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

Deliverable 3.1: Version 1.1

Current use and legal status of crop protection inputs

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1. Summary

This deliverable 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. In some cases the survey was based on already available data of the Organic-PLUS partner while an online questionnaire was also developed and used (e.g. CUT for Poland). The collected raw material is presented in D3.1 Annex I.

Statistical data concerning the organic farming in the countries under study are also presented. The deliverable includes also documentation of current policies and legal status of the use of contentious plant protection products in organic farming with emphasis on potato, tomato, citrus and olive crops.

Copper-based products are used in plant protection as bactericides and fungicides. Copper is the only active ingredient with a strong antimicrobial effect and a wide range of action that is approved for use in organic farming particularly for grape, potato and apple crops. Recently, the demonstrated adverse effects on the environment (on soil organisms and auxiliary species) have led to a reduction in its use in several European countries.

The current regulation in EU related to the use of cooper in organic production sets the limit of up to 6 kg copper per ha per year. For perennial crops, Member States may, by derogation, provide that the 6 kg copper limit can be exceeded in a given year provided that the average quantity actually used over a 5-year period consisting of that year and of the four preceding years does not exceed 6 kg.

Among the investigated crops (mainly citrus, olive, tomato, potato, strawberry), large amounts of copper are used mainly by Mediterranean growers in citrus, olive and potato. For crops like citrus and olives the limit of 6 kg per ha and per year may not be always respected. Tomato producers apply high amounts of copper in winter crops (greenhouses).

In the case of Norway, the use of copper and mineral oil were not permitted for organic growing until March 2017, when the EC regulations were implemented. However, the national limit for copper in Norway is 4 kg per ha and year, thus it is easier for these growers to comply with lower limits of copper use than those in EU.

In Denmark, copper is not used in organic agriculture at all because national authorities have not (yet) been asked to approve any commercial product containing copper, or they have not approved it.

Many alternatives to copper are under development, but few are already available on the market, and fewer still are currently used by growers to a substantial extent. Alternatives with a low concentration of copper ion are demonstrating good levels of efficacy. Possibly, a reduction of the concentration of copper, together with more efficient formulations, could reduce the presence of copper in the crops (and soils). Nevertheless, abandoning copper

cannot be easily achieved through a simple substitution strategy (for instance, replacing copper by biocontrol products); it requires a more or less profound reconstruction of the crop production system, including changing cultivars (in favour of resistant ones), developing prophylaxis and sanitation measures, adjusting fertilisation, etc. This requires an integrative approach, which is still under-developed.

Regarding sulphur, this substance is very common for organic vegetable growers, especially for greenhouse growers. The uses of sulphur can move from 10 to 100 kg/ha/year depending on the production system and the incidence of pests. However, it is seldom considered that the use of sulphur is problematic, except as a main component of sulphites in wine production.

It is a sort of universal phytosanitary product: repellent to pests, killer of mites, and effective against powdery mildews. However, it is not selective, and it has harmful effects on beneficial arthropods. So, the use of sulphur can limit biological control. Alternatives to sulphur are not currently applied mainly for economic reasons since sulphur is cheap compared to other compounds. Moreover, since sulphur can be an alternative to mineral oil, its use is not easily reduced.

Mineral oils are applied to exclusively control insects and mites in citrus and olive orchards and occasionally in tomato. There are not many data available for the use of mineral oils but from the data presented it was found that in some cases (e.g. in citrus) they are considered as the main contentious input. The wide spectrum of this substance makes it more versatile than other alternatives. In other cases, mineral oils are of minor use, and can easily be replaced by organic oils.

2. Introduction

The use of contentious inputs linked to plant protection, and the use of peat, plastic and fertilisers used in growing, in 10 countries participating in Organic-PLUS (Figure 1).

Figure 1. Map of participating countries in the "mapping task".

The analysis was carried out based on the data collected 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. In some cases the survey was based on already available data of the Organic-PLUS partner.

For Poland, the information was based on inputs recorded by a simple web survey from several producers. For Germany, information available from large growers' associations was used. 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 D3.1 Annex I while the crops recorded per county are summarised in Table 1.

The survey of Task 3.1 was carried out together with the survey carried out for Task 5.1. The same tables which were used to record plant protection inputs were also used to record inputs of peat, plastic and fertilisers. The output and analysis of peat, plastic and fertilisers inputs is

summarised per country and discussed in an extensive report (Løes, et al. 2018). The report and Annex are available on www.organic-plus.net

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				3				3	9
Turkey						1		1		1	1	1	1	1	7
SUM	**3**	**2**	**1**	**2**	**3**	**8**	**1**	**2**	**1**	**8**	**9**	**1**	**4**	**15**	**60**
UK	*2*	*2*	*2*	*2*					*1*				*1*		*8*

2.1 Main statistical findings for organic farming in EU[1]

2.1.1 Total organic area

Total organic area continues to increase in the EU. The total organic area in the EU-28 was 11.9 million hectares (ha) in 2016 and is expected to grow in the coming years (Figure 2). The increase in organic area between 2012 and 2016 was 19% (see Table *2*). The total organic area is the sum of the 'area under conversion' and the 'fully converted area'. Before an area can be considered as 'fully organic', it must undergo a conversion process, which may take 2-3 years depending on the crop.

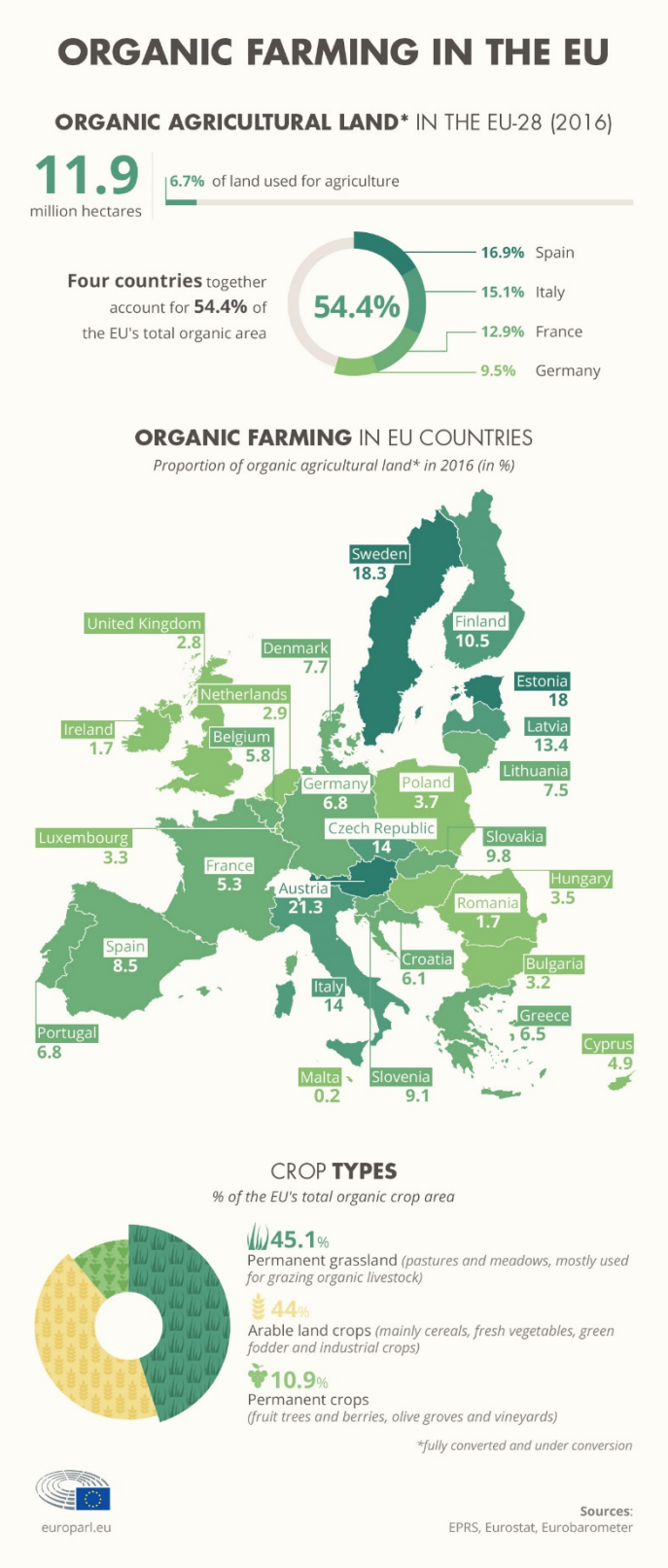


Figure 2. The EU's organic food market: facts and rules (infographic). www.europarl.europa.eu/news/en/headlines/society/20180404STO00909/the-eu-s-organic-food-market-facts-and-rules-infographic

[1] Source: Eurostat

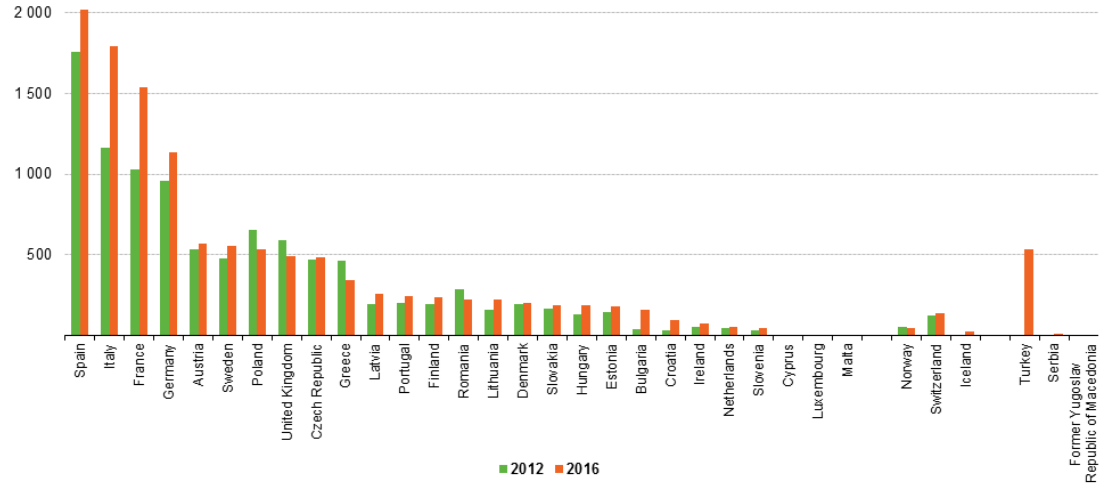
Table 2. Total organic area, 2012 and 2016. Sum of land in conversion and certified organic area. Source: Eurostat.

	Total organic area (ha)		2012–16 (% change)
	2012	2016	
EU-28	**10 047 896**	**11 931 589**	**18.7**
Belgium	59 718	78 452	31.4
Bulgaria	39 138	160 620	310.4
Czech Republic	468 670	488 591	4.3
Denmark	194 706	201 476	3.5
Germany	959 832	1 135 941	18.3
Estonia	142 065	180 852	27.3
Ireland	52 793	76 701	45.3
Greece	462 618	342 584	-25.9
Spain	1 756 548	2 018 802	14.9
France	1 030 881	1 537 351	49.1
Croatia	31 904	93 593	193.4
Italy	1 167 362	1 796 333	53.9
Cyprus	3 923	5 550	41.5
Latvia	195 658	259 146	32.4
Lithuania	156 539	221 665	41.6
Luxembourg	4 130	4 274	3.5
Hungary	130 607	186 322	42.7
Malta	37	24	-35.1
Netherlands	48 038	52 204	8.7
Austria	533 230	571 423	7.2
Poland	655 499	536 579	-18.1
Portugal	200 833	245 052	22.0
Romania	288 261	226 309	-21.5
Slovenia	35 101	43 579	24.2
Slovakia	164 360	187 024	13.8
Finland	197 751	238 240	20.5
Sweden	477 684	552 695	15.7
United Kingdom	590 011	490 205	-16.9
Iceland	:	22 594	:
Norway	55 260	47 621	-13.8
Switzerland	121 013	141 249	16.7
Former Yugoslav Republic of Macedonia	:	3 245	:
Serbia	:	14 358	:
Turkey	:	533 218	:

(:) data not available

Between 2012 and 2016, Croatia and Bulgaria recorded growth in the total organic area of over 100%. However, five EU Member States as well as Norway reported a downward trend: Greece (-26%), Malta (-35%), Poland (-18%), Romania (-22%), the United Kingdom (-17%) and Norway (-14%). Whereas the economic crisis may explain the decreased organic area in Greece and Poland, the decrease in UK and Norway have different explanations, e.g. too fast growth before, reduction in organic lines in supermarkets due to the economic crisis despite being relatively rich countries. A more general explanation is that the organic area is dominated by large parcels of permanent grassland and rough grazing land, and although the horticultural area has increased in the UK this effect was 'drowned' by the reduction of organic grazing land e.g. in Scotland's highlands. In Norway, it may be similar to Scotland and a large interest in local food, and high trust in Norwegian food products, may be part of the explanation. In the case of Malta, the organic area is small and the 35% reduction is in absolute

numbers only 13 hectares. As shown in Figure 2, Spain, Italy and France had the three highest total organic areas both in 2012 and 2016. Organic area in Turkey has grown rapidly in recent years.



Source: Eurostat (online data code: org_cropar)

Figure 3. Total organic area, 2012 and 2016 (ha), sum of land in conversion and certified organic area. Source: Eurostat.

The size of the organic area differs considerably between European countries. Four Member States of the EU accounted for more than half of all organically farmed land in 2016: Spain (17%), Italy (15%) France (13%) and Germany (10%), together making up 54% of the total EU-28 organic area (see Figure 3). In 2015, these four countries represented 53% (Figure 4).

Total organic area made up 7% of total EU-28 utilised agricultural area (UAA) in 2016. From 2012 to 2016, the share of total organic area in the total utilised agricultural area within the EU rose from 6% to 7%.

Figure 5 shows the organic crop area as a percentage of the total utilised agricultural area (UAA) by country for 2016. In Austria, Sweden and Estonia, the share of organic area was over 18%, while in Italy, the Czech Republic, Latvia and Finland it was over 10% of the UAA. In the remaining countries, the share of organic area ranges from 0.2% in Malta to 10% in Slovakia.

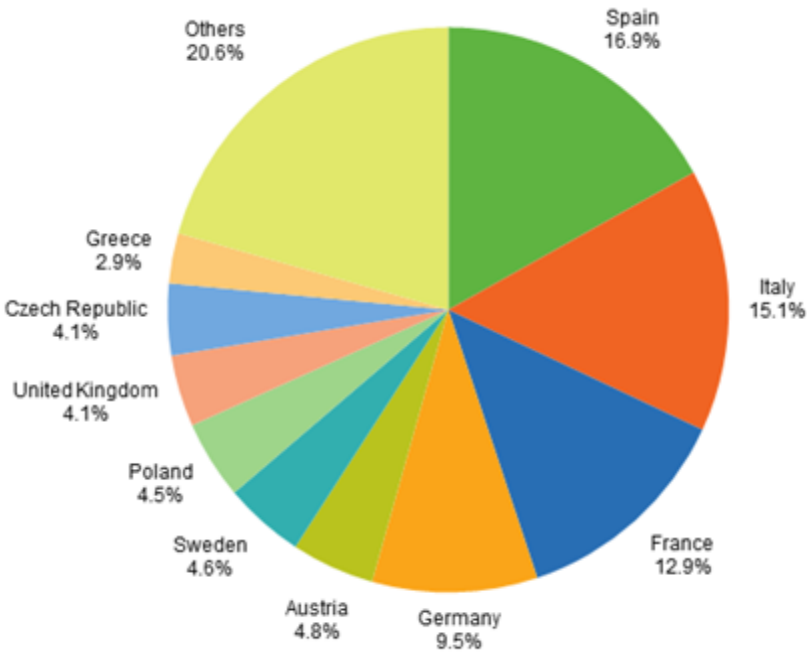


Figure 4. Share of total organic area, EU-28, 2016 (% of total EU-28). Sum of land in conversion and certified organic area. Source: Eurostat.

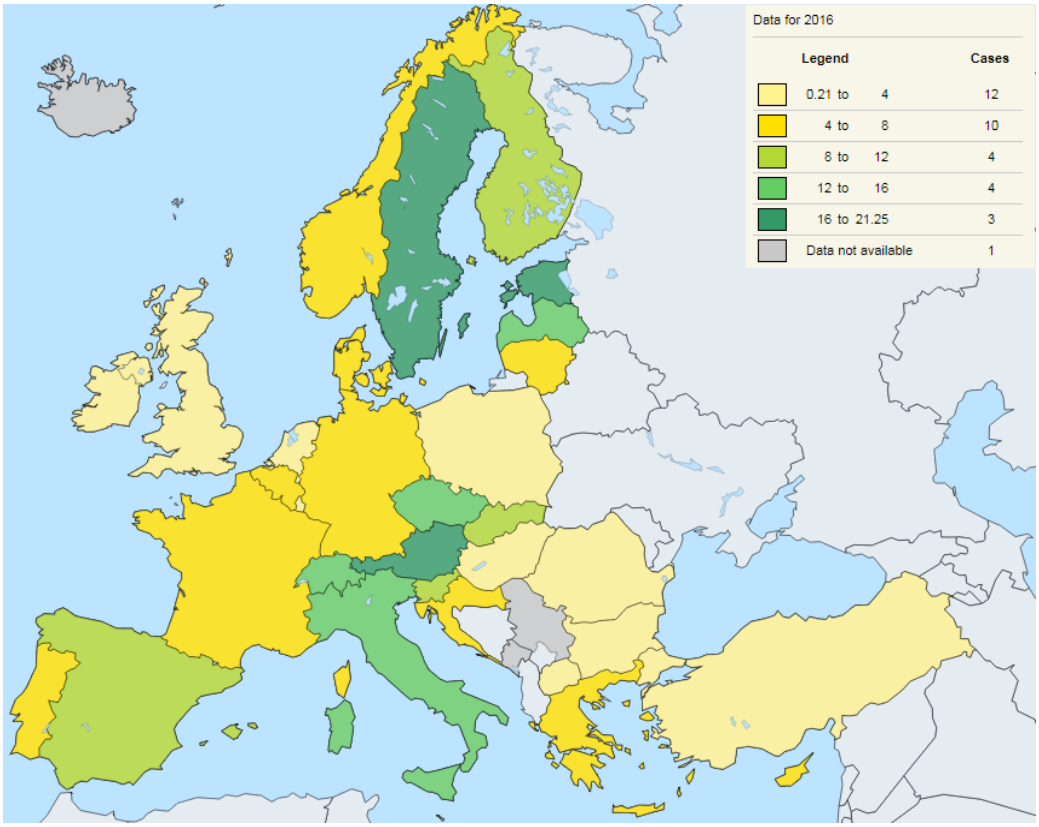


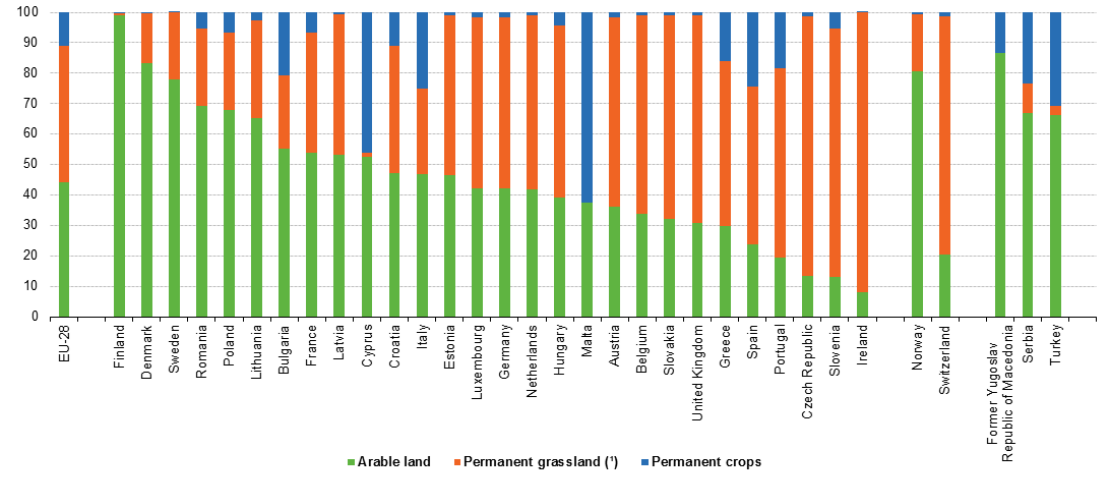
Figure 5. Area under organic farming (% of utilised agricultural area). Source: Eurostat.

2.1.2 Crop types

Agricultural production is commonly divided into three main crop types: arable land crops (mainly cereals, fresh vegetables, green fodder and industrial crops), permanent grassland (pastures and meadows), and permanent crops (fruit trees and berries, olive groves and vineyards). Permanent grassland, mostly used for grazing organic livestock, exceeded 5 million ha and represented 45% of the EU-28 total organic crop area in 2016, Arable crops followed closely with 44%, while permanent crops made up the smallest share (11%).

In 10 countries arable crops accounted for more than 50% of the organic area, while in 15 countries pasture and meadows predominated (> 50% of organic area). Arable crops were highly predominant in Finland, Denmark and Sweden with shares of 99%, 83%, and 78%. Ireland (92%), the Czech Republic (86%) and Slovenia (82%) were in the lead in terms of pasture and meadows (see Figure 6).

According to Eurostat (2018), in most countries, permanent crops accounted for the lowest share of the organic area. In about 18 countries it was < 5% of the organic area. In 2016, permanent crops accounted for between 10% and 20% in Croatia, Greece and Portugal, while in Serbia, Turkey, Bulgaria, Spain and Italy the share was over 20%. Cyprus and Malta had the highest shares, with 46% and 63%. Olive trees dominated the organically farmed area in these two countries.



Note: No data available for Iceland
(¹) Pasture and meadow, excluding rough grazing.
Source: Eurostat (online data code: org_cropar)

Figure 6. Arable land crops, permanent grassland and permanent crops, 2016 (% of total organic area — fully converted and under conversion). Source: Eurostat.

