LIFE14 CCA/GR/000389 - AgroClimaWater
Promoting water efficiency and supporting the shift towards a climate resilient agriculture in Mediterranean countries

Sub-Deliverable C2.3: Inventory of applied substances in the project's registered farms

Action C2: Identification and assessment of water efficiency in the three F.ORs - Before LIFEAgroClimaWater

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Terminology / Abbreviations

Term	Description
AWMS	Agricultural Water Management System
BPR	Biocidal Product Regulation
CAP	Common Agricultural Policy
CAS	Chemical Abstracts Service
CLP	Classification, Labelling and Packaging
EEA	European Economic Area
EQS	Environmental Quality Standards
EQSD	Environmental Quality Standards Directive
EWS	European Water Stewarship
F.OR.	Farmer Organization
JMD	Joint Ministerial Decision
MS	Member States
OJ	Official Journal
PIC	Prior Informed Consent Regulation
PPP	Plant Protection Product
RBSP	River Basin-Specific Pollutants
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SDS	Safety Data Sheet
WFD	Water Framework Directive

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1 EUROPEAN LEGISLATION: WATER SOURCES AND AGRICULTURE

1.1 Water Sources and Water Framework Directive

Water pollution is among the five main environmental issues that Europeans are worried about with a percentage equal to 47%, while this number is almost 71% for individual countries (Introduction to the new EU Water Framework Directive, EC). This in combination with the fact that the demand for cleaner rivers and lakes, groundwater and coastal beaches had been evident for considerable time are among the main reasons why the Commission has made water protection one of the priorities of its work (Introduction to the new EU Water Framework Directive, EC). Water source protection involves the protection of both surface water sources (e.g. lakes, rivers, manmade reservoirs, coastal) and groundwater sources (e.g. spring protection, dug well protection, and drilled well protection) to avoid water pollution.

The legal framework for the protection of water sources in the European Union is provided by Directive 2000/60/EC, commonly known as the **Water Framework Directive** (WFD).

The purpose of the WFD was to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater, which contributes to the:

- prevention and reduction of pollution
- promotion of stainable water use
- protection of aquatic environment
- improvement of the status of aquatic ecosystems
- mitigation of the effects of floods and droughts
- provision of the sufficient supply of good quality surface water and groundwater as needed for sustainable, balanced and equitable water use.

For the first time, the WFD sets ecological criteria and objectives, designs to protect and, where necessary, restore the structure and function of aquatic ecosystems themselves, and thereby safeguard the sustainable use of water resources. The WFD also introduced an integrated water resources management on the basis of river basins, rather than administrative borders. Furthermore, costs and benefits can be properly taken into account when setting environmental objectives and proportionate and cost-effective combinations of measures to achieve the objectives can be designed and implemented.

The WFD sets out "Strategies against pollution of (surface) water", article 16, outlining the steps to be taken (http://ec.europa.eu/environment/water/water-dangersub/pri_substances.htm). The first step was to establish by way of Decision 2455/2001/EC a First list of priority substances to become Annex X of the WFD. These substances were selected from amongst those presenting a significant risk to or via the aquatic environment, using the approaches outlined in Article 16 of the WFD. This first list was replaced by Annex II of the Directive on Environmental Quality Standards (Directive 2008/105/EC) (EQSD), also known as the Priority Substances Directive, which set environmental quality standards (EQS) for the substances in surface waters (river, lake, transitional and coastal) and confirmed their designation as priority or priority hazardous substances, the latter being a subset of particular concern. As required by the WFD and EQSD, the Commission subsequently reviewed the list and in 2013 it was included in the Directive 2013/39/EU amending the WFD and the EQSD as

regards priority substances. According to Annex V, point 1.4.3 of the WFD and Article 1 of the EQSD, good chemical status is reached for a surface water body when it complies with the EQS for all the priority substances and other pollutants listed in Annex I of the EQSD.

In addition, the Groundwater .Directive 2006/118/EC has been developed in response to the requirements of Article 17 of the Water Framework Directive "Strategies to prevent and control pollution of groundwater". On 12 December 2006 the European Commission adopted the Groundwater Directive through which set groundwater quality standards and introduced measures to prevent or limit inputs of pollutants into groundwater. The Groundwater Directive complements the WFD, as it requires Member States, among others, to:

- define groundwater bodies within river basin districts
- establish groundwater quality standards
- carry out pollution trend studies
- reverse pollution trends
- prevent or limit inputs of pollutants into groundwater to be operational
- achieve compliance with good chemical status criteria (based on EU standards of nitrates and pesticides and on threshold values established by Member States).

1.2 Agriculture and water resources pollution

In Europe, agricultural activity has been a positive force for the development of the rich variety of landscapes and high conservation value habitats (woodlands, wetlands etc.) many of which are maintained by extensive farming and a wide range of wild species rely on them for their survival. However, inappropriate agricultural practices and land use can also negatively affect natural resources, via soil, water and air pollution, fragmentation of habitats and loss of wildlife (Agriculture and the environment: Introduction)

Concerning water bodies, agricultural activities can prove to be one of the most significant sources of diffuse pollution, since the need of intensive farming has led to the utilization of fertilizers (organic and/ or inorganic) that cause the diffusion of excess nutrients (nitrogen and phosphorous) resulting in the eutrophication of surface and coastal waters. Pollution from agricultural activities may be caused by fertilization depending on the type of crop, as well as the use of biocides (pesticides, insecticides etc.), necessary to face the parasites, pests, insects and diseases that pose a threat to the growth of the crops cultivated. When used in excess, the above agrochemicals can pose a serious threat to both surface and groundwater bodies, resulting in the deterioration of water quality, as well as the modification of natural ecosystems, loss of biodiversity, etc.

Apart from the Water Framework Directive and the new Groundwater Directive which are responsible for the achievement of the "good environmental status" objective of water bodies there is also a rich legislative framework which protects them from agrochemicals. In more specific, this framework includes the Nitrates Directive (96/676/EEC), the Plant Protection Products Directive (91/414/EEC), the Biocides Directive (98/8/EC), as well as Regulation (EC) No 2003/2003, regarding fertilizers.

- The **Nitrates Directive** (Council Directive 91/676/EEC) aims to reduce and prevent water pollution caused by nitrates from agricultural sources. Nitrates pollution results in a) the degradation of surface water quality, caused by eutrophication and b) the deterioration of groundwater quality. The Nitrates Directive requires Member

States to designate vulnerable zones in all areas whose waters – including groundwater – are or are likely to be affected by nitrate pollution. Vulnerable zones are defined as those waters which contain a nitrates concentration of more than 50 mg/l or are susceptible to contain such nitrates concentration if measures are not taken. The measures for action of the nitrates directive are also listed in the Water Framework Directive (Annex VI) and the Groundwater Directive (Annex IV, part B).

- The **Plant Protection Products Directive** (Council Directive 91/414/EEC) concerns the authorization, placing on the market, use and control of commercial plant protection products. Authorization is only granted if plant protection products have no harmful effect on human health or on groundwater and do not have undesirable effects on the environment, particularly with respect to the contamination of water, including drinking water and groundwater.
- The **Biocides Directive** (Council Directive 98/8/EC) deals with the authorization and the placing on the market of biocidal products such as pesticides, herbicides, or fungicides. Like the Plant Protection Products Directive the authorization of biocidal products may only be granted if the products have no harmful effect on human health, or groundwater and that do not have undesirable effects on the environment, particularly on the contamination of water such as drinking and groundwater.
- **Regulation (EC) No 2003/2003** of the European Parliament and of the Council, lays down rules relating to the placing of fertilizers on the market, and details the conditions to meet in order to use the title EC fertilizers, as well as the provisions regarding their labelling and packaging.

Moreover, having recognized the important interactions between agricultural land use and environmental processes, appropriate environmental management in the agricultural sector is supported through the EU Common Agricultural Policy (CAP). The latter has identified three priority areas for action to protect and enhance the EU's rural heritage:

- biodiversity and the preservation and development of 'natural' farming and forestry systems, and traditional agricultural landscapes
- water management and use
- climate change

1.3 Chemical legislation

Chemicals used in most companies in one way or another. They are essential for the way of life and the economy, but they have to be managed safely so as to protect human health and the environment. For this reason equal standards for the manufacturing, supply and safe use of chemicals applied across the entire European Economic Area (EEA), regardless the companies' position in the supply chain and the products they manufacture, import, export, supply or use.

Among the most important EU chemicals legislation that applied trying to make companies responsible for the safety of chemicals they place on the market are the:

- Registration, Evaluation, Authorization and Restriction of Chemicals (REACH, Regulation (EC) No 1907/2006)
- Classification, Labeling and Packaging (CLP, Regulation (EC) No 1272/2008) Regulation
- Biocidal Product Regulation (BPR, Regulation (EU) 528/2012)
- Prior Informed Consent Regulation (PIC, Regulation (EU) 649/2012)

Agrochemicals, including fertilizers, contain a number of chemical substances that are controlled mainly by REACH and CLP regulations. REACH is a regulation of the European Union, adopted to improve the protection of human health and the environment from the risks that can be posed by chemicals, while enhancing the competitiveness of the EU chemicals industry. REACH establishes procedures for collecting and assessing information on the properties and hazards of substances. On the other hand, CLP Regulation is the regulation that ensures that hazards presented by chemicals are clearly communicated to workers and consumers in the European Union through classification and labelling of chemicals.

2 WATER PROTECTION FROM CHEMICAL POLLUTION

2.1 Surface waters

EU legislation provides measures against chemical pollution of surface waters. There are two components:

- the selection and regulation of substances of European Union (EU) of wide concern (*priority substances*) and
- the selection by Member States of substances of national or local concern (*river basin specific pollutants*) for control at the relevant level (Strategies against chemical pollution of surface waters)

2.2 Priority Substances legislation

This component constitutes the major part of the Union's strategy against the chemical pollution of surface waters. It is set out in Article 16 of the Water Framework Directive 2000/60/EC. This requires the establishment of a list of priority substances, selected amongst those presenting a significant risk to or via the aquatic environment at EU level. It also requires the designation of a subset of priority hazardous substances, and proposals for controls to reduce the emissions, discharges and losses of all the substances, as well as to phase out the emissions, discharges and losses of the subset of priority hazardous substances.

The first list of priority substances was established by Decision 2455/2001/EC, while Directive 2008/105/EC (Environmental Quality Standards Directive – EQSD) set the quality standards as required by Article 16(8) of the Water Framework Directive. Annex II to the EQSD replaced Annex X of the Water Framework Directive.

In 2013, Directive 2008/105/EC was revised by Directive 2013/39/EU in accordance with Article 16(4) of Directive 2000/60/EC and Article 8 of Directive 2008/105/EC. The revised EQSD for existing priority substances should be taken into account for the first time in river basin management plans covering the period 2015 to 2021.

According to Directive 2013/39/EU 45 substances or groups of substances were determined as priority substances in the field of water policy. From those substances the priority substances that could be presented in plant protection products used in agriculture are reported in the following Table 1 (Directive 2013/39/EU, EWS guideline).

