biological protection often used against mites and aphids (Biological control with living organisms: introduction of crop aids, bought from groups like Koppert or Biobest, and / or establishment of plants that attract natural auxiliaries (flowers ...)); Black soap against mites and aphids; Very rarely: sulfur against mites.
Peat	Soil mulching: Very often: woven fabric A little less often: plastic mulching (often biodegradable) A little less often: bare, no mulching used
Yields and harvest method	In the nursery (it seems to me that potting soil contains mostly peat) to make the seedlings.
Machinery	40t/ha/year
Irrigation	Tillage and preparation of the board: often at the tiller or using hand tools Plantation: manual Culture maintenance: pruning and trellising: manual Harvesting: manual Picking up: manual
Alternatives/comments	Necessarily irrigated plants
Crop	The use of green manures is developing in greenhouse , to create a maximum of biomass and to enrich the soil.

Name and position/title/function of the person filling in:	GRAB

Region to which the information applies:	Sud of France
Crop	*Olive tree*
Propagation material	Aglandau, Picholine, Salonenque
Cultivation system	In field
Fertilisation	Commercial organic fertilizers brought in the spring.
Crop protection:	Clay or Spinosad on fly Copper on peacock's eye, 2 to 3 applications / year
Plastics	
Peat	Used in nursery «one of the weak points is the production of seedlings in the nursery which requires a lot of water and nitrogen, as well as other elements and synthetic hormones for rhizogenesis"
Yields and harvest method	
Machinery	
Irrigation	
Alternatives/comments	In biodynamy : Michel Faure 0475262827 Plants companions of the olive tree to maintain auxiliaries near the orchards

Name and position/title/function of the person filling in:	ITAB (Technical institut in organic farming)
Region to which the information applies:	France
Crop	*Tomato*
Propagation material	Many varieties are available. Essentially F1 hybrids of indeterminate varieties (under shelter) and determined (full field, for industry, limited to South East of France). *Undetermined varieties = varieties that can grow indefinitely, up to several meters long (15-20 bunches of fruit can be harvested); Specific varieties, used rather in the open field, have a bushy habit and limited growth at 6-8 bouquets.* There is a large segmentation (shapes, color, caliber ...) especially since the renewal of the "old" varieties for which there are now F1 hybrid versions.
Cultivation system	Culture under shelter (tunnels in market gardening/horticulture, multichapelles plastic and some glass greenhouses). Variable height from 2m50 to more than 6m (8 in the new "cathedrals" recommended by the builders for reasons of climate management. Simple rotation (even simplistic): until recently there were tomatoes every year in greenhouses, with a winter crop between 2 tomatoes (in the best case). Otherwise, the basic rotation was tomato (year 1), green manure or winter vegetable (lamb's lettuce, salad, spinach) or nothing, cucumber (year 2), green manure or winter vegetable or nothing ... and back tomato. The tightening of rotational

	regulations will encourage farmers to more diversify their rotations (at least towards tomato-cucumber rotation above), or even to lengthen it by including green manures. Ideally it would take at least 4 years between 2 tomato crops. No culture under cover (= no implantation of tomato in a vegetal cover or in a vegetable mulch). In open fields, the rotations are more extensives.
Fertilisation	Before planting, Amendment and fertilization are brought: fertilizer / manure or farm compost if available - 30 to 40 T / ha; otherwise fertilizer in commercial cork + catch-up "minerals" with Patenkali 200-300kg / ha or natural phosphates depending on soil tests and needs of the plant. It exist a fertilization of "catch-up" during cultivation for long summer crops (liquid fertilizer via the drip system) or fertilization at the foot of each plant. The first system is very (too) close to the conventional ferti-irrigation, even if it is organic fertilizers that are used (from the trade: beet vinasse, seaweed fertilizer, etc ....). The quantity depends on the expected yield, the desired culture time...
Crop protection:	Biological control and the use of bumblebees are almost systematic in undercover cultivation. There are few phytosanitary interventions (except mildew, in this case copper use but in very small doses). Sulfur is sometimes used sparingly against mites and powdery mildew (but with a deleterious effect on pollinators and greenhouse plastic). In the field, the problem is close to the potato concerning mildew.
Plastics	Plastic is used in "mass": for blankets of greenhouses (more and more multichapelles are besides double inflatable wall). The service life is variable (3-10 years depending on the initial quality of the plastic, the region, the sunshine, the bleaching of greenhouses or not in summer, and the use or not of sulfur). Soil mulching is not systematic, but widespread (with polyethylene or polypropylene, varying in thickness depending on the type of mulching).
Peat	The use is mandatory for the production of seedlings. The clumps used are squares of 7 or 8 cm on the side. The potting soil is composed mostly of peat (90-95% in conventional potting soil). For information, we make about 150 tomatoes plants with 70L of potting soil. The search for alternatives is underway at potting manufacturers and at some experimental stations. Private specifications (especially for export to Switzerland) impose potting soil with less than 70% peat.
Yields and harvest method	In a lambda market gardener, around 10-15kg / m2, in red round tomato / bunch with modern varieties over 3 months of production. In intensive system, up to 40 kg / m2 (for info, 70 to 80kg in conventional), over 5 months.

Machinery	- Decompaction of the soil (heavy cultivator), - Amendment, fertilization - Soil preparation (eg rotobeach) - Preparation of boards (cultirateau, cultibutte) - Planting and pallissage manuals - Regular manual maintenance (suckering, thinning, trellising/palissage, harvesting) - Grubbing
Irrigation	From 20 cL (centiliters) per plant (beginning of cycle) per day to 3-4 cL depending on the stage and the region. Reduction possible (to have tomatoes more tasty ...) or not (to extend harvests ...). Quite variable depending on the regions. Watering drip under shelter, sprinkling in the field (hence the worries of late blight/mildew).
Alternatives/comments	See potato for full field Alternative to plastic for greenhouses: glass, but the cost of a glass greenhouse is 3 times higher than that of a plastic greenhouse ...

Name and position/title/function of the person filling in:	ITAB (Technical institut in organic farming)
Region to which the information applies:	France
Crop	*Salads*
Propagation material	Too frequent renewal of the ranges to give names of variety (lifespan of 3 to 5 years max). Very segmented range (lettuce, oak leaf, batavia...). Focus on Bremia resistance and aphids.
Cultivation system	All systems exist. Very intensive rotations, especially under shelter in the south: rotation with melon, then 3 salads, then melon again... with problem of fatigue of soil, diseases (sclerotinia), ...
Fertilisation	Use of green fertilizers recommended, to fight against the soil's fatigue and certain pests. Fertilisation dependent on the production season and full field / shelter. Organic background fertilisation usually suffices. No fertilisation is dedicated to the salad, the excess of nitrogen being often detrimental.
Crop protection:	Very frequent soil mulching in organic farming. The pest control is limited (the products damage the foliage, hardly reach the pests ...) Sometimes a little copper (in foliar fertilizer because no AMM copper on bremia lettuce) !!! Or SDN (stimulator of natural defenses). Little effect. In general, diseased cultures are destroyed because the market does not accept any defect (0 aphids, no blight due to mildew).

Plastics	Greenhouse cover, forcing sail for early and late crops, mulching (almost systematic, except summer).
Peat	For plant production (see Argumentation for tomato). About 1000 lettuce plants with 70 L of potting soil.
Yields and harvest method	40-60 T / ha, on several successive series (40-60T for the first series, but 2 or 3 series could follow one another).
Machinery	• Floor preparation, • Mulching, • Planting (manual or mechanical depending on the material available and the presence or absence of mulching), • Manual harvest
Irrigation	Very variable. Soil necessarily full of water at the plantation, then rational irrigation (in the morning).
Alternatives/comments	SDN (stimulator of natural defenses) to fight against fungal diseases and aphids. Few results in deux national French research projects (Casdar 4P and Casdar HE projects). Surely things to dig further...

Name and position/title/function of the person filling in:	ITAB (Technical institut in organic farming)
Region to which the information applies:	France
Crop	patatoes
Propagation material	Allians, Nicola, Ditta, Agata, (Charlotte, Bintje, Ostara : these 3 varieties are "references" known to consumers, and demanded by the distribution. They are produced in AB, but less and less because they are not adapted (average resistance to mildew).) Huge varietal range in potatoes (more than 600 varieties in Europe, with a maximum of around 50 used in AB and available in organic plants, the varieties used and those available in organic plants are not necessarily the same ...). Very segmented range (depending on the use of the potato), but the organic market is mainly based on varieties "firm flesh" (French specificity).
Cultivation system	In general, field cultivation, on large surfaces. It exists limited greenhouse culture for early production, on very small surfaces. Rotations are very variable depending on the region and on the production system (vegetable / market gardener), but the potato is usually at the head of rotation. It's implanted after meadow or after cereal + green manure in field system. It's implanted after vegetables + green fertilizer in horticulture, or after vegetable + other vegetable ...
Fertilisation	Fertilization before the crop, no catch-up during cultivation.

	It's done according to the previous. If necessary, manure is bring on plowed soil (preferred a composted manure) at the rate of 15-30 tons per ha. In general, it's bring in spring, before planting (March / April).
Crop protection:	Main problem = mildew (late blight) = Phytophthora infestans. Unique means of struggle = Copper in different formulations (sulfate, hydroxide, oxide, oxychloride ...). Low application rates at the beginning of the season (200-300 g of Cu metal per hectare per passage), reaching 500 or 600 under high pressure, taking care to respect the maximum dose of 6 kg / ha / year) . According to Esco Copper sorite early 2018: these doses are sufficient in most areas ... except in coastal areas, with high hygrometry. However, more than half of the potato production is centered in the Brittany and Haut de France regions, which receive a lot of rain, and then where these doses are insufficient, and the alternatives are not efficient enough.
Plastics	No plastic on potatoes (excepted for early crop that can be made punctually under cover, or in the field under polyethylene mulch = cultivation with mulch placed on the ground).
Peat	Never for potato
Yields and harvest method	Yields: 15 to 25 T / ha, depending on the varieties and regions. Very strong regional and annual variations, depending on the climatic conditions and the pressure of mildew, and of course on the variety used.
Machinery	In "intensive" system (which represents more and more important volumes): - Labor, Fertilization, - Billonnage (formation of mounds, with very deep furrows), - Stone removal (removal of pebbles in the mound, and burial in the furrows), - Fine preparation of the mound, - Plantation, - Hersage and possible weedings, - Fungicidal organic treatments (rarer insecticides), - Topkill (grinding, burning), - Pulling. In more classical system: - Plowing, fertilization, - Soil preparation, - Plantation, - Successive burrowing and ridging, - Fungicidal treatment (and insecticides if necessary), - topkill, - Harvest.

	Patatoes are culture that requires a lot of interventions, with very heavy equipment, with important consequences on the ground (beyond the use of contentious inputs).
Irrigation	Irrigation is limited to the least watered areas (central region, southern Hauts de France) and / or periods of drought. In 2018, yields were very strongly impacted by drought because irrigation is not possible or not planned everywhere (for example in Brittany or in Hauts de France).
Alternatives/comments	No interesting alternative practices in "fight" against pests / diseases. The main levers concern: - The plant material (use adapted varieties, tolerant to diseases, and corresponding to the expectations of the market) => need to work on the selection, - The use of Decision Aid Tools to optimize the use of inputs.

Name and position/title/function of the person filling in:	ITAB (Technical institut in organic farming)
Region to which the information applies:	France
Crop	*Carot*
Propagation material	Hybrid varieties essentially (Maestro, in particular). Not necessarily available in organic seeds.
Cultivation system	Open-field cultivation for early cultivation (summer-fall harvest) and conservation (fall winter harvest). Production under shelter for early crops (spring harvest, in boots, exclusively). Culture in small tunnel or greenhouse (see description tomato sheet), according to producers. No culture under cover. Rotation of about 5-6 years, between vegetable crops. Very variable from one producer to another.
Fertilisation	Amendment or farm fertilization if available (preferred composted products). Otherwise commercial plug fertilizer. To be done in 1 month or 1 month and a half before sowing No fertilization in culture.
Crop protection:	Preparation of soil and false seeding. Burning to control weeds. Systematic sails to fight the carrot fly. Manual weeding is almost always obligatory, in addition to mechanical hoeing. No treatment in cultivation.
Plastics	Insect protection veils.
Peat	No
Yields and harvest method	30 T / ha in market garden system (horticulture); up to 60 in specialized production.
Machinery	Plowing, fine preparation of the soil, False seedling,

	seedling, Pre-emergent burn, Antiinsect veiling, Successive bins (mechanical or manual), Picking up (manual or mechanical).
Irrigation	Regular needs (emergence then growth phase) but variable depending on the region, soil, climate.
Alternatives/comments	GAEC Pierrepont (Lessay, 50) One of the biggest producers of organic carrots in France Use no or very few sails to fight the fly

Name and position/title/function of the person filling in:	organic horticulture technician – FRAB AuRA
Region to which the information applies:	Auvergne (France) – groupe of around 100 organic gardeners
Crop	*Tomato*
Propagation material	Old varieties (many cultivars populations mainly) + some modern (the most used: Paola, Estiva, Cindel, Previa).
Cultivation system	Mainly under unheated tunnel, in the ground. In a very diversified system (rotation of about 3-4 years).
Fertilisation	Fertilization is based on compost mainly dehydrated commercial pellets (some gardeners use farm compost), often supplemented with commercial organic fertilizer and sometimes mineral (potassium in particular). Most of the inputs are brought before planting.
Crop protection:	Copper is used by a minority of market gardeners (less than 1 or 2 in the group). It is used sometimes as a preventive but especially as soon as the first symptoms of diseases appear. Some gardeners use herbal preparations (decoctions, nettle maceration, comfrey, horsetail, etc.) as plant stimulant (phytostimulants). Some apply biodynamic preparations.
Plastics	Greenhouses are almost exclusively made with plastic (only 1 market gardener on the hundred Auvergnat gardeners is equipped with glass greenhouses). 2 to 3 market gardeners use plastic mulch, mainly 130 g woven fabric.
Peat	Peat is used for the production of seedlings.
Yields and harvest method	Average of 10 kg / m² (= 100 t / ha) but very variable depending on the variety and production conditions.
Machinery	• Preparation of the soil: usually tractor, sometimes tiller. • Establishment of irrigation (mostly drip), • Planting, • pruning, • trellising, • treatments, • harvesting: exclusively manual
Irrigation	Data not available

Alternatives/comments	Use of self-made herbal preparations to enhance the resistance of culture to diseases: - In foliar pulverization: Corinne Pigeard in Viscomtat (63). - In contribution to the soil via irrigation: Marie-Claude Patiès-Moncelon in Beaune d'Allier (03).