2.1.3 Legal status - use of Cu, sulphur and mineral oils

The legal status of Cu, S and mineral oils in the EU is regulated by the European Commission regulation (EC) No 889/2008 of 5 September 2008, laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control. This is published in the Official Journal of the European Union 18.9.2008. In ANNEX I, Fertilisers and soil

conditioners referred to in Article 3(1) Elemental Sulphur is listed Under 6. Other substances from traditional use in organic farming.

Name	**Description, compositional requirement, conditions for use**
Copper in the form of copper hydroxide, copper oxychloride, (tribasic) copper sulphate, cuprous oxide, copper octanoate	Fungicide. up to 6 kg copper per ha per year For perennial crops, Member States may, by derogation from the previous paragraph, provide that the 6 kg copper limit can be exceeded in a given year provided that the average quantity actually used over a 5-year period consisting of that year and of the four preceding years does not exceed 6 kg
Sulphur	Fungicide, acaricide, repellent
Lime Sulphur (calcium polysulphide)	Fungicide, insecticide, acaricide
Paraffin oil	Insecticide, acaricide
Mineral oils	Insecticide, fungicide; only in fruit trees, vines, olive trees and tropical crops (e.g. bananas)

Livestock

Sulphur (as sodium sulphate) is also allowed in feed as feed material of mineral origin. Copper is allowed as feed additive as a trace element. It is allowed as copper (II) oxide, basic copper (II) carbonate, monohydrate copper (II) sulphate, pentahydrate. Both uses are noted here but they are outside of the scope of this specific deliverable within WP3 PLANT.

Fertiliser

Sulphur and sulphates are also allowed as Fertilisers and soil conditioners referred to in Article 3(1):

- Potassium sulphate, (Product obtained from crude potassium salt by a physical extraction process, containing possibly also magnesium salts)
- Magnesium sulphate (kieserite) only of natural origin
- Calcium sulphate (gypsum) only of natural origin
- Elemental sulphur (products as specified in Annex ID.3 of Regulation 2003)

These uses are noted here but they are outside of the scope of this specific deliverable within WP3 PLANT.

3. Results and Findings from Denmark

3.1 Main statistical findings for organic farming in Denmark

3.1.1 Organic farming crops, covered area and production

The main organic farming crops in Denmark are cereals and grass-clover. The central and south part of Jutland comprise 156,503 ha (2017) and the rest of Denmark 87,000 ha. This is because on the mainland (Jutland) there are many livestock farms, which make it possible to grow organic crops. Due to the restrictions of usage of conventional livestock manure and other conventional products (although allowed in annex I of the EU commission regulation no 889/2008) it is very hard to grow organic products in areas without organic livestock.

The area with organic production gas increased drastically in 2017 and 2018 (Figure 7). From the mentioned 201,000 ha in 2016, the area is now 243,503, an increase of 21%. 54% of the organically grown area is rough grazing, 35% is cereals for harvest. The conventional and organic farming (fully converted+ under conversion) area of main organic farming crops in Denmark are presented in Table 3, while the total area is presented in Table 4.

Table 3. Conventional and organic farming (fully converted+ under conversion) area of main organic farming crops in Denmark.

	Cereals Oilseed pulses	Seed production	Industrial crops Potatoes/beets	Rough grazing	Land with restriction	Vegs
Organic (ha)	85554	2828	3576	132523	5895	3596
Conv (ha)	1556454	87323	69190	581233	66751	8645
Organic to total (%)	5.2	3.1	4.9	18.5	8.1	29.4

Table 4. Conventional and organic farming (fully converted+ under conversion) area of main organic farming crops in Denmark.

	Total (crops and grazing)	Total crops	Total number of farms
Organic (ha)	245159	106741	3469
Conv (ha)	2423490	1775506	35935
Organic to total (%)	9.2	5.6	8.8

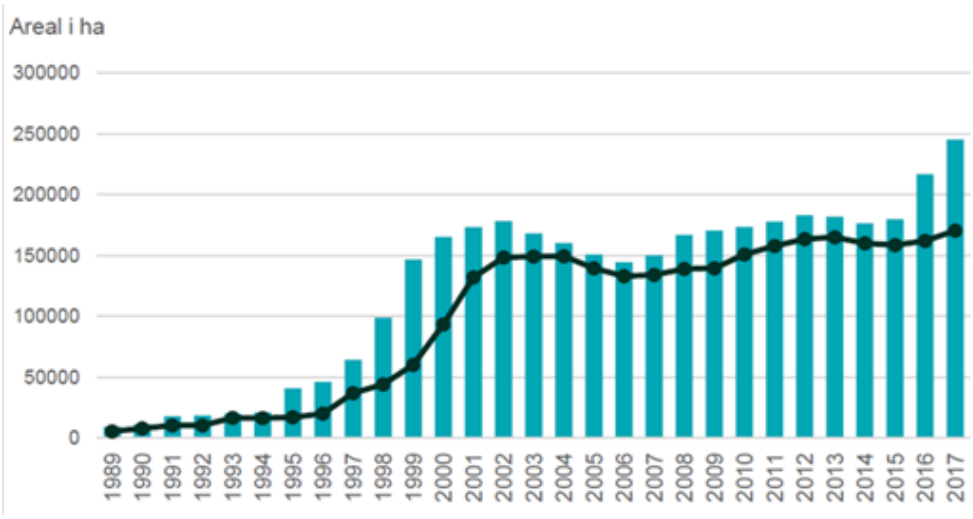


Figure 7. Evolution of organic growing area (ha) in Denmark. Line: Fully converted organic area, column: Total organic area.

3.1.2 Main organic farming growers/producers associations

In Denmark there are two major farmers' organisations, The Danish agricultural and food council DAFC (which has the aim to serve all Danish farmers) and organic Denmark OD, which focusses on organic farmers. No figures are available on memberships.

3.1.3 Main organic farming Certification bodies

In Denmark, there is one certification body, the Danish ministry of agriculture and environment, which means that the consumers are comfortable with the brand. The brand secures that the products sold live up to the EU standards.

Stats-
kontrolleret
økologisk

To be able to receive the special transition fees and the permanent organic ha subsidy, an official certification is obliged.

The different sectors (dairy and meat) in Denmark have jointly made an intentional agreement that puts the standards higher. For instance, the pig and poultry sectors should feed their livestock 100% organic. This is a voluntary agreement made between the grower and the company, which lays on top of the official EU standards. The sectors align with the general

consumers' claim for 100% organics. It is estimated that at least 1000 producers/farms have made this voluntary agreement.

In addition, the biodynamical retailers and shops have their extra standards (Demeter), which they lay on top of the official certification. It is estimated that around 30 producers/farms aim for this certification.

3.2 Use of contentious inputs in organic farming in Denmark

In Denmark 6 crops were investigated, where contentious inputs for the plants and the soil might be expected. Potatoes, spring barley, greenhouse tomatoes, apples, strawberry, and brassicas (broccoli as example). For each crop, experts were interviewed and the general situation was described in the template which was supplied. This report is a summary of these template replies.

3.2.1 Legal status for the use of contentious inputs

Copper

In Denmark, the use of copper for control of fungi is not allowed. The use of copper is generally forbidden, also for conventional growers. Arguments were the toxicity for animal life and humans, which was valued higher than the beneficial effect for agriculture and a general EU prohibition was foreseen (precautionary principle).

If there is evidence for copper deficiency, and a certified organic advisor reports the deficit, copper fertiliser by leaf spray, may be used. In the crops that have been analysed in Denmark, only very few cases of copper fertilization have been registered (advisors were asked). The registration of the use of copper as fertiliser is not obligatory, as with the use of copper as fungi repellent. Sulphur is allowed in fruit and potatoes as fungicide.

Mineral Oils. In the surveys of the different organic crops in Denmark, no use of mineral oils was accounted for. This does not mean they are not used, but only very little. In Denmark, the use of paraffin oil is permitted as preventive acaricide and insecticide, and sometimes recommended in orchards.

Sulphur. Concerning sulphur, the Danish Environmental Protection Agency, the chemical companies, the grower industry, collected and present the regulations related to its use in the following webpage:

https://middeldatabasen.dk/product.asp?productID=70068

3.2.1.1 Strawberry

In Denmark 86.2 ha is grown organically, of which 4.3 ha is under conversion, and 0.5 ha in greenhouses. This is 7% of the total area of strawberry production. The strawberry cultivation is for direct use, industry production with automated picking is not used, and the prices are too low.

Field strawberry is grown in rotation, with 5-6 years in between, to prevent soil carried diseases. Yields reported of 8-12 tonnes per ha are reported (lowest in self-pick), with exceptions of 20 tonnes per ha.

3.2.1.2 Apples

In Denmark 387 ha apples is grown organically, of which 17.1 was under conversion. This is 27% of the total area of apples in Denmark. Organic apples are very sought, however due to the restriction of Copper use, the production area is low. In 2013, it was registered that 7% of the growers had more than 5 ha, and produced 40% of the organic apples, with yields > 10 tonnes/ha. The smaller growers had lower yields. Now, in 2017, yields are higher (up to 20 tonnes/ha). An estimate (expert knowledge) is, that 25% of the growers that use sulphur (Cumulus S), cultivate 75% of the organic apple area. This means that around 300 ha of apples are sprayed with 6-10 kg Cumulus S /ha (80% S).

3.2.1.3 Potatoes

In Denmark 1796 ha of potatoes are grown organically, of which 109 ha for starch (harvest sold directly to the industry), 1615 ha for consumption, and 72 ha for seedlings and other applications (chips). This is respectively 0.4%, 17.4% and 1.5% of the total area of potatoes in DK. In 2017, for the first time, sulphur has been allowed for usage in potatoes against fungi. The effect is not very good, and according to the advisors and specialists consulted, no growers have used it.

3.2.1.4 Greenhouse tomatoes

No sulphur is used in tomatoes in Denmark.

3.2.1.5 Cabbage (outdoor grown vegetables)

No sulphur is used in organic cabbage in Denmark.

3.2.1.6 Summary

Only in apples, sulphur is used, as protection against scab, and with the side effect against insect infestations.

3.2.2 Use of alternatives for copper, mineral oils and sulphur in the most important organic crops

Alternatives for copper and sulphur against fungi:

In potatoes: Blight is a problem and to prevent devastating early infection attacks, potatoes are pre-germinated/sprouted, with heat boost. The laying of the potatoes seedlings after 1st of May is not advised.

Research is trying to find resistant varieties, and advisors stress the fact that choice of resistant varieties available is important. The independent advisory system in Denmark, owned by the farmers, works hard to find alternatives, as for now, the net consumption of organic potatoes exceeds the national production.

Some farmers try and prevent blight by spraying probiotics.

In apples: mainly scab and apple cancer (*Nectria galligena)* are problems. However different insect infestations can also cause considerable damage, especially for consumption.

As alternatives for the prohibition of copper and the consumer resistance against sulphur, the growers try and find resistant varieties, fertilise less (has been proven to prevent outbreaks), and experiment with plastic roof tops to decrease the “wet leaf time”. This is, however, expensive.

Biological control is used against insect attacks, biodiversity is promoted (variety of herbs between the tree rows to attract insects and birds) as natural control.

In vegetables and tomatoes: In Denmark, some growers are experimenting with the use of probiotics, which are sprayed on the seeds before seeding or on the leaves in the growing season. No registration of the area or crops treated has been undertaken. In addition, no scientific evidence of the effect has been reported.

3.3 Discussion and Conclusion for contentious inputs use in organic farming in Denmark

Some organic growers of apples and potatoes are asking for permits to use similar repellents or pesticides as their colleagues in other parts of Europe. They claim they are less competitive in the global trades with organic products. However, in Denmark, authorities and the agricultural organisations, work for retaining and recreating integrity in the organic production, well knowing that the consumers buying organic products, can be hugely influenced by adverse publicity, or bad rumours. As the Danish production of crops is primarily for the Danish market, the national sales have to be met first. Therefore, the precautionary principle of organic farming, especially considering the use of chemical pesticides, is given prominence. Even if the authorities permit the use, and yields (tradable) in apples can be doubled or tripled with the use of sulphur, not all apple growers chose to use it.

In general, Danish consumers would rather pay extra for the products, instead of allowing potential poisonous pesticides. Large amounts of funding have been granted to research in organic farming, to stimulate the development of alternatives, both by cultivation methods (fertilisation, soil preparation, rotation) and by alternative treatments (probiotics, slaked lime, etc.).

It is generally agreed on that the strength of the Danish organic production, is its alignment with the national market. That is why the Danish consumption of organic products peaks the statistics of the world.

4. Results and findings from France

4.1 Main statistical findings for organic farming in France

As shown in the most recent figures available about organic production in France, the share of organic agriculture is steadily increasing in France, especially for fruits and herbs/medicinal plants (Plantes à Parfum, Aromatiques et Médicinales - PPAM) (Figure 8). About 10% of the French vineyard is grown organically, while less than 3.5% of arable crops are produced in organic farms.

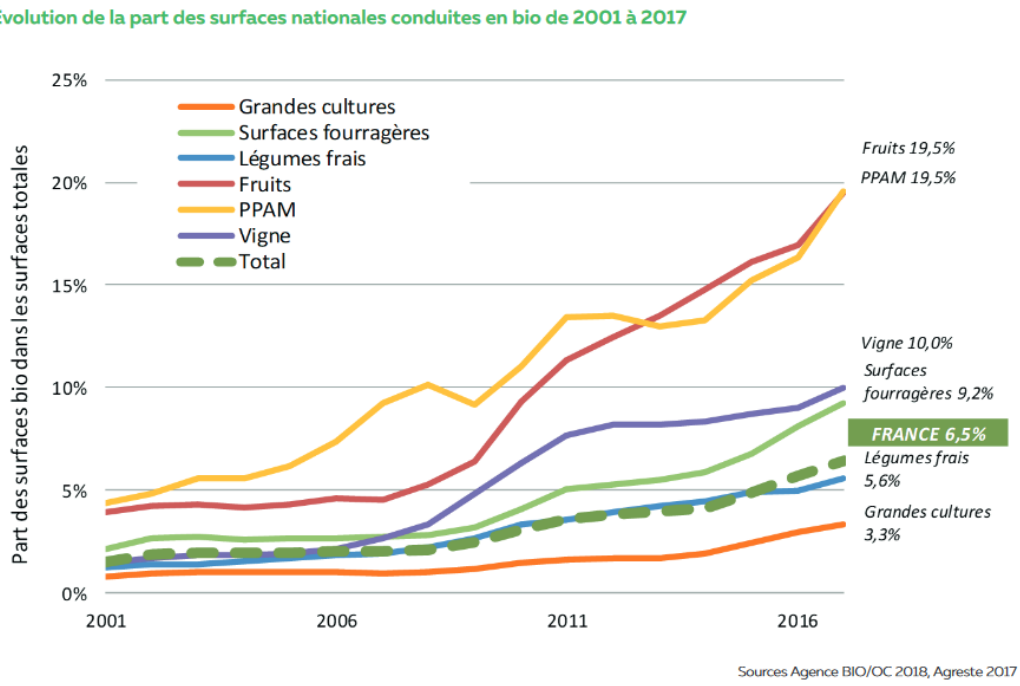


Figure 8. Evolution of organic farming in France.

4.2 Use of contentious inputs in organic farming in France

4.2.1 Legal status for the use of contentious inputs (if different than EU regulation)

France allows the use of copper as per the EU regulation. The same goes for the other contentious inputs.

4.2.2 Use of cooper in the most important organic crops

Among the most recent data published about copper use in organic farming in France is a survey carried out by ITAB in 2009 on different crops (Jonis, 2009). This survey highlights three main targets for copper use in France (grape downy mildew, potato late blight and apple scab), as well as more scattered uses in many 'minor' crops. For this report, we used these survey data and supplemented those with expert replies to the O+ survey form, especially for crops not targeted by the 2009 survey.

4.2.2.1 Tomato

According to the experts interviewed (see annexes), the use of copper is low in most tomato production. Standard schedules involve 0 to 3 applications of Bordeaux mixture (5 kg/ha) between planting and early harvest; extra, "curative" applications (up to 4) with copper hydroxide (Kocide 35 at 3.5 kg/ha or Nordox at 1.6 kg/ha) can be made if symptoms of late blight, cladosporiosis, botrytis, or early blight are seen.

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. Most gardeners do not use it, and cope with symptoms (removal of diseased leaves, 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 grow tomatoes generally do not seek very high yields (not as the primary goal).

Some errors are observed due to lack of information: some growers spray 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).

4.2.2.2 Potato

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). These doses are sufficient in most areas except in coastal locations, with high humidity. However, more than half of the potato production is centred in the Brittany and Haut de France regions, which receive a lot of rain, where these doses are insufficient, and the alternatives are not efficient enough.

4.2.2.3 Olive trees

Bordeaux pulp, 2 to 3 applications per year.

4.2.2.4 Grapevine

In France, the mean annual use of copper in grapes is about 5 kg per ha per year with a high pressure of downy mildew (*Plasmopara viticola*) – i.e. every other year during the first 10 years of the 21st century. However, there are very strong discrepancies between regions: 1.6 kg per ha per year in Alsace, 5.6 kg per ha per year in the Loire Valley, and up and over to 6 kg per ha per year Champagne, Midi Pyrenees or Languedoc-Roussillon (Jonis, 2009). The inter-annual discrepancies, due to variations in the pressure of the disease, are also quite strong: the mean rate used in years with low to moderate disease pressure is only 3 kg per ha per year, vs 5 kg per ha per year in high disease pressure years.

The French figures are generally higher than those obtained in a similar survey in Switzerland (Speiser 2015). This might reflect the more diverse production situations in France, but also the fact that the French survey is older than the Swiss one. Indeed, the values reported in the 2009 survey are higher in viticulture and fruit trees than the recommendations of the most

recent guides for growers. It is thus quite likely that the current use of copper in French organic crop protection is lower than the figures reported in the 2009 survey.

4.2.2.5 Summary

Overall, the data reported here tend to indicate that the average use of copper in France generally stays well below the maximum rates allowed, but with strong disparities between crops, regions, and growers.

Many field experiments suggest that a rate reduction by half (3 kg Cu per ha per year) would be sustainable in a number, but not all situations. For instance, grape growers in Champagne would have difficulties sticking to this limit, as the environment is very conducive to downy mildew there and the grape cultivars used are very susceptible to the disease. The same is true with organic potato growers in coastal areas of the northern half of France. On the other hand, many growers use very little copper already. Copper is phytotoxic and not allowed in some crops (for instance against lettuce downy mildew), and would not be used in crops with zero tolerance to blemishes.

4.2.3 Use of mineral oils in the most important organic crops

There is no use of paraffin oil in tomato in France. Mineral oils are sometimes used in seed potato crops to prevent attacks by virus-transmitting aphids, but nowadays, all organic seed potato growers in France have replaced the mineral oils by organic oils of plant origin (mainly oilseed rape).

4.2.4 Use of sulphur in the most important organic crops

Sulphur (as Thiovit, 7.5 kg/ha) is used against some fungal diseases (mainly powdery mildews) and as an acaricide against spider mites. Its use in tomato is very occasional, and very rare in eggplants where black soap is preferred. It is more common in grapevines, especially in the drier regions where powdery mildew is a problem.

4.2.5 Use of alternatives for copper, mineral oils and sulphur in the most important organic crops

Detailed descriptions of alternatives to copper in organic agriculture, with an analysis of their potential, modes of action and limits, have been published recently (Andrivon et al., 2018; La Torre et al, 2018). Their use in French organic agriculture is currently limited by the small number of biocontrol solutions actually available on the market, and by their often lower efficacy compared to copper applications. Another limit is the slow diffusion of varietal innovations, in particular in perennial or vegetative propagated crops (grapevine, fruit trees, potato) which rank among the main targets for copper use. The lack of organic certified planting material, once a severe hindrance, is now increasingly overcome. Some gardeners use herbal preparations (decoctions, nettle maceration, comfrey, horsetail, etc.) or biodynamic preparations as plant stimulants (phytostimulants) to replace copper-based products.

The usual substituent for mineral oils is organic oils (e.g. from rapeseed), in particular in seed potato production. The substitution provides a satisfactory efficacy, organic and mineral oils having a similar performance in preventing insect-borne viral transmission. It should however be noted that organic oilseed rape production is scarce.

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4.3 Discussion and Conclusion for contentious inputs use in organic farming in France

Copper is still the most contentious input for plant protection in organic farming in France. By contrast, sulphur is seldom considered problematic, except as a main component of sulphites in wine production. Mineral oils are of minor use, and can easily be replaced by organic oils.

Many alternatives to copper are under development, but few are already available on the market, and fewer still are currently used by growers to any substantial extent. Abandoning copper can seldom be attained through a simple substitution strategy (for instance, replacing copper by biocontrol products); it requires a more or less profound reconstruction of the crop production system, including changing cultivars (in favour of resistant ones), developing prophylaxis and sanitation measures, adjusting fertilisation, etc. This requires an integrative approach, which is still under-developed.

5. Results and findings from Germany

5.1 Main statistical findings for organic farming in Germany

The following chapter summarises data on total and conventional farming area in Germany as well as the development of organic farming in Germany during 20 years, from 1996 to 2016. In addition, an overview of the most important organically produced crops and grower associations in Germany is given. Also, all certification bodies are listed.

5.1.1 Organic farming crops, covered area and production

Table 5. Farming area in Germany (Year 2017).

Total farming area [ha]	Organic farming area [ha]	Organic share of total farmland [%]	Total number of farms	Number of organic farms	Organic share of total farm number [%]
16,780,085	1,375,967	8.2	267,651	29,174	10.9

Table 6. Development of organic farming area and number of organic farms in Germany from 1996 to 2016 (source: federal ministry of food and agriculture BMEL).