Table 1: Priority substances or groups of substances in the field of water policy (Annex I of Directive 2013/39/EU) that can be presented in Plant Protection Products

Number	Name of Priority Substance	CAS number	Identified as priority hazardous substance	Use/Sources
1	Alachlor	15972-60-8		Herbicide, used against grass weeds and broadleaves.
2	Atrazine	1912-24-9		Herbicide used on grassy weeds and broadleaves.
3	Cadmium and	7440-43-9	**X**	Artificial fertilizers contain cadmium as a

	its compounds			pollutant.
4	Chlorfenvinphos	470-90-6		Insecticide used on use on cabbage and swede
5	Chlorpyrifos (Chlorpyrifos-ethyl)	2921-88-2		Common insecticide
6	Di(2-ethylhexyl) phthalate (DEHP)	117-81-7	**X**	Antifoaming agent in pesticides
7	Diuron	330-54-1		Herbicide
8	Endosulfan	115-29-7	**X**	Insecticide and acaricide
9	Hexachlorobenzene	118-74-1	**X**	Formed in a great variety of reactions such as in the manufacture of pesticides
10	Hexachlorocyclohexane	608-73-1	**X**	Pesticide
11	Isoproturon	34-123-59-6		Herbicide used in cereal production across Europe to control grasses and broadleaves
12	Mercury and its compounds	7439-97-6	**X**	Pesticide and biocide on grain and in paper industry
13	Naphthalene	91-20-3		Combustion of wood and fossil fuels and the production of coal tar. Naphthalene is also a component in some fumigants and repellents (moth balls)
14	Pentachlorobenzene	608-93-5	**X**	Intermediate in the production of the fungicide quintozone as a flame retardant and as a contaminant of hexachlorobenzene which has been used as a fungicide
15	Simazine	122-34-9		Herbicide to control grasses and broadleaves in agriculture and forestry
16	Trichlorobenzenes	12002-48-1		Intermediate in the production of herbicides, as a solvent or dye carrier as additive to PCB and as anticorrosive agent
17	Trichloromethane (chloroform)	67-66-3		Solvent and as a chemical intermediate in the manufacture of dyes and pesticides
18	Trifluralin	1582-09-8	**X**	Herbicide mainly used for grasses and broadleaves
19	Quinoxyfen	124495-18-7	**X**	Fungicide, used mainly on cereals, grape vines.
20	Aclonifen	74070-46-5		Herbicide, used on a range of arable crops
21	Bifenox	42576-02-3		Herbicide, used to kill broadleaf weeds in cereal crops and grassland
22	Cypermethrin	52315-07-8		Insecticidal pyrethroid plant protection product and biocide, used in arable farming. Salmon farming, sheep dipping and wood preservation
23	Dichlorvos	62-73-7		Organophosphorus insecticide and biocide used in grain/nut stores, insecticidal sprays/strips
24	Heptachlor and heptachlor epoxide	76-44-8/ 1024-57-3	**X**	Organochlorine insecticide, no longer authorised but secondary emissions possible.

The new Directive 2013/39/EU, in reference to the priority substances in the field of water policy, has been introduced in the national legislation of Greece and Italy with

the Government Gazette No. 68B/2016 and the Legislative Decree n. 172/2015, respectively.

2.3 Specific pollutants legislation

Besides the set of Priority Substances laid down in Annex X of the Water Framework Directive 2000/60/EC (WFD), which are regulated and to be monitored at EU level, the EU Member States (MS) need to identify pollutants of regional or local importance (in particular substances listed in WFD, Annex VIII) and set environmental quality standards (EQS), monitoring schemes and regulatory measures for them for the purpose of evaluating the ecological status of water. This means that MS need to decide which of the candidate substances need further investigation and to declare the substances that are related to River Basin-Specific Pollutants (RBSP).

Greece, defined the threshold values for the pollutants, groups of pollutants and indicators of pollution contained in Part B of Annex II of the Groundwater Directive with JMD 1811/OJ 3322/B/2011 (Table 2).

Table 2: Environmental Quality Standards of Specific pollutants according to Greek legislation (EQS: Environmental Quality Standard, EMS: mean annual concentration, unit: μg/l)

Number	Name of chemical parameter	CAS number	EQS - MAC
1	1,1,1-Trichloroethane	71-55-6	10
2	1,1,2-Trichloroethane	79-00-5	10
3	1,1-Dichloroethene	75-35-4	10
4	1,2-Dichloroethene	540-59-0	10
5	1,2-dichlorobenzene	95-50-1	10
6	1,3-Dichlorobenzene	541-73-1	10
7	1,4-dichlorobenzene	106-46-7	10
8	(2,4,5-Trichlorophenoxy)acetic acid	93-76-5	0,1
9	(2,4-Dichlorophenoxy)acetic acid	94-75-7	0,1
10	1-Chloro-2-methylbenzene	95-49-8	1
11	3,4-Dichloranilin	95-76-1	0,5
12	4-chlorotoluene	106-43-4	1
13	4-Chloranilin	106-47-8	0,05
14	Azinphos-ethyl	2642-71-9	0,005
15	Azinphos-methyl	86-50-0	0,005
16	Bentazon	25057-89-0	0,1
17	Coumaphos	56-72-4	0,07
18	Demeton o,s	8065-48-3	0,05
19	Demeton-S-methyl	919-86-8	0,1
20	Dichlorprop	120-36-5	0,1
21	Dimethoate	60-51-5	0,5
22	Disulfoton	298-04-4	0,004
23	fenitrothion	122-14-5	0,003
24	Fenthion	55-38-9	0,001
25	Heptachlor	76-44-8	0,05

26	Heptachlor epoxide	102-45-73	0,05
27	Linuron	330-55-2	0,5
28	malathion	121-75-5	0,01
29	MCPA	94-74-6	0,1
30	Mecoprop	7085-19-0	0,1
31	Methamidophos	10265-92-6	0,1
32	Mevinphos	7786-34-7	0,01
33	Monolinuron	1746-81-2	0,1
34	Omethoate	1113-02-6	0,1
35	Oxydemeton - methyl	301-12-2	0,1
36	parathion	56-38-2	0,01
37	parathion methyl	298-00-0	0,01
38	propanil	709-98-8	0,1
39	pyrazon	1698-60-8	0,1
40	triazophos	24017-47-8	0,03
41	trichlorfon	52-68-6	0,002
42	Ethyl benzene	100-41-4	10
43	Surfactants - Linear alkylbenzene sulphonate	-	270
44	Hydrocyanic acid	74-90-8	10
45	m-xylene p-xylene	108-38-3 106-42-3	10
46	o-xylene	95-47-6	10
47	Total phenols	-	50
48	Polychlorinated biphenyls		0,014
49	Toluene	108-88-3	10
50	Phenol	108-95-2	8
51	Chlorobenzene	108-90-7	1
52	Arsenic	7440-38-2	30
53	Tin	7440-31-5	2,2
54	Cobalt	7440-48-4	20
55	Molybdenum	7439-98-7	4,4
56	Selenium	7782-49-2	5
57	Copper	7440-50-8	3(<40 mgCaCO3/l) 6(40-50 mgCaCO3/l) 9 (50-100 mgCaCO3/l) 17 (100-120 mgCaCO3/l) 26 (>200 mgCaCO3/l)
58	Hexavalent chromium (chromium(VI))		3
59	Chromium	7440-47-3	23(<40 mgCaCO3/l) 42(40-50 mgCaCO3/l) 50 (>50 mgCaCO3/l)

60	Zinc	7440-66-6	8(<50 mgCaCO3/l) 50 (50-100 mgCaCO3/l) 75 (100-200 mgCaCO3/l) 125 (>200 mgCaCO3/l)

As far as Italy is concerned, the Italian specific pollutants have been determined according to the Allegato 1 of the MD 260/2010 and are presented in the following Table 3.

Table 3: Environmental Quality Standards of Specific pollutants according to Italian legislation (EQS: Environmental Quality Standard, EMS: mean annual concentration, unit: μg/l)

Number	Name of chemical parameter	CAS number	EQS - MAC	
			Inland Surface Waters	Other Surface Waters
1	Arsenic	7440-38-2	10	5
2	Azinphos-ethyl	2642-71-9	0,01	0,01
3	Azinphos-methyl	86-50-0	0,01	0,01
4	Bentazon	25057-89-0	0,5	0,2
5	2-Chloroaniline	95-51-2	1	0,3
6	3-Chloroaniline	108-42-9	2	0,6
7	4-Chloroaniline	106-47-8	1	0,3
8	Chlorobenzene	108-90-7	3	0,3
9	2-Chlorophenol	95-57-8	4	1
10	3-Chlorophenol	108-43-0	2	0,5
11	4-Chlorophenol	106-48-9	2	0,5
12	4-chloro-2-nitroanisole	89-21-4	1	0,2
13	1-Chloro-2-nitrobenzene	88-73-3	1	0,2
14	1-Chloro-3-nitrobenzene	121-73-3	1	0,2
15	Chlorine nitrottoluene	-	1	0,2
16	1-Chloro-2-methylbenzene	95-49-8	1	0,2
17	1-Chloro-3-methylbenzene	108-41-8	1	0,2
18	1-Chloro-4-methylbenzene	106-43-4	1	0,2
19	Chromium	74440-47-3	7	4
20	(2,4-Dichlorophenoxy)acetic acid	94-75-7	0,5	0,2
21	Demeton	298-03-3	0,1	0,1
22	3,4-Dichloranilin	95-76-1	0,5	0,2
23	1,2-dichlorobenzene	95-50-1	2	0,5
24	1,3-Dichlorobenzene	541-73-1	2	0,5
25	1,4-dichlorobenzene	106-46-7	2	0,5
26	2,4-Dichlorophenic acid	120-83-2	1	0,2
27	Dichlorvos/2,2-dichlorovinyl dimethyl phosphate (DDVP)	62-73-7	0,01	0,01

28	Dimethoate	60-51-5	0,5	0,2
29	Heptachlor	76-44-8	0,005	0,005
30	Fenitrothion	122-14-5	0,01	0,01
31	Fenthion	55-38-9	0,01	0,01
32	Linuron	330-55-2	0,5	0,2
33	Malathion	121-75-5	0,01	0,01
34	MCPA	94-74-6	0,5	0,2
35	Mecoprop/methylchlorophen oxypropionic acid (MCPP)	93-65-2	0,5	0,2
36	Methamidophos	10265-92-6	0,5	0,2
37	Mevinphos	7786-34-7	0,01	0,01
38	Omethoate	1113-02-6	0,5	0,2
39	Oxydemeton - methyl	301-12-2	0,5	0,2
40	Parathion	56-38-2	0,01	0,01
41	Parathion methyl	298-00-0	0,01	0,01
42	(2,4,5-Trichlorophenoxy)acetic acid	93-76-5	0,5	0,2
43	Toluene	108-88-3	5	1
44	1,1,1-Trichloroethane	71-55-6	10	2
45	2,4,5-Trichlorophenol	95-95-4	1	0,2
46	2,4-Dichlorophenic acid	120-83-2	1	0,2
47	Terbuthylazine (including metabolites)	5915-41-3	0,5	0,2
48	Triphenyltin Compounds	-	0,0002	0,0002
49	Xylene	1330-20-7	5	1
50	Individual Pesticides		0,1	0,1
51	Total Pesticides		1	1

2.4 Ground waters

According to Directive 2000/60/EC the achievement of good status of groundwater bodies depends not only on good quantity, but also on good quality status, and more specific on the:

- avoidance of salinization
- compliance with the quality standards
- avoidance of the impact on the surface waters in such an extent that will not be able to achieve the environmental scopes and
- avoidance of significant degradation of terrestrial ecosystems which are depended directly on groundwater ecosystems.

Especially for drinking water, it is foreseen (article 7 par. 3) the gradual limitation of the degree of its treatment.

Moreover, the daughter Groundwater Directive 2006/118/EU includes (articles 1 & 6):

- criteria for the assessment of chemical status according to Directive 2000/60/EU
- criteria for the determination of the most important and stable pollutant trends and the determination of the starting points for their reversal

- measures for the prohibition of the groundwater pollution with dangerous substances and especially the substances 1 to 6 and 7 to 9 of Annex VIII, Directive 2000/60/EU that are considered as dangerous
- measures for the reduction of pollution from substances that are listed in Annex VIII of Directive and any other pollutant

The criteria for the assessment of chemical status include (article 3):

a) quality standards: the following groundwater quality standards will be the quality standards referred to in Table 2.3.2 in Annex V to Directive 2000/60/EC and established in accordance with Article 17 of that Directive.