Name and position/title/function of the person filling in:	vegetables and soft fruits **producer** /horticulture teacher
Region to which the information applies:	Clermont Ferrand/Auvergne/France:
Crop	Strawberries, tomatoes, potatoes and squash, and Herbs
Propagation material	Mainly Charlotte, but also Mara des bois and Gariguette.
Cultivation system	Cultivation in soil, light and sandy, rich in organic matter. My field is located along a brook. Continental climate, fairly mild springs and dry summers. Winters can be harsh. No protection at all for small fruits. Insect proof used for leeks, carrots, and cabbage though. 1m high tunnels.
Fertilisation	I essentially use horse manure collected in a farm nearby. Mainly horse dung and few straw, and I can also collect grass when I cut it on my field. I apply the two around may and july, on layers on pathways. I dont have a precise quantity used as I use plants as indicators of the fertility. If nothing is needed, I dont apply. I'm correctingt fertilisation depending on the crop (tomatoes and cucurbits greedy for instance). No commercial fertiliser is applid. Ashes sometimes, after potatoes, or before garlic. Calcium applied every two years.
Crop protection:	I dont use any crop protection. Baking soda two to three times on tomatoes in spring. No copper, no oils, no sulfur. I have pests sometimes and accept them. It's a part of my commercial success, as my customers don't have any doubt about my methods. I can sell with a higher price.
Plastics	No plastic mulch used yet. However, as I used them while teaching at Marmilhat (the school), I got the impression that it can improve weeding greatly, and I'm thinking about buying few rolls to try them on my farm, for strawberries at first, and maybe for squash also. I have a tiny tunnel for melons and sweet potatoes, 30 square meters, bought three years ago. I use a lot of plastic pots. They are 100% recycled as I got them from a horticulturist nearby. I got thousands of them, only used once.
Peat	I buy professionnal substrat (floragard) to start my tomatoes and herbs. It contains peat. Its exceptionnal quality helps me to keep my plants in containers for weeks. I heard recently that this brand is about to stop being sold, as peat starts to be criticized in sourcing. I buy ten 70 liters bags a year.
Yields and harvest method	I never estimated my production. 100 square meters yield 12 kilograms of strawberries every week during a month. Its about a ton per hectare.

Machinery	Water pomp and cultivator. 50 liters gazoil every year. Water pomp used four hours every week in summer, cultivator ten hours in spring.
Irrigation	My half hectare field receives 10 cubic meters of water every week in full summer. Its extremely low, as I try to maintain path covered and plants in good condition, but not soaked. The brook along my field is weak every end of summer. I take great care to pomp water when its possible and not as severe lows.
Alternatives/comments	I think I'm one of the most carefull growers regarding plastic, or peat used. I'm working on a total less than an hectare, and my results are not enough to live only on that activity. I teach also, which help financially. I don't want to have impacts on environment if money is only the goal. My activity provides me with satisfaction, one of the most important is sustainibility.

2.3 Germany's Annex I-Tables

Country:	Germany
Region referred to:	Ba-Wü, Donau, Schwäbische Alb
Approximate nr. of farms that you consult:	50
Farm type(s):	[90%] Arable farming/mixed farming [ ] Vegetable [10%] Fodder [ ] Fruits [ ] Wine
Most important crops across all farms that you consult:	Cereals, Fodder
Region: Ba-Wü, **Donau, Schwäbische Alb**	
Crop	*Cereal*
Propagation material	
Which varieties are dominating?	Varieties from own farm, from organic breeders, Exceptions: when no or not enough seeds are available
Fertilization	Slurry, farm yard manure, compost, purchased fertilizer
What is the most relevant fertilization on the farms?	Slurry, farm yard manure
How relevant is the purchase of commercial fertilizers? Which fertilizers are bought?	Minor lime, sulfur
How relevant is the purchase of fertilizers from conventional farms?	sometimes farm yard manure
Give reasons for the purchase of fertilizers from conventional farms	Arable farming, not much livestock, yield increase
Plant protection	Non, diluted slurry in spring, tee from hay
What are the major diseases and pests for this crop? What are the problems of the farmers in this context?	Plant louse, cereal leaf beetles (*Oulema melanopus*), fungal disease, mice
How relevant is the use of copper, sulfur and/or mineral oil?	Not relevant
In your experience, what are the most successful strategies to avoid these inputs?	variety, crop rotation
Which alternative do you NOT recommend?	
Plastic mulch	*(regarding horticulture)*
How relevant is the use of plastic mulch?	
In your experience, what are the most successful strategies to avoid these inputs?	
Which alternative(s) do you NOT recommend?	
Yield	
Please give the mean yield of this crop (in t/ha)	
Peat	*(regarding horticulture)*
How relevant is the use of peat for this crop? At which point during the vegetation period it used?	
In your experience, what are the most successful strategies to avoid these inputs?	
Which alternative(s) do you NOT recommend?	
Irrigation	

Is irrigation typically used for this crop?	[ ] Yes [ ] NO
Comments	

Country:	Germany
Region referred to:	Ba-Wü, Nordwürttemberg (Hohenlohe)
Approximate nr. of farms that you consult:	100
Farm type(s):	[x] Arable farming/mixed farming [ ] Vegetable [x] Fodder [ ] Fruits [ ] Wine
Most important crops across all farms that you consult:	Cereal, potato, fodder (arable and grasland)
Region:	
Crop	*Winter wheat*
Propagation material	Ecological
Which varieties are dominating?	Conventional breedings are progressively replaced by organic breedings like: Butaro, Wiwa…
Fertilization	
What is the most relevant fertilization on the farms?	Farm fertilizer (cattle slurry, manure) and lime
How relevant is the purchase of commercial fertilizers? Which fertilizers are bought?	No relevance
How relevant is the purchase of fertilizers from conventional farms?	No relevance
Give reasons for the purchase of fertilizers from conventional farms	
Plant protection	
What are the major diseases and pests for this crop? What are the problems of the farmers in this context?	Bunt (Tilletia), yellow rust (due to different varieties less and less a problem), in some years brown rust
How relevant is the use of copper, sulfur and/or mineral oil? Give approximate amount per area (e.g. kg/ha)	Not relevant
In your experience, what are the most successful strategies to avoid these inputs?	Resistent varieties, increase of humus, examination of following crop regarding bunt spores, possible dressing with Tillecur or purchase of Z-seeds
Which alternative do you NOT recommend?	
Plastic mulch	*(Regarding horticulture)*
How relevant is the use of plastic mulch?	
In your experience, what are the most successful strategies to avoid these inputs?	
Which alternative(s) do you NOT recommend?	
Yield	
Please give the mean yield of this crop (in t/ha)	3-5 t/ha
Peat	*(Regarding horticulture)*

How relevant is the use of peat for this crop? At which point during the vegetation period it used?	
In your experience, what are the most successful strategies to avoid these inputs?	
Which alternative(s) do you NOT recommend?	
Irrigation	
Is irrigation typically used for this crop?	[ ] Yes [X] NO
Comments	

Questionnaire for advisors

Country:	Germany
Region referred to:	Ba-Wü, Nordwürttemberg (Hohenlohe)
Approximate nr. of farms that you consult:	100
Farm type(s):	[x] Arable farming/mixed farming [ ] Vegetable [x] Fodder [ ] Fruits [ ] Wine
Most important crops across all farms that you consult:	Cereal, potato, fodder (arable and grasland)
Region:	
Crop	*Potatoes*
Propagation material	**Ecological**
Which varieties are dominating?	Only conventional breedings like: Agria, Ditta, Marena, Melina, Nicola, Annabelle, Rosara, Belana, Allians…..
Fertilization	
What is the most relevant fertilization on the farms?	Farm fertilizer (cattle slurry, manure), lime and phosporus
How relevant is the purchase of commercial fertilizers? Which fertilizers are bought?	Relatively low. Depending on soil analysis, lime, phosphorus and micronutrients are bought.
How relevant is the purchase of fertilizers from conventional farms?	No relevance
Give reasons for the purchase of fertilizers from conventional farms	
Plant protection	
What are the major diseases and pests for this crop? What are the problems of the farmers in this context?	Late blight, wire worm, potato beetle, rhizoctonia. Late blight comes first, then comes the wire worm. Rhizoctonia is manageable and against potato beetle Novodor and Neem is used.
How relevant is the use of copper, sulfur and/or mineral oil? Give approximate amount per area (e.g. kg/ha)	With demeter, copper is not allowed for potatoes. Some farms would use it if legal.
In your experience, what are the most successful strategies to avoid these inputs?	Wide crop rotation, varieties, increase of humus
Which alternative do you NOT recommend?	

Plastic mulch	*(Regarding horticulture)*
How relevant is the use of plastic mulch?	
In your experience, what are the most successful strategies to avoid these inputs?	
Which alternative(s) do you NOT recommend?	
Yield	
Please give the mean yield of this crop (in t/ha)	15-35 t/ha
Peat	*(Regarding horticulture)*
How relevant is the use of peat for this crop? At which point during the vegetation period it used?	
In your experience, what are the most successful strategies to avoid these inputs?	
Which alternative(s) do you NOT recommend?	
Irrigation	
Is irrigation typically used for this crop?	[ ] Yes [X] NO

Country:	Germany
Region referred to:	Ba-Wü, Nordwürttemberg (Hohenlohe)
Approximate nr. of farms that you consult:	100
Farm type(s):	[x] Arable farming/mixed farming [ ] Vegetable [x] Fodder [ ] Fruits [ ] Wine
Most important crops across all farms that you consult:	Cereal, potato, fodder (arable and grasland)
Region:	
Crop	*Potatoes*
Propagation material	Ecological
Which varieties are dominating?	Only conventional breedings like: Agria, Ditta, Marena, Melina, Nicola, Annabelle, Rosara, Belana, Allians…..
Fertilization	
What is the most relevant fertilization on the farms?	Farm fertilizer (cattle slurry, manure), lime and phosporus
How relevant is the purchase of commercial fertilizers? Which fertilizers are bought?	Relatively low. Depending on soil analysis, lime, phosphorus and micronutrients are bought.
How relevant is the purchase of fertilizers from conventional farms?	No relevance
Give reasons for the purchase of fertilizers from conventional farms	
Plant protection	
What are the major diseases and pests for this crop? What are the problems of the farmers in this context?	Late blight, wire worm, potato beetle, rhizoctonia. Late blight comes first, then comes the wire worm. Rhizoctonia is manageable and against potato beetle Novodor and Neem is used.

How relevant is the use of copper, sulfur and/or mineral oil? Give approximate amount per area (e.g. kg/ha)	With demeter, copper is not allowed for potatoes. Some farms would use it if legal.
In your experience, what are the most successful strategies to avoid these inputs?	Wide crop rotation, varieties, increase of humus
Which alternative do you NOT recommend?	
Plastic mulch	*(Regarding horticulture)*
How relevant is the use of plastic mulch?	
In your experience, what are the most successful strategies to avoid these inputs?	
Which alternative(s) do you NOT recommend?	
Yield	
Please give the mean yield of this crop (in t/ha)	15-35 t/ha
Peat	*(Regarding horticulture)*
How relevant is the use of peat for this crop? At which point during the vegetation period it used?	
In your experience, what are the most successful strategies to avoid these inputs?	
Which alternative(s) do you NOT recommend?	
Irrigation	
Is irrigation typically used for this crop?	[ ] Yes [X] NO
Comments	

Country:	Germany
Region referred to:	Ba-Wü, Bodensee
Approximate nr. of farms that you consult:	40
Farm type(s):	[ ] Arable farming/mixed farming [x] Vegetable [ ] Fodder [ ] Fruits [ ] Wine
Most important crops across all farms that you consult:	Under glas: Cucumber, Tomato, Paprika, Field: Cabbage, Cellerie, Salat
Region: BaWü, **Bodensee**	
Crop	*Tomato in greenhouse (no german field tomatoes in organic farming!)*
Propagation material	
Which varieties are dominating?	Roterno, Lyterno, Agro, Baylee, Tica, several others
Fertilization	
What is the most relevant fertilization on the farms?	Purchased fertilizer: Horn dung, Maltaflor, Florapell. and other manure compost
How relevant is the purchase of commercial fertilizers? Which fertilizers are bought?	Highly relevant in greenhouse. In organic farming there is practically no organic certified fertilizer available for purchase!
How relevant is the purchase of fertilizers from conventional farms?	Relevant to some extend for horse manure, farm yard manure with farms that do not have own manure and Cooperation.

Give reasons for the purchase of fertilizers from conventional farms	No bio-manure readily available in this region, Phosphorus amounts in soil to high
Plant protection	
What are the major diseases and pests for this crop? What are the problems of the farmers in this context?	White fly, red spider mite, phytophtora
How relevant is the use of copper, sulfur and/or mineral oil? Give approximate amount per area (e.g. kg/ha)	Not that relevant. Most likely sulfur against red spider mite. But it is not used by the mentioned farms.
In your experience, what are the most successful strategies to avoid these inputs?	Use of benificials against white fly and res spider mite. Climate regulation and stock maintenance with phytophtora, planning to end crop when pathogen is appearing.
Which alternative do you NOT recommend?	
Plastic mulch	*(Regarding horticulture)*
How relevant is the use of plastic mulch?	Not much
In your experience, what are the most successful strategies to avoid these inputs?	In greenhouses they use more mulch. It increases soil moisture, suppresses weed, supports soil fauna through a steady input of nutrients as well as their turnover.
Which alternative(s) do you NOT recommend?	
Yield	
Please give the mean yield of this crop (in t/ha)	It varies extremely with farms. It depends on the use of heat and if planting is done earlier. Direct marketing farms may have 15-25kg/m²
Peat	*(Regarding horticulture)*
How relevant is the use of peat for this crop? At which point during the vegetation period it used?	Very relevant for operations producing seedlings. In bigger tomato growers buy the seedlings. Some smaller tomato growers produce seedlings themselfes and do not use peat.
In your experience, what are the most successful strategies to avoid these inputs?	Own seedling production with own soil mixture. Soil can be mixed from several individual ingrediences (Partially with coconut fibre). Due to holiday season the plant growers did not give details on their mixtures yet.
Which alternative(s) do you NOT recommend?	
Irrigation	
Is irrigation typically used for this crop?	[x] Yes [ ] NO
Comments	

Country:			
Farm size:	Total	Arable	Grassland
	6,69ha 6.69 ha	1 ha	5,69 ha 6.59 ha
Livestock:	Animal		Nr. of animals

Crops:	**Vegetables, grass-clover, meadow**	
Typical crop rotation on the farm(s)	1) Cabbage	
	2) Fruit	
	3) Root/Leaf	
Region: North Rhine Westfalia (Detmold)		
Crop		
Propagation material		
Which varieties are dominating?	Vegetables: In the field and greenhouse	
Fertilization		
Please describe along the growing period, the application time (month/season) and quantity (per application and unit land area) of fertilisers from the farm itself, and any commercial fertilisers used	Winter/spring time Approx. 30 t composted conventional horse manure, received for free from the neighbor, about one third on the arable land, two thirds on the grassland From time to time horn shavings on leek and cabbage (in the field)	
If no additional fertilizer is bought, give reasons why	-	
Plant protection		
What are the major diseases and pests for this crop? What are your problems?	Cabbage fly, lice (in the field), spider mite (greenhouse)	
Do you use copper, sulfur and/or mineral oil? If yes: Please give amount (e.g. kg/ha)	No	
If no copper, sulfur and/or mineral oil is used: What are your strategies? If alternative inputs are used: Please give amount (e.g. kg/ha)		
What is your experience with the strategy? Is improvement needed?	-	
Have you tested other strategies? How did they work?	-	
Plastic		
Is plastic of any kind used at any time during the vegetation period? (Mulch, cover, tunnel, etc. NOT packing material)	3 foil tunnels - Coverage soil during growing period at greenhouse cultures and cultures of foil house tomato, cucumber, egg plant, pepper, zucchini (outdoors) as suppression of wild herbs - cultivation protection nets for cabbage fly etc. (in the field)	
If no: What is your alternative for the use of plastic?	-	
What is your experience with the strategy? Is improvement needed?	Very good, unfortunately necessary, viz. now with advanced age, for health reason and because there is neither	

	money nor time to weed everything every 1 to 2 weeks like in the past.
Have you tested other strategies? How did they work?	-
Peat	
Is peat used at any point of the production chain? If yes: Please give estimated peat amount used per area	- for seedling cultivation - about 2.500 liters per year (field and (pre-) breeding greenhouses)
If no: What is your alternative for the use of peat?	-
What is your experience with the strategy? Is improvement needed?	- good - better an alternative without or with fewer peat
Have you tested other strategies? How did they work?	For many years produced own soil for cultivation with foliage components, a lot of wild herbs if you do not want to steam. Too time consuming now for reasons of health and time
Yield	
Please give the mean yield for this crop (in t/ha)	
Irrigation	
Is irrigation used?	[x] Yes [ ] NO