Year	**Area (ha)**	**Share [%] of total farm land**	**Number of farms**	**Share [%] of total farm number**
1996	354.171	2,1	7.353	1,3
1997	389.693	2,3	8.184	1,5
1998	416.518	2,4	9.213	1,7
1999	452.327	2,6	10.425	2,2
2000	546.023	3,2	12.740	2,8
2001	634.998	3,7	14.702	3,3
2002	696.978	4,1	15.626	3,6
2003	734027*	4,3	16.476	3,9
2004	767.891	4,5	16.603	4,1
2005	807.406	4,7	17.020	4,3
2006	825.538	4,9	17.557	4,6
2007	865.336	5,1	18.703	5
2008	907.786	5,4	19.813	5,3
2009	947.115	5,6	21.047	5,6
2010	990.702	5,9	21942**	7,3
2011	1.015.626	6,1	22.506	7,5
2012	1.034.355	6,2	23.032	7,7
2013	1.044.955	6,3	23.271	8,2
2014	1.047.633	6,3	23.398	8,3

Year	Area (ha)	Share [%] of total farm land	Number of farms	Share [%] of total farm number
2015	1.088.838	6,5	24.736	9
2016	1.251.320	7,5	27.132	10

*Not fully comparable with earlier years due to a different assessment in one federal state.

**Not fully comparable with earlier years due to changes in the assessment limits.

Table 7. Main conventional and organic crops in Germany (fully converted + under conversion). (Source: www.destatis.de, 2015).

	Cereal	Rape and turnip rape seeds	Grain maize	Sugar beet	Potatoes
Organic (ha)	231,300	4,700	10,700	1,000	8,600
Conventional (ha)	6,517,500	1,285,500	455,500	312,800	236,700
Percentage of organic to total (%)	3.5	0.4	2.3	0.3	3.6

5.1.2 Main organic farming grower/producer associations

In Germany a total of ten organic grower associations exist. Among these the most important are presented in table 4. Next to *Bioland, Naturland, Demeter* and *Biokreis*, the associations *Biopark, Ecoland, Ecovin, Gäa, Verbund Ökohöfe* and *BIO.VEG.AN* should be mentioned.

Table 8. Share of most important grower associations in Germany.

	Bioland	Naturland	Demeter	Biokreis	Total
Area [ha]	387,980	181,428	81,841	56,588	1,375,967
Farms (number)	7,305	3,448	1,529	1,222	29,174
Area [%] of organic farmland	28.2	13.2	5.9	4.1	
Farms [%] of organic farmland	25.0	11.8	5.2	4.2	

5.1.3 Main organic farming certification bodies

There is a total of 17 organic farming certification bodies in Germany (Table 9). The list was published by the European commission as “LIST OF CONTROL BODIES AND CONTROL AUTHORITIES IN THE ORGANIC SECTOR” in the DIRECTORATE-GENERAL FOR AGRICULTURE AND RURAL DEVELOPMENT (B.4. Organics). The list can be found at:
http://ec.europa.eu/agriculture/ofis_public/pdf/EUCBLIST_new1.pdf?uid=4B041AEA-EA29-FB88-6309A03904B5B0C3

Table 9. Overview of all organic certification bodies in Germany.

Certification body	ID

Kiwa BCS Öko-Garantie GmbH	(DE-ÖKO-001)
LACON GmbH	(DE-ÖKO-003)
Ecocert IMO GmbH	(DE-ÖKO-005)
ABCERT AG	(DE-ÖKO-006)
Prüfverein Verarbeitung Ökologische Landbauprodukte e.V.	(DE-ÖKO-007)
LC Landwirtschafts-Consulting GmbH	(DE-ÖKO-009)
AGRECO R.F. GÖDERZ GmbH	(DE-ÖKO-012)
QC & I GmbH	(DE-ÖKO-013)
Grünstempel® - Ökoprüfstelle e.V.	(DE-ÖKO-021)
Kontrollverein ökologischer Landbau e.V.	(DE-ÖKO-022)
Fachgesellschaft für ÖKO-Kontrolle mbH	(DE-ÖKO-034)
ÖKOP Zertifizierungs GmbH	(DE-ÖKO-037)
GfRS Gesellschaft für Ressourcenschutz mbH	(DE-ÖKO-039)
ARS PROBATA GmbH	(DE-ÖKO-044)
QAL Gesellschaft für Qualitätssicherung in der Agrar- und Lebensmittelwirtschaft GmbH	(DE-ÖKO-060)
ABC GmbH	(DE-ÖKO-064)
PCU Deutschland GmbH	(DE-ÖKO-070)

5.2 Use of contentious inputs in organic farming in Germany

The mapping refers to the most important crops produced in Germany. After conducting literature research and scanning statistical data from different relevant platforms, a questionnaire on the use of contentious inputs and possible alternatives in Germany was sent out to farming advisors as well as farmers (see Annex). In this chapter the first results of our survey are presented.

5.2.1 Legal status for the use of contentious inputs

Table 10 summarises the regulations for the use of sulphur, mineral oil and copper among the most important German grower associations.

Table 10. Summary of regulations from main German growers associations on contentious inputs in organic plant protection.

	Permission			
	Bioland	**Naturland**	**Demeter**	**Biokreis**
Sulphur	Only permissible in horticulture and permanent cultures	Against fungus diseases	wettable sulphur, sulfuric lime	Wettable sulphur, (max.3 kg Cu/ha/a, in hop cultivation max. 4 kg Cu/ha/a)

Copper	Copper preparations, only permissible in horticulture and permanent cultures (max.3 kg Cu/ha/a, in hop cultivation max. 4 kg Cu/ha/a, in potato cultivation only with permission. If Cu is used, soil content must be continuously monitored)	Copper compounds (max. 3 kg Cu/ha/a, also for potatoes; for hops max. 4 kg/ha/a)	Only permissible in permanent cultures: Copper (max 3kg Cu/ha/a and not more than 500g per application	
Mineral oil	Paraffin oil generally permitted	Not allowed	paraffin oil (with exceptional permission)	Paraffin oil generally permitted

5.2.2 Use of cooper in the most important organic crops

From 1890 to approximately 1940 up to 50 kg copper were used each year in German viticulture. Regarding hops, the Cu amount was about 60 kg/year from 1924 to 1964. In 2009 a 15 to 20 fold decrease of applied copper could be recorded.

The regulations of organic farming grower associations reduce the maximum amount always to 3 kg/ha/year (4 kg with hops). In the current national authorization of copper compounds in Germany, the application of copper is restricted to the same amounts (3-4 kg/ha/year) (IFOAM, 2018). The Cu application is forbidden for the members of Demeter association except in the case of permanent cultures (e.g. wine, orchards and other).

5.2.2.1 Potatoes

In 2010 a strategy paper on minimizing copper use for plant protection was developed. It was produced by the „Bund Ökologische Lebensmittelwirtschaft“ (BÖLW e.V.), an umbrella association formed by the organic grower associations (Bioland e.V., Demeter, ECOVIN e.V, Gäa e.V., Naturland) and some conventional grower associations. In 2016, the current status of the strategies to minimise copper use was presented. Within the project „Platform for phytosanitary strategies in organic farming“, strategies to prevent and combat diseases or pests in organic agriculture and horticulture systems were devised or updated. Special emphasis lay on further minimization of Cu as an active substance in plant protection products. The following chapters show data on Cu use in Germany as monitored within this project.

The area of organic produced potatoes in Germany and the amount of copper applied are presented in Table 11 and Table 12, respectively.

Table 11. Area of organic produced potatoes in Germany (Years 2010-2015).

	2010	**2011**	**2012**	**2013**	**2014**	**2015**
Total area in Germany [ha]	8200	8300	8300	8100	8600	8200

Monitored and treated with copper [ha]	1633	1928	1330	1916	2330	2140

Table 12. Copper amount applied with potatoes in Germany (Years 2010-2015).

	2010	**2011**	**2012**	**2013**	**2014**	**2015**
Mean Cu in kg/ha	1.36	1.60	1.87	1.38	1.54	1.50

Statistics reveal that the mean Cu amount was always between 1.4 and 1.9 kg/ha during recent years. Yet, there have been many farms that had to use up to 3 kg (BÖLW e.V.) and others which had used 0 kg/ha.

5.2.2.2 Fruits

Data on organically produced stone fruit in Germany and relevant copper amount applied are presented in Table 13 and Table 14, respectively.

Table 13. Data on organically produced stone fruit in Germany (Years 2010-2015).

	2010	**2011**	**2012**	**2013**	**2014**	**2015**
Total area in Germany [ha]	approx. 400	approx. 400	approx. 400	approx. 400	approx. 400	approx. 400
Monitored and treated with copper [ha]	42.3	119.1	121.3	46.7	102.6	222.4

Table 14. Quantity (pure Cu in kg/ha) used in organic orchard crops in Germany (Years 2010-2015).

	2010	**2011**	**2012**	**2013**	**2014**	**2015**
Apples [Cu kg/ha]	1.59	1.3	1.31	1.47	1.49	1.51
Pears [Cu kg/ha]	1.49	1.1	1.26	1.07	1.12	1.44
Peaches [Cu kg/ha]	2.21	1.9	2.0	1.7	not assessed	
Stone fruits [Cu kg/ha]	1.28	0.94	0.99	0.83	1.05	1.2

For the years 2010-2015, the mean Cu amount per ha/a was 1.4 kg for apples, 1.2 kg for pears, 1.9 kg with peaches and 1.0 kg for stone fruits. Highest amounts were applied in 2010 with each fruit.

Regarding the assessment of organically produced dessert apples (Table 15), the project had to cope with difficulties differentiating between dessert fruit and commercially produced fruit for juice production. For the years 2012 and 2013, similar ratios from organic to total area as in 2010 were assumed.

Table 15. Data on organic produced dessert apples in Germany (Years 2010-2015).

	2010	**2011**	**2012**	**2013**	**2014**	**2015**
Total area in Germany [ha] (approx.)	3000	3300	3500	3500	3500	3500
Monitored and treated with copper [ha]	1038	1517	1617	2136	1934	1981

Table 16 shows data on the use of copper with apples in different regions in Germany. Data was collected by the community to promote organic fruit growing (FÖKO e.V.).

Table 16. Use of copper to regulate fungal disease with apples in the regions "Bodensee", "Neckar/Baden", "West", "Niederelbe" and "East" in Germany, (Years 2014 and 2015) (Source: FÖKO e.V.).

	BBCH	**Treated area%**		**Mean amount per application**		**Total amount per ha**		**Number of applications**	
Year		**2014**	**2015**	**2014**	**2015**	**2014**	**2015**	**2014**	**2015**
Region "Bodensee"									
Pure copper [kg/ha]	till 59	81	99	0.20	0.21	0.54	0.64	2.8	3.0
	from 60	94	97	0.10	0.09	0.75	0.73	7.6	8.0
Region "Neckar/Baden"									
Pure copper [kg/ha]	till 59	91	75	0.25	0.17	0.47	0.37	1.8	2.3
	from 60	91	81	0.07	0.13	0.36	0.84	5.2	6.0
Region "West"									
Pure copper [kg/ha]	till 59	97	97	0.15	0.18	0.38	0.57	2.5	2.9
	from 60	90	95	0.09	0.16	0.4	0.73	4.6	6.8
Region "Niederelbe"									
Pure copper [kg/ha]	till 59	100	99.6	0.17	0.18	1.29	1.15	7.8	6.6
	from 60	100	100	0.06	0.06	0.83	0.82	13.1	12.6
Region "East"									
Pure copper [kg/ha]	till 59	100	100	0.16	0.2	0.72	0.82	4.7	4.4
	from 60	100	20	0.07	0.07	0.15	0.23	1.9	3.2

5.2.2.3 Horticultural crops

Table 17. Area of organic horticultural crops in Germany (Years 2010-2015).

	2010	2011	2012	2013	2014	2015
Total area in Germany* [ha]	10,590	10,890	10,470	10,470	10,749	10,750
Monitored and treated with copper [ha]**	86	3019	2559	1268	1725	5160

*with organic vegetables there is a not negligible area farmed according to EU standards that is not documented here

**data on Bioland and Naturland. Within Demeter Cu is not used.

Table 18. Mean Copper amount [kg/ha/year] on treated area for most important vegetables in Germany (Years 2010-2015). Empty shells indicate missing values.

Crop Year	2010	2011	2012	2013	2014	2015
Celery [mean kg/ha]	2.32	1.1	0.85	-	-	1.25
Pumpkin [mean kg/ha]	1.80	2.1	1.4	0.36	0.98	1.48
Cucumbers [mean kg/ha]	1.43	-	-	-	-	-
Fennel [mean kg/ha]	-	0.9	-	-	-	-
Leek [mean kg/ha]	-	3.0	-	-	-	-
Asparagus [mean kg/ha]	-	2.0	1.2	1.09	0.92	1.27
Greenhouse crops [mean kg/ha]	-	1.4	1.3	-	-	-
Other vegetables [mean kg/ha]	-	1.8	1.1	-	-	0.50
Flowers [mean kg/ha]	-	-	0.1	-	1.5	-
Onions [mean kg/ha]	-	-	-	0.85	2.17	1.63
Carrots [mean kg/ha]	-	-	-	-	-	1.50

Because data on certain crops and years is missing, it is hard to compare mean amounts of Cu applied among different crops. Highest yearly Cu amount was used with Celery (2.32 kg/ha in 2010). The lowest Cu amount was recorded with pumpkin (0.36 kg in 2013). From the data, no year effect can be deviated.

5.2.2.4 Wine

Table 19. Area of organic produced wine in Germany (Years 2013-2015).

	2013	2014	2015
Total area in Germany [ha] (approx.)	7100	7500	8100
Monitored and treated with copper** [ha]	2868	2924	3027

** Area of Bioland, Demeter, ECOVIN and Naturland

Table 20. Mean copper amount applied with organic wine in Germany (Years 2013-2015).

	2013	2014	2015
Mean Cu amount in kg/ha with regard to treated area	2.29	2.42	1.85

For the years 2013 to 2015 a mean Cu amount of 2.18 kg was used per ha and year

5.2.2.5 Summary

Current data available on Cu application in Germany revealed that less than 6 kg Cu is used per ha and year with potato, fruit and wine. Recordings from the Demeter association show that the mean Cu amount was lower than 3.5 kg/ha/year for wine.

5.2.3 Use of mineral oils in the most important organic crops

Research efforts in this project so far did not lead to robust information on the amount of mineral oil with plant protection in Germany. Therefore no numbers are presented. Paraffin oil is used together with sulphur every five years with viticulture. It is applied to fight rust mites. Some producers use rape oil instead but it is not clear yet whether this is an adequate substitute. Similar use might be possible with fruit, but with the latter significantly less problems do occur with the mentioned mites. With growers association Naturland the use of paraffin is not allowed. With Demeter fruits paraffin oil is used by 10% of the producers to fight the red spider mite. Amounts differ from year to year as well as between regions. Therefore no statistics exist.

5.2.4 Use of sulphur in the most important organic crops

5.2.4.1 Apples

Table 21 shows data on the use of sulphur with apples in different regions in Germany. Data was collected by the community to promote organic fruit growing (FÖKO e.V.).

Table 21. Use of sulphur to regulate fungal disease with apples in the regions "Bodensee", "Neckar/Baden", "West", "Niederelbe" and "East" in Germany, (Years 2014 and 2015) (Source: FÖKO e.V.).

	BBCH	Treated area%		Mean amount per application		Total amount per ha		Number of applications	
Year		2014	2015	2014	2015	2014	2015	2014	2015
Region "Bodensee"									
Net sulphur [kg/ha]	till 59	93	98	3.6	3.7	7.2	6.4	2.1	1.7
	from 60	100	100	3.0	3.28	38.7	35.2	13.0	11.0

	BBCH	Treated area%		Mean amount per application		Total amount per ha		Number of applications	
Year		**2014**	**2015**	**2014**	**2015**	**2014**	**2015**	**2014**	**2015**
Lime sulphur [Cu ratio in l/ha]	till 59	97	96	13.9	13.8	60.1	49.8	4.3	3.6
	from 60	98	100	11.1	11.9	60.1	48.9	5.1	4.2
Region "Neckar/Baden"									
Net sulphur [kg/ha]	till 59	83	76	3.16	4.34	4.8	9.92	1.5	2.3
	from 60	100	100	2.87	2.96	35.2	27.9	12.2	9.3
Lime sulphur [Cu ratio in l/ha]	till 59	48	73	13.8	13.3	45.8	38.1	3.4	3.0
	from 60	63	26	12.9	11.6	42.6	34.8	3.4	3.1
Region "West"									
Net sulphur [kg/ha]	till 59	100	67	3.24	4.59	4.8	12.2	1.5	2.6
	from 60	100	100	3.16	3.0	30.0	18.3	9.8	6.5
Lime sulphur [Cu ratio in l/ha]	till 59	100	98	15.4	15.5	39.1	46.3	2.7	3.0
	from 60	100	93	13.5	12.1	56.5	29.5	3.9	2.4
Region "Niederelbe"									
Net sulphur [kg/ha]	till 59	100	99.7	3.58	3.44	24.9	16.3	7.2	4.8
	from 60	100	99.7	2.17	2.45	43.6	47,2	20.4	19.4
Lime sulphur [Cu ratio in l/ha]	till 59	99	90	16.6	19.8	38.1	49.2	2.3	2.5
	from 60	45	70	15.7	17.4	27.4	22.1	1.7	1.3
Region "East"									
Net sulphur [kg/ha]	till 59	100	100	2.82	2.84	10.2	9.3	3.9	4.0
	from 60	100	100	2.18	2.32	22.7	22.2	11.7	9.9
Lime sulphur [Cu ratio in l/ha]	till 59	87	97	13.4	11.4	49.9	33.4	3.8	3.4
	from 60	97	97	10.6	9.8	41.0	33.9	3.4	3.4

5.2.5 Use of other plant protection products in the most important organic crops

Next to pure copper and sulphur preparations (table 12 and 14) the use of potassium and calcium was assessed by the community to promote organic fruit growing (FÖKO e.V.). Results are presented in Table 22.

Table 22. Use of potassium and calcium to regulate fungal disease with apples in the regions "Bodensee", "Neckar/Baden", "West", "Niederelbe" and "East" in Germany, (Years 2014 and 2015) (Source: FÖKO e.V.).

	BBCH	Treated area%		Mean amount per application		Total amount per ha		Number of applications	
Year		**2014**	**2015**	**2014**	**2015**	**2014**	**2015**	**2014**	**2015**
Region "Bodensee"									
Potassium bicarbonate [kg/ha]	from 60	100	92	4.5	4.6	22.6	20.9	5.0	5
Calcium hydrogen-carbonate [kg/ha]	from 93	46	40	40	30.6	76.7	91.5	2.1	3.1
Region "Neckar/Baden"									
Potassium bicarbonate [kg/ha]	from 60	62	92	5.2	4.7	35.6	15.2	6.6	3.6
Calcium hydrogen-carbonate [kg/ha]	from 93		9		92		92		1
Region "West"									
Potassium bicarbonate [kg/ha]	from 59	14	0	7.5	0	7.5	0	1.0	0
	from 60	92	100	4.3	4.9	13.7	13.2	2.9	2.5
Region "Niederelbe"									
Potassium bicarbonate [kg/ha]	from 60	47	94	3.75	3.6	9.0	9.8	2.4	2.9
Calcium hydroxide [kg/ha]	from 93		11		14.5		28.9		2.0
Region "East"									
Potassium bicarbonate [kg/ha]	from 60	66	94	5.6	3.6	13.0	9.7	2.4	2.9

5.2.6 Use of alternatives for copper, mineral oils and sulphur in the most important organic crops

A project on strategies to reduce and avoid copper in organic potato production (measures to reduce primary infections) was carried out by the Bavarian State Research Centre for Agriculture (LfL) over 4 years. It was funded by the Federal Organic Farming Scheme and other forms of sustainable agriculture (BÖLN). Within the project 20 alternative preparations were

tested in a laboratory experiment regarding their effect on phytophthora infections. The most promising substances were also tested in a field trial. Results of the study are published on http://orgprints.org/29305/1/29305-09OE045-lfl-bayern-zellner-2015-kupferminimierung-kartoffelbau.pdf
The following summary cites the findings of this publication.

> "…For some substances efficiencies similar to that of the copper fungicide could be observed, in both abscised leaf as well as in potted plant assays. The most effective preparations (chitosan, knotweed, liquorice, horsetail, and citrus, as well as a foliar fertiliser with low copper content) were also tested in field trials. Liquorice, chitosan, horsetail and the copper fertiliser showed some activity against leaf infection in these tests. The combination of reduced amounts of copper with an alternative product in some cases reached efficiencies almost equal to that of copper alone, depending on start and progress of the epidemic. Seed tuber dressings before storage or before planting also can provide protection against Phytophthora infections. In laboratory experiments with artificially infected tubers many alternative seed dressings brought an increase in the survival rate of the plants, or a reduction of brown rot on the stored tubers. Phosphonate, chitosan and a yeast preparation showed the best effect. In field trials an effect on the primary infection could not be clearly demonstrated, however, in 2012 plots with treated tubers showed lower late blight infection rates, and in 2014 lower rates of failing tubers. Together with other agronomic and technical measures such as mechanical or thermal leaf reduction, foliar and seed treatments with certain alternative preparations in exchange for or in addition to copper could be part of a late blight management strategy for organic potato production."

5.3 Discussion and Conclusion for contentious inputs use in organic farming in Germany

When looking at the survey period (summertime), it is not surprising that farmers did not have the time to give any relevant information. In addition, most advisors stressed the lacking information on application rates of sulphur and mineral oil. This again underlines the importance of the Organic-PLUS project. First information could be collected on potatoes, winter wheat, tomatoes and cereals in south Germany as well as horticultural crops (one farm in western Germany). The advisors gave an overview on the use of inputs for overall 190 farms. However, questionnaires are still awaited both from advisors and farmers. Regarding mineral oil published data as well as the feedback from advisors lead to the conclusion that the use of mineral oil seems to be of little relevance for the respective regions/with the respective crops. Not many farmers used the maximum Cu amount allowed. In the wine sector, in 2011, approx. 15% of the investigated area was treated with more than 2.5 kg/ha. In 2012 and 2013, with more unfavourable weather conditions, this area was more than doubled to about 30%. In the fruit sector, the area treated with more than 2.5 kg/ha/year is varying also. Usually about 10% or less of the area receives applications. The amount of Cu applied strongly depended on the year.