Table 4: Quality standards for the concentrations of nitrates and pesticides.

Pollutant	Quality standard
Nitrates	50 mg/l
Active substances of pesticides (including relative metabolites, breakdown products and reaction products)[1]	0,1 μg/l 0,5 μg/l (total)

1) "Pesticides" means the plant protection products according to the definition of article 2 of Directive 91/414/EEC and all the biocides according to article 2 of Directive 98/8/EU.

2) "Total" means the sum of the individual pesticides which are detected and determined based on their quantity during the monitoring process, including relevant metabolism products, breakdown products and reaction products.

b) Threshold values which are determined by the Member States and separate the good and the bad status taking into account the water uses, the impact on surface waters and terrestrial ecosystems and information in reference to the natural background levels.

As it is concluded from the above mentioned, for the groundwater bodies it is not foreseen recovery in their initial "undisturbed" conditions but avoidance of their degradation and compliance with their uses.

For the assessment of the chemical status of groundwater the determination of threshold values is foreseen in Directive 2006/118/EU. According to this Directive the determination of threshold values is required (only) for those groundwater systems which, during the preliminary assessment, were characterized as at risk not to achieve good chemical status and for those parameters that are related to the uses (Directive 2006/118/EU, Annex II, Part A) and for which exceeding the quality limits is observed and expected.

Regarding the level at which the threshold values will be defined, Directive 2006/118/EU foreseen (article 3, par. 2) that it can be at national level, catchment area, Groundwater System or group of Groundwater Systems.

In Greece, JMD 39626/2208/E130/2009 (OJ B' 3322) foreseen:

- The definition of threshold values at national level with MD after the recommendation of the Central Water Service and the decision of the Minister of Ministry of Environment and
- The ability of the General Secretary of the Decentralized Administration to determine additional or more stringent threshold values for the catchment area, Groundwater System or group of Groundwater Systems (article 3, par. 3 & 8).

In Annex of the above JMD it is also foreseen the way according to which the threshold values will be determined. According to JMD 39626/2208/E130/2009 (OJ B'

3322), article 3, par. 2, the threshold values were determined at National Level and they are presented in the following Table 5.

Table 5: Threshold values for the concentrations of substances in groundwater according to the Greek legislation

No	Parameter	Threshold value
1	Nitrates	50 mg/l
2	Total phosphorus	0.5 μg/l
3	Active substances of pestic	0.1 μg/l
4	As	10 μg/l
5	Cd	5 μg/l
6	Pb	25 μg/l
7	Hg	1 μg/l
8	NH_4^+	0.5 mg/l
9	Conductivity	2500 μS/cm
10	Chlorides	250 mg/l
11	Sulphates	250 mg/l
12	Total of synthetic substances (trichloroethylene and tetrachloroethylene)	10 μg/l
13	pH	6.5 to 9.5
14	Nitrites	0.5 mg/l
15	Ni	20 μg/l
16	Cr	50 μg/l
17	Al	200 μg/l

In Italy, the threshold values were determined at National Level according to the Legislative Decree n. 30/2009 (OJ n.79/4-4-2009) and they are presented in the following Table 6.

Table 6: Threshold values for the concentrations of substances in groundwater according to the Italian legislation

No	Parameter	Threshold value
1	Antimony	5 μg/l
2	Arsenic	10 μg/l
3	Cadmio	5 μg/l
4	Total chromium	50 μg/l
5	Chromum VI	5 μg/l
6	Mercury	1 μg/l
7	Nickel	20 μg/l

8	Lead	10 μg/l
9	Selenium	10 μg/l
10	Vanadium	50 μg/l
11	Boron	1000 μg/l
12	Free cyanide	50 μg/l
13	Fluorurides	1500 μg/l
14	Nitrite	500 μg/l
15	Sulphates	250 mg/l
16	Chlorides	250 mg/l
17	Ammonium ion	500 μg/l
18	Ethylbenzene	50 μg/l
19	Toluene	15 μg/l
20	Para-xylene	10 μg/l
21	Benzo (a) pyrene	0.01 μg/l
22	Benzo (b) fluoranthene	0.1 μg/l
23	Benzo (k) fluoranthene	0.05 μg/l
24	Benzo (g,h,i,) perylene	0.01 μg/l
25	Dibenz (a,h) anthracene	0.01 μg/l
26	Indeno (1,2,3-c,d) pyrene	0.1 μg/l
27	Trichloromethane	0.15 μg/l
28	Vinyl chloride	0.5 μg/l
29	1,2 Dichloro-ethane	3 μg/l
30	Trichloroethylene	1.5 μg/l
31	Tetrachloroethylene	1.1 μg/l
32	Hexachlorobutadiene	0.15 μg/l
33	Sum of organohalogens	10 μg/l
34	1,2 Dichloroethylene	60 μg/l
35	Dibromochloromethane	0.13 μg/l
36	Bromochloromethane	0.17 μg/l
37	Nitrobenzene	3.5 μg/l
38	Monochlorobenzene	40 μg/l
39	1,4 Dichlorobenzene	0.5 μg/l
40	1,2,4 Trichlorobenzene	190 μg/l
41	Pentaclorobenzene	50 μg/l
42	Hexachlorobenzene	0.01 μg/l
43	Aldrin	0.03 μg/l
44	β-HCH	0.1 μg/l
45	DDT, DDD, DDE	0.1 μg/l
46	Dieldrin	0.03 μg/l
47	Sum of PCDD, PCDF	4x10(raised to
48	PCB	0.01 μg/l

49	Total hydrocarbons	350 μg/l
50	Conductivity	2500 μScm

3

3 AGROCHEMICALS CLASSIFICATION ACCORDING EWS STANDARD

Chemical substances contained in agrochemicals can be classified into the following four different categories based on the European and National legislation of each Member State:

- Main pollutants included in Annex VIII to WFD
- Priority substances included in Annex X to WFD and Directive 2013/39/EU
- Specific pollutants in a river basin regulated by national legislation (according to EC 2000/60)
- Hazardous to the aquatic environment according to REACH and CLP Regulations

The priority substances and specific pollutants were presented in the previous chapter.

3.1 Main pollutants

Main pollutant is considered any substance liable to cause pollution. According to WFD (Annex VIII), the indicative list of the main pollutants includes the following:

- Organohalogen compounds and substances which may form such compounds in the aquatic environment
- Organophosphorous compounds
- Organotin compounds
- Substances and preparations, or the breakdown products of such, which have been proved to possess carcinogenic or mutagenic properties or properties which may affect steroidogenic, thyroid, reproduction or other endocrine-related functions in or via the aquatic environment
- Persistent hydrocarbons and persistent and bioaccumulable organic toxic substances
- Cyanides
- Metals and their compounds
- Arsenic and its compounds
- Biocides and plant protection products
- Materials in suspension
- Substances which contribute to eutrophication (in particular, nitrates and phosphates)
- Substances which have an unfavourable influence on the oxygen balance (and can be measured using parameters such as BOD, COD, etc.)

Amongst the above categories of main pollutants biocides and plant protection products, as well as substances that contribute to eutrophication are of particular interest to the agricultural sector.

3.2 Hazardous substances

Hazardous substances to the aquatic environment fall into two categories of chemicals those that cause Acute Aquatic Toxicity and those that cause Chronic Aquatic Toxicity. Acute aquatic toxicity means the intrinsic property of a substance to be injurious to an organism in a short term exposure to that substance, while Chronic aquatic toxicity means the intrinsic property of a substance to cause adverse effects to aquatic

organisms during exposures which are determined in relation to the life-cycle of the organism.

According to CLP (EC1272/2008) labels of substances or mixtures, which meet the criteria for classification as hazardous to the aquatic environment that cause Acute Aquatic Toxicity, will bear the elements of Table 7, while label elements for substances or mixtures that cause chronic aquatic toxicity are presented on Table 8.

Table 7: Label Elements according to CLP (EC 1272/2008) for substances that cause acute aquatic toxicity

Acute Aquatic Toxicity	
	Category 1
GHS Pictogram	
Signal word	Warning
Hazard Statement	**H400** Very toxic to aquatic life (EN) Πολύ τοξικό για τους υδρόβιους οργανισμούς (EL) Molto tossico per gli organismi acquatici (IT)
Precautionary Statement Prevention	**P273**: Avoid release to the environment
Precautionary Statement Response	**P391**: Collect spillage
Precautionary Statement Storage	
Precautionary Statement Disposal	**P501**: Dispose of contents/container to … … in accordance with local/regional/national/international regulation (to be specified).

Table 8: Label Elements according to CLP (EC 1272/2008) for substances that cause chronic aquatic toxicity

Chronic Aquatic Toxicity				
	Category 1	Category 2	Category 3	Category 4
GHS Pictogram			No pistogram is used	No pistogram is used
Signal word	Warning	No signal word is used	No signal word is used	No signal word is used

Chronic Aquatic Toxicity				
	Category 1	Category 2	Category 3	Category 4
Hazard Statement	**H410** Very toxic to aquatic life with long lasting effects (EN) Πολύ τοξικό για τους υδρόβιους οργανισμούς, με μακροχρόνιες επιπτώσεις (EL) Molto tossico per gli organismi acquatici con effetti di lunga durata (IT)	**H411** Toxic to aquatic life with long lasting effects (EN) Τοξικό για τους υδρόβιους οργανισμούς, με μακροχρόνιες επιπτώσεις (EL) Tossico per gli organismi acquatici con effetti di lunga durata (IT)	**H412** Harmful to aquatic life with long lasting effects (EN) Επιβλαβές για τους υδρόβιους οργανισμούς, με μακροχρόνιες επιπτώσεις (EL) Nocivo per gli organismi acquatici con effetti di lunga durata (IT)	**H413** May cause long lasting harmful effects to aquatic life (EN) Μπορεί να προκαλέσει μακροχρόνιες επιπτώσεις στους υδρόβιους οργανισμούς (EL) Puo essere nocivo per gli organismi acquatici con effetti di lunga durata (IT)
Precautionary Statement Prevention	**P273**	**P273**	**P273**	**P273**
Precautionary Statement Response	**P391**	**P391**		
Precautionary Statement Storage				
Precautionary Statement Disposal	**P501**	**P501**	**P501**	**P501**

4 APPLIED SUBSTANCES IDENTIFICATION AND CLASSIFICATION

Based on the identification and classification of all applied substances on the production sites of the organization, agriculture in our case required by the EWS standard, two inventories were completed, one for the PPPs and another for fertilizers used.

4.1 PPP inventory and classification

The following Table 9 represents the classification of the PPPs utilized in the three pilot areas (Greece and Italy), based on the data provided by the farmers of pilot areas.

Taking for granted that all plant protection products and biocides marketed in EU conform to the requirements of the Plant Protection Products Directive (91/414/EEC) and Biocides Directive (98/8/EC), respectively, for each product listed by farmers in the 1st AWMS form, the primary and secondary active substances were identified and then classified as main pollutant, priority substance, specific pollutant and/ or hazardous to the aquatic environment.

To identify substances that are considered as hazardous to the aquatic environment for every agrochemical listed by farmers in the 1st AWMS form, the respective trade name and / or composition, the respective safety data sheet (SDS) and the European Chemicals Agency database were used.

Table 9 contains information related to:

- the commercial name of the PPP and the substance and other physical pollutants that is used in the three pilot areas
- the area in which the above PPPs are used
- the composition or the active substance of each PPP
- the CAS Number, which is a unique numerical identifier assigned by Chemical Abstracts Service (CAS) to every chemical substance described in the open scientific literature
- the classification of substances as hazardous to the Aquatic Environment according to the SDS and CLP Label
- if any of the listed substances is either characterized as Priority Substance or specific pollutant in river basin

At this point it should be mentioned that as all the substances of Table 9 are included in the category of Plant Protection Products they are considered as Main Pollutants.