2.4 Greece's Annex I-Tables

Name and position/title/function of the person filling in:TECHNICAL ADVISOR	
Region to which the information applies: Greece	
Crop	*Brocolli (open field)*
Propagation material	1) Parthenon 2) Naxos
Cultivation system:	Open field soil. Crop rotation with zucchini. The irrigation system is drip irrigation.
Fertilisation:	Before planting: All organic fertilisers 125 kg/1000 m^2 POLYSULPHATE (48%S,14%K2O,6%Mg,17%Ca) 120 kg/1000 m^2 BIOILSA (11%N) 30 kg/1000 m^2 NEOGEN (chicken manure) https://www.kipoefodia.gr/neogen-%CE%B2%CE%B9%CE%BF%CE%BB%CE%BF%CE%B3%CE%B9%CE%BA%CE%BF-%CE%B5%CE%B4%CE%B1%CF%86%CE%BF%CE%B2%CE%B5%CE%BB%CF%84%CE%B9%CF%89%CF%84%CE%B9%CE%BA%CE%BF-p-425.html During the growing period: All organic fertilisers 5 lit/1000 m^2 BETABIO FULL (3%N, 4%P, 3%K) fertigation every 7 days 5 L/1000 m^2 AZOMIN (4%N, organic N) fertigation every 7 days.
Crop protection:	Cooper 1.5 kg/ha
Plastics:	No
Peat:	No
Yields and harvest method:	Harvest by hand. 9,000-11,600 kg/ha
Machinery:	Ploughing once per year Rotary tiller before planting
Irrigation	Drip irrigation: 3-6 cm^3 per 1000 m^2 depending on the growing stage of the plant
Alternatives/comments:	Nature Breaker (Pyrethrins): 2 applications every 7-10 days dose: 0.6 kg/ha Bactospeine (*Bacillus thuringiensis* subsp kurstaki): 6-8 applications every 7-10 days dose: 1 kg /ha

Name and position/title/function of the person filling in: TECHNICAL ADVISOR	
Region to which the information applies: GREECE	
Crop	*Greenhouse Tomato*
Propagation material	1)Elpida 2)Bellfort 3)Ducati 4)Nissos 5)Sonato
Cultivation system:	Greenhouse soil. Plastic greenhouse. Height: 3.5 m Crop rotation with cucumber or zucchini

	The soil is covered with white plastic which is perforated every 50 cm where the plants are transplanted. The irrigation system is drip irrigation.
Fertilisation:	Before planting: <u>All organic fertilisers</u> 60 kg/1000 m^2 POLYSULPHATE (48%S,14%K2O,6%Mg,17%Ca) 15 kg/1000 m^2 TOP-N (13%N, 42% C organic) 40 kg/1000 m^2 DUALSPORE ACTIVATOR (25% C organic, 7%Fulvic, 1,2% N organic, C/N 20,8%) http://www.microspore.com/wp-content/uploads/2015/02/CATALOGUE_ENG_1.4_WEB.pdf During the growing period: <u>All organic fertilisers</u> 3 lit/1000 m^2 BETABIO FULL (3%N, 4%P, 3%K) fertigation every 4 days 3 lit/1000 m^2 AZOMIN (4,5% organic N) fertigation every 4 days 5 lit/1000 m^2 POTASSIO BIOLOGICO (8,5% organic K) fertigation every 4 days
Crop protection:	Cooper: 4 kg / ha Sulphur: 2-3 applications on to flowering dose: 3 kg/ha
Plastics:	The soil is covered with white plastic which is perforated every 50 cm where the plants are transplanted.
Peat:	No
Yields and harvest method:	Harvest by hand. 50 - 70 kg/ha
Machinery:	Rotary tiller before planting
Irrigation	Drip irrigation: 3-6 cm^3 per 1000m2 depending on the growing stage of the plant
Alternatives/comments:	Acaridoil (Potassium salts of fatty acids): 3-4 applications every 7-10 days dose:19 kg /ha Bactospeine (Bacillus thuringiensis subsp kurstaki): 6-8 applications every 7-10 days dose: 1 kg/ha Laser: 2 applications every 10 days dose: 0.25 kg/ha Serenade max: 2-4 applications dose: 2.5-4 kg/ha

Name and position/title/function of the person filling in: TECHNICAL ADVISOR	
Region to which the information applies: GREECE	
Crop	*Potato*
Propagation material	Spunta Marfona Juerla Kennebec
Cultivation system:	Crop rotation with legumes, cereals and corns. Vegetables can also be used in crop rotation cycles. Plantation space is 15-25 cm between the plants
Fertilisation:	Low copper grade fertilizers Plant defence stimulators;) Agrimartin (based on sheeps manure) 20-30 lt /ha. Application before the sowing Femvigor before the sowing, during plantation and during the cultivation period 4000-5000 kg / ha

	Axion-N (organic bio-stimulator N 14%), 10-20 kg/ha Macrocystis (physical extract of Macrocystis nteglifolia (0.8-1 L per ha with irrigation
Crop protection:	Average use of cooper 5-10 kg / ha Applications against of *Phytophtora infestans* 6-12 applications per year according to the outside weather conditions and the infection intensity
Plastics:	No plastics are used
Peat:	No
Yields and harvest method:	20-25 tonnes per ha
Machinery:	Plough every 1 years (4 h/ha) Manure spreader (4h/ha) Fertilizer spreader (2 h/ha)
Irrigation	30 m^3 per ha per application Seeding and germination phase 0.3 – 0.8 mm/day Plantation row covering: 2-2.5 mm/day Full coverage 4-4.5 mm /day
Alternatives/comments:	

Name and position/title/function of the person filling in: TECHNICAL ADVISOR	
Region to which the information applies: GREECE	
Crop	*Apple*
Propagation material	1) Golden Delicious 2) Red Delicious 3) Gala 4) Fuji
Cultivation system:	Cultivation in the soil with good drainage potential. Optimum PH 6.5 The irrigation system is drip irrigation. Cultivation in a depth of 0.4 m for optimum grow of the young trees.
Fertilisation:	N (100-150 gr / tree / year) in the 2nd year. Increase these quantity per 100 g per tree per year taking into accoun the general helath of the tree. Manure usually from chicken (poultry) farms is used. Activit pellets (chicken maure): 1–5 kg per tree Cooper sulfate: 1-1.5 kg per tree
Crop protection:	Cooper 150 gr/1000m^2
Plastics:	No plastics are used
Peat:	No
Yields and harvest method:	15000-20000 kg/ha, harvesting is usually done by hand
Machinery:	Plough every 2 years (4 h/ha) Manure spreader (3h/ha) Fertilizer spreader (3 h/ha) Sprayer for copper/sulphur/biological control (1 h/ha pr. operation) Tractor for collecting harvest (2 h/ha)

Irrigation	Drip irrigation: 5-10 cm^3 per 1000m2 depending on the growing stage of the plant
Alternatives/comments:	Bactospeine or Xentarli (Bacillus thuringiensis): First application in flowering 2-4 applications every 8-10 days dose:300 L /1000 m^2 Parafinic oil SUPPORT 200 L/1000m^2 Admiral: 225 L/ 1000 m^2 I know other farmers also cultivating organic apples but more or less use the same techniques and methods described here

Name and position/title/function of the person filling in: TECHNICAL ADVISOR	
Region to which the information applies: GREECE	
Crop	*Orange*
Propagation material	1) Merlin 2) Valencia
Cultivation system:	Cultivation in the soil with good drainage potential. The irrigation system is drip irrigation. Cultivation in a depth of 0.3 m for optimum grow of the young trees.
Fertilisation:	N (100-150 gr / tree / year) in the 2nd year. Increase these quantity per 100 g per tree per year taking into account the general health of the tree. Manure usually from chicken (poultry) farms is used. Active pellets (chicken manure): 1–5 kg per tree Cooper sulfate: 1-1.5 kg per tree
Crop protection:	Cooper 300 gr / 1000 m^2
Plastics:	No
Peat:	No
Yields and harvest method:	12000-20000 kg/ha, harvesting is usually done by hand
Machinery:	Plough every 2 years (4 h/ha) Manure spreader (3h/ha) Fertilizer spreader (3 h/ha) Sprayer for copper/sulphur/biological control (1 h/ha pr. operation) Tractor for collecting harvest (2 h/ha)
Irrigation	Drip irrigation: 4-7cm^3 per 1000m2 depending on the growing stage of the plant
Alternatives/comments:	Bactospeine or Xentarli (Bacillus thuringiensis): Application when first larvae appears. Applications every 6 days dose:150 L/1000 m^2 Parafinic oil SUPPORT 250 L/1000m^2 Admiral: 100 L/ 1000 m^2

Name and position/title/function of the person filling in: Consultant	
Region to which the information applies: Greece	
Crop	*Olives*
Propagation material	Chondrolia Conservolea Kalamata

Cultivation system:	Cultivated in soil, in open field, no crop rotation
Fertilisation:	Animal manure, applied in the soil around the canopy Application period: early to late winter Up to 6 tons/ha/yr K-Mg sulfate, from 0 to 500 kg/ha/yr Borate, from 0 to 50 kg/ha/yr Plant extracts (seaweed, nettle) sprayed on the trees, from May to August, up to 80 kg/ha/yr
Crop protection:	Copper application ranges from 1 to 2 (to less sensitive olive cvs) up to 6 kg Cu/ha/yr, depending on weather conditions in particular areas, owner's knowledge, and cultivar sensitivity (cvs Kalamata and Chondrolia more sensitive than cv Conservolea). Rarely, mineral oils in <4 kg/ha/yr for scale pests Sulfur, up to 1 time per year as acaricide, only in areas with crop damages (<20% of the olive cultivation land in the country)
Plastics:	Soil covering is not applied
Peat:	No peat used
Yields and harvest method:	In the On year, it is from 2000-8000 kg/ha In the Off year, it is <1000 kg/ha
Machinery:	In all application below tractor with proper machinery or light truck is used Pest management, 5 times/yr, 1.5 hrs/applic/ha, total 7.5 hrs/ha Weed management, 2 times/yr soil cultivator, 1.5 hrs/applic/ha, total 3 hrs/ha Weed cutter, 2 times/yr, 1 hr/applic/ha, total 2 hrs/ha Manure application, 6 hrs/ha/yr Harvest, 20 hrs/ha/yr in On year, 6 hrs/ha/yr in Off year
Irrigation	From 0 to 400 mm/ha/yr 0.47-0.6 kWh/m^3
Alternatives/comments:	No, everybody is using repeatedly Cu over each year, and, in some cases, mineral oils and sulfur. Bacillus thuringiensis for insect protection (1 application per year, <2 kg/ha) Traps (various types, wet or dry, 1 every one or two trees) for olive fruit fly Rotenone (foliar application, <2 kg/ha/yr) for olive fruit fly (in >20% of farms)

2.5 Italy's Annex I-Tables

Name, district: Catania, Sicily (ITA), organic citrus advisor	
Region to which the information applies: Sicily	
Crop	*Citrus*
Propagation material	Only few nurseries produce organic citrus plants; "conventional" plants can only be used if organic plants are not available. Blood and blonde oranges are grown. Major blood orange varieties are *Tarocco*, *Moro* and *Sanguinello* and among blonde oranges *Navelina* and *Valencia* are the most widespread varieties. *Nova* and clementine *Comune* are common mandarin-type varieties and among lemons, the Italian variety *Femminello siracusano*, less susceptible to Mal Secco, is the most cultivated.
Cultivation system:	Farmers use their own soil, organically certified. Soil is mechanically cultivated between rows while weeds along the row are mowed. Sulphur (about 400 Kg/ha) is occasionally distributed in winter along plant rows to lower the soil pH. This practice is limited to plants grafted on citrange *Carrizo* rootstock which suffer for high soil pH. Between rows, especially in young orchards, faba bean (Vicia faba minor) is used as green manure.
Fertilisation:	In late winter up to 4 tons of cattle manure/ha is distributed. If not available, up to 800 kg/ha of organic soil improver or organic fertilizer is applied. During spring and summer organic nitrogen (f.p. Nifert) or vegetable distillery slops (borlanda: f.p. Kappabios) or potassium sulphate are applied as fertilizers. Iron chelate is also used for citrange rootstocks. A few farms are starting to inoculate plants with mycorrhizal fungi. 1-2 foliar sprays of organic nitrogen and micronutrients or vegetable distillery slops (borlanda: f.p. Kappabios) are also carried out especially on young plants.
Crop protection	Azadirachtin is used on young plants against *Phyllocnistis citrella*. A few farms apply Sulphur proteinate (f.p. Sulfar) to control scales and mites. It is used at 300 g/hl and is applied 1 or 2 times per year. Spray volume used is 2000-2500 l/ha. Mineral oil is applied 1 or 2 times per year (one in summer and, if necessary, one in winter) at 1.5-2% targeting insects and/or mites. A few farms apply Cynoyl Z (sulphur-brown seaweed based compound) as alternative to mineral oil at rate of 0,5-1 litres/100 litres of water According to pest presence, rearing of the beneficials *Aphytis melinus* and/or *Cryptolaemus montrouzieri* and/or *Leptomastix dactylopii* is common practice. For medfly control Spintor Fly or attract and kill traps are used. Copper is used in autumn-winter in orange and mandarins to control pathogens (*Phytophthora* spp., *Alternaria* spp., *Colletotrichum* spp., *Pseudomonas syringae*). 1 or 2 yearly applications are performed. It is generally applied as copper

	oxychloride at rate of 350 g/hl or copper hydroxide at rate of 200 g/hl. In Lemon orchards, due to the Mal Secco disease, 3 or 4 copper applications per year are necessary. A few farms are starting to use low copper grade fertilizers (Cu 2-6%), which they apply by foliar spray, to reduce the amount of copper per ha.
Plastics:	White plastic film wrapped around the trunk is used to protect the trunk of young plants (up to 3-4 years old).
Peat:	No use
Yields and harvest method:	About 20-25 tons per ha for orange and "mandarins" and 30 tons per ha for lemons. Harvested by hands.
Machinery:	1 plough per year in spring between rows (3 h/ha) 1 harrowing in summer between rows (2 h/ha) 2-3 weed mowing (2h/ha) along the row
Irrigation	The most used irrigation system consists in two under-canopy sprinklers per plant which wet about 1.5 meter soil round the plant. System is now changing and all new plantings are going to be served by drip irrigation. 2000-3000 m3/ha/year
Alternatives/comments:	

Name, district: Catania, Sicily (ITA), organic citrus advisor and organic citrus farmer	
Region to which the information applies: Sicily	
Crop	*Citrus*
Propagation material	Only few nurseries produce organic citrus plants; "conventional" plants can only be used if organic plants are not available. Blood and blonde oranges are grown. Major blood orange variety is *Tarocco*, with many clones (i.e. *Scirè*, *Nucellare*, *Sciara*, *Meli* etc.); *Moro* and *Sanguinello* blood varieties are now less cultivated. Among blonde oranges, *Navelina* and *Valencia* are the most widespread varieties. *Nova* and clementine *Comune* are common mandarin-type cultivars and among lemons, the Italian varieties *Femminello siracusano*, *Monachello* and *Femminello Zagara Bianca*, less susceptible to Mal Secco disease, are the most cultivated.
Cultivation system:	Farmers use their own soil, organically certified. Soil is mechanically cultivated between rows while weeds along the row are mowed. Between rows, especially in young orchards, faba bean (Vicia faba minor) is used as green manure.
Fertilisation:	In late winter up to 4-6 tons of cattle manure/ha is distributed. If not available, up to 1000 kg/ha of organic fertilizer is applied. During spring and summer organic nitrogen (f.p. Nifert 100 kg/ha or Protamix 100 kg/ha) and/or potassium sulphate (200 kg/ha) are applied as fertilizers.