From experience with Demeter potato farmers it can be noted that they would use copper if it was allowed by the regulations of Demeter. Today, the copper application with organic farming in Germany is mainly restricted to special cultures. However, organic farmers tend to use higher amounts of copper per ha than conventional producers regarding potatoes, wine and fruit. This is due to the lack of available alternatives.

6. Results and findings from Greece

6.1 Main statistical findings for organic farming in Greece

6.1.1 Organic farming crops, covered area and production

The major crops and areas cultivated in organic farming in Greece are presented in Table 23 and Table 24, while the production from organic areas is presented in Table 25.

Table 23. Conventional and organic farming (fully converted+ under conversion) area of main organic farming crops in Greece. (Source: statistics.gr, 2016)

	Cereals	Olives	Grapes	Citrus	Grazed land
Organic (ha)	51540	62700	5000	1520	37000
Conventional)ha)	1000000	840000	69000	360000	1500000
Percentage of organic to total (%)	5	7	7	0.5	2.5

Table 24. Conventional and organic farming (fully converted+ under conversion) area of main organic farming crops in Greece. (Source: statistics.gr, 2016)

	Total (agricultural and grazed)	Total (agricultural land)	Total number of farms
Organic (ha)	462618	102166	24998
Conventional)ha)	5680000	3820000	680000
Percentage of organic to total (%)	8	2.5	2.5

Table 25. Production from conventional and organic farming (fully converted+ under conversion) crops of main organic farming crops in Greece. (Source: Ministry of Agriculture, 2016)

	Cereals	Olives	Grapes	Citrus
Organic (tonnes X1000)	0.8	0.15	0.24	1.8
Conventional (tonnes X1000))	1.28	0.24	0.38	2.5
Percentage of organic to total (%)	6.2	6.2	6.3	7.2

In Greece, the number of holdings practising organic farming increased dramatically between 2000 and 2007 from 1460 to 27700. In 2010, however this almost halved to 14530 farms, accounting for 2.0% of the country's holdings. The agricultural area under organic farming followed the same trend, increasing rapidly from 52090 to 192930 hectares between 2000 and 2007, then decreasing sharply to 116420 hectares in 2010. This area accounted for 3.3% of the country's UAA.

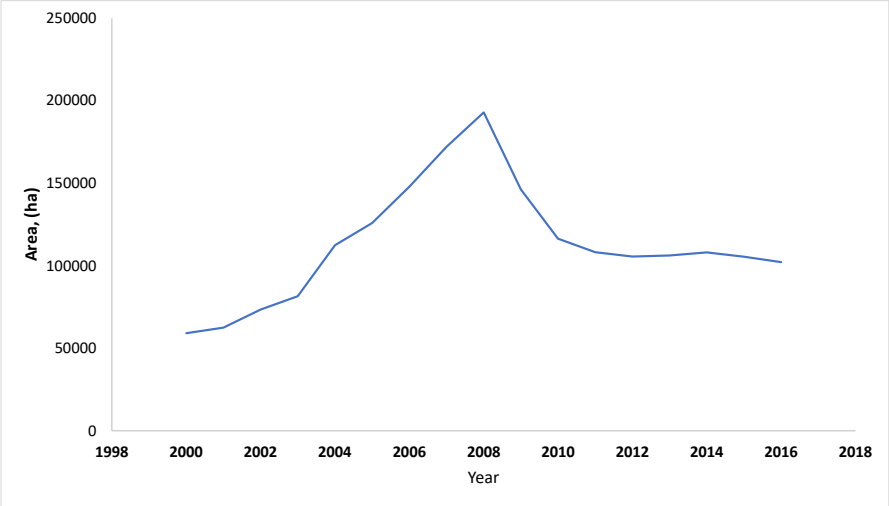

Figure 9. Evolution of organic farming areas (total agricultural land) in Greece.

History of Organic Farming in Greece

- 1980s: Production of organic olive oil and raisins for export
- 1993: EU Regulation (EEC) No 2092/91 comes into force
- 2004 to 2006: Increase in organic area due to support from the EU
- 2011: Fall in organic area and the organic market, due to the financial crisis and delays in compensatory payments for organic farming

6.1.2 Main organic farming growers/producers associations

The domestic market for organic products was estimated to be around EUR 60 million (2010). The market for organic products was developing slowly until 2010, when growth was halted by the economic crisis. Between 2011 and 2013, consumption of organic products fell by almost half.

Market channels: Supermarkets and specialised organic shops covering about 40 to 50% of the market each. Further channels are farmers' markets and other points of sale.

Exports and imports: About one third of the organic products sold are Greek. Most of the processed products are imported. Key products for the growing export market are olive products, wine and to some extent fresh fruit, vegetables and feta cheese. No data are available on import and export volumes.

Main organic farming growers are:

Organic Farmers Union of Northern Greece

Organic Farmers Union of Attica

Organic Farmers Union of Zakynthos

Organic Farmers Union of Serres

Organic Farmers Union of Crete

Network of Organic products (BioCluster)

6.1.3 Main organic farming Certification bodies

The inspection and Certification system in Greece conforms with the EU legislation (EU-Regulation 2092/91 with all the amendments, EU-Regulation 2078/92 for the introduction of hectare subsidies and all the modifications so far) as well as with the International standards (Codex Alimentarius and IFOAM). The most recent amendment is the COM (2014): Regulation of the European parliament and of the council on organic production and labelling of organic products. The competent authority for the accreditation and control of all inspection and certification bodies is the Ministry of Rural Development and Food (Sector of Organic Farming). Under the auspices of the Ministry there are several certifications bodies as presented below:

Control and Certification Body for Biological products	ΔΗΩnet Οργανισμός Ελέγχου και Πιστοποίησης Βιολογικών Προ
Green Control – Πράσινος Έλεγχος	GREEN CONTROL πράσινος έλεγχος GR-BIO-07
Physiologiki -Φυσιολογική ΕΠΕ	"ΦΥΣΙΟΛΟΓΙΚΗ" GR-BIO-02 "PHYSIOLOGIKE"
BIO-Hellas	BIO HELLAS ΟΡΓΑΝΙΣΜΟΣ ΕΛΕΓΧΟΥ ΚΑΙ ΠΙΣΤΟΠΟΙΗΣΗΣ ΒΙΟΛΟΓΙΚΩΝ ΠΡΟΪΟΝΤΩΝ
GM Cert	GMCert ΕΛΕΓΧΟΣ ΚΑΙ ΠΙΣΤΟΠΟΙΗΣΗ

A CERT	
TUV Hellas	
IRIS BIO	
Euro CERTT- BIO	
Bio-Geolab – Γεωτεχνικό Εργαστήριο	

All these entities have control jurisdiction throughout the country, giving farmers the chance of selection. According to the regulation each Inspection and Certification Organization should make an annual site inspection in each unit integrating organic farming. Additional inspections are made depending on the type of crop, for example in vegetables there are successive crops. Sampling is performed at a rate of 5% of the approved quantities for further laboratory testing and unannounced inspection visits are carried out in addition to full control at more than 10% of the integrated units of each Inspection and Certification Organization.

6.2 Use of contentious inputs in organic farming in Greece

In task 3.1 of WP3-Plant, the use of copper, mineral oil and sulphur as plant protection measures is studied. While recording a representative use of these inputs in some important organic crops, other plant protection measures such as commercial beneficial organisms were also recorded. The use was recorded by interviewing at least one experienced advisor per crop, asking them to fill in a table describing a typical organic production of the relevant crop, emphasising the use of various inputs. Olives, apples, potatoes, oranges, broccoli and greenhouse tomatoes were studied.

6.2.1 Legal status for the use of contentious inputs

Same as for EU

6.2.2 Use of cooper in the most important organic crops

6.2.2.1 Tomato

Average use of copper: 1-4 kg per ha per year. Organic tomato is cultivated in greenhouses with adequate climate control which can ensure acceptable levels of temperature all year round. Application against of *Phytophthora infestans*, *Xanthomonas* spp. 4-10 applications per year according to the outside weather conditions (and accordingly internal, greenhouse environment) and the infection intensity.

6.2.2.2 Apple

Average use of copper 1.5-4 kg/ha/year. Applications against mainly apple scab (*Venturia inaequalis*) but also against powdery mildew (*Podosphaera leucotricha*). 4-8 applications per year according to the outside weather conditions and the infection intensity.

6.2.2.3 Orange

Average use of copper: 1-3 kg/ha/year. Application against of *Phytophthora* spp., *Alternaria* spp., *Colletotrichum* spp. 1-2 applications per year according to the weather conditions and the infection intensity.

6.2.2.4 Broccoli

Average use of copper: 1-2 kg/ha/year. Application against of *Alternaria brassicae* and *Peronospora brassicae*. 4-6 applications per year according to the weather conditions and the infection intensity.

6.2.2.5 Potato

Average use of copper 5-6 kg/ha/year. Applications against of *Phytophthora infestans*

6-8 applications per year according to the weather conditions and the infection intensity.

6.2.2.6 Olive

From 1 to 6 kg Cu/ha/year, depending on weather conditions in particular areas, owner's knowledge, and cultivar sensitivity (cvs Kalamata and Chondrolia are more sensitive to disease than cv Conservolea).

6.2.2.7 Summary

The use of copper in Greece is for some crops close to 6 kg/ha/ year but below 4 kg/ha/year for some other. It seems possible to reduce the allowed limit to 4 kg/ha/year with not many problems but it may be difficult to reduce this limit further, if other alternatives are not yet used in practice.

6.2.3 Use of mineral oils in the most important organic crops

Mineral oils are not usually used, instead some alternatives are listed.

6.2.3.1 Tomato

Applications according to the infection intensity and as described above against insects. Acaridoil (Potassium salts of fatty acids): 3-4 applications every 7-10 days dose: 19 kg/ha/year.

Laser: 2 applications every 10 days dose: 0.25 kg/ha/year, Serenade max: 2-4 applications dose: 2.5-4.0 kg/ha/year

6.2.3.2 Apple

Applications are made against the infection of insects. Usually 2-4 applications depending on the outside weather conditions and infection intensity. Admiral: 50-100 L/ha.

6.2.3.3 Orange

Applications are made against the infection of whiteflies and mites. Usually 2-4 applications depending on the outside weather conditions and infection intensity. Admiral: 80-160 L/ha

6.2.3.4 Broccoli

Nature Breaker (Pyrethrins): 2 applications every 7-10 days dose: 0.6 kg/ha

6.2.3.5 Potato

Usually not used.

6.2.3.6 Olive

Two to three applications yearly. Total from 30 to 90 L/ha/year, depending on insect pressure.

6.2.4 Use of Sulphur in the most important organic crops

6.2.4.1 Tomato

Sulphur is used according to the infection intensity (pathogens and mites). Care is taken to avoid the use it if bumblebees are used for pollination. 2-3 applications up to flowering. Average use is 2.5-5 kg/ha of sulphur per year.

6.2.4.2 Apple

Sulphur is not usually used. When used, against mites, it is done 1-2 times per year. Average use of sulphur is 3-7 kg/ha per year.

6.2.4.3 Orange

Sulphur is not usually used. When used, against mites, it is used 1-2 times per year. Average use of sulphur is 3-6 kg/ha per year.

6.2.4.4 Broccoli

Used against mites and other pathogens. Application 1-2 per year. Average use is 1-3 kg/ha per year.

6.2.4.5 Potato

Not usually used.

6.2.4.6 Olive

Against leaf-feeding insects, from 15-20 kg/ha/year, depending on insect pressure

6.2.5 Use of other plant protection products in the most important organic crops

Crop	**Other plant protection products**
Tomato	Fatty acid potassium salt (Savona, Acaridoil 13 SL,DUXON 13,9 SL) / Vivere-Fyt / Biological Control Agents Mycotal (*Verticillium lecanii*) Bacillus thuringiensis),

	Aphidali (*Adalia bipunctata*), Chrysopa (*Chrysoperla carnea*), mating disruption against *Tuta absoluta*, Beneficials (*Phytoseiulus persimilis*)
Apple	Spinosad (Laser 480 SC, Success 0,24 CB, Vivere-Fyt (Special mix with essences and plants extract), Ecocide(Special mix with essences and plants extract), Natural Essence Cinnamon (mix of essence oils and 100% cinnamon)
Citrus	Spinosad (Laser 480 SC, Success 0,24 CB, Ecocide (Special mix with essences and plants extract), Natural Essence Cinnamon (mix of essence oils and 100% cinnamon)
Potato	*Bacillus thuringiensis* (XenTari WG, Delfin WG, Bactecin DP)
Olives	Lime-sulphur for disease and mite protection, Sprayable zeolite and kaolin for abiotic stress protection and olive fruit fly protection, Spinosad for olive fruit fly protection, *Bacillus thuringiensis* for insect protection, Pyrethrum extra for olive fruit fly protection.

6.2.6 Use of alternatives for copper, mineral oils and sulphur in the most important organic crops

Crop	**Alternatives for copper**	**Alternatives for mineral oils**	**Alternatives for sulphur**
Tomato	Low copper grade fertilisers (Cu 2%-6%); Plant defence stimulators	Fatty acid potassium salt (i.e. Savona) Plant defence stimulators	None
Apple	Low copper grade fertilisers (Cu 2%-6%); Plant defence stimulators	Fatty acid potassium salt (i.e. Savona) Plant defence stimulators	None
Citrus	Low copper grade fertilisers (Cu 2%-6%); Plant defence stimulators	Fatty acid potassium salt (i.e. Savona) Plant defence stimulators	None
Potato	Low copper grade fertilisers Plant defence stimulators)	None	None
Olives	Zeolite and kaolin sprays for disease and damage minimization	Zeolite and kaolin sprays for insect damage minimization	None

6.3 Discussion and Conclusion for contentious inputs use in organic farming in Greece

Plant protection products based on Cu are used in Greece in plant protection as bactericides and fungicides. An effort to reduce the use of Cu in Greece is done during the recent years due to the demonstrated adverse effects on the environment (on soil organisms and auxiliary species).

These restrictions impact severely organic growers who are prohibited from using synthetic fungicides and alternatives to copper are currently limited.

Among the investigated crops (oranges, olives, tomato, potato and broccoli), high amounts of copper are used mainly in olives reaching usually the limit of 6 kg per ha per year (probably the limit sometimes may not be respected).

The surveys to experts pointed out that alternatives to copper currently rely on resistant varieties, on plant defence stimulators and on the prevention of infections by agronomic management.

Mineral oils are not usually applied, instead alternatives are applied to exclusively control insects and mites.

Sulphur is used as insecticide or acaricide. It is not used in olive orchards and potato crops. Alternatives to sulphur are not currently applied mainly for economic reasons since sulphur is a cheap means of control compared to other compounds. Moreover, since sulphur can be an alternative to mineral oil, its use is not easily reduced.

7. Results and findings from Italy

7.1 Main statistical findings for organic farming in Italy

7.1.1 Organic farming crops, covered area and production

According to Eurostat and Istat data, in 2016 the total area cultivated with organic methods (arable and grazed) in Italy have reached 1796363 ha, corresponding to a growth of 20% if compared to the previous year (1.49 million of hectares in 2015). This is considered a big increase, being the whole organic area 11% of total conventional agricultural and grazed area in Italy (16525472 ha) (Table 26). When considering total agricultural lands (without grazed), the percentage of organic to total is quite similar.

The growth of the organic sector in Italy is also highlighted by the number of farms that have chosen to produce according to the organic method (Table 26). In fact, the operators certified with the organic method (producers, processors and importers) are 72154 at 31 December 2016, representing 5% of total operators (1471185 total conventional operators). Going into the details of the 72154 organic operators, 55567 are the exclusive producers (farms); 7581 are processors (companies that carry out transformation and marketing activities, including retail sales); 8643 are producers-processors (agricultural companies that carry out both production and processing and marketing activities) and 363 are importers. The regions with the highest number of organic operators are Sicily (11451, with an increase of 1% compared to 2015), Calabria (11330, with an increase of 30%) and Puglia (10029, with an increase of 50%). Over half of the Italian organic operators are located in Sicily, Calabria, Puglia and Tuscany.

Table 26. Conventional and organic farming (fully converted+ under conversion) area of main organic farming crops in Italy. (Source: organic values from Eurostat 2016; conventional values from ISTAT 2016)

	Total (agricultural and grazed)	Total (agricultural land)	Total number of farms [b]	Citrus	Olives	Tomato	Potato
Organic (ha)	1796363	1475352[a]	72154	36125	222452	4057	1189
Conventional (ha)	16525472	13292241[f]	1471185	147626[c]	1164389	96782[d]	48138[e]
Percentage of organic to total (%)	10.87	11.09	4.9	24.47	19.1	4.19	2.46

[a]excluded "forage crops" (342,653 ha); [b]Organic operators including producers, processors and importers; [c]value include oranges, mandarin, clementins, lemons, pomelos, bergamot, cedar, chinotte; [d]value includes tomato and industrial tomato (18,190+78,592 ha); [e]value includes early potatoes and potatoes (14,050+34,088 ha); [e]xcluded "grazed" (3,233,241 ha)

With reference to the regional distribution of organic area, the largest extension is registered in Sicily (363688 ha), followed by Puglia (255853 ha) and Calabria (204527 ha). The organic area of these three regions holds 46% of the entire national total.

Citrus trees in Italy are mainly grown for the production of fruit to be used for fresh consumption. The production in excess or not suitable for marketing as fresh fruit is destined for industrial use. Citrus are also important as ornamental plants. For 2016, the ISTAT data for

Italy show an area invested with citrus equal to 148 thousand ha (Table 26), with a production of 3.1 million t of citrus (Table 3). The citrus trees cultivated with biological methods involves an area of 36 thousand ha (Table 2) with an increase of about 13.4% compared to 2015 and with a production of 0.68 million tonnes of citrus (Table 27). The region with the largest extension of organic citrus fruits is Sicily with 21147 ha, followed by Calabria with 11718 ha and Apulia with 2052 ha.

Table 27. Production from conventional and organic farming (fully converted+ under conversion) crops of main organic farming crops in Italy. (Source: organic values from Eurostat 2016; conventional values from ISTAT 2016).

	Citrus	Olives	Tomato	Potato
Organic (tonnes)	68607	72858	25427[a]	1931
Conventional (tonnes)	3072150[b]	2188922	6159790[c]	1394227[d]
Percentage of organic to total (%)	2.2	3.3	4.1	0.1

[a]value includes vegetables cultivated for fruit (including melons); [b]value include oranges, mandarin, clementins, lemons, pomelos, bergamot, cedar, chinotte; [c]value includes tomato and industrial tomato (558950.7 + 5600839.7); [d]value includes early potatoes and potatoes (324393.9+1069833.5).

The olive tree is an identifying element of the landscape of Italy, above all in central and southern areas. Most olive farms are family-owned, part-time and non-specialised. For 2016, the ISTAT data for Italy show an area planted with olive trees equal to 1.2 million ha with a production of 2.2 million tonnes of olives. The olive oil sector is going through a very critical phase due to the spread of the quarantine bacteria *Xylella fastidiosa* in the Salento area. The olive tree cultivated with biological methods in Italy involves an area of 0.22 million ha with a production of 72858 tonnes of olives. Apulia is the region that has the greatest extension of organic olive groves with 72 thousand ha, followed by Calabria with 68 thousand ha and Sicily with 30.6 thousand ha.

Tomato is a plant widely cultivated in Italy, both as a table tomato for fresh consumption, and as an industrial tomato for processing. In 2016, the area invested with tomato was 96782 ha, with a production of 6.16 million tonnes. Cultivation is practiced both in open fields and in greenhouses, based on the area and the season. The tomato, in the organic vegetables sector, represents a leading product with an important investment in terms of dedicated area, which in 2016 amounted to 4057 ha and 25428 tonnes of production.

Potato cultivation has a particular economic value in the context of the national agricultural system, with reference both to the values of production and to some of its productive and commercial characteristics. Italy, with a surface of 48 thousand ha, produces 1.4 million tonnes of potatoes. Total area dedicated to organic potato cultivation in Italy is 1189 ha, and total production is 1932 tonnes of potato.

On the whole, the evolution of biological surfaces in Italy from 2012 to 2016 with reference to citrus, olive, tomato and potato, are summarised in Table 28.

Table 28. Evolution of organic growing surfaces in Italy (Eurostat). Unit: ha.

CROPS	2012	2013	2014	2015	2016
Citrus	25340	28816	29849	31869	36125
Olives	164488	175946	170067	179886	222452
Tomatoes	2087	1966	2379	2864	4057
Potatoes (incl. seed potatoes)	894	667	920	855	1189

7.1.2 Main organic farming growers/producers associations

The main organic farming growers/producers associations are listed below:

MAIN ASSOCIATIONS		WEB SITE
AIAB	Associazione Italiana per l'Agricoltura Biologica	www.aiab.it
ANABIO	Associazione Nazionale Agricoltura Biologica	www.anabio.it
FEDERBIO	Federazione Italiana Agricoltura Biologica	www.federbio.it
TERRA SANA PIEMONTE	Associazione Produttori e Consumatori Prodotti Biologici	www.terrasanapiemonte.it

About a half of all Italian organic producers are partner of FEDERBIO (www.federbio.it, Federazione Italiana Agricoltura Biologica e Biodinamica - Italian Organic and Biodynamic farming Federation), which includes not only growers but other figures of the organic industry. Associated to FEDERBIO are: A.VE.PRO.BI; Anabio, Biodinamica, Bioland, Consorzio Natura e Alimenta, CTPB, Demeter Italia, La Buona Terra, Organica Sicilia, Soc. Coop. "Daunia & Bio", UPBIO. Of these, UPBIO (www.upbio.it, Unione Nazionale dei Produttori Biologici e Biodinamici - National Union of Organic and Biodynamic Growers), represents the first and most important national union of organic growers with over 20,000 organic farms.