Table 9: Substances and potential pollutants that are used in three pilot areas (Platanias, Mirabello & Metapontino)

SUBSTANCE and other Physical pollutants/ Commercial name	Pilot Area	Composition/Active substance	CAS No.	Potential Pollutant		
				Classified as hazardous to the Aquatic Environment (H phrases)		Priority Substance or specific pollutant in river basin
				Safety Data Sheet (SDS)	CLP Label	

INSECTICIDES						
CALYPSO 480SC	Metapontino			H400, H410	H410	
		Thiacloprid	111988-49-9	H400, H410		
		1,2-Benzisothiazol-3(2H)-one	2634-33-5	H400		
LASER 200 O-TEQ	Metapontino			H400, H410	H410	
		Imidacloprid	138261-41-3	H400, H410		
		2-Esanole di etilepropilen etilenglicolic o etere	64366-70-7 613-582-1	H412		
		Derivati dipolialchilen e amina	68511-96-6	-		
KARATE 10 CS with Zeon technology	Metapontino	lambda-cyhalothrin	91465-08-6	H400, H410	H410	
		propane-1,2-diol	57-55-6	-		
		solvent naphtha (petroleum), highly arom.	64742-94-5	H411		
		1,2-benzisothiazOl -3(2H)-one	2634-33-5 220-120-9	H400		
MOVENTO 48 SC	Metapontino			H411	H411	
		Spirotetramat	203313-25-1	H400, H410		
		Etere Alchilarilpoliglicolico	104376-75-2	H412		
		5-cloro-2-metil-2Hisotiazol-3-one; 2-metil-2H-isotiazol-3-one	55965-84-9	H400, H410		
		1,2-Benzisotiazol-3(2H)-one	2634-33-5	H400		
TREBON UP	Metapontino			H410	H410	
		Idrocarburi aromatici C10 naftalene	64742-94-5	H411		
		Etofenprox	80844-07-1	H400, H410		
		Tensioattivo (etossialcole < 35%)	-	H411		
		Tensioattivo (etossialcole	-	H411		

		< 10%)				
VERTIMEC 1,8 EC	Metapontino			H400, H410	H410	
		cyclohexanol	108-93-0			
		propane-1,2-diol	57-55-6	-		
		abamectin	71751-41-2	H400,H410		
		2,6-di-tert-butylp-cresol	128-37-0	H400,H410		
ZELIG 480 EC	Metapontino			H400,H410	H410	
		Chlorpyrifos - ethyl	2921-88-2	H400,H410		Priority Substance
		Hydrocarbon , C9, aromatics	N/A	H411		
		Benzenesulfonic acid, C10-13-alkyl derivs., calcium salt	N/A	-		
		butan-1-ol	71-36-3	-		
RELDAN	Metapontino , Mirabello			H400, H410	H410	
		Chlorpyrifos -methyl	5598-13-0	H400, H410		
		Hydrocarbons, C10-C13, aromatics, <1% naphthalene	-	H411		
		Hydrocarbons, C10, aromatics, <1% naphthalene	-	H411		
		Calcium dodecylbenzene sulfonate	26264-06-2	-		
		Naphthalene	91-20-3	H400, H410		Priority Substance
		Chlorpyrifos (ISO) or Chlorpyrifos -ethyl) or Chlorpyrifos	2921-88-2	H400, H410		Priority Substance
OLIOCIN	Metapontino			-	-	
		Olio di vaselina	8042-47-5	-		
EPIK SL	Metapontino			H410	H410	
		acetamiprid (ISO)	135410-20-7	H412		
		Mix tensioattivi anionici e non ionici	-	-		
NEEMIK	Metapontino			H412	H412	
		Azadiractin A	11141-17-6	H400,H410		
PYRETHRUM NATURE	Metapontino			H410	H410	
		piretrine	8003-34-7	H400,H410		

		Sorbitan, trioleate, ethoxylated	9005-70-3	H412		
SUCCESS 0.24	Mirabello, Platanias			-	-	
BULLDOCK 2,5 SC	Mirabello	Beta-cyfluthrin	68359-37-5	H400, H410	H410	
		Polyethoxy polyaryl phenyl ether	99734-09-5	H412		
ROGOR L 40 EC	Mirabello, Platanias			H410	H411	
		dimethoate	60-51-5	H410		Specific Pollutant
		Idrocarburi, C9, aromatici	-	H411		
SURROUND WP	Mirabello	Aluminium silicate (kaolin)	1332-58-7	Not classified		
DECIS	Platanias			H400, H410	H410	
		Deltamethrin	52918-63-5	H400, H410		
		Tetrapropylene benzene sulfonate, calcium salt	11117-11-6	H412		
		2,6-Di-tert-butyl-4-methylphenol	128-37-0	H400, H410		
		Solvent Naphtha (petroleum), light aromatic	64742-95-6	H411		
DURSBAN 480 EC	Platanias			H400, H410	H400, H413	
		Chlorpyrifos (ISO) or Chlorpyrifos -ethyl) or Chlorpyrifos	2921-88-2	H400, H410		Priority Substance
		Hydrocarbon, C9, aromatics,	-	H411		
		Hydrocarbon, C10, aromatics, naphthalene <1%	-	H411		
PROTEUS 110 OD	Platanias			H410	H410	
		thiacloprid	111988-49-9	H400, H410		
		deltamethrin	52918-63-5	H400, H410		
		2-Ethylhexanol propylene ethyleneglycol ether	64366-70-7	H412		
		2,6-Di-tert-	128-37-0	H400,		

		butyl-4-methylphenol		H410		
PYRETHRON 5 SC – 100 CC	Platanias			H400, H410	H410	
		Pyrethrins	8003-34-7 64742-47-8	H410		
PYRINEX	Platanias			H400, H410	H410	
		Chlorpyrifos (ISO) or Chlorpyrifos -ethyl) or Chlorpyrifos	2921-88-2	H400, H410		Priority Substance
		Hydrocarbon, C9, aromatics	-	H411		
PARAFFINIC OIL	Platanias			-	-	
FUNGICIDES						
CHORUS 50 WG	Metapontino			H400, H410	H410	
		cyprodinil	121552-61-2	H400, H410		
		Terra di diatomee	61790-53-2	-		
		sodium dibutylnaphthalene sulphonate	25417-20-3 246-960-6	H412		
CUPRAVIT 35 WG	Metapontino			H400, H411	H410	
		Ossicloruro diRame/ 1332-40-7	1332-40-7	H400, H410		
		2-[Metiloleoilammino]etan-1-solfonato disodio	137-20-2	-		
		Diisopropilnaftalene sulfonato di sodio	1322-93-6	-		
DELAN® 70 WG	Metapontino			H400, H410	H400, H410	
		Dithianon	3347-22-6	H400, H410		
		Kaolin	1332-58-7	-		
		Ammonium sulphate	7783-20-2	-		
		Sulfuric acid diammoniu m salt	7783-20-2	H412		
MEZENE 76 WG	Metapontino			H400, H410	H410	
		Ziram	137-30-4	H400, H410		
NIMROD 250 EW	Metapontino			H412	H412	
		Bupirimate	41483-43-6	H411		
		Metil estere	68186-14-1	H412		

		di colofonia				
		EPTAMETILTRISILOSSANO POLIALCHILENEOSSIDO	27306-78-1	H411		
POLTIGLIA DISPERSS	Metapontino			H400, H410	H410	
		Bordeaux Mixture (Metal Copper*) * Copper (pure active) : 20 %	8011-63-0	H400, H410		
POMARSOL 80 WG	Metapontino			H400, H410	H410	
		Tiram	137-26-8	H400, H410		
SIGNUM® 26.7/6.7 WG	Metapontino			H400, H410	H400, H410	
		3-Pyridinecarboxamide, 2-chloro-N-(4'-chloro[1,1'-biphenyl]-2-yl)-	188425-85-6	H411		
		pyraclostrobin (ISO); N-{2-[1-(4-clorofenil)-1H-pirazolo-3-ilossimetil]fenil}(N-metossi)carbammato di metile	175013-18-0	H400, H410		
		Diisobutil naftalensolfonato di sodio	27213-90-7	H412		
		Sulfuric acid diammoniumsalt	7783-20-2	-		
THIOVIT 80 WG	Metapontino			-	-	
		Sulfur	7704-34-9	-		
TOPAS 10 EC	Metapontino			H411	H411	
		Penconazolo	66246-88-6	H400, H410		
		Cyclohexanone (en)	108-94-1 203-631-1	-		
		Dodecilbenzensulfonato di calcio	26264-06-2 84989-14-0 90194-26-6 247-557-8 284-903-7 290-635-1	H412		
		2-Metil-1-propanolo	78-83-1 201-148-0	-		

TIOVIT JET	Metapontino			-	-	
		Zolfo	7704-34-9	-		
PROTIL EC	Metapontino			H400, H410	H410	
		Propiconazolo 1-[[2-(2,4-dichlorophenyl)-4-propyl-1,3-dioxolan-2-yl]methyl]-1*H*-1,2,4-triazole	60207-90-1	H400, H410		
		Acido solfonato di benzolo, C10-C13 alchilderivati, sali di calcio	-	-		
		Butan1-olo n-butanol	71-36-3	-		
COBRE NORDOX	Metapontino				H410	
		Copper	7440-50-8	H400, H411		
COPPER (Cu containing in fungicides)	Mirabello, Platanias				H410	Specific Pollutant
		Indicatively: Copper oxychloride or Copper hydroxide or Bordeaux mixture	1332-65-6 20427-59-2	H410, H410, H411		
PESTICIDES						
LASER GF-976 Spinosyn A & D 44.2%wt SC	Metapontino			H400, H410	H410	
		spinosad (ISO)	168316-95-8	H400, H410		
		1,2-Propanediol	57-55-6	-		
HERBICIDES						
ROUNDUP GOLD 36 SL	Metapontino, Platanias			H400, H410, H411	H411, H413	
		Glyphosate	1071-83-6	H411		

4.2 Data Analysis

According to the deliverable C2 "Assessment of water efficiency by the participant F.ORs before LIFEAgroClimaWater" (part B) data collected from the pilot areas of Platanias, Mirabello and Metapontino referred to a total of 301 orchards. From those 100 are located in Platanias (91 olive, 8 citrus orchards and 1 avocado orchard), 101 (101 olive orchard) in Mirabello and 100 in Metapontino (15 olive, 19 citrus, 48 peach and 18 apricot orchards). Due to the special irrigation needs of avocado crop and the

fact that it was not included in the original plan of studying crops in the pilot sub-basins, the single avocado orchard was not considered as typical for further evaluation and as a result it was excluded from further analysis.

As it is shown on the following Fig. 1, the 21% (63 orchards) of the total orchards were organic while the rest of them (79% or 237 orchards) were conventional. Also, 55% (164) of the total orchards were irrigated and the rest 136 were rainfed orchards.