	1-2 foliar sprays of organic nitrogen and micronutrients are also carried out especially on young plants.
Crop protection	Azadirachtin is used on young plants against leafminers. A few farms apply Sulphur proteinate (f.p. Sulfar) to control scales and mites. It is used at 300 g/hl and is applied 1 or 2 times per year. Spray volume used is 2000-2500 l/ha. Mineral oil is applied 1 or 2 times per year (one in summer and, if necessary, one in winter) at 1.5-2% targeting insects and/or mites. According to pest presence, rearing of the beneficials *Aphytis melinus* to control the most damaging scale (*Aonidiella aurantii*) and/or *Cryptolaemus montrouzieri* to control mealy bugs is common practice. For medfly control Spintor Fly is used. Copper is used in autumn-winter in orange and mandarins to control pathogens (*Phytophthora* spp., *Alternaria* spp., *Colletotrichum* spp., *Pseudomonas syringae*). 1 or 2 yearly applications are performed. It is generally applied as copper oxychloride at rate of 350 g/hl or copper hydroxide at rate of 200 g/hl. In Lemon orchards, because of Mal Secco disease, 3 or 4 copper applications per year are necessary. A few farms are starting to use low copper grade fertilizers (Cu 2-6%), which they apply by foliar spray, to reduce the amount of copper per ha.
Plastics:	White plastic film is used to protect the trunk of young plants (up to 3-4 years old).
Peat:	No use
Yields and harvest method:	About 18-22 tons per ha for orange and “mandarins” and 25 tons per ha for lemons. Harvested by hands.
Machinery:	1 plough per year in spring between rows (3 h/ha) 1 harrowing in summer between rows (2 h/ha) 2-3 weed mowing (2h/ha if performed by tractor or 5-6h/ha if performed by hand along the row))
Irrigation	The most used irrigation system consists in two under-canopy sprinklers per plant which wet about 1.5 meter soil round the plant. System is now changing and all new plantings are going to be served by drip irrigation. 1500-3000 m3/ha/year
Alternatives/comments:	Currently it is not possible to manage a citrus orchard without copper and mineral oil. Yield and quality of fruits will be severely affected.

Name, district: Catania, Sicily (ITA), organic citrus advisor	
Region to which the information applies: Sicily	
Crop	*Citrus*

Propagation material	Only few nurseries produce organic citrus plants; "conventional" plants can only be used if organic plants are not available. Blood and blonde oranges are grown. Major blood orange variety is *Tarocco*, with many clones (i.e. *Scirè*, *Nucellare*); *Moro* and *Sanguinello* blood varieties are now less cultivated. Among blonde oranges, *Navelina* is the most widespread variety. *Nova* and *Avana* mandarin are common mandarin-type cultivars and among lemons, the Italian varieties *Femminello Zagara Bianca*, *Monachello*, less susceptible to Mal Secco, are the most cultivated.
Cultivation system:	Farmers use their own soil, organically certified. Soil is mechanically cultivated between rows while weeds along the row are mowed. Between rows, especially in young orchards, faba bean (Vicia faba minor) is used as green manure.
Fertilisation:	In winter up to 3-5 tons of manure/ha is distributed. If not available, up to 1000 kg/ha of organic fertilizer is applied. During spring and summer organic nitrogen and/or potassium sulphate (250 kg/ha) are applied as fertilizers. 1-2 foliar sprays of organic nitrogen and micronutrients are also carried out especially on young plants.
Crop protection	Azadirachtin is used on young plants against leafminers. Spray volume used is 2000-2500 l/ha. Mineral oil is applied 1 or 2 times per year (one in summer and, if necessary, one in winter) at 1.5-2% targeting insects and/or mites. According to pest presence, rearing of the beneficials *Aphytis* spp. and/or *Cryptolaemus montrouzieri* and/or *Leptomastix dactylopii* is common practice. For medfly control Spintor Fly is used. Copper is used in autumn-winter in orange and mandarins to control pathogens (*Phytophthora* spp., *Alternaria* spp., *Colletotrichum* spp., *Pseudomonas syringae*). 1 or 2 yearly applications are performed. It is generally applied as copper oxychloride at rate of 350 g/hl or copper hydroxide at rate of 150-200 g/hl. In Lemon orchards, because of Mal Secco disease, 2 - 4 copper applications per year are performed. A few farms are starting to use low copper grade fertilizers (Cu 2-6%), which they apply by foliar spray, to reduce the amount of copper per ha.
Plastics:	No plastic is used during the growing.
Peat:	No use
Yields and harvest method:	About 20 tons per ha for orange and "mandarins" and 25 tons per ha for lemons. Harvested by hands.
Machinery:	1 plough per year in spring between rows (3 h/ha) 1 harrowing in summer between rows (2 h/ha)

	2-3 weed mowing (2h/ha if performed by tractor or 5-6h/ha if performed by hand along the row))
Irrigation	The most used irrigation system consists in two under-canopy sprinklers per plant which wet about 1.5 meter soil round the plant. System is now changing and all new plantings are going to be served by drip irrigation. 1500-3000 m3/ha/year
Alternatives/comments:	Currently it is not possible to manage a citrus orchard without copper and mineral oil. Yield and quality of fruits will be severely affected.

Name, district: advisor for organic olives	
Region to which the information applies: Sicily	
Crop	*Olive*
Propagation material	Only few nurseries produce organic olive plants; "conventional" plants can only be used if organic plants are not available. Major varieties are *Nocellara Etnea* and *Tonda Iblea* which are grown almost exclusively for olive oil production.
Cultivation system:	Farmers use their own soil, organically certified. Soil is mechanically cultivated.
Fertilisation:	Up to 2-3 tons of manure/ha is distributed before planting.
Crop protection	For olive fruit fly control Spintor Fly or attract and kill traps are used. Copper is used in autumn-winter to control pathogens (*Spilocaea oleagina* and *Pseudomonas savastanoi*). 2 or 3 applications per year of copper oxychloride at rate of 350-500 g/hl are performed. In substitution of copper oxychloride, Bordeaux mixture is applied (after harvest) at rate of 1%. Depending on pest presence mineral oil is applied once a year during summer time at rate of 1.5-2% targeting scales.
Plastics:	No plastic is used
Peat:	No use during any stage of the production cycle.
Yields and harvest method:	Olive production is not constant, every other year yields reach about 15-20 tons per ha. In low production years the average yield is 4-5 tons per ha. Harvest is done by hands with the help of nets on the ground under the canopy.
Machinery:	1 plough in spring (3-4 h/ha) 1-3 arrowings for weed control (2 h/ha)
Irrigation	No irrigation is provided. The only exception occurs in the first years after planting but it is limited to emergency irrigation.
Alternatives/comments:	None

Name, district: Calabria, "conventional" and organic olive advisor	
Region to which the information applies: Calabria	
Crop	*Olive*

Propagation material	Only few nurseries produce organic olive plants; "conventional" plants can only be used if organic plants are not available. Major variety is *Carolea* which is grown almost exclusively for olive oil production.
Cultivation system:	Farmers use their own soil, organically certified. Soil is mechanically cultivated.
Fertilisation:	Up to 2-3 tons of manure/ha is distributed before planting upon availability. In substitution of manure organic fertilizers are used. Micronutrients, mainly borum, and amminoacids are generally applied once in spring by foliar spray.
Crop protection	For olive fruit fly control Spintor Fly is used. Copper is used in autumn-winter to control pathogens (*Colletotrichum gleosporioides, Spilocaea oleagina* and *Pseudomonas savastanoi*). A total of 4 to 8 copper applications per year are performed. Used compound can be copper oxychloride at rate of 350-500 g/hl, copper hydroxide at rate of 150-200 g/hl or Bordeaux mixture (after harvest) at rate of 0.8-1%. Depending on pest presence mineral oil is applied during summer time at rate of 1.5-2% targeting scales (in average one application every other year). No use of sulphur.
Plastics:	No plastic is used
Peat:	No use during any stage of the production cycle.
Yields and harvest method:	Olive production is not constant, every other year yields reach about 18-24 tons per ha. In low production years the average yield is 5-6 tons per ha. Harvest is done by hands with the help of nets on the ground under the canopy. A few large farms use mechanical harvesting.
Machinery:	1 plough in spring (3-4 h/ha) 1-3 arrowings for weed control (2 h/ha) In case of mechanical harvesting, soil rolling is usual practice (2 h/ha)
Irrigation	No irrigation is provided.
Alternatives/comments:	

Name, district: territory of Siracusa, Sicily (ITA), advisor for organic vegetable and citrus productions	
Region to which the information applies: Sicily	
Crop	*Potato*
Propagation material,	Organic potato seeds are generally available. "conventional" seed can only be used if organic once is not available. Major grown variety is Spunta.
Cultivation system	Farmers use their own soil which is organically certified. Soil is mechanically cultivated before seeding. The cultivation of potato is part of a crop rotation in which this crop is grown every three years. Rotation include at least one crop as green manure (mostly a graminacea crop) and

	other crops for yield. Seeding of potato is generally carried out in September for early production or at the end of December/beginning of January. This latter is the most common and preferred timing.
Fertilisation:	At the start of a new rotation, during ploughing, up to 1000 kg/ha of organic fertilizer is applied. During the plant growing season, organic nitrogen or a 5-4-4 organic fertilizers are applied.
Crop protection:	Generally 1-2 applications of sulphur-copper based compounds are used to reduce the input of copper. Main use of copper is for control of downy mildew of potato. 8 to 12 applications per year of copper by using either copper oxychloride at rate of 350 g/hl or copper hydroxide at rate of 200 g/hl are performed. The number of applications depends on weather conditions. Average application volume is 1000 l/ha. The average copper use is up to 15.0 kg/ha per year. A few farms are starting to use low copper grade fertilizers (Cu 2-6%), which they apply by foliar spray, to reduce the amount of copper per ha. No oil is used. *Bacillus thuringiensis* is used for lepidoptera control
Plastics:	No use of plastic materials during growing.
Peat:	No use of peat in any stage of the production cycle.
Yields and harvest method:	Yield generally ranges between 25 and 40 tons per hectare. Harvested by hands.
Machinery:	Growing potatoes involves extensive ground preparation. Ploughing and successive arrowing are needed before the soil reaches a suitable condition (soft, well-drained and well-aerated) for seeding (4 h/ha). Ridging is carried out after 10-20 days from seeding and it is repeated to cover the growing tubers (2h/ha). Potato harvesters unearth the tubers which are then collected by hands
Irrigation	Drip irrigation is preferred. 500 to 700 mm/year of water is needed to grow potatoes

Name, district: territories of Siracusa and Ragusa, Sicily (ITA), advisor for organic vegetable productions	
Region to which the information applies: Sicily	
Crop	*Potato*
Propagation material,	Organic potato seeds are generally available. “conventional” potato seed can only be used if organic once is not available. Major grown varieties are Ditta, Nicola, Spunta. Seed of a variety resistant to late blight, named Carolus, is available on the market.
Cultivation system	Farmers use their own soil which is organically certified. Soil is mechanically cultivated before seeding. Potato is grown in rotation of three years, alternating with other, dissimilar crops (generally rotation include at least one

	crop as green manure such as grass or legume). Carrot is one of the most common crop grown in the territories of Siracusa in rotation with potato. Seeding of potato is generally carried out in September for early production or at the end of December/beginning of January. This latter is the most common and preferred timing.
Fertilisation:	At the start of a new rotation, during ploughing, up to 800 kg/ha of organic fertilizer is applied. During the plant growing season, organic nitrogen and potassium sulphate are applied as fertilizers.
Crop protection:	Main use of copper is for control of potato late blight. Up to 12 applications per year of copper by using either copper oxychloride at rate of 350 g/hl or copper hydroxide at rate of 200 g/hl are performed. The number of applications depends on weather conditions. Average application volume is 1000 l/ha. The average copper use is up to 15.0 kg/ha per year. Sulphur compounds are occasionally used and generally as sulphur-copper based compounds in order to reduce the inputs of copper. No oil is used. In case of lepidoptera control, *Bacillus thuringiensis* is used
Plastics:	No use of plastic materials during growing.
Peat:	No use of peat in any stage of the production cycle.
Yields and harvest method:	Yield generally ranges between 20 and 30 tons per hectare. In case of an early strong late blight attack the yield can be severely affected up to the complete destruction of the crop. Harvested by hands.
Machinery:	Growing potatoes involves extensive ground preparation. Ploughing and successive arrowing are needed before the soil reaches a suitable condition (soft, well-drained and well-aerated) for seeding (4 h/ha). Ridging is carried out after 10 days from seeding and it is repeated to cover the growing tubers (2h/ha). Potato harvesters unearth the tubers which are then collected by hands
Irrigation	Drip irrigation is preferred. 500 to 700 mm/year of water is needed to grow potatoes

Name, district: Siracusa and Ragusa provinces, Sicily (ITA), advisor for organic vegetable productions	
Region to which the information applies: Sicily	
Crop	*Tomato* (protected crop)
Propagation material,	Only few nurseries produce organic vegetables; “conventional” plants can only be used if organic plants are not available. Medium-Large tomato varieties and Cherry tomato varieties are grown.
Cultivation system	Farmers use their own soil which is organically certified. Tomato is grown in greenhouses whose structure are either made of iron or wood. In both cases the greenhouse covering

	consists of transparent plastic film (with EVA 12%) which is generally changed every two years. Openings are protected by nets to avoid the entrance to insects. Soil solarization is usual practice during summer, generally in July-August. Soil is mechanically cultivated and the entire soil ground is mulched with a black plastic film before transplant. The cultivation of tomato is part of a crop rotation including at least one crop as green manure and one crop diverse from the solanacea family (generally a brassica species). Tomato is generally transplanted at the end of August or at the end of October/beginning of November to reduce losses due to the late blight tomato disease.
Fertilisation:	Once a year, generally in October, up to 800 kg/ha of organic fertilizer is applied. During spring and summer organic nitrogen (f.p. Dominus) or potassium sulphate are applied as fertilizers. 4-3-3 organic fertilizer is also used and, if necessary, iron chelate is provided. A few farms are starting to inoculate plants with mycorrhizal fungi.
Crop protection:	3 to 6 applications per year of copper hydroxide at rate of 150-200 g/hl are performed. The number of applications depends on air humidity. Average application volume is 1000 l/ha. Ultra fine mineral oils at rate of 0.5% are exclusively used. 1 or 2 applications per year are carried out with an application volume of 1000 l/ha. Mineral oils are generally applied for their repellent effect on insects or mites. Application are performed at early stage of tomato growth in absence of bumble bees in the greenhouses. 2.5-5 kg/ha of sulphur per year is applied. Main use of sulphur is for control of mites and tomato powdery mildew. Maltodextrin 49%, light mineral oils are used to control white flies. Potassium bicarbonate 85% is used to control tomato powdery mildew. Biological Control Agents (*Tricoderma harzianum* against soil-born diseases, *Bacillus subtilis* or *Bacillus amyloliquefacens* 25% against grey mould disease) are also used According to pest presence, rearing of the beneficials *Amblyseius swirskii* and *Phytoseiulus persimilis* is common practice. For *Tuta absoluta* control, *Bacillus thuringiensis* and Azadirachtin are applied and the sexual confusion through the homogeneous distribution of the pheromone (800-1000 dispenser for hectare) in the growing environment is used.
Plastics:	Black (or in few cases white) plastic film is used as mulching and is changed after each cultivation.
Peat:	The use is limited to nurseries.
Yields and harvest method:	Yield is generally reduced by 30-40% with respect to the “conventional” crop which is about 4-5 kg per square metres. Harvested by hands.
Machinery:	1 harrowing per year (3 h/ha)