7.1.3 Main organic farming Certification bodies in Italy

Code	Official Certification bodies (MIPAAF)	Web site
IT-BIO-002	CODEX srl	www.codexsrl.it
IT-BIO-004	Suolo e Salute srl	www.suoloesalute.it
IT-BIO-005	BIOS srl	www.certbios.it
IT-BIO-006	ICEA	www.icea.info
IT-BIO-007	Bioagricert srl	www.bioagricert.org

IT-BIO-008	Ecogruppo Italia srl	www.ecogruppoitalia.it
IT-BIO-009	CCPB srl	www.ccpb.it
IT-BIO-012	SIDEL CAB SPA	www.sidelitalia.it
IT-BIO-013	ABCERT srl	www.abcert.it
IT-BIO-014	Q Certificazioni srl	www.qcsrl.it
IT-BIO-015	Valoritalia srl	www.valoritalia.it
IT-BIO-016	SIQURIA SPA	www.siquria.it
IT-BIO-017	CEVIQ srl	www.ceviq.it
IT-BIO-018	Agroqualità S.p.A.	www.agroqualità.it

7.2 Use of contentious inputs in organic farming in Italy

The mapping refers to the most important crops of Sicily and Calabria (Italy) by interview of 2-3 experts/advisors per crop.

7.2.1 Legal status for the use of contentious inputs (if different than EU regulation)

The current legislation in Italy refers to the most recent regulation of the European Community (COMMISSION IMPLEMENTING REGULATION No 354/2014) amending and correcting Regulation (EC) No 889/2008 on organic production and labelling of organic products with regard to organic production, labelling and control.

Copper is subject to the following provisions:

1) Copper in organic farming: allowed in the form of copper hydroxide, copper oxychloride, copper oxide, Bordeaux mixture, and tribasic copper sulphate
2) Only uses as bactericide and fungicide up to 6 kg copper per ha per year. For perennial crops, Member States may, by derogation from the first paragraph, provide that the 6 kg copper limit can be exceeded in a given year provided that the average quantity actually used over a 5-year period consisting of that year and of the four preceding years does not exceed 6 kg. Risk mitigation measures shall be taken to protect water and non-target organisms such as buffer zones.
3) In Italy, in the frame of re-evaluation of active substances at the EU-level, copper is actually registered until 31-01-2019. Italy set a maximum level of 6 kg/ha/year of copper, both for conventional and organic citrus farming.

Sulphur and mineral oils are not subject to any restrictions or provisions

7.2.2 Use of copper in the most important organic crops in Italy

7.2.2.1 Citrus

Orange and Mandarin: 1 or 2 applications per year of copper oxychloride at rate of 350 g/hl. The number of applications depends on rainfalls. Average application volume is 2000 l/ha with a maximum 2500 l/ha.

The average copper use ranges from 2.5 to 6.1 kg/ha per year. Main use of copper is for control of *Phytophthora* spp., *Alternaria* spp., *Colletotrichum* spp., *Pseudomonas syringae*.

Lemon: 2 to 4 applications per year of copper oxychloride at rate of 350 g/hl or copper hydroxide at rate of 200 g/hl. The number of applications depends on rainfalls, wind-driven rainfalls and hails (which cause wounds favouring Mal Secco (*Plenodomus tracheiphilus*)). Average application volume is 2000 l/ha with a maximum 2500 l/ha. Main use of copper is for control of *Phytophthora* spp., *Alternaria* spp., *Colletotrichum* spp., *Pseudomonas syringae*, *Plenodomus tracheiphilus.*

The average copper use ranges from 5.0 to 12.0 kg/ha per year.

7.2.2.2 Olive

Data refers to Olives cultivated in Sicily and Calabria regions. In Sicily dry weather conditions and the grown olive varieties allow 1 or 2 applications per year of copper oxychloride at rate of 350-500 g/hl whereas in Calabria the cultivated variety, *Carolea,* which is susceptible to *Colletotrichum gleosporioides, Spilocaea oleagina* and *Pseudomonas savastanoi,* and the rainy weather (in comparison with Sicily) determine a higher number of copper applications: up to 8 per year. Average application volume is 1500 l/ha.

The average copper use ranges from 1.8 to 14.0 kg/ha per year.

7.2.2.3 Tomato

In Sicily organic tomatoes are generally grown in greenhouses.

3 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 application volume is 1000 l/ha. Main use of copper is for control of *Phytophthora infestans*, *Xanthomonas* spp., *Pseudomonas* spp. The average copper use ranges from 1.5 to 6.0 kg/ha per year.

7.2.2.4 Potato

In Sicily organic potatoes are grown in two different periods, with early seeding in September and late seeding in January, to avoid infections of *Phytophthora infestans* at an early stage of crop growth.

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. Main use of copper is for control of *Phytophthora infestans*.

The average copper use is up to 15.0 kg/ha per year.

7.2.2.5 Summary

High amounts of copper compounds are used by growers primarily in lemon orchards and potato. For these two crops the limit of 6 kg per ha and per year is exceeded. In Calabria, on olives, the usage is far over 6 kg/ha per year. For the above crops a reduced limit is currently not affordable.

7.2.3 Use of mineral oils in the most important organic crops

7.2.3.1 Citrus

1 or 2 applications per year of mineral oil at rate of 1.5-2.0% are performed. The number of applications depends on pest presence and are generally carried out in summer or winter. Average application volume is 2000 l/ha with a maximum 2500 l/ha.

The average mineral oil use ranges from 30 to 100 l/ha per year. Main use of mineral oils is for control of scales, mites and whiteflies.

7.2.3.2 Olive

1 application of mineral oil at rate of 1.5-2.0% is generally carried out every other year depending on pest presence. It is generally carried out in summer. Average application volume is 1500 l/ha.

The average mineral oil use is up 30 l/ha per year. Main use of mineral oils is for control of scale insects.

7.2.3.3 Tomato

Mineral oils at rate of 0.5% are exclusively used. One or 2 applications are generally carried out per year. Average application volume is 1000 l/ha.

The average mineral oil use is up 10 l/ha per year. Mineral oils are generally applied for their repellent effect on insects or mites.

7.2.3.4 Potato

No mineral oils are used.

7.2.3.5 Summary

There is no maximum level restriction for the amount of mineral oil to be used per ha and year in Italy. For the above crops a reduced limit is currently affordable.

7.2.4 Use of sulphur in the most important organic crops

7.2.4.1 Citrus

The use of sulphur compounds is sporadic. In case of use, sulphur proteinate (45% sulphur) is applied at rate of 350 g/hl. One or 2 applications per year may be carried out with an application volume of 2000-2500 l/ha. In case of use, about 3.5 kg/ha of sulphur per year is applied. Main use of sulphur is for control of scales and mites.

It is important to note that in recent years the use of *Citrange* spp. in place of sour orange as rootstock determined the use of sulphur, as powder, to correct the soil pH. For this purpose 400 kg/ha per year of sulphur is used.

7.2.4.2 Olive

No sulphur is used.

7.2.4.3 Tomato

1 or 2 applications per year are carried out with an application volume of 1000 l/ha. Application is performed at an early stage of tomato growth in absence of bumble bees in the greenhouses. 2.5-5 kg/ha of sulphur per year is applied. The main use of sulphur is for control of mites and pathogens.

7.2.4.4 Potato

The use of sulphur compounds is sporadic. Only combined copper-sulphur compounds are used in order to reduce the inputs of copper.

7.2.4.5 Summary

Generally the use of sulphur is sporadic except for tomato and citrus crops.

7.2.5 Use of other plant protection products in the most important organic crops

Crop	Other plant protection products
Citrus	azadirachtin, spinosad as bite, attract and kill technique (ex. Eco Trap, Decis Trap), beneficials (*Aphytis* spp., *Cryptolaemus montrouzieri*, *Leptomastix dactylopii*)
Olive	Spinosad as bite (f.p. Spintor Fly)
Tomato	Maltodextrin 49%, potassium bicarbonate 85%, sweet orange essential oil 5,88%, garlic extract 45% or 100%, Biological Control Agents (*Trichoderma harzianum*, *Bacillus subtilis*, *Bacillus amyloliquefacens* 25%, *Bacillus thuringiensis*) mating disruption against *Tuta absoluta*, Beneficials (*Amblyseius swirskii, Phytoseiulus persimilis*)
Potato	*Bacillus thuringiensis*

7.2.6 Use of alternatives for copper, mineral oils and sulphur in the most important organic crops

Crop	Alternatives for copper	Alternatives for mineral oils	Alternatives for sulphur
Citrus	Low copper grade fertilisers (Cu 2%-6%); Sweet orange essential oil (f.p. Prev-am Plus); Plant defence stimulators	Soft potassium soap 28%; Plant defence stimulators (ex. Cynoyl Z); beneficials (*Aphytis* spp., *Cryptolaemus montrouzieri*, *Leptomastix dactylopii*, phytoseids)	None
Olive	Low copper grade fertilisers (Cu 2%-6%); Plant defence stimulators	None	None
Tomato	Low copper grade fertilisers (Cu 2%-6%); Plant defence stimulators	None	None
Potato	Low copper grade fertilisers (Cu 2%-6%); Plant defence stimulators; Cultivar resistant to downy mildew (ex. cv. Carolus)	None	None

7.3 Discussion and Conclusion for contentious inputs use in organic farming in Italy

Copper-based products are used in plant protection as bactericides and fungicides. Copper is the only active ingredient with a strong antimicrobial effect and a wide range of action that is approved for use in organic farming particularly for grape, potato and apple crops. Recently, the demonstrated adverse effects on the environment (on soil organisms and auxiliary species) have led to a reduction in its use in several European countries, Italy included.

These restrictions impact severely organic growers who are prohibited from using synthetic fungicides and alternatives to copper are currently limited.

Among the investigated crops (citrus, olive, tomato and potato), high amounts of copper are used by Sicilian growers in lemon orchards and potato. For these two crops the limit of 6 kg per ha and per year is generally not respected. In olive orchards in Calabria the amount of copper applied exceeds greatly 6 kg/ha per year.

The surveys to experts pointed out that alternatives to copper currently rely on resistant varieties (i.e. potato cv. Carolus), on the so-called plant defence stimulators and on the prevention of infections by agronomic actions (i.e. early or late seeding of potato).

Mineral oils are applied to exclusively control insects and mites in citrus and olive orchards and occasionally in tomato. The use of them can be reduced and alternatives are in use or begin to be used, that is soft potassium soap and plant defence stimulators (ex. Cynoyl Z which is a sulphur-brown seaweed based compound with side on insects and mites).

Sulphur is used as insecticide or acaricide in citrus orchards and as fungicide in tomato crops. It is not used in olive orchards and potato crops. Alternatives to sulphur are not currently applied mainly for economic reasons since sulphur is a cheap mean compared to other compounds. Moreover, since sulphur can be an alternative to mineral oil, its use is not easily reduced.

8. Results and findings from Norway

8.1 Main statistical findings for organic farming in Norway

8.1.1 Organic farming crops, covered area and production

The main organic products in Norway are dairy cows (for milk and meat) and sheep (for meat). Hence, the organic area is dominated by grassland, and by arable land which is used for fodder production, mainly silage from perennial leys. Totally 47,366 ha were in conversion or certified organic in 2017 (source: https://debio.no/statistikk/). Out of this, 57% was arable land used for perennial ley, and 14% were used for cereals. The horticultural sector is very small, with only 5.5 ha of certified glasshouse area in 2017, used mainly for tomato and cucumber. Eight ha were used for strawberries, and 94 ha for other berries. One hundred sixty two ha were used for organic apples, and 55 for other fruits (plums, cherries). Among field grown vegetables, carrots are the most common crop, with 88 ha in 2017. Totally, 536 ha were used for field grown vegetables in 2017. The area used for potatoes was 150 ha. Altogether, the area used for fruit, berries, vegetables and potatoes comprised only 2% of the total organic certified area in 2017. Still, with these limited areas, organic carrots and apples are grown on a relatively high proportion of land (see Table 29).

Table 29. Conventional and organic farming (fully converted+ under conversion) area of the main organic farming crops in Norway. (Source: for organic crops debio.no, 2017; for conventional crops ssb.no, for potatoes 2012, other crops 2017 www.ssb.no/statbank/table/10507/tableViewLayout1/; farmland www.ssb.no/stjord)

	Tomato (glasshouse)	Potato	Strawberry	Carrot	Apple	Total*	Total#	Organic and total number of farms
Organic (ha, 2017)	2.5	150	8	88	162	47366	39120	2070
Conventional (ha)	33	12664	1536	1476	1379	984096	803881	40269
Percentage of organic to total (%)	5	1.2	0.5	6	12	4.8	4.9	5.1

*agricultural and grazed land, outlying fields not included

#agricultural land

As in many other industrialised countries, the structure in Norwegian agriculture is rapidly changing with the numbers of farms being reduced by about 2% per year. Most of the farmland on such farms is rented to active farmers, hence rapidly increasing the proportion of rented land that farmers manage. However, rented land is usually less intensively managed, and the area of cultivated land has decreased significantly the last 10-15 years due to marginal areas not being harvested. Some farmers go for large-scale industrial farming, whereas others keep the production at a minimum level and earn their living form work outside the farm. None of these strategies are easy to combine with organic management. This explains to some extent why the interest in organic agriculture is much lower in Norway than in other Nordic countries.

8.1.2 Organic growers/producers' associations and certification body

In Norway, all auditing of organic production and distribution is carried out by the certification body Debio, on behalf of the Norwegian Food Safety Authority (NFSA; in Norwegian: Mattilsynet) which is the responsible national body. Debio also conducts inspections for Demeter-certification. Norway is not a member of the EU, but EU legislation has been implemented in Norwegian national law according to the European Economic Area agreement since 1994. EU regulations for organic production were implemented as part of Norwegian law in 1994, but EC 889/2008 and 834/2007 were not implemented in Norway until March 2017.

There are two farmers' organisations in Norway, the Norwegian Farmers' Association and the Norwegian Farmers and Smallholder's Association. Both promote organic agriculture to some extent and have several organic farmers as members. The national NGO for organic growing and consumption, Organic Norway, has about 5000 members, but is more active on the consumption than on the production side. Different from several other countries, there are no growers' associations with private labels and standards in Norway, except Demeter (biodynamic) which is administrated by Debio. Hence, the major part of organic production in Norway is certified according to EU regulations (only).

8.2 Use of contentious inputs in organic farming in Norway

In task 3.1 of WP3-Plant, the use of copper, mineral oil and sulphur as plant protection measures is studied. While recording a representative use of these inputs in some important organic crops, other plant protection measures such as commercial beneficial organisms were also recorded. The use was recorded by interviewing at least one experienced advisor per crop, asking them to fill in a table describing a typical organic production of the relevant crop, emphasising the use of various inputs. Strawberries, carrots, apples, potatoes and tomatoes were studied.

8.2.1 Legal status for the use of contentious inputs (if different than EU regulation)

The Norwegian regulation of inputs in organic growing is similar to the EU regulation. However, until EC 889/2007 and 834/2008 were implemented in March 2017, application of copper was not permitted in Norway. Little use of copper salts in Norwegian crop examples may be because some farmers and advisors still believe that copper is not permitted (asking them about Cu use had the unintended consequence to make them aware that it is now permitted to use in Norway, too!). A list of all plant protection inputs permitted in organic growing in Norway can be found at this website: www.mattilsynet.no/plantevernmidler/oko.asp

The NFSA publishes data (in Norwegian) about the annual use of active substances in plant protection inputs, but does not specify use on organically managed land: www.mattilsynet.no/planter_og_dyrking/plantevernmidler/godkjenning_av_plantevernmidler/omsetningsstatistikk_for_plantevernmidler_20132017.29869/binary/Omsetningsstatistikk%20for%20plantevernmidler%202013-2017

8.2.2 Use of copper in the most important organic crops

In Norway, one commercial product containing copper is available, called **Nordox**. This is a copper (I) oxide, Cu_2O, which is produced in Norway (www.nordox.no/plant-protection/nordox-75-wg/). The total use in Norway in 2017 was 3965 kg (given on the website referred above). On average during 2014-17, the average annual amount was 4332 kg. The product is mostly used in fruit production (apples), and the maximum amount permitted per ha by Norwegian regulations is 4 kg per year.

The product is highly toxic to water fauna, with a long-term effect (www.mattilsynet.no/plantevernmidler/etiketter/2008_43_16.pdf). Copper accumulates in soil. However, copper is also an essential micronutrient for plants, and copper may also be applied as a leaf fertiliser.

By September 2018, copper use was reported only for apples, in amounts less than 4 kg per ha and year. See further details in section 4.5. e.g. for strawberries, the informant advisor was, by June 2018, not aware that the Norwegian ban on copper in organic growing had not been valid since March 2017.

The use of copper in Norway is not above the proposed new regulation of 4 kg/ha/year. It will be very difficult to reduce this limit further, especially unless the fruit producers again get access to lime-sulfur. If limits are decreased, producers may utilise the permission to apply copper as a leaf fertiliser in situations when plant protection is really the most important reason for use. It will be interesting to see whether producers of potato and other crops start to use copper in future.

8.2.3 Use of mineral oils in the most important organic crops

In Norway, one commercial product containing paraffin oil is available, called **Fibro** (Belchim Crop Protection), containing 94% paraffin oil with some additional compounds (www.nordiskalkali.se/wp-content/uploads/fibro-s-se.pdf). This product was not approved for use in Norway until 2018. The main recommended use is against aphids in (seed) potatoes, to avoid spreading of virus. Such application is restricted to each 3rd year to protect soil biology. In fruits, the product may be used against various insects such as mites, aphids and pear psyllid (*Cacopsylla pyri*). One application per year in apples, and maximum two in pears, are recommended. Recommended doses are up to 10-20 litters of product per ha per application, mixed with water. The most relevant use in organic growing will be in fruits.

In conclusion, the use of mineral oil is still very restricted in organic growing in Norway.

8.2.4 Use of sulphur in the most important organic crops

Sulphur was permitted for organic growing in Norway when the first regulations were introduced, in 1991, and is still permitted. The first regulation stated that sulphur ("netssvovel"), maximum 0.7% could be used for fruits and berries until flowering; later only combined with e.g. bentonite or algae lime. The term "netssvovel" likely refers to a German product containing elementary sulphur, Netz-Schwefelit (more at www.pflanzenschutz-information.de/Apps/WebObjects/PSInfo.woa/wo/AjXk4YF3ZdUFJ3csWVbxLg/0.15.40.5.11.

1.1.0.3.5.1, in German). Later, e.g. in the regulations from 2001, lime sulphur was permitted. This product was popular among growers. However, following a debate about the safety of this product around 2002, the national authorities asked for information relevant for Norwegian conditions, which the Norwegian producer was not able/willing to produce. The major supplier in Europe, Polisenio in Italy, has not (yet) been interested in applying for an approval in the restricted Norwegian market. Hence, since 2003 this product has not been available for Norwegian growers anymore, and they have returned to elementary sulphur. A paper in Norwegian, with an English summary (Stensvand et al., 2003), describes this process as well as the results of using lime-sulphur under Norwegian conditions. Reference: Stensvand A, Meland J, Røen D (2003) Lime sulphur – an old chemical with renewed interest. Grønn kunnskap vol 7 no 125, 4 pp. Available at:

https://brage.bibsys.no/xmlui/bitstream/handle/11250/2505825/Planteforsk-GKe-2003-07-125.pdf?sequence=1&isAllowed=y

Currently, only one commercial product containing elementary sulphur is available, called Thiovit Jet (Syngenta). This is ground elementary sulphur (80%) mixed with compounds facilitating application in field and adhesion to plant organs. Sulphur has an effect on fungi (mildew and scab), and insects, especially mites. The total use in Norway in 2017 (given on the website referred above) was 14,720 kg. On average during 2013-17, the average annual amount was 13,210 kg. The product is mostly used in fruit production (apples), and it is listed in the statistics as an input against fungal disease, reflecting that this is the most important purpose for using it.

The recommended doses

(www.mattilsynet.no/plantevernmidler/etiketter/2007_30.pdf) vary between cultures, but are highest for strawberries, where up to 750 g of product are proposed (mixed with water) per 1000 m of row to be repeated each 10-12 days from early spring to flowering, and after harvest. Other berries are more sensitive and a maximum of 3-4 applications per year is recommended, with 4.5-7.5 kg of product applied per ha per application. In fruit, 1-3 applications before flowering is recommended, with doses up to 12 kg per ha per application.

Sulphur is toxic for insects, including beneficial insects, and for water fauna. It does not accumulate in living organisms or in soil.

https://prosjekt.fylkesmannen.no/Okologiske-foregangsfylker/Okologisk-frukt-og-bar/Nyheter/Okologisk-plantevern/

In conclusion, the use of sulphur is the most commonly applied commercial pesticide product in organic growing in Norway. It is used for apples, strawberries and tomatoes, but not for potatoes or carrots. There is no maximum limit to the dose per ha and year.

8.2.5 Overview of commercial plant protection inputs in some relevant crops

In addition to potato and tomato, which are important crops in Organic PLUS, we searched for crops grown organically in a significant volume in Norway, and concurrently crops where we

expected to find the largest inputs of commercial plant protection products. Carrots, strawberries and apples were selected in addition to potato and tomato.

8.2.5.1 Potato

Olaug Bach, NLR Trøndelag provided this information:

No use of copper.

No use of mineral oil.

No use of sulphur.

So far, only preventive efforts are used against potato late blight (*Phytophthora infestans*): 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.

8.2.5.2 Tomato

By 2018 there were only 3 producers of organic tomatoes in green house in Norway, growing totally 10,200 m^2 out of which 4,000 m^2 was used for growing in soil and the rest for growing in plastic bags. Astrid Sigaard Andersen, NLR Viken, interviewed producers and provided following information about a typical production:

No use of copper.

No use of mineral oil.

Sulphur is used against mildew.

Beneficial organisms: *Macrolophus pygmaeus* (formerly called *M. caliginosus*), 1-2 per m^2 once a year. This mirid bug is an omnivorous predator e.g. on whiteflies, different species of aphids, thrips and spider mites.