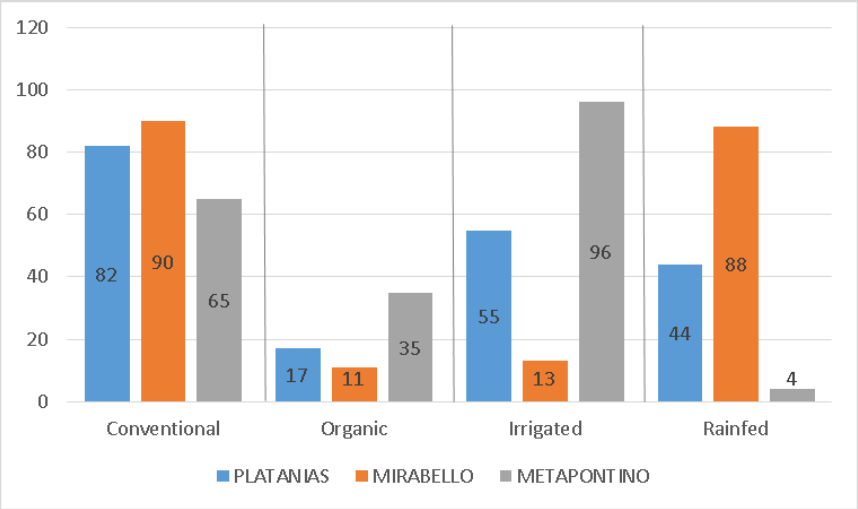

Fig. 1: Conventional, organic, irrigated and rainfed orchards per pilot area

In the 70% (210 out of 300) of the total orchards included in this study PPPs were applied. From those, 122 are olive orchards (58.9% of the total olive orchards or 122 out of 207), 26 are citrus orchards (96.3% of the total citrus orchards or 26 out of 27), 45 peach (94% of the total peach orchards or 45 out of 48) and 17 apricot orchards (94% of the total apricot orchards or 17 out of 18).

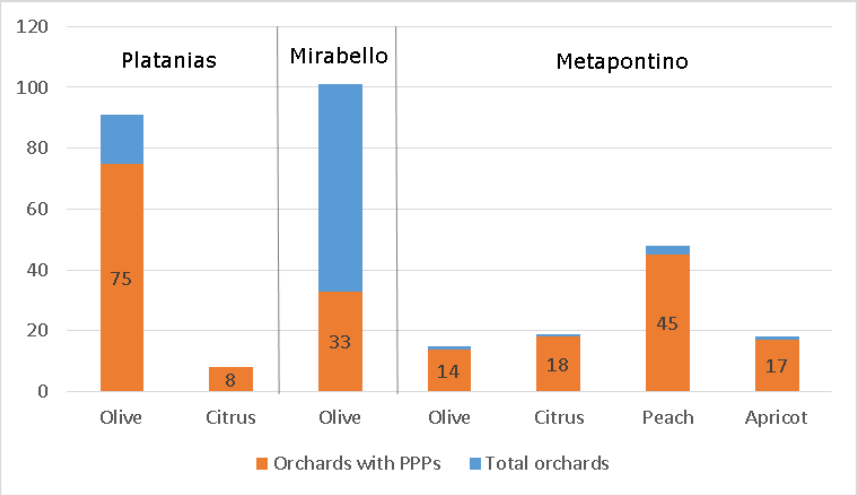

Fig. 2: Olive, citrus, peach and apricot orchards in the three pilot areas of Platanias, Mirabello and Metapontino in which PPPs are applied

Considering the data collected from Platanias and taking into account both Fig. 2 and Table 10, in 83 out of 99 (84%) orchards in the area PPPs were applied. From those 90% were olive orchards (75 out of 83) and 10% were citrus orchards (8 out of 83). As far as Mirabello is concerned PPPs were applied in 33% (33 out of 101) of the olive

orchards included in the project. In Metapontino pilot area PPPs were applied in 94% of the total orchards (94 out of 100) included in the project. From those 15% (14 out of 94) were olive, 19% (18 out of 94) were citrus, 48% (45 out of 94) were peach and 18% (17 out of 94) were apricot orchards.

Table 10: Application of Plant Protection Products in the three pilot areas

			Platanias	Mirabello	Metapontino
Total orchards			99	101	100
Orchards with applied PPPs			**83**	**33**	**94**
Olive trees	No of orchards		91	101	15
	Orchards with PPPs	Number	75	33	14
		%	**90%**	**100%**	**15%**
Citrus trees	No of orchards		8	-	18
	Orchards with PPPs	Number	8	-	18
		%	**10%**	**-**	**19%**
Peach trees	No of orchards		-	-	48
	Orchards with PPPs	Number	-	-	45
		%	-	-	**48%**
Apricot trees	No of orchards		-	-	18
	Orchards with PPPs	Number	-	-	17
		%	-	-	**18%**

Based on data provided by the farmers in the 1st AWMS forms and analyzing them in reference to the PPPs that are used per crop and pilot area a total of 40 PPPs were used (Fig. 3). From those 7 were used in Platanias, 3 in Mirabello and 25 in Metapontino. Also, there were 3 PPPs which were used both in Platanias and Mirabello areas, 1 PPP which was common in Mirabello and Metapontino and 1 PPP which was common in Platanias and Metapontino.

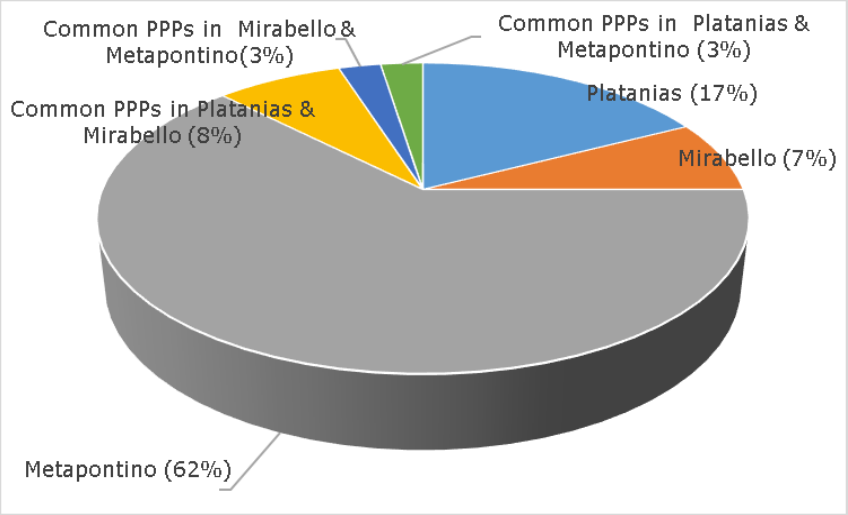

Fig. 3: PPPs used in Platanias, Mirabello and Metapontino area

Only 10% (4 out of 40, Fig. 4) of the total PPPs used in the three pilot areas consisted of substances that have been characterized as "priority substances" according to the European legislation. More specific, two active substances were detected as priority substances: "Chlorpyrifos-ethyl" and "Naphthalene" in the composition of four PPPs.

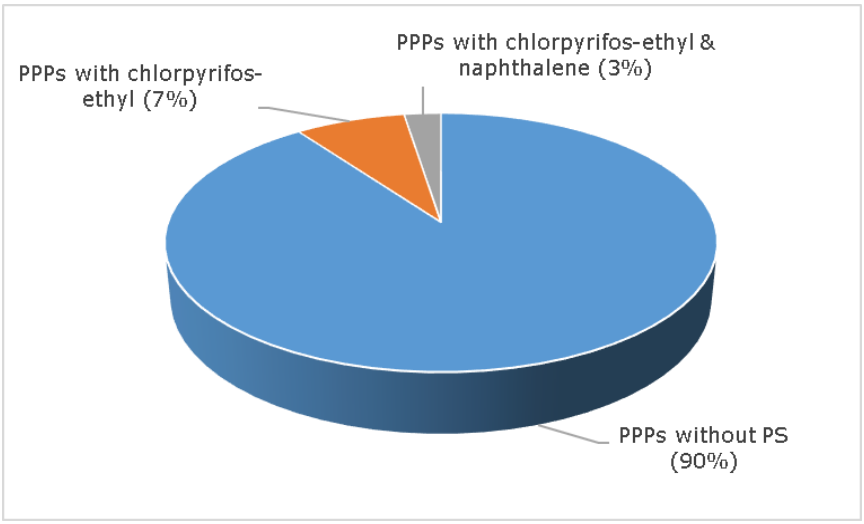

Fig. 4: PPPs used in three pilot areas and contain priority substances (PS)

Chlorpyrifos-ethyl is one of the main components of four PPPs (ZELIG, RELDAN, DURSBAN and PYRINEX). The above mentioned PPPs are utilized in all three pilot areas in a total of 59 orchards (olive, citrus and apricot).

DURSBAN and PYRINEX are used in Platanias in two and one orange orchard, respectively, while RELDAN is used in Mirabello in 3 olive orchards. As far as Metapontino area is concerned ZELIG is used in 12 citrus orchards, while RELDAN is used in 7 citrus and 36 apricot orchards.

On the other hand Naphthalene is the main components of RELDAN which is used only in Mirabello and Metapontino. In Mirabello, as it was mentioned above, RELDAN is used in three olive orchards while in Metapontino it is used in a total of 43 orchards, 7 of which are citrus and the other 36 are apricot orchards.

Table 11: PPPs per pilot area that contain either priority substances (PS) or specific pollutants (SP)

		Platanias		Mirabello	Metapontino		
PPPs		10		6	27		
PS1: PPPs with chlorpyrifos-ethyl		2		1			1
	Commercial name	DURSBAN 480 EC PYRINEX		RELDAN			ZELIG 480 EC
Orchards in which PS1 is used		Citrus		Olive	Citrus	Apricot	Citrus
	Number	3		3	7	36	12
PS2: PPPs with naphthalene		-		1			
	Commercial name			RELDAN			
Orchards in which PS2 is used				Olive	Citrus	Apricot	
	Number			3	7	36	
SP1: PPPs with Dimethoate		1			-		
	Commercial name	Rogor L 40 EC					
Orchards in which SP1 is used		Olive	Citrus	Olive			
	Number	47	3	10			
SP2: PPPs with Copper		1			-		
	Commercial name	Copper (containing in fungicides)					
Orchards in which SP2 is used		Olive	Citrus	Olive			
	Number	9	1	14			

As far as specific pollutants are concerned, according to Table 11, two specific pollutants according to Greek legislation (dimethoate and copper) were identified in the 10% (4 out of 40, Fig. 5) of the total PPPs which are used in the three pilot areas. Dimethoate (specific pollutant according to the European legislation) is one the main components of Rogor L 40 EC, which is used as insecticide both in Platanias and Mirabello. In Platanias it is used in 50 orchards, 47 of which are olive orchards and the other 3 are citrus orchards, while in Mirabello it is used in 10 olive orchards.

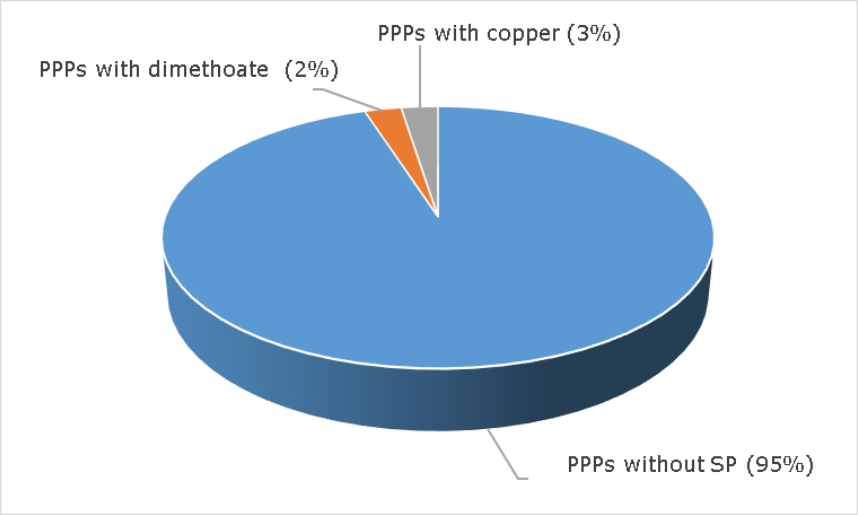

Fig. 5: PPPs used in the three pilot areas that contain specific pollutants (SP)

Copper (specific pollutant according to the European legislation) is used as insecticide both in Platanias and Mirabello. In Platanias it is used in 10 orchards, 9 of which are olive orchards and 1 is citrus orchard, while in Mirabello it is used in 14 olive orchards.
In the following paragraphs the classification of the PPPs used in the three pilot areas that cause either acute or chronic aquatic toxicity is presented. Based on the CLP (EC 1272/2008) labels of the products used in the three pilot areas 3 out of the 40 PPPs contain hazardous to the aquatic environment substances that cause acute aquatic toxicity.
In specific, the hazard statement H400 which means that the substance is "very toxic to aquatic life" is mentioned in the labels of DELAN and SIGNUM which are used as fungicides in the area of Metapontino and DURSBAN which is used as insecticide in the area of Platanias (Table 12 and Fig. 6).
In Platanias DURSBAN is used in 25% (2 out of 8) of citrus orchards which corresponds to 2% of the total orchards for which data was collected in this pilot area. As far as Metapontino is concerned H400 substances are used in 35% of the total orchards and only in peach, as DELAN is used in 14.6% (7 out of 48) and SIGNUM is used in 70.8% (34 out of 48) of peach orchards, respectively.