Irrigation	Drip irrigation. About 1500-2000 m3/ha/year

Name, district: territory of Siracusa, Sicily (ITA), advisor for organic vegetable productions	
Region to which the information applies: Sicily	
Crop	*Tomato* (protected crop)
Propagation material	Only few nurseries produce organic vegetables; "conventional" plants can only be used if organic plants are not available. No resistant varieties to downy mildew are available. Large and Cherry tomato varieties are grown.
Cultivation system:	Farmers use their own soil which is organically certified. Tomato is grown in greenhouses whose structure is either made of iron or wood. In both cases the greenhouse covering consists of transparent plastic film (with EVA 12% - 15%) which is generally changed every two years. Openings are protected by nets to avoid the entrance to insects. Soil solarization is usual practice during summer, generally in July-August. Soil is mechanically cultivated and the entire soil ground is mulched with a black plastic film before transplant. The cultivation of tomato is part of a crop rotation which include at least one crop as green manure and one crop different from the solanacea family (generally a brassica species). Tomato is generally transplanted at the end of August or at the end of October
Fertilisation	Once a year, generally before transplanting, up to 1000 kg/ha of organic fertilizer is applied. During the crop growing season, organic nitrogen (f.p. Nifert) and potassium sulphate are applied as fertilizers. A 5-4-4 organic fertilizer is also used. Iron chelate is also used. A few farms are starting to inoculate plants with mycorrhizal fungi.
Crop protection	Main use of copper is for control of downy mildew of tomato. 5 to 8 applications per year of copper hydroxide at rate of 150-200 g/hl are performed. The number of applications depends on air humidity. Average interval is of two weeks. Average application volume is 1000 l/ha. A few farms are starting to use low copper grade fertilizers (Cu 2-6%), which they apply by foliar spray, to reduce the amount of copper per ha. No oil is used. Sulphur compounds are used only once or twice at early crop growth stage when bumble bees are not used for pollination. 2.5-5 kg/ha of sulphur per year is applied. Main use of sulphur is for control of mites and tomato powdery mildew. Maltodextrin 49% is used to control white flies. Potassium bicarbonate 85% is used to control tomato powdery mildew, 3-4 applications per year are generally performed. Biological Control Agents (*Tricoderma harzianum* against soil born

	diseases, *Bacillus subtilis* or *Bacillus amyloliquefacens* 25% against grey mould disease) are also used. According to pest presence, rearing of the beneficial *Phytoseiulus persimilis* is common practice. For *Tuta absoluta* control, *Bacillus thuringiensis* and Azadirachtin are applied.
Plastics:	White-Black plastic film is used as mulching which is changed after each cultivation.
Peat:	The use is limited to nurseries.
Yields and harvest method:	Yield is generally reduced by 20-30% with respect to the "conventional" crop. Yield is about 3 kg per square metres. Harvested by hands.
Machinery:	1 arrowing per year (3 h/ha)
Irrigation	Drip irrigation. About 1200-1800 m3/ha/year
Alternatives/comments:	

2.6 Norway's Annex I-Tables

Name and position/title/function of the person filling in: NLR Trøndelag	
Region to which the information applies: Trøndelag	
Crop	*Potato*
Propagation material	Publically certified Norwegian seed potatoes; new seed material purchased each 4th year. Several cultivars are used such as Troll, Folva, Ariel, Solist and many more.
Cultivation system:	Crop rotation with cereals, grass or vegetables. Potatoes should not be grown more often than each 4th year.
Fertilisation:	Pre-crop: Ryegrass or green fodder to reduce weeds, or a young ley, which will release N. 10-30 tons per ha of animal manure or compost, or a similar (N) amount applied with dried poultry manure, Marihøne or FK Grønn. If pH is too high, leaves are fertilised with Mn, Zn (Mantrac, Zintrac). Poor growth may be supported by leaf fertilisation with PHC Organic Plant Feed (made from molasse of sugar canes).
Crop protection:	Rows are mechanically cleaned or harrowed each second week dependent on the weather, until the canopy closes and eliminates the need for weed control. Late blight is controlled by preventive efforts: Careful sorting and pre-growth of seed potatoes, resistant cultivars, rows placed to dry off rapidly upon rain, removal of infected plants, burning or mechanical removal of canopy if/when attacked, harvest by dry weather conditions and careful storage.
Plastics:	Early cultivars are covered by plastic and/or agryl nets.
Peat:	No
Yields and harvest method:	20 tons per ha. Potato harvester, possibly on a tractor.
Machinery:	Ploughing, harrowing or other tillage, manure application, seed planting, row cleaning and harrowing, removal of canopy (thermic or mechanical), harvesting.
Irrigation	Not in Trøndelag

Name and position/title/function of the person filling in: NLR Viken, advisior organic greenhouse	
Region to which the information applies: There are only few organic tomato producers in Norway, they are in Vestfold and Rogaland counties	
Crop	*Tomato in greenhouse*
Propagation material	Main source is imported young plants, but some produces their own young plants form seeds. When growing in soil plants are grafted.
Cultivation system:	Of the 10200 m2 in total used for production of organic greenhouse tomato, at 4000 m2 the plants are grown in soil, and at the rest plants are grown in grow-bags. Planting is usually done in the beginning of February first harvest is about 8 weeks later and the production ends in November.

	Young plants are planted (3-4 plants per m2) in soil or growbags. As they grow one or two branches is kept and put on wire, the rest are removed. The branches grow up the wire (work is done through out the season to secure the plants to the wire). This way the branches can grow from 7-12 meters long. Leaves are removed from the bottom of the plants and the branches are hanging from the wire in a way so that the top are always around 3- 4 meters over the ground. The fruits are harvested by hand a few times a week from about 8 weeks after planting till the end of production. Plants are watered with drip irrigation.
Fertilisation:	Soil is fertilized with solid organic manure before planting in late winter / early spring. Growth media in bags come already mixed with solid organic manure. In soil production organic manure from own farm can be used, when producing in bags the organic manure is commercial. Commercial solid organic manure are usually composted chicken manure in pellets. Throughout the season liquid organic manure is added through irrigation system. Mainly vinasse products. Liquid manure is mainly commercial, but one grower uses pig slurry from close by farm.
Crop protection:	Mainly beneficial organisms are used for plant protection: Macrolophus 1-2/m2 once a year *Phytoseiulus persimilis,* used when needed Nematodes against scarid fly Sulphur is used against fungus like downery mildew.
Plastics:	Growing bags are wrapped in plastic, one grower is trying out degradable plastic on bags. In houses where they grow in bags, plastics is also used to cover the floor underneath the bags.
Peat:	On 4000 m2 , the growing media is soil. On 6,200 m2, the growing media is peat in growbags with a small amount of other additives like moss, sand, clay and organic manure. I total about 150 m3 of peat is used per ha and year.
Yields and harvest method:	For standard round tomato about 40 kg / m2 /year, for small tomatoes and cocktail about 20 kg / m2 /year
Machinery:	Most labor is manual. Some use wagons for raising the workers to the level of the crop. These are battery driven
Irrigation	Irrigation is done by drip irrigation systems, in growbags about 700 L /m2 a year.
Alternatives/comments:	Hanasand Gaard, Stig Jacob Hanasand; stig.jakob@hanasandgard.no Eirik Voll: Eirik.voll@lysa.net

Name and position/title/function of the person filling in: NLR Trøndelag
Region to which the information applies: Trøndelag

Crop	*Carrot*
Propagation material	Pelletised or natural seeds, not coated with chemicals. Common varieties Triton, Nominator, Romance.
Cultivation system:	Crop rotation with cereals, grass or potato. Preferably 7 years between each carrot crop.
Fertilisation:	Precrop: Ryegrass for weed control, or young ley which may release N. 10-20 tons/ha animal manure or compost, or a similar amount (of N) applied with dried poultry manure, Marihøne or FK Grønn. Often required to apply B with the fertilser, or as a leaf fertiliser. . If pH is too high, leaves are fertilised with Mn, Zn (Mantrac, Zintrac). Poor growth may be supported by leaf fertilisation with PHC Organic Plant Feed (made from molasse of sugar canes).
Crop protection:	Weeds are controlled by burning one or more times before planting of seeds. Rows are cleaned by tractor equipment and/or manually. Serenade may be used to protect against fungal disease. Insect nets (0.6 mm) are used to protect against carrot fly (*Psila rosae*) and carrot psyllid (*Trioza apicalis*).
Plastics:	Early cultivars are covered by plastic.
Peat:	No
Yields and harvest method:	40 -50 tons/ha, uptake by hand or special machine
Machinery:	Ploughing, harrowing or other tillage, manure application, seed planting, thermal weed control (by tractor), row cleaning (by tractor), harvesting, manually or by tractor.
Irrigation	No
Alternatives/comments:	Insect nets may not be required in windy areas

Name, district: NLR Agder	
Crop	*Strawberries*
Propagation material, which varieties are dominating?	Some production of young plants for cv. *Rondo* (remontating) Some certified young plants produced in Norway Some imported, ready-for-production young plants Organic young plants must be ordered on advance; conventional plants can only be used if organic are not available. Organic young plants for export (e.g. to Norway) is under way. The current major cultivar is *Sonata*; upcoming are *Sensation* and *Faith*. Remontating *Rondo* (Norwegian variety) has been used by some. In other regions than South-Norway, *Polka* (Norwegian cv) has been used. *Korona* is not resistant enough against mildew.
Cultivation system:	Farmers use their own soil, organically certified, crop rotation 2-3 years with perennial ley. All growing is on plastic-covered beds (drill) with drip irrigation. In between these beds, strips of grass. Beds should be wide enough, and

	planted stripes slim enough, to ensure berries will be located on the plastic and not on the edges and where beds meet grass stripes and a grass mower is used to cut grass. All growing occurs in plastic tunnels to protect plants against grey mould (*Botrytis cinerea*). Tunnels contain 5 rows and are 8 m high.
Fertilisation:	Before planting: 30 – 40 tons of cattle manure/ha In years where berries will be harvested: 400 kg/total ha in spring with dried chicken manure + meat and bone meal and vinasse, «Marihøne Pluss 8-4-5», applied in a row on top of the plastic in early spring to be solubilized before the tunnels are mounted shortly before flowering. Later in the season on light soils, and when growth is a bit weak, supplementing fertilisation with Pioneer Complete 6-1-3 Organic fertiliser. In the autumn, cv. Sonata on light soils will receive 200 kg/total ha of Marihøne Pluss 8-4-5.
Crop protection:	Thiovit (sulphur) each 8.-12. day from start of growth in early spring to onset of flowering. Dose: 500 g Thiovit/100 litres of water; initially 40 litres/1000 m row, later, on large plants up to 100 litres/1000 m row. Serenade (beneficial bacteria) once per week against mildew and *B. cinerea*, more often if the weather is moist. Beneficial nematode *Heterorhabditis bacteriofora* against larvae of strawberry weevils. Beneficial mite *Neoseiulus cucumeris* twice against strawberry mites, spinning mites and trips. Dose varies from state of infection, usually 800 mites/m of row per application. Beneficial mite *Amblyseius montodorensis* against white fly, 50 – 100 mites/m. Sonata very susceptible to iron deficiency; regular leaf applications of 2 x 1000 ml Ferrittrac/ha. Other leaf applications as required from plant analysis of leaves.
Plastics:	Soil covering: Black polyethylene plastic 0.05 µm, for a short growing period up to 2 seasons, degradable plastics 30 – 40 µm. Fibre cloth standard 18 – 19 g/m^2 used in early season, and for protection against night frost during flowering. Nets against insects have been tested, but reduced pollination and made damage to plants.
Peat:	When growing in restricted growing media, peat might be included; not much used yet.
Yields and harvest method:	17-21 tons per ha and year. Harvested by hand
Machinery	Plough every 3 years (2 h/ha) Plant machine (6 h/ha) Manure spreader (1h/ha) Fertilizer spreader (1 h/ha) Sprayer for copper/sulphur/biological control (0,5 h/ha pr. operation) Tractor for collecting harvest (1 h/ha)

Alternatives/comments:	Strawberry yields without these inputs will be 1-2 tons per ha and year. Without plastic cover of soil, weed problems are significant (*Elytria repens, Poa annua*), and tunnels are required to reduce *B. cinerea.* Without plant protection, mildew gets a big problem in tunnels.

Name, district: NLR Vest	
Crop	*Apple*
Propagation material, which varieties are dominating?	Planting of 2-year old trees with branches. Traditionally, trees were produced nationally and delivered in pots in mid-summer, but imported, non-organic trees with bare roots are now taking over due to problems with witches' broom (*Taphrina betulina*) in the Norwegian production of fruit trees. Varieties Discovery and Red Aroma are the most common in organic apple growing in Norway.
Cultivation system:	Apple growers usually own their land. Pre-crop before a planned conversion is often grassland, but established orchards may also be converted. Fruit trees should not be planted in soil where fruit trees were formerly grown. It this is required anyway, planting rows should be relocated between former rows, in "fresh" soil. Trees will usually be on the land for 20-25 years. The modern system of planting is a dense system with strings, with spacing 0.9 m between trees and 3.5 m between rows. This gives about 3000 trees per ha. The normal height of a tree is 3 m. Impregnated poles are used for support of rows, and bamboo sticks as support for single trees. Pipes for drip irrigation/fertilisation are usually established in new planted fields. Weeds between rows are regularly cut.
Fertilisation:	Before planting, liming and fertilisation is planned according to chemical soil analysis. Animal manure, preferably composted, is recommended before an old field is replanted. In years of production, animal manure or dried poultry manure is applied in early spring; typically 100-200 g of manure per tree = 200-300 kg/ha. In orchards equipped for liquid fertilisation, N and K is applied from medium May to end of July. Cuts of grass and weeds between rows is mulched and supplies some (late) fertilisation. At flowering and/or after harvest, leaves are fertilised with B, Mn, Zn and/or Mg to strengthen subsequent flowers and buds. S and Cu, which ar often lacking in organically managed orchards, are applied as fungicides Thiovit (S) and Nordox (Cu).
Crop protection:	Early spring: Nordox (Cu), 1 kg/ha Vegetable oil + soap, 30 + 5 l/ha Against apple scab: Thiovit Jet + Nordox WG 3 kg + 150 g/ha, applied one or more times until flowering. After flowering Thiovit 3 kg/ha before rain Against apple fruit moth: Vegetable oil + soap 20 kg + 3 kg/ha Against aphids and other insects: Pyretrum (Natria), ca 0.5 l/ha After harvets: 1 kg Nordox/ha against scab etc., possibly mixed with leaf fertilisers (B, Mn, Zn, Mg) 0,5-1 l/ha.