Predatory mites, *Phytoseiulus persimilis,* are used when needed to control various spider mites.

Nematodes (*Steinernema feltiae*) may be used to control sciarid flies.

8.2.5.3 Carrot

Olaug Bach in NLR Trøndelag provided this information:

No use of copper.

No use of mineral oil.

No use of sulphur.

Beneficial organisms: *Bacillus subtilis QST713*; commercial product Serenade (Bayer) is used up to 6 times during root development to protect against fungal diseases, powdery mildew (*Erysiphe heraclei*) and carrot leaf blight (*Alternaria dauci*).

Early varieties are covered with plastic in field.

8.2.5.4 Strawberry

This information is relevant for growing of organic strawberries in plastic tunnels, with imported plants, most often cv. Sonata. The information was received from Jan Karstein Henriksen, NLR Agder.

No use of copper.

No use of mineral oil.

Sulphur; commercial product Thiovit (Syngenta) is used 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.

Bacillus subtilis QST713; commercial product Serenade (Bayer) is used once per week up to 6 times to protect against fungal diseases, powdery mildew (*Erysiphe heraclei*) and grey mould (*Botrytis cinerea)*, more often if the weather is moist.

Beneficial nematode *Heterorhabditis bacteriofora* is used against larvae of strawberry weevils.

Beneficial mite *Neoseiulus cucumeris* twice against strawberry mites, spinning mites and thrips. 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.

8.2.5.5 Apple

Marianne Bøthun, NLR Vest provided this information.

Discovery and Red Aroma are the most common in organic apple growing in Norway. By establishment, 2-year old trees with branches are planted and will usually last for 20-25 years. Non-organic trees with bare roots are imported for planting, due to problems with witches' broom (*Taphrina betulina*) in the Norwegian production of fruit trees. The main problem to control is scab, but several insects also pose (increasing) problems.

Use of copper: Early spring Nordox, 1 kg/ha, later combined with sulphur (Thiovit Jet) against apple scab. 4-6 treatments per year. Maximum total dosage in Norway is 4 kg/ha and year.

No use of mineral oil.

Use of sulphur: Thiovit Jet 3 kg/ha as a protection before rain, alone or combined with copper.

Vegetable oil mixed with soap, 30 l of oil and 5 l of soap per ha is used in spring, later 20 l oil and 3 l of soap per ha against apple fruit moth (*Argyresthia conjugella)*.

Attacks of aphids and other insects may be controlled by pyrethrum; commercial product Natria (Bayer; rape oil with pyrethrum).

Good forecast software is available for advice on treatments in fruit production (VIPS, RimPro).

A plant protection product which is very much missed by organic fruit growers in Norway is lime sulphur (calcium polysulphate), which was commonly used until 2003. It was produced in Norway (Stensvand et al., 2003), but the producer found the demand for evidence testing to be too laborious and costly, and other producers, e.g. Polisenio, have not found it worthwhile to apply for approval for the restricted Norwegian market.

8.2.6 Use of other plant protection products in the most important organic crops

Several beneficial organisms are used, especially in protected growing (tomato, strawberries), but also in field (carrots).

Plant oil and soap is used in apple growing, see details in section 4.5.5.

8.2.7 Use of alternatives for copper, mineral oils and sulphur in the most important organic crops

No alternatives to copper, mineral oil or sulphur were revealed by the mapping of inputs in the selected crops in Norway, except the mixture of soap and plant oil which is well known already.

8.3 Discussion and Conclusion for the use of contentious inputs in organic farming in Norway

The access to inputs protecting important crops is restricted by EU regulations for organic production, but also by national regulations, and in practice by the interest from the producer of relevant inputs to apply for an approval from the responsible national body, the Norwegian Food Safety Authority (NFSA). Whereas sulphur has been used for several years, copper and mineral oil were not permitted for organic growing in Norway until March 2017, when the EC889/2007 and 834/2008 were implemented, and mineral oil was in practice not available until the season of 2018. Apple growers were aware of the changed regulation conditions and immediately started using copper. Other producers have not yet started to use copper, even if it may be relevant especially in potatoes where Norwegian climatic conditions make potatoes vulnerable towards this disease.

Several beneficial organisms, mainly insects and nematodes but also soil bacteria, are used. Whereas most inputs are imported, copper is produced by Norwegian industry.

The national limit for copper is 4 kg per ha and year. Hence, proposed stricter regulations for application of copper will not pose large problems for Norwegian growers, unless the regulations go even further to completely expel the use of copper. With weather conditions favouring fungal disease (a warmer and more humid climate) and new insect pests, the demand for inputs to protect the crops is increasing over time.

10. Results and findings from Poland

10.1 Main statistical findings for organic farming in Poland

10.1.1 Organic farming crops, covered area and production

Organic agriculture in Poland is expected to grow in respect to vegetable and fruit production. The total organic agricultural land in 2016 was estimated at 3.7% of the total agricultural land. From 2013 the gradual decrease in the organic agricultural land has been recorded (Agricultural and Food Quality Inspection: The report on organic farming in Poland in 2015-2016).

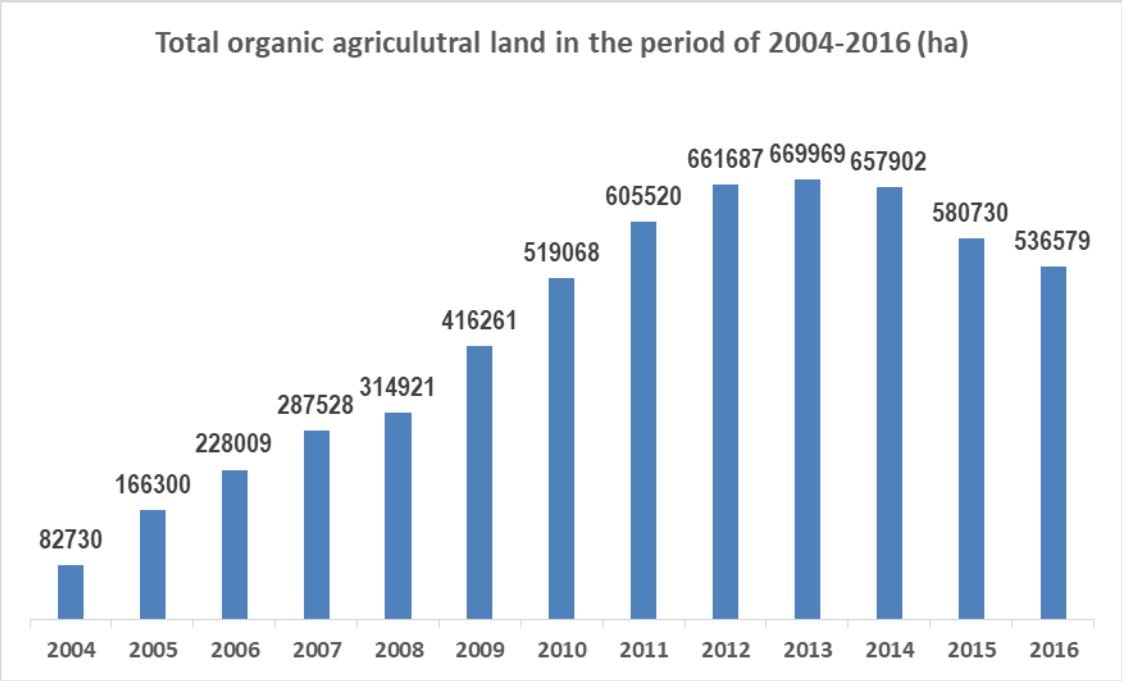

Figure 10. Total organic agricultural land in the period of 2004-2016 (Agricultural and Food Quality Inspection: The report on organic farming in Poland in 2015-2016).

The number of organic farms was estimated at 22435 (growing plants: 83.2%; growing plants and animal farming: 16.8%). The number of farms with organic and conventional systems increased in 2016 to 11045 from 9129 in 2015.

The area of main crops (after conversion, 2015) covered 101,436 ha for grains, 46,723 ha for fruit, 40564 ha for vegetable and 1983 ha for potato. The production of main crops (after conversion, 2015) was estimated at 147830 tonnes for grains, 57941 tonnes for fruit, 38120 tonnes for vegetables and 17902 tonnes for potato. In 2016 the area of main crops (after conversion) covered 101147 ha for grains, 34427 ha for fruit, 51865 ha for vegetables and 1837 ha for potato. A significant increase in the organic growing area of vegetables was observed in 2016 in comparison to 2015.

The total conventional and organic farming area and production for the main organic farming crops i.e. strawberry, tomato, potato and cucumber in Poland is presented in Table 30 and Table 31.

Table 30. Conventional (ground) and organic farming (fully converted+ under conversion) area of main organic farming crops in Poland. (source: Agricultural and Food Quality Inspection, 2017; note: statistical data obtained on request; Statistics Poland, Agriculture Department, Production of agricultural and horticultural crops in 2017; Agricultural and Food Quality Inspection, The report on organic farming in Poland in 2015-2016,)

	Strawberry	Tomato	Potato	Cucumber	Total (agricultural land)	Total number of farms
Organic (ha)	1237	3617	1614	673	536579 (2016)	22435 (2016)
Conventional (ha)	49642	9292	329000	13892		
Percentage of organic to total (%)	2.5	38.9	0.5	4.8		

Table 31. Production from conventional (ground) and organic farming (fully converted+ under conversion) crops of main organic farming crops in Poland. (Source: Agricultural and Food Quality Inspection, 2017; note: statistical data obtained on request; Statistics Poland, Agriculture Department, Production of agricultural and horticultural crops in 2017)

	Strawberry	Tomato	Potato	Cucumber
Organic (t)	6300	991	20437	2497
Conventional (t)	1779214	2545480	92000000	2490988
Percentage of organic to total (%)	0.4	0.04	0.02	0.1

The organic farming crops i.e. strawberry, tomato, potato and cucumber constitute 0.4%, 0.04%, 0.02% and 0.1% of the total conventional farming crops, respectively.

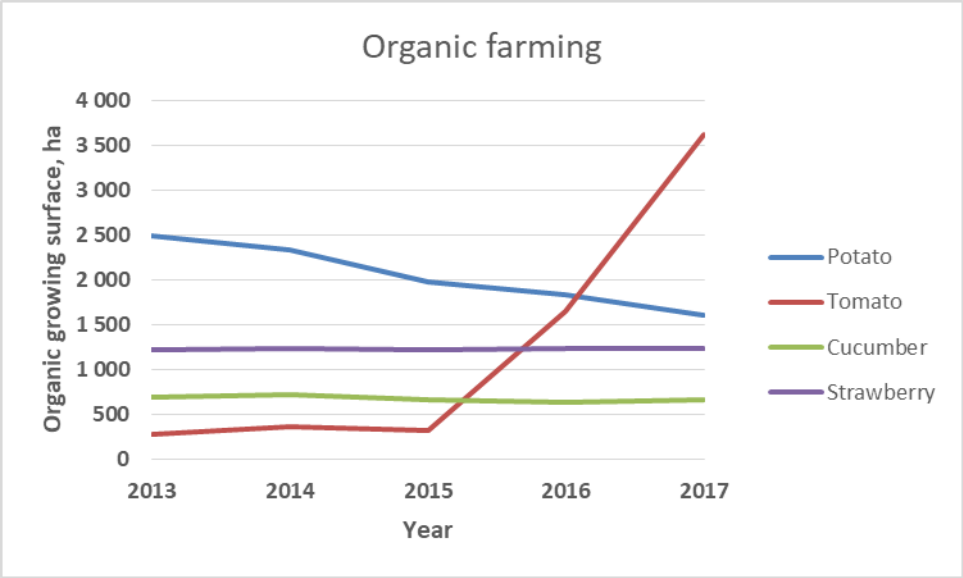

Figure 11. Evolution of organic area (ha) (fully converted+ under conversion) in Poland for selected crops: strawberry, tomato, potato, cucumber (source: Agricultural and Food Quality Inspection, 2017; note: statistical data obtained on request)

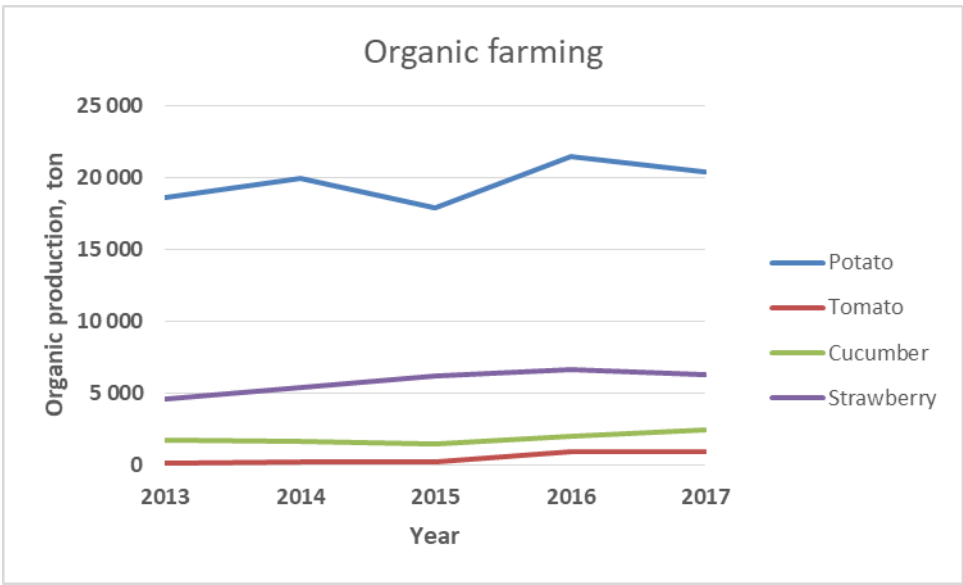

Figure 8. Evolution of organic production (tonnes, fully converted) in Poland for selected crops: strawberry, tomato, potato, cucumber (source: Agricultural and Food Quality Inspection, 2017; note: statistical data obtained on request)

The organic growing surface and production for organic farming crops per region in Poland are presented in Figure 9 and Figure 10.

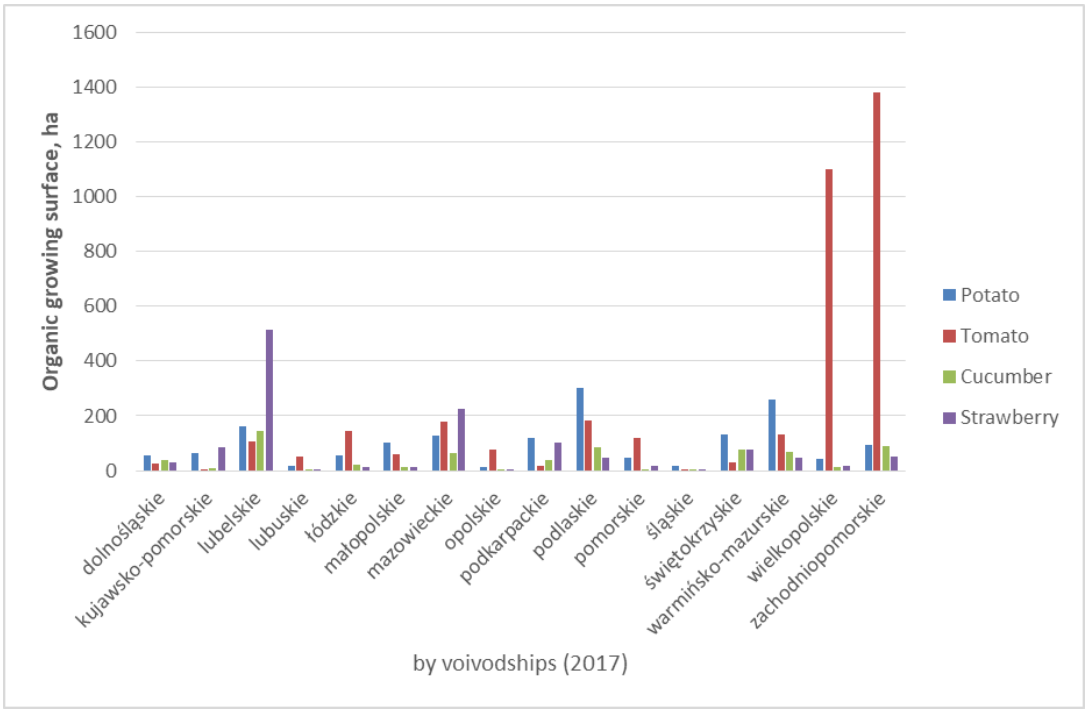

Figure 9. Evolution of organic growing surface (ha) in 2017 by region for selected crops: strawberry, tomato, potato, cucumber (source: Agricultural and Food Quality Inspection, 2017; note: statistical data obtained on request)

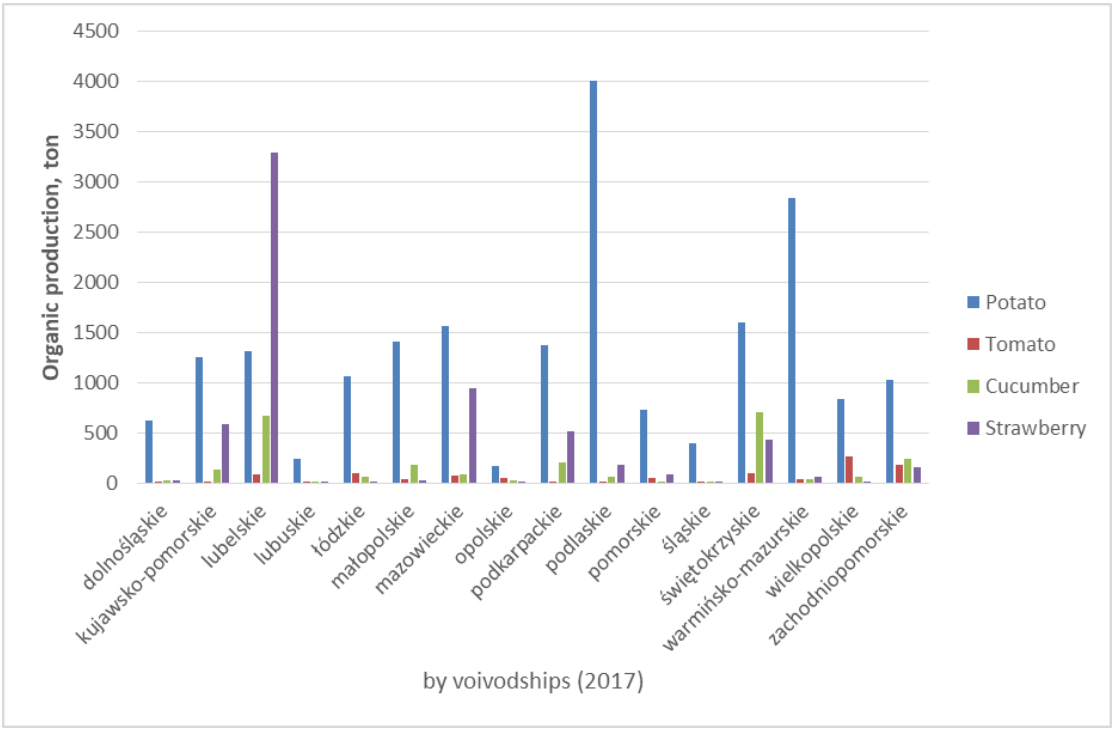

Figure 10. Evolution of organic production (t) in 2017 by region for selected crops: strawberry, tomato, potato, cucumber (source: Agricultural and Food Quality Inspection, 2017; note: statistical data obtained on request)

10.1.2 Main organic farming growers/producers associations

The list of existing associations for organic farming growers/producers includes:

-Polskie Towarzystwo Rolników Ekologicznych (PTRE),

-Stowarzyszenie Producentów Żywności Metodami Ekologicznymi "EKOLAND"

-Stowarzyszenie Gospodarstw Ekologicznych „Truskawka".

However, there is little known how many growers and producers are members to those associations

10.1.3 Main organic farming Certification bodies

In Poland organic farming is controlled by the Agricultural and Food Quality Inspection through 11 control bodies (in 2016) presented in Table 32.

Table 32. Control bodies and the number of controlled organic producers in 2016 (Agricultural and Food Quality Inspection: The report on organic farming in Poland in 2015-2016).

Name of the control body	2015	2016
Agro Bio Test Sp. z o.o.	3 494	3 286
Biocert Małopolska Sp. z o.o.	3 003	2 823
Bioekspert Sp. z o.o.	435	593
Centrum Jakości Agroeko Sp. z o.o.	2 410	2 914
Cobico Sp. z o.o.	1 557	1 515
DQS Polska Sp. z o.o.	0	1
Ekogwarancja PTRE Sp. z o.o.	5 733	5 531
PCBC S.A	2 650	2 287
PNG Sp. z o.o.	1 135	1 169
SGS Polska Sp. z o.o.	222	239
TUV Rheinland Polska Sp. z o.o.	2 376	3 017

10.2 Use of contentious inputs in organic farming in Poland

10.2.1 Legal status for the use of contentious inputs

Legal status for the use of contentious inputs does not differ from the EU regulation.

10.2.2 Use of copper in the most important organic crops

10.2.2.1 Strawberry

No data available from the online questionnaire. However, the organic farming experts indicated that in some cases copper oxide is used. There is no information on the dosage.

There are some commercially available copper products for growing strawberries on the market.

10.2.2.2 Potato

According to the organic farming experts and farmers, copper is used in potato growing as fungicides, including copper oxide, copper oxychloride (2.5-3 kg/ha, hydrated copper sulphate (5 L/ha).

10.2.2.3 Tomato

No data available from the online questionnaire. However, the organic farming experts indicated that copper is used in organic growing of tomato (the maximum permissible dose is up to 6 kg per ha).

10.2.2.4 Cucumber

No data available from the questionnaire. However, the organic farming experts indicated that copper is used in organic growing of cucumber (the maximum permissible dose is up to 6 kg per ha).

10.2.2.5 Summary

From the information provided by the organic growers and organic farming experts the limit of 6 kg of copper per year is not exceeded.

10.2.3 Use of mineral oils in the most important organic crops

10.2.3.1 Strawberry

No data available from the online questionnaire.