Table 12: PPPs classified as H400 per pilot area and crop

	PPPs with statement H400		**Orchards in which PPP with H400 is used**			**% of orchards in the pilot area**
	Number	**Commercial name of PPP**	**Crop**	**Number**	**% of similar orchards**	
Platanias	1	DURSBAN	Citrus	2	25.0	2.0
Metapontino	2	DELAN	Peach	7	14.6	35.0
		SIGNUM	Peach	34	70.8	

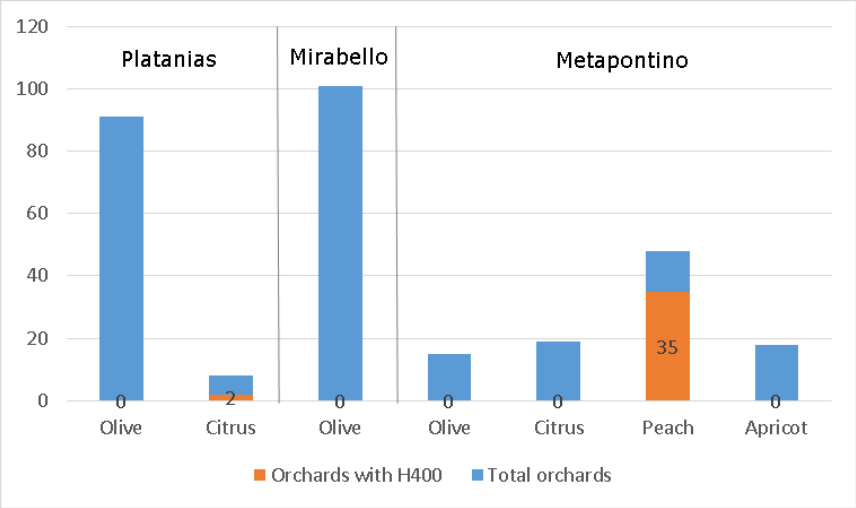

Fig. 6: Orchards in the three pilot areas in which PPPs classified as H400 are used

Also, the PPPs used in the three pilot areas fall into four categories (H410, H411, H412 & H413) that are hazardous to the environment as they cause chronic aquatic toxicity. 27 PPPs that used in the pilot areas classified as H410 which means that contain substances that are very toxic to aquatic life with long lasting effects (Table 13).

Table 13: PPPs classified as H410 per pilot area and crop

	PPPs with statement H410		Orchards in which PPP with H410 is used			% of orchards in the pilot area
	Number	Commercial name of PPP	Crop	Number	%	
Platanias	5	DECIS	Olive	21	23.1	47.5
			Citrus	1	12.5	
		PROTEUS	Olive	9	9.9	
		PYRETHRON	Olive	7	7.7	
		PYRINEX	Citrus	1	12.5	
		COPPER	Olive	9	9.9	
			Citrus	1	12.5	
Mirabello	3	RELDAN	Olive	3	3.0	19.8
		BULLDOCK	Olive	16	15.8	
		COPPER	Olive	14	13.9	
Metapontino	18	CALYPSO	Apricot	17	94.4	91.0
			Peach	2	4.2	
		CHORUS	Apricot	16	88.9	
		LASER	Peach	44	91.7	
		CUPRAVIT	Apricot	11	61.1	
			Peach	38	79.2	
		DELAN®	Peach	7	14.6	
		EPIK SL	Citrus	13	68.4	
		KARATE	Peach	35	72.9	
		Mezene	Peach	37	77.1	
		POLTIGLIA DISPERSS	Apricot	11	61.1	

		POMARSOL	Peach	38	79.2	
			Apricot	2	11.1	
		SIGNUM®	Peach	34	70.8	
		TREBON UP	Olive	4	26.7	
			Citrus	8	42.1	
			Apricot	14	77.8	
		VERTIMEC	Apricot	11	61.1	
			Peach	1	2.1	
			Citrus	14	73.7	
		ZELIG	Citrus	12	63.2	
		RELDAN	Peach	36	75.0	
			Citrus	7	36.8	
		PROTIL EC	Apricot	2	11.1	
		COBRE NORDOX	Citrus	2	10.5	
			Peach	7	14.6	
		PYRETHRUM NATURE	Olive	7	46.7	
			Peach	7	14.6	
			Citrus	2	10.5	

In total 5 PPPs that has been classified as H410, as they contain substances that are very toxic to aquatic life with long lasting effects (DECIS, PROTEUS, PYRETHRON, PYRINEX and COPPER) are used in the 47.5% (47 out of 99) of the total orchards of Platanias pilot area. 44.5% (or 44 out of 99) of them are olive orchards and the rest (3% or 3 out of 99) are citrus orchards. DECIS is used in 23.1% (21 out of 91) and 12.5% (1 out of 8) of olive and citrus orchards, respectively. PROTEUS and PYRETHRON are used in 9.9% (9 out of 91) and 7.7% (7 out of 91) of olive orchards of Platanias, respectively while PYRINEX is used in only one citrus orchard which accounts for 12.5% of citrus orchards in Platanias. COPPER (Cu containing in fungicides) is used in 9.9% (9 out of 91) and 12.5% (1 out of 8) of olive and citrus orchards, respectively.

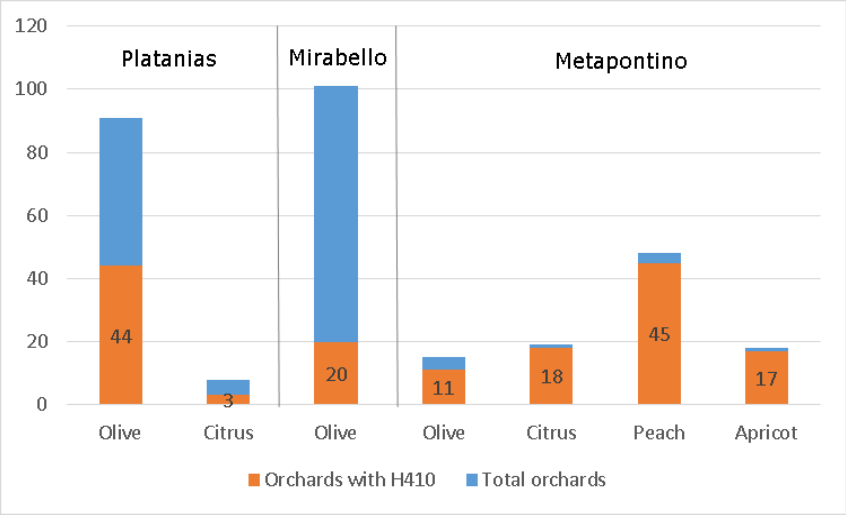

Fig. 7: Orchards in the three pilot areas in which PPPs classified as H410 are used

Mirabello is the only pilot area where substances which have been classified as H410 are less used, only in the 19.8% (20 out of 101) of the total orchards. Three PPPs (RELDAN, BULLDOCK and COPPER) which have been classified as H410 are used in this area. RELDAN is used in only 3% (3 out of 101), BULLDOCK is used in 15.8% (16 out of 101) and COPPER is used in 13.9% (14 out of 101) of olive orchards. In Metapontino, substances which have been characterized as very toxic to aquatic life with long lasting effects (H410) are used in the 91% (or 91 out of 100) of the total orchards. More specific, according to Fig. 7 they are used in 73.3% (11 out 15) of olive orchards, in 94.4% (17 out of 18) of apricot orchards, in 94,7% (18 out of 19) citrus orchards and in 93,8% (45 out of 48) of peach orchards.

The CLP label of 4 PPPs includes the hazard statement H411 which means that the product is toxic to aquatic life with long lasting effects (Table 14). ROUNDUP is commonly used both in Platanias and Metapontino area, while ROGOR is commonly used in Platanias and Mirabello. Fig. 8 represents the orchards where PPPs classified as H411 are used compared with the total orchards per crop per pilot area.

In Platanias two PPPs classified as H411 are used in the 62.6% of the total orchards of the pilot area. ROUNDUP is used in the 38.5% (35 out of 91) of olive orchards and 25.0% (2 out of 8) citrus orchards, while ROGOR is used in the 49.5% (45 out of 91) and 37.5% (3 out of 8) of olive and citrus orchards, respectively.

Table 14: PPPs classified as H411 per pilot area and crop

	PPPs with statement H411		Orchards in which PPP with H411 is used			% of orchards in the pilot area
	Number	Commercial name of PPP	Crop	Number	%	
Platanias	2	ROUNDUP	Olive	35	38.5	62.6
			Citrus	2	25.0	
		ROGOR	Olive	45	49.5	
			Citrus	3	37.5	
Mirabello	1	ROGOR	Olive	10	9.9	9.9
Metapontino	3	MOVENTO	Citrus	15	78.9	69.0
			Peach	36	75.0	

		TOPAS	Peach	36	75.0	
		ROUNDUP	Olive	2	13.3	
			Apricot	15	83.3	
			Peach	37	77.1	
			Citrus	11	57.9	

For one more time Mirabello is the only pilot area where PPPs classified as H411 are used in a small number of orchards, as ROGOR is used only in the 9.9% (10 out of 101) of the total olive orchards of this area.

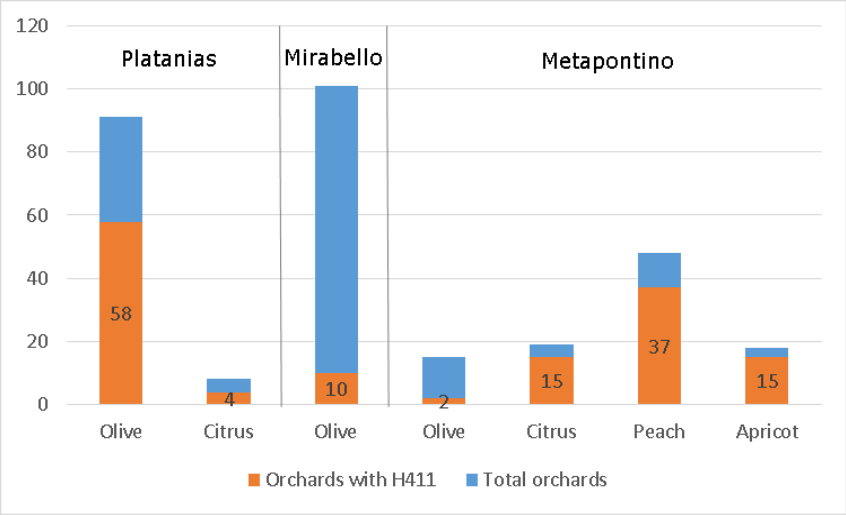

Fig. 8: Orchards in the three pilot areas in which PPPs classified as H411 are used

As far as Metapontino pilot area is concerned, 3 PPPs classified as H411 (MOVENTO, TOPAS and ROUNDUP) are used in the 69.0% of the total orchards of the area. MOVENTO is used in the 78.9% (15 out of 19) and 75.0% (36 out of 48) of citrus and peach orchards. TOPAS is used only in peach orchards (75.0% or 36 out of 48) while ROUNDUP is used in all crop types. More specific, ROUNDUP is used in the 83.3% (15 out of 18) of apricot orchards, in 77.1% (37 out of 48) of peach orchards, in 57.9% (11 out of 19) citrus orchards and only in 13.3% (2 out of 15) of olive orchards.