	In 2017, 6 applications of sulphur and copper By August 9, 2018, 1 application of copper and 3 of sulphur this season Software RimPro used to forecast risk of apple scab infection.
Plastics:	Woven plastic has been tried as a ground cover to reduce weeds but is not recommended anymore because of problems with pests such as ants, mice and water vole (*Arvicola amphibious*).
Peat:	If young trees are received in pots, the growing media includes peat.
Yields and harvest method:	Apples are picked by hand and sorted into class I and industrial purpose (juice) in the orchard. Packed in 300 kg containers of wood or plastic and transferred to local storage/sorting facilities. Yield levels typically 1600-20000 kg/ha and year for Red Aroma; less for Discovery. Modern, dense planting systems may produce 30000-40000 kg/ha and year.
Machinery	Establishment of new orchards is a massive work effort. In producing fields, the anual operations require about: Application of fertiliser 10 t/ha Pruning ca 30 t/ha Application of pesticides 5 t/ha per application Cutting of grass between rows 5 t/ha (tractor) Irrigation 30 t/ha, harvesting 30 t/ha
Alternatives/comments:	Only private gardeners with no commercial production for sale do not use inputs described above. A significant challenge for Norwegian organic fruit production is that a combined chemical with S and Cu is not certified for use in Norway any longer due to restricted market (the producer does not want to apply for approval in Norway because of the restricted market). Later years, significant challenges have come with insects, such as aphids, stink bugs and codling moth (*Cydia pomonella*). A national software, RimPro provides efficient warnings against scab (*Venturia inaequalis*) and recommendations for application of S and Cu. Green manures are generally not well synchronized with the nutrient demands of a fruit crop.

2.7 Poland's Annex I-Tables

Note on the data collection through an online questionnaire and personal communication

The template of the questionnaire was adopted to a simpler online questionnaire (in a google format) with understandable questions, and quick and easy to select answers and fill in the information (when necessary) for the selected crops. The online questionnaire was distributed to organic farming experts after contacting them by phone and to organic farmers. The online questionnaire was sent to the organic farmers who grow organically strawberry, potato, tomato and cucumber:

- strawberry: https://docs.google.com/forms/d/e/1FAIpQLSdexR-dydmuB8r4S3UfX6iVl_8Mc2QFbVZaIUngJXdujF9SHA/viewform
- potato: https://docs.google.com/forms/d/e/1FAIpQLSfL0JAEoMlLIjB_INpnsEuhb5SV0BjG_OfGfbpYR0ZNgl6tFg/viewform
- tomato: https://docs.google.com/forms/d/e/1FAIpQLSdlVX6gR8Ez1ZlVS-QRz7sWiq9h3vFECOgILLF4h7KCcHI-yw/viewform
- cucumber: https://docs.google.com/forms/d/e/1FAIpQLSdXxz6lulUV23-thotti2vbbMvRG6uN-63PvSCNAP6HHPe7OQ/viewform

In addition, we contacted the Agricultural and Food Quality Inspection and selected control bodies and used their data base of organic farmers for distributing the online questionnaire. Prior to sending the questionnaire we were advised to make the questionnaire anonymous.

The tables below contain summarized output from the online questionnaire as well as from the phone/personal communications with the organic farming experts.

Name and position/title/function of the person filling in: Based on the anonymous questionnaire output and personal communication with organic farming experts.	
Region to which the information applies: Silesia region, Poland	
Crop	*Strawberries*
Propagation material	The most popular variety is Polka, other common varieties are Vibrant, Honeoye, Senga and also Salut and Diamente.
Cultivation system	In most cases strawberry is grown in ground systems. Soil is not exchanged (or there is no information that is otherwise). Often crop rotation is applied with alfalfa, clover, lupine, mustard.
Fertilisation	In most cases fertilization is applied before and early spring or after the growing period is completed. The most typical fertilizers are: compost from a conventional farm or manure. The quantity of fertilizers applied to soil differs significantly. On average, it is estimated that 10-25 t of compost is applied per ha, whereas about 30-35 t of manure is applied per ha. As for mineral fertilizers, some organic farms use calcium fertilizers (e.g. dolomite, CaO), potassium fertilizers (potassium sulfate). The most typical is CaO (on average 8 kg/ha).
Crop protection	It is typical to use straw as a natural mulching. The quantity of straw differs, 4-5 t of straw is applied per 1 ha to form a 3-5 cm cover. Using natural mulching is affordable. However, in few cases, black plastic foil (polyethylene) is used for

	protection from weeds. Also, in more advanced organic farming different types of fiber cloth is used (e.g. Pegas Agro with 19g/m2 for early season and 23 g/m2 for protecting the plants from low temperatures for autumn-winter season). No information on using copper or mineral oils.
Plastics	Plastics are used in growing as soil mulching materials for protection from weeds, e.g. black LDPE foil. Many experts pointed out that using plastic mulch (polyethylene foil) is an alternative to crop protection products. However, there is a problem with removal and recycling of these plastic mulches. There is no information on using biodegradable materials.
Peat:	From the obtained information both from the experts and the farmers peat is not used in organic growing of strawberry.
Yields and harvest method:	No information available.
Machinery: **Machinery**	Plough and a plant machine combined with spreading plastic mulch.
Irrigation	Typical irrigation systems include drip irrigation and sprinkler irrigation. No data on the amount of water used per growing season.
Alternatives/comments:	No information available.

Name and position/title/function of the person filling in: Based on the anonymous questionnaire output and personal communication with organic farming experts.	
Region to which the information applies:	
Crop	*Potato*
Propagation material	The most typical varieties of potato grown organically include: Bartek, Bila, Vineta.
Cultivation system	Ground cultivation system. Potatos are grown in narrow-row and wide-row technology. Crop rotation every 4-5 years, the most common rotation crops include winter wheat, triticale.
Fertilisation	Fertilization of potato is mostly done with organic fertilizers such as cow manure, poultry manure mixed with compost. The application of manure is 20-30 t/ha, poultry manure mixed with compost is 5,0-7,5 t/ha. In addition, mineral fertilizers are also used (e.g. urea).
Crop protection	Potatos are protected by substances enlisted as those which can be applied in organic farming. The experts pointed out that in potato cultivation copper fungicides are used. These include copper sulfate, copper oxychloride, copper hydroxide. For Colorado potato beetle (*Leptinotarsa decemlineata*) one of the plant substances is the extract from Chrysanthemum Cinerariifolium. It is available commercially (Polish name – "Pyretryna naturalna") and the recommended application is 0.5 kg/ha. Other natural

	insecticides include paraffinic oils, potassium salts and grey soap but they are less frequently used.
Plastics	No plastics are used in growing potato.
Peat:	Peat is not used in growing potato.
Yields and harvest method:	The average yield is about 10-15 t/ha.
Machinery	Ploughing, harrowing, earthing, ridging are applied in potato cultivation. Potato planting and harvesting machines, potato sprayer.
Irrigation	It is estimated that the water used per growing season for potato accounts for 200-400 mm, depending on the type of variety, soil properties and temperature during growing season.
Alternatives/comments:	Some alternatives include plant extracts from nettle or tansy (*Tanacetum vulgare*). Also, an alternative way to using substances for crop protection is selection of potato varieties that are resistant to diseases.

Name and position/title/function of the person filling in: Based on the anonymous questionnaire output and personal communication with organic farming experts.	
Region to which the information applies:	
Crop	*Tomato*
Propagation material	Tomymaromacho washyngton, Atut F1, Merkury F1, Gracja F1, Julia F1
Cultivation system	Tomato is predominantly grown in tunnels. For example, one of the largest organic tomato producers grows tomato in soil on the area of 600 m^2 . The tunnels are covered with multi-seasonal foil with the high tot 3 m. Crop rotation include tomato, then gherkin – after each crop legumes.
Fertilisation	In tomato cultivation the following fertilization is used: manure, composted legume residues, macerated nettle. Other fertilizers include: potassium sulfate, potassium phosphate, florovit, microelements. The plants are treated with fertilizers in the dose of 30 L/m^2. Fertilization is done in spring and autumn.
Crop protection	Common crop protection methods include: biological methods, plant extracts and application of natural mulching e.g. with straw. In addition, fiber cloth is used to protect the plants and facilitate the growth.
Plastics	During tomato growing plastic materials are used in the form of tunnel foil, strings, etc.
Peat:	Peat is not used in tomato cultivation.
Yields and harvest method: What is a typical yield level that qualifies for sale? (kg/ha)	For tunnel cultivation of tomato, the typical yield is about 5-6 kg/m^2. This is also typical for sale.

Machinery: **Machinery** List operations performed in the field and estimated time consumption pr. operation	Mostly manual work.
Irrigation	Typical irrigation for tomato grown under tunnels (drip irrigation).
Alternatives/comments:	Alternatives for crop protection include different plant extracts obtained on-site.

Name and position/title/function of the person filling in: Based on the anonymous questionnaire output and personal communication with organic farming experts.	
Region to which the information applies:	
Crop	*Cucumber*
Propagation material	Cezar F1, Ares, Kronos F1, Cyryl F1, Alibi F1
Cultivation system	Cucumber is grown both in ground and tunnel systems. Crop rotation: after 3 years mainly after tomato and potato. Tunnel system uses plastic foil for about 4 seasons, the height about 190 cm.
Fertilisation	Fertilizers used in cultivation of cucumber are of natural origin, e.g. green fertilizers (lupine, lucerne, etc.). Also, manure is used. Mineral fertilizers such as phosphorus, calcium and magnesium. The application of fertilizers is usually done prior to cultivation (autumn) Manure is spread on the land and then mixed with soil. Typical doses of fertilizers in tunnel systems: - prior to seeding 0.08 t /ha P_2O_5, 0.1 t/ha N, i 0.19 t/ha K_2 O. - after harvesting 20 m^3/ha
Crop protection	In protection of cucumber usually biological methods are used. Commonly, the crop protection is done with natural plant extracts (e.g. garlic) obtained on-site. Also, some growers use commercially available bioproducts.
Plastics	Plastic is used as a foil for tunnels. Also, fiber cloth or black foil can be used to protect the crops from e.g. weeds.
Peat:	Peat can be used in tunnel system. It is mixed with straw and/or manure.
Yields and harvest method:	The typical yield of cucumber in tunnel system is about 12-16 kg/m^2 whereas in ground system it is about 16-17 t/ha.
Machinery	In ground systems: seeding machine, spraying machine, irrigation. In tunnel systems: fertigation devises with application system.

Irrigation	On average the amount of water is 350-400 mm in order to maintain 70-80% of moisture content.
Alternatives/comments:	No additional information.

2.8 Spain's Annex I-Tables

Name and position/title/function of the person filling in: Freelance Organic Agriculture Advisor	
Region to which the information applies: Andalusia	
Crop	Tomato
Propagation material	The same cultivars than conventional. There are many of them. Flavour and resistance to virus are requested.
Cultivation system	Crop rotation is mandatory. Common rotations: tomato-cucurbitaceous-bean (or other legume). Also long-cycle tomato (August-May) plus legume or zucchini. Seeds come from transnational seed companies. Local cultivars are not common. Organic seeds are not easily available (availability below 10% of demand), normally non-treated seeds are used. Seeds go to a commercial nursery then seedlings produced. Plantation material in the greenhouses are always seedlings from the nursery. The typical greenhouse structure is 'raspa y amagado' type (i.e. polyethilene plastichouse).
Fertilisation:	Most of the soils are mulched with sand. 80% growers use exclusively liquid fertilisers. 20% introduce plant debris and/or manure before planting. All greenhouses are irrigated every day. 10% of growers apply biosolarisation with transparent polyethylene cover.
Crop protection:	Copper: 4-5 applications for long cycles and 2 applications for short cycles. After pruning. Diversity of products: Increasing the presence of complexed Cu 5.5%. Sulphur: Powder formulation: 4 applications (first 4 weeks) at 25 kg/ha/week. After 5th week, bi-weekly applications by pulverisation. Not used from nov to feb. Main target: *Aculops lycopersici*. Mineral oils: Paraffinic oil (54%). Used sporadically in winter. Not compatible with sulphur.
Plastics:	Transparent polyethylene for biosolarisation or solarisation (50% growers). Strings to tie and wind the plants. Clips for supporting strings. Thermal sheet. Double roof (15% of growers). Mulching (15% of growers)
Peat:	Peat is used only in the nurseries.
Yields and harvest method:	
Machinery: **Machinery**	Phytosanitary treatments: 6 h/week/ha
Irrigation	Between 2,000-5,000 m^3/ha cycle
Alternatives/comments:	Substitutions of sulphur: Maltodextrin. Copper substitution: Plant extracts, *Bacillus subtilis*, *Trichoderma* spp., Potassium bicarbonate, Laminarin. Biodegradable strings are getting more and more common, but still less than 2%.

	Some growers produce vermicompost as a feasible alternative to peats for nurseries.

Name and position/title/function of the person filling in: Technical advisor of BioProcam.	
Region to which the information applies: Andalusia	
Crop	Tomato
Propagation material	The same cultivars than conventional. There are many of them.
Cultivation system	Crop rotation is mandatory. Common rotations: tomato-cucurbitaceous-bean (or other legume). Seeds come from transnational seed companies. Local cultivars are not common. Organic seeds are not easily available, normally non-treated seeds are used. Seeds go to a commercial nursery then seedlings produced. Plantation material in the greenhouses are always seedlings from the nursery. The typical greenhouse structure is 'raspa y amagado' type (i.e. polyethilene plastichouse).
Fertilisation:	Most of the soils are mulched with sand. Every 3-4 years sand is fully removed and manure buried. Each year organic matter is added by means of pellets through plantation rows. In August starts the tomato crop until March-April. Then melon or watermelon are cultivated, and in May beans are sown. Fertilizers: • Potassium sulfate): K2O 52%. • Magnesium sulfate • Solorganic Plus: N 1,31% y K2O 4,15%. All greenhouses are fertigated every day. Plant debris are buried together with Brassica debris as biofumigant in Summer, in rows.
Crop protection:	Copper: 7 applications from end September to April. Formulation: Complexed Cu 5.5%. Sulphur: 6 applications. 80% S richness Mineral oils: Not used.
Plastics:	Transparent polyethylene for biosolarisation. Strings to train the plants. Clips for supporting strings. Thermal sheet. Double roof.
Peat:	Peat is used only in the nurseries.
Yields and harvest method:	
Machinery: **Machinery**	Irrigation: 5 h/month/ha Phytosanitary treatments: 6 h/week/ha
Irrigation	About 3,000 m^3/ha cycle (August-March) Average 0.40 kWh/m^3/month

Alternatives/comments:	Substitutions of sulphur: plant extracts. Copper substitution is harder. Biodegradable strings are getting more and more common. Biosolarisation is increasing its presence in the area.

Name: ADV Ponent (Lleida-Catalonia)	
Crop	Olive
Propagation material	Arbequina
Cultivation system	**Irrigated lands** Very intensive: training in «palmeta» 1.25-1.5 between trees and 3.5-4 m between rows (+ 1000 trees/ha) Training trees based on canes or wires Intensive: trees in tall vase of 8 x 4 m, 7 x 7 m (200 to 400 trees/ha) **Non irrigated arable land/dryland** Different densities, but -in general- 100 trees/ha. In vase.
Fertilisation:	Composted manure at 6 000-8 000 kg/ha during winter time. Potassium can be applied (K salts) Magnessium sulphate in case of shortcomings. Iron chelates Granulates rich in Organic N (punctual cases) The dosage would depend on the kind of plantation, the uptake for production and the shortcomings according to leaf and soil analysis.
Crop protection:	Sulphur: 10-12 kg/ha spring (against fungi) Cupper: 2 kg oxyclorur 50%/ha before blooming (against fungi) Kaolin: 25-30 kg/ha maturation of the fruit (olive fruit fly) Spintor cebo: 1L/ha (against olive fruit fly) Bacillus thuringensis: 0.5-1 kg/ha (Lepidoptera larvae).
Plastics:	No
Peat:	No
Yields and harvest method:	Very intensive: 8 000-10.000 kg/ha. Harvesting and special machinery Intensive: 5000-7000 kg/ha. Shakers. Traditional: very variable, depending on the year and rainfall 2000 kg/ha Manual harvesting or manual shakers.
Machinery: **Machinery**	Strimmer («picadora») Strimmers under the line, between adjacent trees Disc harrow (very intensive) Manual pruning Machinary for spreading manure or fertilizers Sprayer (treatment phytosanitary)
Irrigation	Irrigation plantations: Intensives: about 7500 m^3/ha Very intensives: about 12 000 m^3/ha

Alternatives/comments:	No. But often happens that such inputs are not applied each year. Or the dosage is reduced.