10.2.3.2 Potato

Some experts indicated that paraffinic oils can be used in organic potato cultivation. However, no detailed information was available.

10.2.3.3 Tomato

No data available from the online questionnaire.

10.2.3.4 Cucumber

No data available from the online questionnaire.

10.2.3.5 Summary

Regarding the use of mineral oils there is little known about it in reference to the selected crops.

10.2.4 Use of sulphur in the most important organic crops

10.2.4.1 Strawberry

In cultivation of strawberry potassium sulphate is used. No detailed information on application was provided.

10.2.4.2 Tomato

In cultivation of tomato potassium sulphate is also used. No detailed information was provided.

10.2.4.3 Potato

In cultivation of potato copper sulphate is used. No detailed information was provided.

10.2.4.4 Cucumber

No data available from the online questionnaire.

10.2.4.5 Summary

It is difficult to provide specific information on the use of sulphur in organic agriculture. This is mostly due to lack of this information from organic growers.

10.2.5 Use of other plant protection products in the most important organic crops

In organic agriculture in Poland other plant protection products that can be used for growing strawberries, tomato, cucumber and potato are included in the list of products allowed in organic agriculture. From the information obtained through the questionnaire and personal communication, organic farmers and organic farming experts pointed out that plant extracts prepared on-site are commonly used in organic farming.

10.2.6 Use of alternatives for copper, mineral oils and sulphur in the most important organic crops

In organic growing of selected crops recommended alternatives include biodegradable plastic and natural mulches and fleece. Other alternatives include natural plant extracts, composts, etc.

10.3 Discussion and Conclusion for contentious inputs use in organic farming in Poland

Organic agriculture in Poland does not constitute a significant share of total agricultural output. For the selected crops, i.e. strawberry, tomato, potato, cucumber, the percentage of organic agriculture is estimated at 0.4%, 0.04%, 0.02% and 0.1%, respectively. However, the organic growers are many and the organic farms cover substantial area.

Based on the information provided by organic growers and organic farming experts, the contentious inputs use in organic farming is related in most cases to using plastic materials such as plastic mulches (e.g. for growing strawberry), plastic film used for tunnel covering (this is typical for growing tomato and cucumber) etc. Some experts indicate that removal of plastic materials from fields, as is typical for ground cultivation of strawberry, requires additional work. Biodegradable plastic mulches are rarely applied due to high costs and low availability. It is difficult to estimate the quantity of plastic materials that are used in organic agriculture. Other contentious inputs include sulphur compounds such as potassium sulphate (strawberry, potato), copper sulphate (potato), copper oxychloride (potato), and copper hydroxide (potato). Some experts indicated that in potato cultivation also paraffinic oils can be used. No detailed information was available.

11. Results and findings from Spain

11.1 Main statistical findings for organic farming in Spain

11.1.1 Organic farming crops, covered area and production

The main organic farming crops in Spain, classified by the value of production, are listed in Table 33. Regarding plant production, vegetables and tubers are the most important crops in terms of value, followed by wine and olive oil production. These important crops, along with the addition of citrus fruits, accounts for 38% of the total value of organic plant production in Spain (meat and livestock are not considered in this calculation).

Table 33. Value of production from organic farming (fully converted+ under conversion) crops. (Source: Sp, 2016).

	Value of production (x10^6 euros)	**% Total value**
1. Vegetables and tubers	28281	16.6
2. Meats	16530	9.7
3. Wine	16421	9.6
4. Olive oil	16384	9.6
5. Nuts	7595	4.4
6. Fruits and strawberries	5058	3.0
7. Citrus	4310	2.5
8. Cereals (rice included)	4356	2.5
9. Aquiculture	2788	1.6
10. Fodder	1996	1.2
11. Legumes	1925	1.1
12. Milk	1860	1.1
13. Industrial crops	805	0.5
14. Honey	585	0.3
15. Eggs	505	0.3
16. Others	61371	35.9
TOTAL	170770	100.00

The total conventional and organic farming area and production for the main organic farming crops of Spain are shown in Table 34 and Table 35.

Table 34. Conventional and organic farming (fully converted+ under conversion) area of main organic farming crops in Spain. (Source: Sp., 2016).

	Vegetables	Grapevine	Olive	Citrus	Total (agricultural land)

Organic (ha)	17182	106720	196567	10183	771615
Conventional (ha)	357891	830068	2325127	285148	13866588
Percentage of organic to total (%)	5%	11%	8%	3%	5.7%

Table 35. Production from conventional and organic farming (fully converted+ under conversion) crops of main organic farming crops in Spain. (Source: Sp., 2016).

	Vegetables	Grapevine	Olive	Citrus
Organic (t)	286,075	211,623	164,177	142,418
Conventional (million t)	14.8	5.9	6.9	6.9
Percentage of organic to total (%)	2%	3%	2%	2%

Andalusia is the Spanish region with the largest surface dedicated to organic agriculture in Spain, i.e. 621265 ha of 16897 ha in 2016. Over the last few years, the evolution of the surface area dedicated to important crops in Andalusia shows a high increase in greenhouse and citrus crops, while olive surface area remains stable.

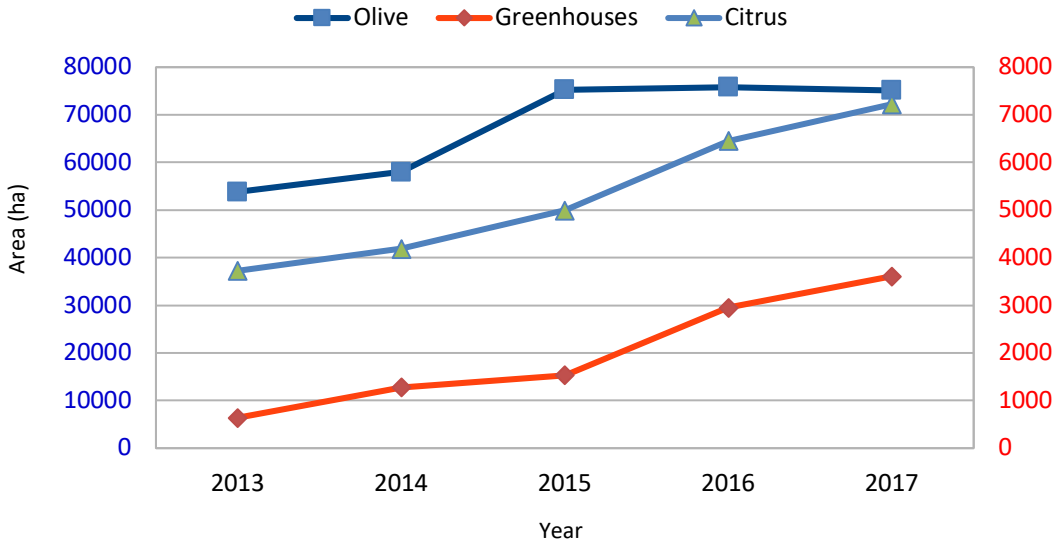

Figure 12. Evolution of organic growing surface area of important crops in Andalusia (Spain).

11.1.2 Main organic farming Certification bodies

In Spain there are 11 private and 7 public certification bodies supported by ENAC (Spanish Accreditation Entity) (www.enac.es/web/enac).

11.2 Use of contentious inputs in organic farming in Spain

Three experts were consulted for the following 3 crops: tomato, olive and citrus crops.

11.2.1 Legal status for the use of contentious inputs (if different than EU regulation)

Same as for EU

11.2.2 Use of copper in the most important organic crops

11.2.2.1 Tomato

Open tomato crops (Northern Spain) use 2 kg of copper oxychloride (50% Cu), per ha and cycle, i.e. 1 kg Cu/ha/year.

In greenhouses (South-eastern Spain) the consumption of copper is being reduced due to the substitution of classic copper formulations by copper gluconate (in the last 2 years the use of gluconate has surpassed classic formulations). Copper gluconate contains less than 6% Cu. However, in greenhouses the main tomato cycle is conducted in winter, and copper is applied 2-5 times (1.5-3 L formulation/ha), this is a maximum of 180 g Cu/ha and application, i.e. up to 600 g Cu/ha/cycle. Those growers using classic copper formulations should reach a maximum consumption of 6 kg/ha/year (e. g. 4 applications of copper oxychloride (75%)).

11.2.2.2 Olive

Copper is used once or twice per year (spring and autumn treatments). In humid years, one more autumn treatment can be carried out. There are no differences between Northern and Southern Spain areas, but irrigated crops can afford the cost of treatments, so it is a common practice to apply copper once (at least). When olives are in drylands, it is not unusual to avoid fungicide applications.

The dosages of copper can reach a maximum of 3 kg/ha/year. The cost of the applications is high (handwork, machinery, copper product) for non-intensive olive crops.

11.2.2.3 Citrus

Copper is normally applied once in winter if necessary; this is 1.2 kg/ha/year using the highest concentration of copper oxide (75% Cu).

11.2.2.4 Summary

Depending on the crop, the use of copper as fungicide shows differences. In the case of organic olives, each foliar treatment implies a cost that is not always affordable by the grower. So, only one or two (3 in the extreme case) applications of copper are carried out. The typical formulation contains 50%-70% Cu and this means less than 4.2 kg/ha/year. For citrus the use is lower, only one application is carried out.

For tomato, if growers apply some copper formulations (oxychloride, hydroxide, Boudreaux mixture, and oxide), the richness of copper and dosages are higher, and applications close to 6 kg/ha/year could be reached. However, it is becoming more common to use low-richness copper formulations, based on complex formulations (mainly copper gluconates). Although these products are not phytosanitary but fertiliser products, efficacy is observed and valued by growers and advisors.

Comparing with conventional growers, the use of copper is quite similar in olive, but 25-50% than organic tomato producers.

11.2.3 Use of mineral oil in the most important organic crops

11.2.3.1 Tomato

Paraffinic oil (55% richness) is applied sporadically (1-2 applications) in organic greenhouses with tomatoes. This product is not compatible with sulphur, which limits its use. The maximum application would reach less than 13 L/ha/year.

11.2.3.2 Olive

Mineral oils are rarely used in olive crops in Spain.

11.2.3.3 Citrus

A maximum of 90 l/ha/year of (54%) product is applied, i.e. approximately 50 l/ha/year of paraffinic oil.

11.2.3.4 Summary

Mineral oils are mainly used in citrus. The use in organic citrus is high, due to the wide spectrum of the product.

11.2.4 Use of sulphur in the most important organic crops

11.2.4.1 Tomato

For open fields there is a typical consumption of 10-12 kg/ha/year of powdered sulphur (98%). The main targets are powdery mildews and tomato russet mite.

Sulphur is widely applied in organic greenhouse crops. Tomato russet mite is the main target for the use of sulphur, but also is applied in powder formulation to repel whiteflies. Powdered sulphur can be applied 3 times (25 kg/ha/application), followed by up to 4 treatments with pulverised sulphur (80% maximum richness) per cycle depending on environmental conditions. This is, in the highest case, a total of 95 kg/ha/year.

11.2.4.2 Olive

A maximum of 10-12 kg/ha of sulphur are applied. Sulphur is not a common fungicide in Organic Southern crops.

11.2.4.3 Citrus

There are no references for use of sulphur in organic citrus in Spain.

11.2.4.4 Summary

Sulphur is used in high amounts in tomato greenhouses, even reaching doses close to 100 kg/ha. This extreme is possible for tomatoes cherry or cocktail types, because these tomatoes are washed with water before packaging (then sulphur is removed). Conventional greenhouse growers apply about 30% less sulphur than organic, but conventional growers substitute sulphur for synthetic fungicides.

On the other hand, olive trees do not receive much sulphur, as this substance is not effective against main olive pests present in Southern Spain, where is the highest presence of this crop.

11.2.5 Use of other plant protection products in the most important organic crops

Tomato

Many different products are offered and used by tomato growers. Each producer decides. Some of them are not strictly phytosanitary products. Biological control organisms are common under augmentative strategies. The most popular Biocontrol insect is *Nesidiocoris tenuis* that is released in the nurseries to allow a good level implementation of this predator. It is used to control instars of *Bemisia tabaci* and eggs and young larvae of *Tuta absoluta*. Less frequently, other natural enemies are released: *Phytoseiullus persimilis* to manage two-spotted spider mites, and *Aphidius* spp. to control aphids.

Olive

Kaolin: 25-30 kg/ha

Spinosad bait product: 1 L/ha

Bacillus thuringensis: 0.5-1 kg/ha

Citrus

Diatomaceous earth, mating disruption, potassium salts of fatty acids

11.2.6 Use of alternatives for copper, mineral oils and sulphur in the most important organic crops

Tomato is a high value crop and it is easy to find alternatives. Classic copper formulations are being substituted by copper gluconate (this contains copper, too). Other alternatives are (in order of preference): Plant extracts, *Bacillus subtilis*, *Trichoderma* spp., potassium bicarbonate and Laminarin.

Substitutions of sulphur to manage mites: Maltodextrin. To control powdery mildew, *Ampelomyces quisqualis* is an option, but its use is not extended.

To avoid infections by fungal outbreaks in the greenhouse, the management of the climate may be improved.

For paraffinic oil some alternatives can be found, depending on the target pest: diatomaceous earth, mating disruption or potassium salts of fatty acids. However, mineral oils have a wider spectrum, and only one application can allow the management of several pests.

11.3 Discussion and Conclusion for contentious inputs use in organic farming in Spain

The three crops considered for Spain have different problems, and the three inputs concerned are used diversely. Copper is a wide-spectrum fungicide used in most organic crops.

For olive trees, foliar fungicide applications are not very frequent, and copper is normally used one to three times, incorporating low amounts of this mineral, far from 6 kg/ha/year. Sulphur and mineral oils are not used in this organic crop in Spain.

Tomato producers apply high amounts of copper in winter crops (greenhouses). However, alternatives with a low concentration of Copper ions are demonstrating good levels of efficacy. Possibly, a reduction of the concentration of copper, together with more efficient formulations, could reduce the presence of copper in the crops (and soils). Regarding sulphur, this substance is very common for organic vegetable growers, especially for greenhouse

growers. The uses of sulphur can move from 10 to 100 kg/ha/year depending on the production system and the incidence of pests. Sulphur is a sort of universal phytosanitary product: repellent to pests, killer of mites, and effective against powdery mildews. On the contrary, it is not selective, and it has harmful effects on beneficial arthropods. So, the use of sulphur can limit biological control.

The main contentious input in citrus are mineral oils. The wide spectrum of this substance makes it more versatile than other alternatives.

In general, the wide spectrum, efficacy and relative low price of these inputs are important concerns.

12. Results and findings from Turkey

12.1 Main statistical findings for organic farming in Turkey

12.1.1 Organic farming crops, covered area and production

The following tables summarise the conventional and organic farming areas in Turkey (Table 36) and the production observed from the most important organic farming crops (Table 37).

Table 36. Conventional and organic farming (fully converted+ under conversion) area of main organic farming crops in Turkey (FAOSTAT, 2018; Eurostat, 2016; MFAL, 2018; Turkish Statistical Institute, 2018).

Year:2016	Olives	Citrus	Tomato	Pepper	Eggplant	Strawberry	Potato	Total (agricultural land)	Total number of farms
Organic (ha)	81055	481	136	80	10	711	341	533218	67878
Conventional (ha)	846000	155000	188270	89032	24783	15431	144706	38328000	3 100 000
Percentage of organic to total (%)	8.74	0.3	0.07	0.08	0.04	4.4	0.23	1.37	2.14

Table 37. Production from conventional and organic farming (fully converted+ under conversion) crops of main organic farming crops in Turkey (FAOSTAT, 2018; Eurostat, 2016; MFAL, 2018; Turkish Statistical Institute, 2018).

Year:2016	Olives	Citrus	Tomato	Pepper	Eggplant	Strawberry	Potato
Organic (tonnes)	168188	6589	9092	2206	326	9416	2497
Conventional) (tonnes)	1730000	4736250	12600000	2457822	854049	415150	4750000
Percentage of organic to total (%)	8.86	0.13	0.07	0.08	0.03	2.21	0.05

12.1.2 Main organic farming Certification bodies

The most significant Control and Certification Bodies (CCB's) of Turkey (2018) are presented below:

No	CCB's of Turkey
1	TR-OT-01 BCS ÖKO-GARANTIE Organic Farming Certification Services Co Ltd.
2	TR-OT-02 IMO Control and Certification Trade Co. Ltd.
3	TR-OT-03 ECOCERT Inspection and Certification Co. Ltd.
4	TR-OT–04 ETKO Ecological Farming Control Organization Co. Ltd.
5	TR-OT–06 EKOTAR Ecological Products Production, Control, Certification Industry and Trade Co. Ltd.
6	TR-OT–09 ICEA Istitulo per la Certificazione Etica e Ambientale - Turkey Branch
7	TR-OT–10 CERES Certification of Environmental Standards - GmbH İzmir Branch
8	TR-OT–11 ORSER Control and Certification Co. Ltd.

No	CCB's of Turkey
9	TR-OT–12 ANADOLU Ecological Products Control and Certification Co. Ltd.
10	TR-OT–13 TURKGAP Agricultural Practices Control and Certification Services Co. Ltd.
11	TR-İTU-6 NİSSERT International Certification and Inspection Services Co. Ltd.
12	TR-OT–15 IMC Co. Ltd.
13	TR-OT–16 ANKA GLOBAL KONTROL VE SERTİFİKASYON A.Ş.
14	TR-OT–17 KALİTEST Certification and Training Services Co. Ltd.
15	TR-OT–18 EGETAR Control and Certification Services Co. Ltd.
16	TR-OT–19 BIO INSPECTA Control Certification Co. Ltd.
17	TR-OT–20 İsmail DEMİRCAN NOPcert Organic Farming Practices Organic Inputs and Organic Products Certification Services
18	TR-OT–22 Control Union Inspection and Certification Co. Ltd.
19	TR-OT–23 ECAS Certification and Inspection Co. Ltd.
20	TR-OT-024 ORTAR Control and Certification Services Co. Ltd.
21	TR-OT-25 BIOBEL Certification Inspection and Training Services Co. Ltd.
22	TR-OT-26 Mehmet BIYIK-TUSCERT National Certification Services
23	TR-OT-27 KAYOS International Certification and Inspection Services Co. Ltd.
24	TR-OT-28 BAŞAK Ecological Products Control and Certification Services Co. Ltd.
25	TR-OT-29 CTR International Control and Certification Services Co. Ltd.
26	TR-OT-31 LİKYA ORGANIC International Organic Product Control and Certification Services Co. Ltd.
27	TR-OT-34 NAVİGA International Control and Certification and Training Services Co. Ltd.
28	TR-OT-35 CERES International Control and Certification Services Co. Ltd.
29	TR-OT-36 ORFARM International Control and Certification Services Co. Ltd.
30	TR-OT-37 De Control International Control and Certification Services Co. Ltd.
31	TR-OT-38 MAGENTA International Organic Agricultural Products Control and Certification Services Co. Ltd.
32	TR-OT-39 CASCERT International Organic Agricultural Products, Tourism, Constraction Control and Certification Services Co. Ltd.
33	TR-OT-40 ORTA ASYA Control and Certification Services Co. Anonym
34	TR-OT-41 BİOTEAM Ecological Farming Control Organization Services Co. Ltd.
35	TR-OT-42 MET Ecological Farming Control Organization Services Co. Ltd.
36	TR-OT-43 GENSA Technology Control and Certification Services Co. Ltd.
37	TR-OT-44 BIOMEL Control and Certification Services Co. Ltd.
38	TR-OT-45 EKOINSPEKT International Control and Certification and Training and Monitoring Services Co. Ltd.
39	TR-OT-46 GAPCERT Control and Certification and Training Co. Ltd.
40	TR-OT-47 ECOGEN Control and Certification Services Co. Ltd.
41	TR-OT-48 TCERT International Technical Control and Certification Services Co. Ltd.

No	CCB's of Turkey
42	TR-OT-49 ORBEY Control and Certification, Training Agriculture and Livestock, Constraction Promissor Services Co. Ltd.

12.2 Use of contentious inputs in organic farming in Turkey

Pesticide use for ten years was estimated by using the ARIMA model and Double Exponential Smoothing Method of time series analysis to 26 years data from FAO (1990-2015). According to the results; in Turkey, the use of pesticides is estimated to be approximately 42 thousand tonnes in 2018. The use of pesticides tends to increase year by year and the annual average increase is expected to be 1.2%. The amount of pesticides and pesticide used per unit area consequently used in Turkey and EU countries are well behind the world average. According to the data of FAO 2015, the amount of pesticide used in the unit area in the world is 4.91 kg in the hectare and 2.69 kg in the EU. The Netherlands (9.34 kg/ha), Italy (6.96 kg/ha), Germany (4.03 kg/ha) and the United Kingdom (3.02 kg/ha) are the EU countries with the highest pesticides usage in the field. In Turkey, according to the data of the same year about 1.63 kg/ha is determined (FAO, 2018). However, application errors made by the uneducated producers in the use of pesticides can turn this advantage into a disadvantage.

Obtained data procedure of Turkey:

1- Data collected from mostly from Izmir Province.

Izmir is a pioneering science centre in organic agriculture. Especially in recent years, important developments in organic agriculture in Izmir have come to the fore. The first organic production started in Izmir in the mid-1980s with seedless raisins.

In Izmir, as of 2016, 3402 farmers and 35773 hectares of field organic farming are recorded. Among the most grown organic products in Izmir are olives, maize, cotton, grapes and figs. Because of the agricultural production polyculture in Izmir, all kinds of vegetables and fruits are grown organically. In 2016, the amount of organic agriculture production in Izmir increased by 22517 tonnes to 105903 tonnes compared to the previous year. Thus, the share of organic agricultural production from Izmir was 4.3% of Turkey's total.

Izmir is at the forefront of exports and is home to many businesses engaged in organic agricultural products. According to MFAL, there are 1463 registered organic production firms in Turkey and 241 of these companies are in Izmir. Totally, 48 Control and Certification organizations (CCB) have been authorised by MFAL in organic agriculture in 2017 and 11 of them are in Izmir.