As it is shown in both Table 15 and Fig. 9, PPPs classified as H412 (Harmful to aquatic life with long lasting effects) are used only in Metapontino area. According to Table 15 only two PPPs (NIMROD and NEEMIK) are used in 64.0% of the total orchards of this pilot area. NIMROD is used in the majority of peach (79.2% or 38 out of 48) and apricot (94.4% or 17 out of 18) orchards, while NEEMIK is used in less peach (14.6% or 7 out of 48) and citrus (10.5% or 2 out of 19) orchards.

Table 15: PPPs classified as H412 per pilot area and crop

	PPPs with statement H412		Orchards in which PPP with H412 is used			% of orchards in the pilot area
	Number	Commercial name of PPP	Crop	Number	%	
Metapontino	2	NIMROD	Apricot	17	94.4	64.0
			Peach	38	79.2	
		NEEMIK	Peach	7	14.6	

			Citrus	2	10.5	

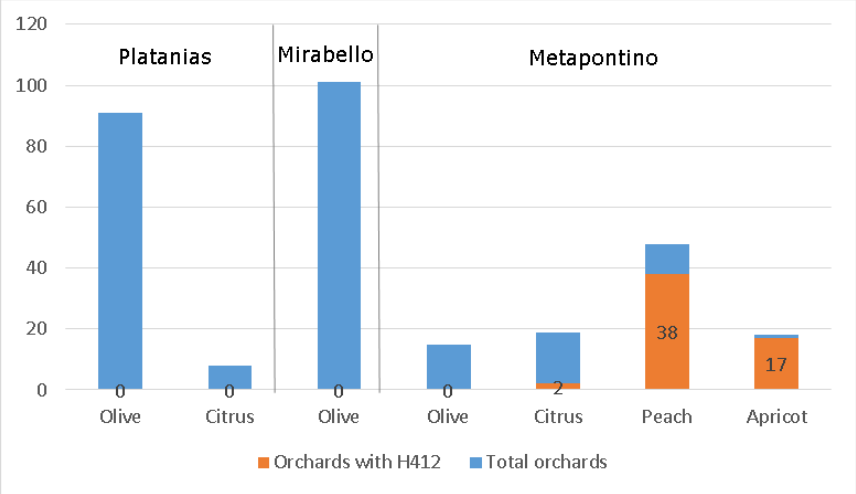

Fig. 9: Orchards in the three pilot areas in which PPPs classified as H412 are used

As far as PPPs classified as H413 are concerned, only two (ROUNDUP and DURSBAN) are used in the pilot areas (Table 16). In specific, ROUNDUP is commonly used both in Platanias and Metapontino area, while DURSBAN is used only in Platanias area.

Table 16: PPPs classified as H413 per pilot area and crop

	PPPs with statement H413		Orchards in which PPP with H413 is used			% of orchards in the pilot area
	Number	Commercial name of PPP	Crop	Number	%	
Platanias	2	ROUNDUP	Olive	35	38.5	39.4
			Citrus	2	25.0	
		DURSBAN	Citrus	2	25.0	
Metapontino	1	ROUNDUP	Peach	37	77.1	65.0
			Citrus	11	57.9	
			Apricot	15	83.3	
			Olive	2	13.3	

As it is shown in Fig. 10 in contrast to the Mirabello area, where none of the 101 olive orchards receive PPPs classified as H413, in Platanias and Metapontino such PPPs are used in the 39.4% and 65% of total orchards, respectively.

In Platanias, ROUNDUP is used in 35 out of 91 (or 38.5%) olive orchards and in 25% (2 out of 8) of citrus orchards, while DURSBAN is used only in 2 citrus orchards (25%). The main PPP classified as H413 in Metapontino pilot area is ROUNDUP. It is used in all types of crops and more specific in 83.8% (15 out of 18) of apricot orchards, in 77.1% (37 out of 48) of peach orchards, in 57.9% (11 out of 19) of citrus orchards and in 13.3% (2 out of 15) of olive orchards.

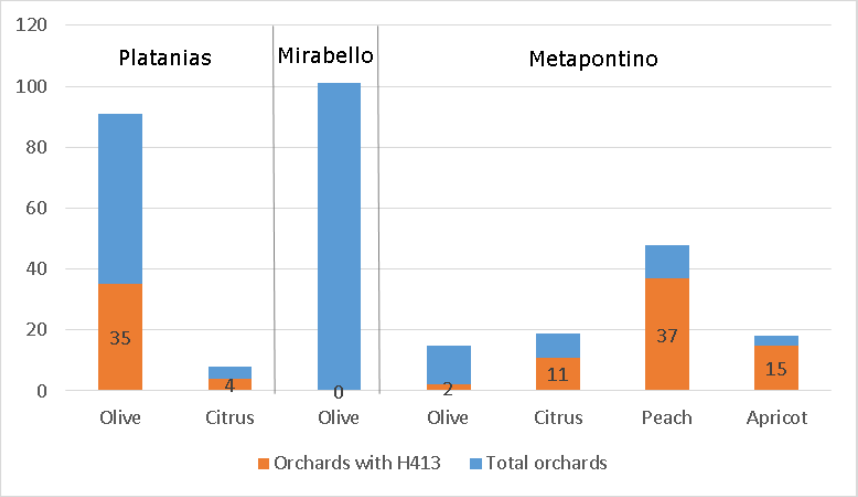

Fig. 10: Orchards in the three pilot areas in which PPPs classified as H413 are used

4.3 Fertilizers inventory and classification

Fertilizers are often classified into one of two types: inorganic (chemical) and organic. Inorganic fertilizers exclude carbon-containing materials except urea. Organic fertilizers are usually (recycled) plant- or animal-derived matter. Inorganic are sometimes called synthetic fertilizers since various chemical treatments are required for their manufacture.

While chemical fertilizers contain higher concentrations of nutrients, they contain fewer unneeded or harmful elements that can be found in organic fertilizers. Chemical fertilizers also enter into the soil more quickly than organic fertilizers because organic fertilizers have to wait for fungi and bacteria to break down the fertilizer.

Chemical fertilizers can be classified into the following three categories based on the type of nutrients contained in them:

- *Major/Primary/Macro*: Nitrogen (N), Phosphorous (P), Potassium (K)
- *Minor/Secondary*: Calcium(Ca), Magnesium(Mg), Sulfur (S), Sodium (Na)
- *Trace/Micro*: Boron (B), Cobalt (Co), Copper (Cu), Iron (Fe), Manganese (Mn), Molybdenum (Mo), Zinc (Zn)

Also, based on primary nutrients that are contained on the fertilizers they are classified as:

- *Straight fertilizers*: a nitrogenous, phosphatic or potassic fertilizer having a declarable content of only one of the primary nutrients
- *Compound fertilizers*: a fertilizer having a declarable content of at least two of the primary nutrients and obtained chemically or by blending or by a combination of both.

According to Greek National Legislation, fertilizers placed on Greek market fall into the following two categories:

a) EC fertilizers, according to Regulation (EC) No 2003/2003, and

b) "New type" fertilizers, that are placed on Greek market according to the provisions of M.D. 291180/11034/2002 (OJ 1274/B'/2002), as amended and in force.

As far as Italy is concerned, the categories of fertilizers placed on Italian market according to the National Legislation are:

a) EC fertilizers, according to the Regulation (EC) No 2003/2003, and

b) "National" fertilizers, that are placed on Italian market according to the D. Lgs. 29 April 2006, n. 217 "Revision of the legislation on fertilizers."

As mentioned before, Regulation (EC) No 2003/2003 details the conditions to meet in order to use the title EC fertilizers, as well as the provisions regarding their labelling and packaging. Requirements before placing fertilizers on the market stem also from CLP Regulation (EC 1272/2008), that was enacted to protect workers, consumers and the environment from the impacts of hazardous chemicals. CLP places a general obligation on all suppliers in the fertilizer supply chain to classify, label and package substances according to CLP requirements before placing them on the market.

The following 3 tables (Table 17 to Table 19) represent the main type of fertilizers and the % of their main nutrient elements utilized in the three pilot areas (Greece and Italy), based on the data provided by the farmers of pilot areas.

Table 17: Type and mineral elements (%) of fertilizers used in Platanias pilot area

Fertilizer	Mineral elements (%)							
	N	P_2O_5	K_2O	CaO	MgO	S/SO_3	Na_2O	B
Organic fertilizer 1	5	5	5					
Organic fertilizer 2	9	5	4					
Organic fertilizer 3	6	6	6					
Calcium ammonium nitrate	26	0	0	8				
Ammonium sulphate	21	0	0			24		
Potassium Sulphate	0	0	50			18		
Potassium Nitrate	13	0	46					
Urea	46	0	0					
Ammonium phosphate – sulphate	16	20	0			13		
Borax ($Na_2B_4O_7.10H_2O$)						15	16.5	11.5
Fertilizer 11-15-15	11	15	15					
Fertilizer 20-10-10	20	10	10			9		
OLIFERT 19-6-15	19	6	15		2	4		0.5
SOLINUR 20-20-20	20	20	20					
Fertilizer 21-7-14	21	7	14					
COMPLESAL 12-12-17	12	12	17		2			
COMPLESAL 12-8-16	12	8	16		3	10		0.02
COMPLESAL 18-6-12	18	6	12		2			0.25
HAIFA 18-8-18	18	8	18		2			
Fertilizer 15-15-15	15	15	15					

Table 18: Type and mineral elements (%) of fertilizers used in Mirabello pilot area

Fertilizer	Mineral elements (%)							
	N	P_2O_5	K_2O	CaO	MgO	S/SO_3	Na_2O	B
Organic fertilizer 1	5	5	5					
Organic fertilizer 2	7	0	0					10

Calcium ammonium nitrate	26	0	0	8				
Ammonium sulphate	21	0	0			24		
Ammonium sulphate +B	21	0	0					0.2
Borax						15	16.5	11.5
Fertilizer 11-15-15	11	15	15					
Fertilizer 15-5-12	15	5	12		2			0.2
Fertilizer 40-0-0	40	0	0			14.5		
Fertilizer 20-10-10	20	10	10			9		
Fertilizer 11-0-43	11	0	43					
ENTEC perfect 14-7-17	14	7	17		2	9		0.02

Table 19: Type and mineral elements (%) of fertilizers used in Metapontino pilot area

Fertilizer	**Mineral elements (%)**							
	N	**P_2O_5**	**K_2O**	**CaO**	**MgO**	**S/SO_3**	**Na_2O**	**B**
Nitrophoska Gold	15	9	15					
Fertilizer 20-20-20	20	20	20					
Calcium Nitrate	16	0	0	26				
Fertilizer 12-12-17	12	12	17					
Fertilizer 20-10-10	20	10	10					
Ammonium Sulphate	21	0	0					
Green Go	12	8	24	10				
Nov@ GR			5					
Urea Sulfate	29	0	0					
Stallatico	2	2	2			21		
Urea Phosphate	18	44	0			21		
Potassium Nitrate	13	0	46			21		
Nitrophoska Perfect	15	5	20		2	8		0.02
Green Go	12	20	30					
Stallatico	3	3	3			21		
Azocor 105	10.5	1.2	1			21		
Boroplus					11	21		
Nitrophoska® super 20+5+10	20	5	10		3	12.5		
Entec 20+5+10	20	5	10					
TIOFERTIL	10					44		
FERTIL 12,5	12.5							

4.4 Data Analysis

218 (72.6%) out of the 300 orchards that included in this study are fertilized. From those 126 are olive orchards (61% of the total olive orchards), 27 citrus orchards (100% of the total citrus orchards), 47 peach (98% of the total peach orchards) and 18 apricot orchards (100% of the total apricot orchards).