Institution: technician from the Organic Farming Service- Valencia Government) growers and advisor on organic citriculture).	
Crop	*Citrus*
Propagation material	Under the rootstock *Citranger carrizo*: variety Clemenules
Cultivation system	No crop rotation (trees). Monoculture.
Fertilisation:	- Organic: 10 000 kg/ha sheep manure (winter and spring time). External input. - Organic matter addtion of spontaneous flora, with cuts (equivalent to 5000 kg manure). - Unwanted addition because of irrigation water pollution with nitrates (70 FU/ha) from March to november, included (depending on rainfall) - Foliar fertilization: Goemar (algae) - Mangessium sulphate: 40 FU/ha (commercial product: Epsonita) - Iron chelates 1.5 FU/ha (commercial product: Sequestrene)
Crop protection:	- Paraffin oil: 80 L/ha - Azaderactina (Alig): 3 L/ha
Plastics:	It is frequent to use it in new plantations, but not in all cases.
Peat:	Not used
Yields and harvest method:	20 000 kg/ha
Machinery: **Machinery**	Strimmer: 12 h/ha and year Crusher: 3 h/ha and year Sprayer: 9 h/ha and year.
Irrigation	7000 m^3
Alternatives/comments:	

Name: growers and advisor on organic citriculture	
Crop	*Citrus*
Propagation material	The grown varieties are the same as the conventional crop. The most frequent variety is Clemenules, but other mandarine cultures are Hernandina, Oronul. Regarding oranges, important ones are: Navel-late, Nàvel chislett, Nàvel lane-late, Sanguines. Sometimes there are small fields with avocado, pomegranate, kaki, kumquat.
Cultivation system	No exchange. The used sol is the original one. No protected crops. Always outside. No rotation (tree culture)
Fertilisation:	Main fertilizer is sheep manure, but also cow (bou) or horse manures. The dosage: 20 t/ha. There are also punctual application of commercial liquid organic matter using 100-200 L/ha.

	Normally 2 foliar nutrition treatments (algae) are applied.
Crop protection:	Crop protection constists in a single treatment with paraffin oil (once a year). At the end of winter time a treatment with cupper.
Plastics:	In the implementation of new cultures, geotextiles have been used with different results.
Peat:	Never
Yields and harvest method:	The yield is very different depending on the year, since the organic farming implies that, after a season with good yields, next year could be bad. But there are varieties like Hernandina that are quite masting ones. An average yield in organic Citrus is 15 000 kg/ha. Harvest is always manual.
Machinery	Rototiller: 8 h/ha Strimmer with tractor and crusher: 6 h/ha Foliar treatment (with turbo) 6 h/ha Manure with shovel: 12 h/ha
Irrigation	Surface irrigation
Alternatives/comments:	The alternative to paraffin oils are: Control of red spidermite: Diatomea soil Control of red scale: mating disruption. Control of whitefly: potassim soap There are some alternative for fungi control but the use of cupper is very punctual (only one treatment/season) and right now the commercial products have low Cu content (14%).

Name and position/title/function of the person filling in: Agronomist/Advisor citric crops.	
Region to which the information applies: Andalusia	
Crop	Citrus
Propagation material	Seedlings not from organic nurseries. Two years after planting start certification eco.
Cultivation system	Open field, original soil, 100% drip irrigation. Harvest: On September (early Citrus), on July (late productions).
Fertilisation:	Fertigation very important. - Algae-based products (60 L/ha/week) via drippers, since pre-flowering until harvest. - Organicum (14-1-1) (15 l/ha/week) - Fertiliza complex (2-0-10) (5 l/ha/week): product to induce maturation. - Fox 20 (Organic phosphorus): 10 (l/ha/week) for two weeks while flowering. - Calcium sulphate. No composting, no biofumigation.
Crop protection:	Copper: Sporadically, Up to two applications of Copper hidroxyde (1.5 kg Cu/ha/year) Sulphur: Not applied. Mineral oils: Summer applications (below 25 l/ha/year active ingredient).
Plastics:	Two uses: - In nurseries for covering the grafting junction. - In West Andalusia, some growers mulch with micro-perforated plastic.
Peat:	Not used
Yields and harvest method:	40,000-60,000 kg/ha
Machinery: **Machinery**	Pruning Tillage: twice per year Treatments with atomizer
Irrigation	6,000 m^3/ha/year
Alternatives/comments:	To copper: *Bacillus subtilis*, *Equisetum arvense* extracts.

Name and position/title/function of the person filling in:	
Region to which the information applies: Andalusia	
Crop	Olive
Propagation material	Seedlings not from organic nurseries.
Cultivation system	Dryland crop.
Fertilisation:	Fertilisation depending on the results of foliar analyses.
Crop protection:	Copper: Not applied to soil. Sulphur: Not applied to soil. Mineral oils: Not applied to soil.
Plastics:	Boxes, plastic for soil (to avoid water runoff).
Peat:	Not used
Yields and harvest method:	2000-2500 kg/ha

Machinery: **Machinery**	Weed chopping Harvest (nov-feb) Treatment against olive fruit fly Foliar fertilizers treatments
Irrigation	Dryland
Alternatives/comments:	To reduce plastic use: Avoid boxes, i. e., moving harvest directly into trailers.

Name and position/title/function of the person filling in: Advisor/Las Parras C.B.	
Region to which the information applies: Andalusia	
Crop	Olive
Propagation material	Seedlings from organic nurseries.
Cultivation system	Dryland crop.
Fertilisation:	Fertilisation depending on the results of foliar analyses.
Crop protection:	Copper: 3-4 treatments depending on foliar analyses. Sulphur: Not applied. Mineral oils: Not applied.
Plastics:	Plastic for soil (to avoid water runoff).
Peat:	Not used
Yields and harvest method:	5000 kg/ha
Machinery: **Machinery**	Weed chopping Harvest (nov-feb) Treatment against olive fruit fly Foliar fertilizers treatments Pruning
Irrigation	Dryland
Alternatives/comments:	

Name: ADV Ponent (Lleida-Catalonia)	
Crop	Olive
Propagation material	Arbequina
Cultivation system	**Irrigated lands** Very intensive: training in «palmeta» 1.25-1.5 between trees and 3.5-4 m between rows (+ 1000 trees/ha) Training trees based on canes or wires Intensive: trees in tall vase of 8 x 4 m, 7 x 7 m (200 to 400 trees/ha) Non irrigated arable land/dryland Different densities, but -in general- 100 trees/ha. In vase.
Fertilisation:	Composted manure at 6 000-8 000 kg/ha during winter time. Potassium can be applied (K salts) Magnessium sulphate in case of shortcomings. Iron chelates Granulates rich in Organic N (punctual cases) The dosage would depend on the kind of plantation, the uptake for production and the shortcomings according to leaf and soil analysis.
Crop protection:	Sulphur: 10-12 kg/ha spring (against fungi)

	Cupper: 2 kg oxyclorur 50%/ha before blooming (against fungi) Kaolin: 25-30 kg/ha maturation of the fruit (olive fruit fly) Spintor cebo: 1L/ha (against olive fruit fly) Bacillus thuringensis: 0.5-1 kg/ha (Lepidoptera larvae).
Plastics:	No
Peat:	No
Yields and harvest method:	Very intensive: 8 000-10.000 kg/ha. Harvesting and special machinery Intensive: 5000-7000 kg/ha. Shakers. Traditional: very variable, depending on the year and rainfall 2000 kg/ha Manual harvesting or manual shakers.
Machinery: **Machinery**	Strimmer («picadora») Strimmers under the line, between adjacent trees Disc harrow (very intensive) Manual pruning Machinary for spreading manure or fertilizers Sprayer (treatment phytosanitary)
Irrigation	Irrigation plantations: Intensives: about 7500 m^3/ha Very intensives: about 12 000 m^3/ha
Alternatives/comments:	No. But often happens that such inputs are not applied each year. Or the dosage is reduced.

2.9 Turkey's Annex I-Tables

Name and position/title/function of the person filling in:	
Region to which the information applies: IZMIR Province	
Crop	*Citrus-*
Propagation material	*Satsuma mandarin*
Cultivation system	-
Fertilisation:	On farm Compost hip (artificial plants+cow manure) 40 tonnes /ha Before the season: Fertilization with composted plant artificials and animal (cow) manure(on-farm).
Crop protection:	Insect problems: mineral oil 600-1500 ml/100L water b) Pheromone traps with deltmethrin c) 0,24gr/l Spinosad CB (1 Liter insecticide + 10 Liters water as partial branch application) 120-130 ml water-bioinsecticide mixture per tree. Sulphur: for acar, spider mite problems (%80 sulphur wp 600 g/100L water) Ectomyelois ceratoniae: 32000 IU/mg Bacillus thuringiensis berliner var kurstaki WP: 100GR/100 liter water Flower thrips: Spinosad 480 g/L 30ml/100L water Phoma spp. Phytophthora spp.: Cupper sulphate, bordeux mixture (as pure cupper 6kg/hectare/year max limit)
Plastics:	There is no plastic mulching
Peat:	No
Yields and harvest method	Harvest method is usually collecting fruits by hand 20-30 tonnes/ha
Machinery:	Disk harrow Sub soil Rotavator tiller 2 timea annually
Irrigation	Drip Irrigation 4 times/ a week in summer season -4 hours/day – 40lt /1000m2
Alternatives/comments:	-

Name and position/title/function of the person filling in:	
Region to which the information applies: Turkey	
Crop	*Olive*
Propagation material	Gemlik, Ayvalik, Memecik, Domat, Kilis Yaglik (In general age: ≥20 year) -Implant on wild type-
Cultivation system	No crop rotation in olive orchards.
Fertilisation:	%80 Olive Orchard : No fertilization (slope %20-25) %20 slightly slope Composted animal manure

	Autumn season: 2-3 kg per tree
Crop protection:	*NO (%80) (SLOPE LAND)* *Olive* fruit *fly* (*Bactrocera oleae, Dacus oleae*): a) By using traps consist of di-ammonium phosphate in plastic bottles. b) Pheromone traps c) 0,24gr/l Spinosad CB (1 Liter insecticide + 10 Liters water as partial branch application) Prays olea Azadirachtin 0,3 gr/l as 500 ml/100Liter water Olive leaf spot, pea cock: Cupper sulphate, bordeux mixture(For 1St. spraying: 1500grams [Cuppersulphate equavalent to %20-25 metallic cupper] + 750 grams quicklime/100Liter water. 2nd. Spraying: 1000 grams [Cuppersulphate equavalent to %20-25 metallic cupper] +500 grams quicklime ***3th spraying will be done in 2019. In Turkey after 2018 farmers will make 3 fungicide application for *Spilocaea oleaginae.* Autumnx1 +Spring x2
Plastics:	There is no plastic mulching.
Peat:	No Apart from OF production During Sappling production, rooting stage peat is required or else sheep manure+soil+perlit is an another obtion . By the way at this moment there is no any commercial sampling organically certified grower in the country.
Yields and harvest method	Harvest method is usually collecting fruits by hand and mechanical way (by using harrow) Variability is high as 20-150 kg per tree
Machinery:	Soil cultivation: plough, harrow
Irrigation	No (%80) It depends on the soil charecteristics, land sloping characteristics, and annual climate. (avarage 600-800 mm per year) need in long summer season. Olive yield mainly depending on irrigation possibility rather than fertilization in most cases.
Alternatives/comments:	-

Name and position/title/function of the person filling in:	
Region to which the information applies: Aegean (Izmir-Odemis is the most convenient place for potato cultivation, Middle Anatolia (Niğde, Nevsehir, Konya, Amasya, etc.)	
Crop	*Potato*
Propagation material	Marabel and Granola (Family farms use their own potato reproduction material)
Cultivation system	Depends on variety in winter (February-June) and summer (August-November seasons in Izmir Odemis Crop rotation is being done with vegetables like melon, watermelon, and cereals corn

Fertilisation:	On farm Compost hip (artificial plants+cow manure) 40 tonnes /ha Before the season: Fertilization with composted plant artificials and animal (cow) manure(on-farm). Vermicompost usage have been improving from commercial national market (in some years)(10 tonnes/ha) Commercial K fertilizer organically certified (50 kg/1000m2)some years- After planting: Compost tea application(spray)(1-2 times)(50lt/1000m2-%0.5 N)
Crop protection:	Insect problems: Leptinotarsa decemlineata: a) 480gr/l Spinosad sc (10 ml/100Lt) b) Azadirachtin 10g/Lt (250 ml/100Lt) Sulphur: for acar, spider mite problems (%80 sulphur wp 600 g/100L water) (Rhizoctonia solani) a) %1,5 1x10^8 kob / ml min. Pseudomonas fluorescens strain CEDRİKS Biyologij Fungicide 500 ml/100 kg seed treatment b) %0,3 Bacillus subtilis GB03 race 1,2x10^7 cfu/gram COMPANION 500 ml/100 kg seed treatment
Plastics:	There is no plastic mulching.
Peat:	No
Yields and harvest method	10-35 tonnes/ ha
Machinery:	Soil cultivation: plough, harrow, tiller
Irrigation	Modern irrigation system (under soil 40 cm depth)
Alternatives/comments:	Soil quality is high in terms of OM and texture is loamy.