2- Data directly collected from face to face interviews (Figure 13)
   a. 6 CCB of Turkey (Bio Inspecta, ETKO, Ecocert, IMO, ICEA, NAVIGA)
   b. 11 leader organic family farms

c. 8 experts working at GDAR (General Directorate of Agricultural Research and Politics) of MFAL as a researcher
d. GDPP (General Directorate of Plant Production) of MFAL, Organic Farming Data Collecting Service
e. GDPC (General Directorate of Protection and Control)
f. Eurostat (online data code: org_cropar)

Figure 13. Dr Alev Kir while interviewing a grower in Turkey (alev.kir.etae@gmail.com).

3- Data collected for the varieties which are as follows;
   a. tomato, pepper, eggplant, olive orchard,
      i. These are TR-O Plus varieties, at WP 3, WP 5
      ii. Farmyard manure, leonhardite, plastic mulch, peat, Cu, S, mineral oil, peat are applying widely in OF in TR
      iii. OF Production of this varieties have been improving in TR

   b. citrus orchard (Satsuma), potato, and
      i. O-Plus varieties of the partners
      ii. OF Production of this varieties have been improving in TR

   c. strawberry
      i. plastic mulch usage is at high level both conventional and organic management in TR
      ii. OF Production of this varieties have been improving in TR

12.2.1 Legal status for the use of contentious inputs (if different than EU regulation)
Same as EU

12.2.2 Use of copper in the most important organic crops

12.2.2.1 Olive

a- Due to moderately sloping land, 80% of olives under OF management in Turkey is grown without any Cu spray.

b- Olive leaf spot, pea cock: copper sulphate, Bordeaux mixture (For 1st spraying: 1.5 kg [copper sulphate equivalent to%20-25 metallic copper] + 0.75 kg quicklime/100Liter water. 2nd Spraying: 1 kg [copper sulphate equivalent to %20-25 metallic copper] +0.5 kg quicklime. ***3th spraying will be done in 2019. In Turkey after 2018 farmers will make 3 fungicide applications for *Spilocaea oleaginae.* Autumn x1 +Spring x2
Not exceeded limitation

12.2.2.2 Citrus

Phoma spp. *Phytophthora* spp.:

Copper sulphate, Bordeaux mixture (as pure copper 6kg/ha/year max limit)

12.2.2.3 Tomato, Pepper, Eggplant

Seedling stage: copper sulphate, Bordeaux mixture (as pure copper 6kg/ha/year max limit)

12.2.2.4 Potato

No usage

12.2.2.5 Strawberry

No usage

12.2.2.6 Summary

Turkey's applications are close to limit of the organic farming regulation of Turkey and EU and it seems that alternatives very weak in terms of availability and economic considerations.

12.2.3 Use of mineral oils in the most important organic crops

12.2.3.1 Citrus

Insect problems: a) mineral oil 600-1500 ml/100L water

12.2.3.2 Summary

Data obtained data (from a total of 25 questionnaires) showed NO USAGE of Mineral Oils in Turkey for all OF production because of lack of awareness and availability except in the case of Citrus. Two big scale private companies producing OF products with their own contracted farmers are unfortunately not providing information.

12.2.4 Use of sulphur in the most important organic crops

12.2.4.1 Olive

No sulphur is used.

12.2.4.2 Citrus

For acari, spider mite problems (%80 sulphur wp 600 g/100L water)

12.2.4.3 Tomato, Pepper, Eggplant

For powdery mildew (%80 sulphur wp 600 g/100L water)

12.2.4.4 Potato

No sulphur is used.

12.2.4.5 Strawberry

Powdery mildew (*Podosphaera aphanis*): Sulfur%80 micronize. 300gr/100Liter water.

Tetranicus spp: %80 Sulphur – 400 g/100 litre water.

12.2.4.6 Summary

It seems that the problem is traditional usage of sulphur twice a month at the beginning of transplantation seedlings to the open field of tomato, pepper, eggplant, and strawberry even if pathogen not determined in both open field and greenhouse production. So, this can be reduced.

12.2.5 Use of other plant protection products in the most important organic crops

Agronomic precautions: Crop rotation, green manure such as vetch for *Solonacea* family

Weeds: Collecting, solarisation, soil mulching

Olive

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 litre insecticide + 10 litres water as partial branch application)

Prays olea

Azadirachtin 0.3 gr/l as 500 ml/100l water

Citrus

Insect problems:

a) Pheromone traps with deltmethrin

b) 0.24gr/l Spinosad CB (1 litre insecticide + 10 litres 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

Tomato, Pepper, Eggplant:

Trichoderma harzianum: for soil born fungal diseases and *Botrytis 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 kurstaki* 100 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

Potato

Insect problems:

Leptinotarsa decemlineata:

a) 480 gr/l Spinosad sc (10 ml/100l)
b) Azadirachtin 10g/Lt (250 ml/100l)

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

Biological Fungicide

500 ml/100 kg seed treatment

b) %0,3 *Bacillus subtilis* GB03 race $1,2x10^7$ cfu/g

COMPANION

500 ml/100 kg seed treatment

Strawberry

Tetranicus spp: Spinosad 480 g/L dosage: 20 ml/1000 m^2

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 ml/1000 m^2)

12.2.6 Use of alternatives for copper, mineral oils and sulphur in the most important organic crops

Mineral oils usage is minor in the country and not known by the farmers. Mostly, this is not available in the market as an organically certified product and has a high price.

The use of alternatives for copper and sulphur in organic -olive, citrus, tomato, pepper, eggplant, potato, and strawberry are common but it is not found any other alternative possible replacing those two.

Mainly, passive precaution strategies are being adopted to their applications such as planting distance, rotation, plant disease tolerant variety usage, using landraces, choosing available land (high soil fertility, high OM and not infected with pathogen), using on-farm and commercial certified compost, compost tea, vermicompost, and vermicompost tea as well as in to the soil and spraying on to the plant leaves and whole part of plant above the soil in a long term. Secondly, private sectors supply some imported plant activator products which are registered as fertiliser in Turkey. This kind of material need to integrate MFAL General Directorate of Food and Control procedures in terms of its plant disease control affects that is claimed by the manufacturer. All plant activators mechanism of action explaining as “induction of resistance”.

MFAL General Directorate of Food and Control has put in use new application for pesticides all over the country since 01.01.2018. The new system is called "QR Code". According to the new application, pesticide production factories have to put a Square code on each pesticide bottle, package and box. This code can be read by electronic devices such as mobile phone, optical reads. Purpose of pesticide label "QR code" application is surveillance of the products by the ministry collecting production statistics and saving the main data in ministry computer servers. In another words; with the help of QR code authorities aim to learn information for each pesticide (both organic and conventional) where it is produced by manufacturer, quantity/ amount, who is supplier and which farmer used it. The system being put into practice step by step since at the beginning of 2018. Firstly manufacturers printing QR code for WP formulations then they will print it for SC, EC, and so on formulations. Monitoring system will help the control of Cu and S usage by the organic farmers.

All over the country, some microorganisms (fungi and bacteria) sourced from national soils, etc. effects have been investigated both at the Research Institutes of MFAL and Universities collaboration with the national private sector. Recently, MFAL initiated a research funding program named “development of national input technologies” and success is expected in the near future.

12.3 Discussion and Conclusion for contentious inputs use in organic farming in Turkey

The organic food consumption in Turkey is below 1 Euro per person per year. This suggests that efforts should be made to increase the consumption of organic products in the internal market. When looking at the size of the organic farming area in the countries in the world, Turkey is in the 18th place. When the share of organic agriculture in total agricultural area is evaluated, Turkey ranks 59th in world rank with 1.4% share. In terms of the number of organic producers, Turkey is among the top 10 countries in the world. Turkey's place in the world of organic farming shows that we are one of the major producers in the market. Organic agriculture in Turkey is among the flourishing sectors. However, despite the rapid growth of the sector, the market is still small and needs to grow when it is compared to the potential capacity.

Organic agriculture in Turkey first began in 1984 with the demands of foreign buyers. The first organic products produced were in the Aegean region with raisins and dried figs and later on dried apricots and hazelnuts and spread to different regions. Until the 1990s, there were 8 types of organic products. In the following years, the product variety developed depending on the foreign demand (214 in 2017). Another important development in 1992 was the establishment of Ecological Agriculture Organization Association (ETO) in Izmir, which aims to promote the healthy development of organic agriculture in Turkey with the participation of all organizations active in organic agriculture in Turkey.

In organic agriculture, Turkey has completed its legal infrastructure. However, regulations all over the world are constantly changing and renewing due to continuous new methods and input development for problems. As the first legal regulation in Turkey, the "Regulation on the Organic Production of Plant and Animal Products" numbered 22145 entered into force on 18 December 1994. After the regulation, in order to define the legal framework in organic agriculture and to establish the necessary sanctions and safeguards in erroneous practices, "Organic Farming Law" numbered 5262 was published in the Official Gazette dated December 3rd 2004 and started to be implemented. The amendment to the Law was published in the Official Gazette dated 8 February 2008 and entered into force. Regulations are frequently revised with scientific and technical developments, needs, and compliance with EU legislation. As well as regulatory conditions in the country of Turkey Legislative alignment with the European Union is also protected. In the EU, harmonization studies were carried out after the new regulation, which was enacted on 1st January 2009. "Regulation on the Principles and Implementation of Organic Agriculture" dated 18.08.2010 numbered 27676 was issued. Finally, "Regulation on the Amendment of the Regulation on the Principles and Implementation of Organic Agriculture" was published in the Official Gazette No. 30297 dated 10th January 2018. The final regulation is the production of all kinds of crops, animal and aquatic products and the production of inputs to be used in accordance with the organic farming method or collection of products in accordance with the principles of organic agriculture from forests and natural areas, which are used as food or feed, processing, packaging, labelling, storage, transport, marketing, control, certification, inspection and penal provisions. It is compatible with the EU's organic agriculture directive.

Turkey’s climate, soil, water resources, is very suitable for organic farming in terms of product diversity and workforce. Biodiversity, disease-resistant species like landraces, ecological balance in many areas, appropriate ecological environment, low use of synthetic inputs due to high prices, etc. have important advantages of the country.

Recently, compost and vermicompost production are improving in Aegean Region of the country and compost and especially vermicompost replacing pure manure usage. These materials have been using for production of seedling, sampling and organic vegetables. Making on-farm compost around the organic farmers is very common in recent 3 years. Aegean Research Institute has conducted several research and demonstration activities of compost and Impact Assessment of the project was observed by the Ministry. The questionnaires were used for farmers in Izmir and Manisa provinces where the researches were conducted by simple random sampling model. It is found that making compost

behaviour on-farm conditions was reached directly to targeted farmers as 40%. Leading farmers have been making considerable use of compost and compost tea.

It is obvious that alternatives for copper, mineral oils and sulphur. It was found that mineral oil is not used; Cu and S usage are in some years near the limitation due to the meteorological risk. The survey showed that application of targeted inputs did not exceed the limitations of the regulation of TR and EU and, in the case of mineral oil and S was much less because the great majority of farmers surveyed waive the high yield that they could be reached. In addition, inputs are mostly imported from abroad to the country and are expensive.

13. Results and findings from United Kingdom

13.1 Main statistical findings for organic farming in United Kingdom

13.1.1 Organic farming crops, covered area and production

The covered areas and production from the main organic farming crops in UK are presented in Table 38 and Table 39.

Table 38. Conventional and organic farming (fully converted + under conversion) area of organic farming crops in UK.

	Total (agricultural and grazed)	Total (agricultural land)	Total number of farms
Organic (ha)	517400	184100	3465
Conventional (ha)	17637000	13880000	217000
Percentage of organic to total (%)	2.9	1.3	1.6

Table 39. Conventional and organic farming (fully converted + under conversion) area of main organic farming crops in UK.

	Barley	Oats	Wheat	Vegetables	Potatoes
Organic (ha)	12800	12000	10000	8500	1100
Conventional (ha)	1177000	161000	1792000	117000	125000
Percentage of organic to total (%)	1.1	7.5	0.6	7.3	0.8

(Sources: https://www.gov.uk/government/statistics/organic-farming-statistics-2017, https://www.gov.uk/government/statistics/agriculture-in-the-united-kingdom-2017)

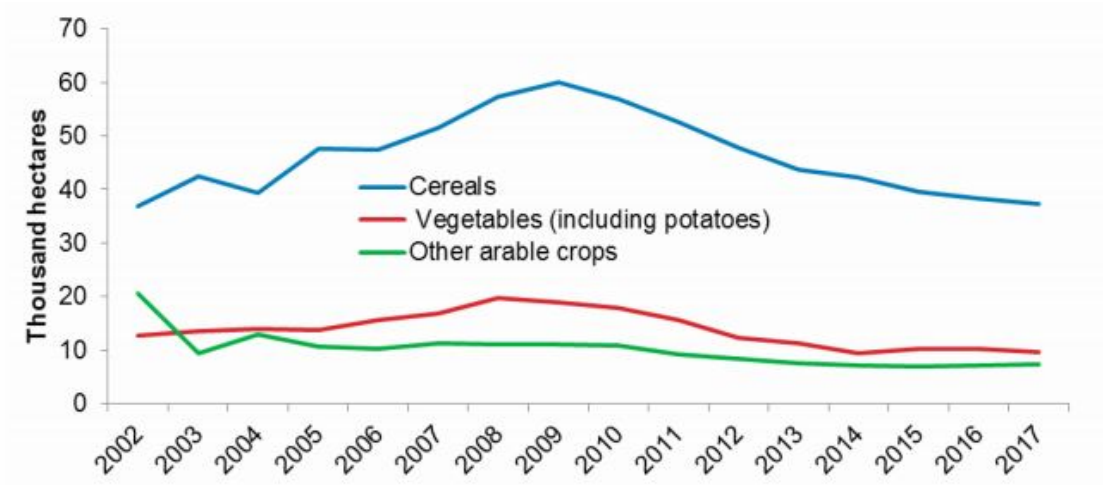

Figure 14. Organic crops grown on organic land and land in-conversion (https://www.gov.uk/government/statistics/organic-farming-statistics-2017).

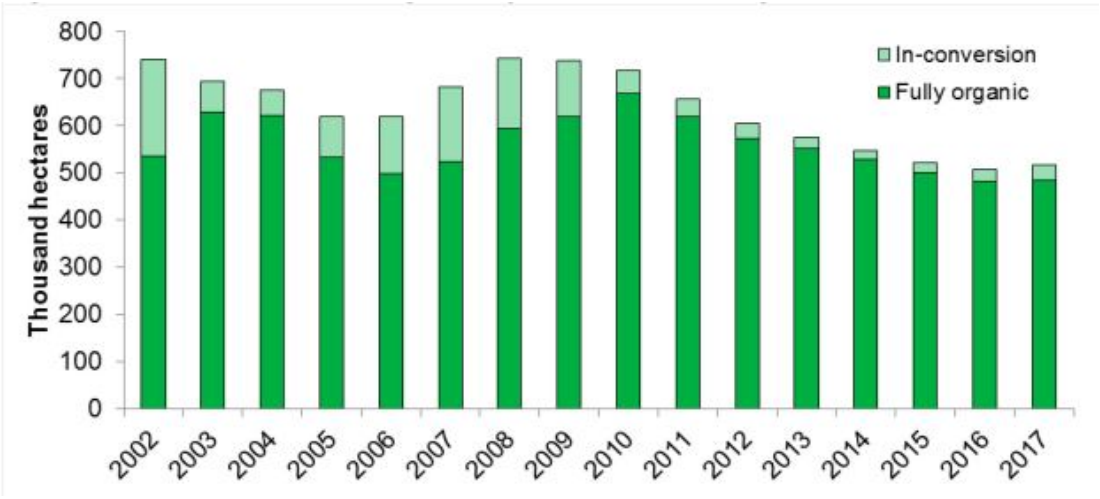

Figure 15. Land area farmed organically and in-conversion (https://www.gov.uk/government/statistics/organic-farming-statistics-2017).

13.1.2 Main organic farming growers/producers associations

Soil Association Charity

Biodynamic Association Charity

Organic Growers Alliance

Vegan Organic Network

13.1.3 Main organic farming Certification bodies

Table 40. Share of main Organic farming Certification bodies in UK.

	Soil Association Certification[1]	OF&G[2]	Biodynamic Association Certification[3]	Total (Ha)[4]
Area [ha]	191,573	258700		517,400
Farms (number)	1793	1500		3465
Area [%] of organic farmland	37%	50%		100%
Farms [%] of organic farmland	52%	43.3%		100%

1. From Soil Association database (Oct, 2018)
2. Based on data from direct OF&G conversation (Oct, 2018)
3. Waiting for data from CB – however comparatively very small area that will not affect overall stats
4. Total UK Organic and In-Conversion DEFRA stats 2017

13.2 Use of contentious inputs in organic farming in United Kingdom

In task 3.1 of WP3-Plant, the use of copper, mineral oil and sulphur as plant protection measures is studied. While recording a representative use of these inputs in some important organic crops, other plant protection measures such as commercial beneficial organisms were also recorded.

We have used the certification records from the Soil Association Certification Limited for years 2017-18 and therefore been able to show all the permissions given by that organisation. However, we were not able to obtain equivalent records from other certifying bodies to compare. In addition, members from the following groups were interviewed:

- Specialist propagators – we talked to 3 of the 5 main ones in the UK
- Growers

13.2.1 Legal status for the use of contentious inputs (if different than EU regulation)

The UK regulation of inputs in organic growing is similar to the EU regulation. There are a few additional standards within the Soil Association (private standards) but they do not relate to copper, sulphur or mineral oil.

13.2.2 Use of copper in the most important organic crops

The use of copper is restricted under multiple Soil Association standards. As a plant protection product, licensees may use up to 6kg copper per ha per year (standard 4.11.4). For perennial crops the 6 kg/ha/year copper limit may be exceeded in a given year provided that the average annual quantity actually used over a 5-year period (consisting of that and of the 4 preceding years) does not exceed 6 kg per ha per year. Licensees must only use this input when there is an established threat and when plants cannot be protected using preventative methods, and licensees must keep records which demonstrate why they need to use the product.

In addition, compost from household waste must contain concentrations no more than 70mg/kg of copper in dry matter (standard 4.7.10). Compost from source separated greenwaste facilities must contain concentrations of no more than 200 mg/kg of dry matter. The total level of copper in manure and soil must not exceed 50mg/kg (or 110 kg/ha) in the soil, or 400 mg/kg (0.4 kg/tonne) in manure. We expect licensees to test for these if it is likely that these levels have been exceeded.

Data has been provided by Soil Association Certification Limited (SACL) on the permissions granted for producer licensees to use products containing copper on potatoes, tomatoes, or other vegetable crops between August 2017 and August 2018.

Copper use in organic agriculture in the UK has decreased in recent years.

One major licensee grower interviewed stated that they have not used any copper on their own farms in the past two years. However they like to have the option available for them to use it for potato blight if they need to. Another medium sized grower licensee stated that each product for each particular application is licensed for use and that due to the temporary renewal system of product licenses for certain applications – such as coop kill, scab, and

canker - farmers have not been able to use copper in the past twelve months for these purposes as freely as they may have done otherwise.

13.2.3 Use of mineral oils in the most important organic crops

The use of mineral fertilisers and supplementary nutrients is restricted under Soil Association standards, and licensees must not use petroleum oils, paraffin oils or other mineral oils as pesticides (standard 4.11.10).

Soil Association Certification Limited does not hold any data on the quantity of mineral oils being used by Soil Association licensees. This is because internal experts are confident that it is highly unlikely for mineral oils to be used in any organic production in the UK. No interviewed growers stated they used mineral oils. One stated they believed mineral oils were used in the 1960s but are not used any more.

13.2.4 Use of sulphur in the most important organic crops

With approval from SACL, licensees may use sulphur to treat severe deficiencies (standard 4.8.11). SACL provides approval either on a case-by-case basis, or through a plan, provided that details are recorded of why licensees need to use it and under what circumstances. Licensees must have a full soil analysis carried out, including clay fractions, heavy metal content and trace element levels. This must be available when requested and at inspection.

Data has been provided by Soil Association Certification Limited (SACL) on the permissions granted for producer licensees to use products containing sulphur between August 2017 and August 2018. 31 permissions were given for sulphur in that year.

Sulphur use in organic agriculture in the UK has decreased in recent years. Some interviewed growers discussed their use of sulphur. One stated they use it for mildew control on top fruit only (around 100 kg/year on 8 hectares of top fruit – so 10/12 kg per hectare. The brands they use are Microfile or Hedland sulphur. Another said they use well over 10 kg per hectare – it is useful as a nutrient as well as to combat fungus diseases on cereals.

13.2.5 Use of alternatives for copper, mineral oils and sulphur in the most important organic crops

13.2.5.1 Potato

Most large grower use copper in most years, however there is one large scale grower that has not used any copper for the last 2 years. 2018 was very dry and little copper was used even in the wetter West of the UK. Most smaller scale grower use no copper

There is no use of mineral oil.

Very occasional use of sulphur.

For many growers preventing efforts are used against potato late blight (*Phytophthora infestans*): Most important is removal of foliage at first sign of blight and selection of blight resistant varieties.

13.2.5.2 *Tomato*

No use of copper.

No use of mineral oil.

Sulphur is occasionally used against mildew.

A range of biological controls are used

13.2.5.3 *Carrot*

No use of copper.

No use of mineral oil.

Sulphur used occasionally for *Alternaria*

Pyrethrins used occasionally for aphids

13.2.5.4 *Strawberry*

No use of copper.

No use of mineral oil.

No use of Sulphur recorded in database for 2017-18 though might be used in extreme years.

13.2.5.5 *Apple*

Use of copper: Most specialist apple growers use copper for canker and scab, even when growing scab resistant varieties. The amount used will depend on the grower's situation and the weather conditions. Some growers also use potassium hydrogen carbonate.

Use of sulphur: many growers treat against mildew and scab.

Attacks of aphids and other insects may be controlled by pyrethrum or Spinosad.

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.

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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	