Name and position/title/function of the person filling in:	
Region to which the information applies: Aegean, Marmara, Middle Anatolia	
Crop	*STRAWBERRY*
Propagation material	Camarosa, Fern, Fortuna, Sweetcherry, Sweet Charlie* *Commercial strawberry Producers prefer this variety and have been growing it for 20 years and reproduce their own seedlings..
Cultivation system	Farmers changing the cultivation area every 1 or 2 year. They are usually making solarisation. In Turkey, under the plastic tunnel cultivation is widespread. Description of plastic tunnels: 2-2,50 meter height and 6-7 meters weight. Percentage of plastic tunnel systems:%50 Percentage of open field systems:%50 (Usually second year of cultivation, farmers take back the plastic tunnel system over the strawberry field.
Fertilisation:	Autum and spring

	Before planting the seedlings: Fertilization with vetch and manure. After planting: Compost tea
Crop protection:	Tetranicus spp: %80 Sulphur – 400 gr/100Liter water. Spinosad 480 gr/L dosage: 20 ml/1000square meter Aphids: Snails: Collecting with hand For root rots (*Fusarium sp, Rhizoctonia solani, Macrophomina sp.*):*Trichoderma harzianum by dipping the cuttings or seedlings before planting.* Grey mould (*Botrytis cinerea*): Seranade SC ® (1000 mili liter/1000 square meters) Powdery mildew (*Podosphaera aphanis*): Sulphur %80 micronize. 300gr/100Liter water. Weeds: Collecting, solarisation, soil mulching
Plastics:	Yes, totally plastic mulching have been using except one from Ankara. He is using straw instead of plastic mulch but in vrery small scale growing area (500 m^2).
Peat:	No
Yields and harvest method	Harvest method is usually collecting fruits by hand 30-40 tonnes /ha
Machinery:	2 times sub-soil+ 2 times rotary tiller
Irrigation	Drip Irrigation (2 lt/h, 17 lt 4 times per week)
Alternatives/comments:	-

Name and position/title/function of the person filling in:				
Region to which the information applies: Aegean				
Crop		*Tomato*	*Pepper*	*Eggplant*
Propagation material	Open Field	Standard Open Pollunated Landraces (56, SC2121) Determinate Type	Standard Open Pollunated Landraces (Çarliston, Dolmalık, İnce Kıl)	Standard Open Pollunated Landraces (Topan, Aydın Karası)
	Greenhouse (Only one greenhouse certified organically in the country since 1995)	Hybrid Pepper (National varieties) (Bred from landraces of TR) Indeterminate type	Hybrid Pepper (National varieties) (Bred from landraces of TR)	Amadeo F1 Topan (Open pollunated landrace)
Cultivation system		Rotation system is using their own field and greenhouses. Growing period open field: April-September In greenhouse: Winter time		
Fertilisation:		All season 2-3 times in a year in open field and greenhouse Mostly on farm composting Before the season: Fertilization with vetch+barley mixture as green manure and animal manure (20-30 tonnes/ha) Before planting the transplants : Compost 20 tonnes /ha		

	Fertilization with composted plant artificials and animal (cow) manure and Vermicompost usage have been improving. After planting: Compost tea application (spray+irrigation) (4 times in early stage)
Crop protection: Describe the type and quantities of crop protection products in amounts per application and unit land area, with special reference to copper, mineral oils and sulfur	*Sulphur: for powdery mildew* *Trichoderma harzianum: for soil born fungal diseases and Botrytic cinerea on fruits.* Tuta absoluta : a)35000 DBM/mg Bacillus thuringiensis var. aizawai strain ABTS-1857 WG: as 150gr /100 l water for greenhouse b)32000 IU/mg Bacillus thuringiensis berliner var kurstaki100 gr/100L water for field conditions. c)480 g/l Spinosad LASER 25 ml / 100 L water for greenhouse d)10 g/l Azadirachtin SUHULET 10 EC 500 ml/100 l water (larvae) Greenhouse NESIDIOCONTROL 500,Nesidiocoris tenuis (Miridae):(Bemisia tabaci, Trialeurodes vaporariorum), (Tetranychus spp.), (Tuta absoluta) 0,5-1,5 beneficial insect/1 square meter
Plastics:	No
Peat:	No.
Yields and harvest method:	Harvest method is collecting fruits by hand Tomato: 40 tonnes/ha open field, 35-75 tonnes / ha in greenhouse Pepper: 15-25 tonnes/ha open field, 35-60 tonnes / ha in greenhouse Eggplant: 35-40 tonnes/ha open field, 30-35 tonnes / ha in greenhouse
Machinery:	Disk harrow Sub soil Rotavator tiller 2 times a year in autumn and spring times
Irrigation	Drip Irrigation Variability very high.
Alternatives/comments:	-

2.10 UK's Annex I-Tables

For UK, information was not compiled in crop tables. Instead, the largest organic growers' association, Soil Association (SA) interviewed several growers, and analysed the permissions to use restricted inputs that were given in one year. The information provided by SA is following.

Restricted crop input/Product	Permission Details (incl. Ingredient/Brand Name of	Contentious input A
Cuprokylt and codacide	Cuprokylt + codacide on potatoes against blight @ 5kg/ha	Copper
Copper Cuprokylt	Request to use Copper (Cuprokylt) to treat potato blight using 4 applications at the rate of 0.8kg (3.2kg/per ha) has been approved	Copper
Laws bespoke	200l 5-0-10 cu zn mn feed and 80l 6-0-7 + mn , cu, zn b Laws bespoke fertiliser on potatoes and beetroot respectively	Copper
Cuprokylt	Request to use Cuprokylt on 15/20 varieties of potato to treat blight in (1.44ha).	Copper
Copper oxychloride	• until end of 2018 • on (0.156ha) • at the following threshold levels: A maximum of 3 sprays of 3kg copper oxychloride (in 200-300L water) per spray per hectare.	Copper
Cuprokylt	Cooper (Cuprokylt) on potatoes against blight	Copper
Sylvinite, Laws Potash Plus, Laws High N, Laws Foliar N, Manganese, Copper, Zinc and boron	Sylvinite, Laws Potash Plus, Laws High N, Laws Foliar N, Manganese, Copper, Zinc and Boron on carrots, onions and potatoes	Copper
Copper	Copper against potato blight WITH CAVEAT that it can only be used if the EAMU comes through...	Copper
Cuprokylt	Cuprokylt on potatoes against blight	Copper
Copper oxychloride	Copper oxychloride - against canker on apples and pears	Copper
Manganese and copper	Manganese and copper applications to winter wheat and barley crop	Copper
Boron, Manganese, Copper	Your request to use Boron, Manganese & Copper on Beetroot & Spring onions (shown as deficient) has been approved	Copper
Copper oxychloride	Copper Oxychloride on apples and pears, prophylactically as a fungicide.	Copper
Copper oxychloride	Copper oxychloride for treating canker on apple and pears	Copper
Laws High N, Na, S, Mn, B, Zn, Cu	Laws High N, Na, S, Mn, B, Zn, Cu on potato, onion and parsnip	Copper
Sulphate	Sulphate of potash on grass fields	Sulphur

Restricted crop input/Product	Permission Details (incl. Ingredient/Brand Name of	Contentious input A
Sulphur	sulphur on leeks and broccoli	Sulphur
Microthiol	Microthiol special on borrage crop at 5kg/ha.	Sulphur
Zynergy Omex	1x application of Zynergy Omex (Zn Zinc + Sulphur S03 + Copper Cu) @ 0.7kg/ha, on 2 parcels of Vining Peas – (4.49ha) & 11 acre, (4.57ha).	Sulphur, Copper
NuGro	NuGro 8-7-7 • during July and August 2018 • only applied to propagating module plants before planting. • 2 litres/acre every 14 days NuGro 6-2-4 & 7-2-2 • during July and August 2018 • 2 litres/acre every 14 days	Sulphur
Bittersaltz & Omex	Request to use: Bittersaltz - Mg Sulphate Bittersaltz @ 5.5kg/ha Boron @ 0.2kg/ha Zynergy Omex (Zn Zinc + Sulfur S03 + Copper Cu) @ 0.7kg/ha On 2 parcels:	Sulphur, Copper
Microthiol (sulphur)	Requested to use Microthiol Special (Sulphur) at 10kg per ha on Onions	Sulphur
Sulphur	Sulphur against mildew on tomatoes	Sulphur
Sulphur	Sulphur on carrots, parsnips, beans, barley, oats and onions against fungal disease - plan for 2018	Sulphur
Manganese sulphate and kumuls DF sulphur	Manganese sulphate and Kumulus DF (sulphur) on spring barley and spring oats	Sulphur
Microthiol special (sulphur)	Microthiol special (sulphur) on hops against powdery mildew	Sulphur
Sulphur	Sulphur on apple and pear trees against mildew	Sulphur
PatentKali	PatentKali 250kg/ha on carrot, onion, onion set, potato	Sulphur
Yaravita Mantrac (manganese sulphate)	Yaravita Mantrac DF (manganese sulphate) on carrots/onions/onion sets/potatoes	Sulphur
PatentKali	Patentkali at 250kg/ha on carrot, onion, onion set and potato	Sulphur
Manganese sulphate	Manganese sulphate, Boron, Sulphur, Magnesium sulphate on carrots, leeks and broccoli.	Sulphur

Restricted crop input/Product	Permission Details (incl. Ingredient/Brand Name of	Contentious input A
PatentKali	request for Patent Kali has been approved: •For use between May-August 2018 •For use on - (- 2.68 ha) - (- 4.93 ha) - For use up to 250g/ha	Sulphur
SoP	SoP	Sulphur
Microthial Special	Microthial Special • until 31st December 2018. • on Spring Oats, Spring Barley, Winter Wheat, Winter Barley and Spring Beans (for treatment of mildew and sulphur deficiency) • at the following threshold levels: as detailed in your submitted management plan	Sulphur
Manganese sulphate	Your request to use Ilex mangenese (Manganese sulphate) has been approved: Subject to: 1) 1ml / m2 applied as 2.5 L in 30m3 tank and irrigated to 5000m2 2) Glasshouse mixed salad and veg	Sulphur
Sulphur	Sulphur For use against scab and mildew in apple trees	Sulphur
Sulphur	Sulphur•On apples•Against mildew•When there is a risk of mildew	Sulphur
Potassium hydrogen carbonate	Potassium hydrogen carbonate •On apples •Against mildew •When mildew is seen on new growth, alternating with sulphur	Sulphur
Sulphur	Sulphur	Sulphur
PatentKali	Patent Kali (sulphate of potash)	Sulphur
SOP	SOP on fields: Between 60 to 180 kg of product depending on field	Sulphur
Manganese sulphate, Boron, Sulphur	Manganese sulphate, magnesium sulphate, boron, sulphur on carrots	Sulphur
Sulphur	Sulphur on apples and pears for powdery mildew	Sulphur
Sulphate	Sulphate of potash for four fields with index of 0	Sulphur

Restricted crop input/Product	Permission Details (incl. Ingredient/Brand Name of	Contentious input A
Law bespoke	Law Fertilisers bespoke mixes on carrots in (9.3ha) and (5.7ha) The 1110 kg will be used over 3 applications as follows: 625 kg/ha BASE SALT MIX: 80K, 170 NaO, 2B, 60 SO3 500 kg/ha BED MIX: 9-0-9+Mn,S,B 10 kg/ha PLACEMENT MIX (with drill): N-P+	Sulphur
Sulphate	Sulphate of potash	Sulphur
Tracer (Spinosad)	Your request to use Tracer (Spinosad) has been approved. For use against Thrips on the following crops: - Tarragon - Mint - Basil - Chives	Spinosad
Tracer (Spinosad)	Tracer (spinosad) on plums for plum fruit moth - 2 applications	Spinosad
Tracer (Spinosad)	Tracer (spinosad) on leaf salads against Silver-Y caterpillars	Spinosad
Tracer	Tracer on spring onions	Spinosad
Tracer	Tracer (spinosad) on plums and gages against plum moth	Spinosad
Spinosad	Spinosad to treat for ermine moth in apples	Spinosad
Spinosad	Spinosad on apple and pears in fields 9, 11 & 33 against moth and sawfly	Spinosad
Spinosad	Spinosad (conserve) on basil, mint, tarragon and chives	Spinosad
Spinosad	Request to use Spinosad on Cauliflower to combat Cabbage Root Fly	Spinosad
Spinosad	Conserve (spinosad) on tomatoes against leaf miner	Spinosad
Tracer (Spinosad)	Tracer (spinosad) on apples	Spinosad
Tracer (spinosad)	Tracer (spinosad) to treat against apple sawfly	Spinosad
Spinosad - tracer	Permission for Spinosad - Tracer	Spinosad
Spinosad	Spinosad against tortrix moth on apples and pears	Spinosad
Spinosad	Spinosad (Conserve)	Spinosad
Spinosad	Permission to use Spinosad on Rapsberries - Spinosad (Tracer)	Spinosad
Spinosad	Permission to use one application of Spinosad - Spinosad (Tracer)	Spinosad
Omex 'saltex'	Omex 'Saltex' (mined salt source) on 7ha fodder beet - 2 applications of 500l/ha	Sodium chloride

Restricted crop input/Product	Permission Details (incl. Ingredient/Brand Name of	Contentious input A
Potassium bicarbonate, Ferric Phosphate, pyrethrins, sulphur, PHC, Laws High N	2018 input and pest control management plan. P&D: potassium bicarb, ferric phosphate, natural pyrethrins, sulpur Restricted inputs: PHC liquid, Laws High N, Boron foliar feeds, Pharm organics Allowed without approval: Zenith, Biolife Pro A and S Rejected: Copper	Pyrethrin, Sulphur
Spruzit	Spruzit on brassicas	Pyrethrin
Pyrethrum	Pyrethrum on kale against aphids.	Pyrethrin
Tracer and Pyrethrum	Tracer and Pyrethrum to following fields:	Pyrethrin
Pyrethrum	Pyrthrum 5EC on leaf salads again Silver-Y	Pyrethrin
Spruzit (pyrethrum)	Spruzit (pyrethrum) on leaf salads against Silver-Y	Pyrethrin
Pyrethrum	Pyrethrum to all purple sprouting broccoli crop against aphid	Pyrethrin
Pyrethrum	pyrethum to control aphids on broccoli	Pyrethrin
Pyrethrum	Pyrethrum on kale against aphids	Pyrethrin
Pyrethrum	Pyrethrum 5EC against plum aphid	Pyrethrin
Spruzit	Spruzit (natural pyrethrum) - on aphids at first sighting, 3l/ha on carrots.	Pyrethrin
Pyrethrum	Pyrethrum on salad brassicas	Pyrethrin
Pyrethrum	Request to use Pyrthrum 5 EC on Asparagus crop to treat Asparagus Beetle.	Pyrethrin
Pyrethrum	Pyrethrum for tortix moth on roses	Pyrethrin
Potassium	Potassium soft soap for aphids on roses	Pyrethrin
Pyrethrum 5EC	Pyrethrum 5EC (natural pyrethrins + piperonyl butoxide synergist)	Pyrethrin
Pyrethrum	Pyrethrum 5EC	Pyrethrin
Pyrethrum	Pyrethrum against pear midge on pear trees	Pyrethrin
Pyrethrum	Pyrethrum 5EC For use against rosy apple aphid and apple sawfly	Pyrethrin
Pyrethrum	Pyrethrum •On apple and plum orchards •Against blossom weevil •When 4-6 insect found per tree	Pyrethrin
Pyrethrum (spruzit)	Pyrethrum (spruzit)	Pyrethrin
Pyrethrum	Pyrethrum for weevils	Pyrethrin
Pyrethrum	Pyrethrum 5EC	Pyrethrin
Pyrethrum	Permission to use pyrethrum 5EC against whitefly on kale - Pyrethrum 5EC	Pyrethrin
Calcium chloride	Calcium chloride (Yaravita StopIt) •On dessert and culinary apples •To aid fruit set •According to agronomist recommendations	Calcium chloride

Restricted crop input/Product	Permission Details (incl. Ingredient/Brand Name of	Contentious input A
	Leeks are suffering from Thrips infestation, verbal permission given by BK.	
Basic Slag	Request to use Basic Slag on selected fields:	
Sawfly	Soft soap against sawfly larvae on gooseberries	
PHC 9-2-2	PHC 9-2-2 on spinach and lettuce	
Organic Natural 2.0	Organic Natural 2.0	
	on Kale Crop when 4 slugs have been caught per trap	
Amino A, Calcium chloride, manganese	Nutrient inputs: Amino A, calcium chloride, manganese,	
Vita Protect	Vita Protect	
Basic Slag	permission to use basic slag - basic slag	
Melcourt Sylvamix	Requested to use Melcourt Sylvamix as a propogating material.	
Dunns Natural 3	Dunns Natural 3 (granular P and K)	
Better Grass Xtra	Better Grass Xtra on fields 4, 5, 14, 15, 16, 17 & 20.	
Basic Slag	Permission to use basic slag - basic slag	