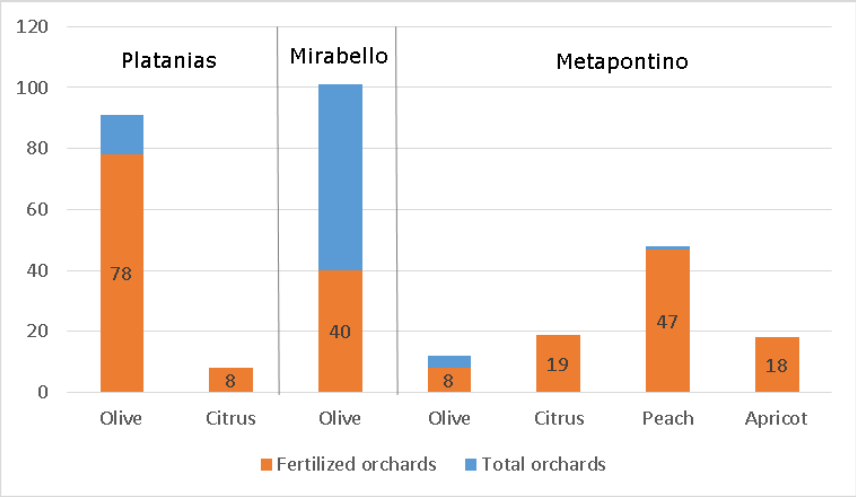

Fig. 11: Fertilized olive, citrus, peach and apricot orchards in the three pilot areas of Platanias, Mirabello and Metapontino

Considering the data collected from Platanias and taking into account both Fig. 11 and Table 20, 86 out of 99 (87%) orchards in the area were fertilized. From those 91% were olive orchards (78 out of 86) and 9% were citrus orchards (8 out of 86). As far as Mirabello is concerned 40% (40 out of 101) of the olive orchards included in the project were fertilized. In Metapontino pilot area 92% of the total orchards (92 out of 100) were fertilized. From those 8.7% (8 out of 92) were olive, 20.7% (19 out of 92) citrus, 51.1% (47 out of 92) peach and 19.6% (18 out of 92) apricot orchards.

Table 20: Fertilized orchards, total orchards and % of total fertilized orchards per pilot area and crop

			Platanias	Mirabello	Metapontino
Total orchards			99	101	100
Number of Fertilized Orchards			**86**	**40**	**92**
Olive trees	Number of Orchards		91	101	15
	Fertilized orchards	Number	78	40	8
		%	**91%**	**40%**	**8.7%**
Citrus trees	Number of Orchards		8	-	19
	Fertilized orchards	Number	8	-	19
		%	**9%**	**-**	**20.7%**
Peach tress	Number of Orchards		-	-	48
	Fertilized orchards	Number	-	-	47
		%	-	-	**51.1%**
Apricot tress	Number of Orchards		-	-	18
	Fertilized orchards	Number	-	-	18
		%	-	-	**19.6%**

A total of 37 fertilizers (Fig.12) are applied in Platanias (35.1% or 13 out of 37 fertilizers), Mirabello (16.2% or 6 out of 40 fertilizers) and Metapontino (48.6% or 18 out of 37 fertilizers) areas. Also, there are 4 fertilizers (10.8%) that are commonly used in Platanias and Mirabello, 2 (5.4%) in all the three pilot areas and 1 (2.7%) in Platanias and Metapontino area.

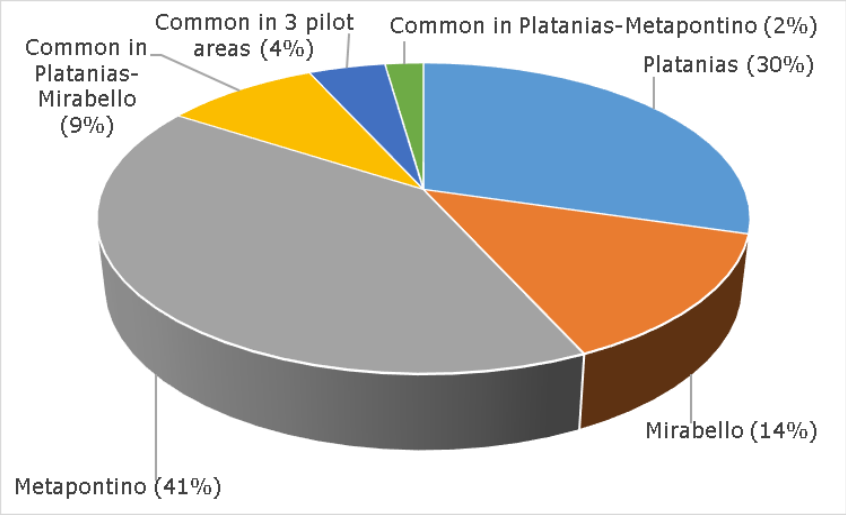

Fig.12: Fertilizers used in three pilot areas

As it has already been mentioned in deliverable C2 "Assessment of water efficiency by the participant F.ORs before LIFEAgroClimaWater" (part B), in Platanias area 20 distinct types of fertilizers are applied. The 85% of them (17 out of 20) are inorganic while the rest of them (15% or 3 out of 20) are composite organic fertilizers. From the total of 20 fertilizers applied, 80% are compound/ multinutrient fertilizers (NP, NK or NPK), while 20% of them (4 out of 20) are straight fertilizers (N, P or K). In general, the 70% (14 out of 20) of the applied fertilizers are characterized by low concentrations (less or equal to 20%) of primary and secondary nutrients. Borax was the only fertilizer used for the application of a micronutrient in high quantities, due to the importance of B in olive tree nutrition. It is applied in 15 out of 91 (16.5%) of olive orchards but in small typical dosages per tree and per year and thus the potential environmental risk linked to its use is relatively low.

Table 21: Data analysis of the applied fertilizers in the three pilot areas

Fertilizers	Platanias		Mirabello		Metapontino	
	Number	%	Number	%	Number	%
Total	20	-	12	-	21	-
Organic	3	15	2	17	0	0
Inorganic	17	85	10	83	21	100
Compound	16	80	6	50	14	67
Straight	4	20	6	50	6	29
With less than 20% concentrations of nutrient	14	70	7	58	16	76

As far as Mirabello area is concerned 12 distinct types of fertilizers are applied. The 83% of them (10 out of 12) are inorganic while the rest of them (17% or 2 out of 12) are composite organic fertilizers. Also, from the total of 12 fertilizers half of them are compound/ multinutrient fertilizers (NP, NK or NPK) and half of them are straight fertilizers (N, P or K). In general the 58% (7 out of 12) of the applied fertilizers are characterized by low concentrations (less or equal to 20%) of primary and secondary nutrients. Borax was the only fertilizer used for the application of a micronutrient in high quantities, due to the importance of B in olive tree nutrition. It is applied in 1 out of 101 (1%) of olive orchards and in small typical dosages and as a result the possible environmental risk linked to its use is relatively low.

In Metapontino area the situation is quite different. 21 distinct types of fertilizers are applied in the area and all of them are inorganic. Also, from the total of 21 fertilizers the 67% (14 out of 21) of them are compound/ multinutrient fertilizers (NP, NK or NPK) and the 29% (6 out of 21) are straight fertilizers (N, P or K) and in general the 76% (16 out of 21) of the applied fertilizers are characterized by low concentrations (less or equal to 20%) of primary and secondary nutrients.

Although the majority of the applied fertilizers in all three pilot areas are characterized by low nutrient concentrations and as a result low environmental risk, the excess fertilization can cause eutrophication of surface water bodies and specifically pollution caused by nitrates and phosphorus. Eutrophication results in the excessive growth of aquatic plant life, depletion of dissolved oxygen thus suffocating fish and other animal life. The combination of the above and ANNEX VIII of WFD according to which substances which contribute to eutrophication (in particular, nitrates and phosphates) are considered to be Main Pollutants leads to the conclusion that all fertilizers utilized in the three pilot areas (as they contain nitrates and/or phosphorus) are considered as Main Pollutants. In groundwater, nitrates pollution causes the accumulation of high concentration of nitrates in water, compromising the quality of water and resulting in water not suitable for drinking.

To identify substances that are considered as hazardous to the aquatic environment for every fertilizer listed by farmers in the 1st AWMS form, the respective trade name, the composition of each fertilizer and the European Chemicals Agency database were used.

Based on the analysis and according to the classification provided by companies to ECHA in REACH registrations and CLP notifications the majority of the utilized substances cause both physical hazards (flammable solid, heating may cause an explosion, self-heating, may cause fire or explosion, contains gas under pressure; may explode if heated etc.) and health hazards (fatal/toxic if swallowed, serious eye damage, damage to organs through prolonged or repeated exposure, may cause respiratory irritation, genetic defects and cancer etc.).

These substances are in most cases not hazardous for the aquatic environment, when utilized properly. The only exception is the Ammonium Sulphate, utilized in all three pilot areas, as the classification provided by companies to ECHA in CLP notifications identifies that this substance is toxic to aquatic life with long lasting effects (H411).

Ammonium Sulphate is applied in Greece only in olive orchards, while in the Italian pilot area this fertilizer is used only in citrus orchards (Fig. 13). More in specific, in Platanias and Mirabello pilot areas it is applied in 11% (10 out of 91) and 7.9% (8 out of 101) of olive orchards, respectively, while in Metapontino area it is utilized in 36.8% (7 out of 19) of citrus orchards.

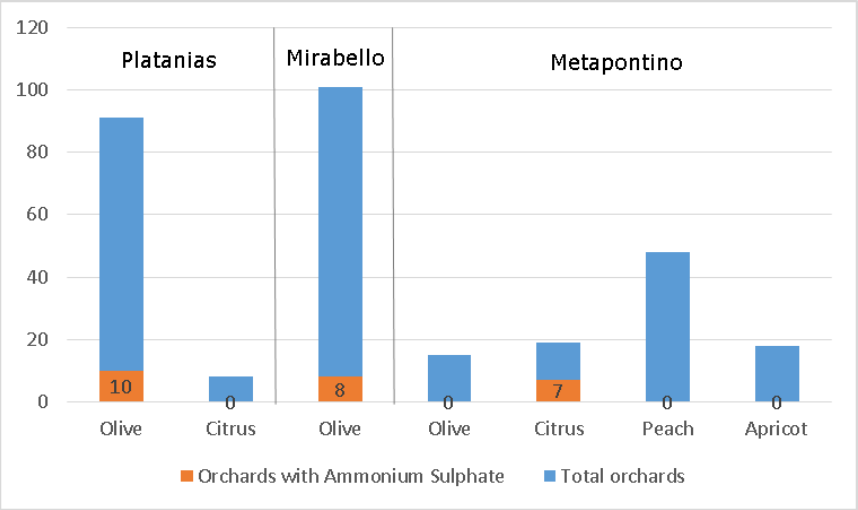

Fig. 13: Orchards in the three pilot areas in which Ammonium Sulphate is utilized

Moreover, substances that have been characterized as specific pollutants according to the Greek legislation have been detected among the main components of the fertilizer "SOLINUR 20-20-20". SOLINUR 20-20-20 contains both Molybdenum (Mo) and Zinc (Zn) and it is utilized in 11% (10 out of 91) of olive and in 12.5% (1 out of 8) citrus orchards in Platanias pilot area.

5 CONCLUSIONS

Summing up the following results were derived from the previous analysis:

Plant protection Products used in the AgroClimaWater registered orchards

- In the 70% (210 out of 300) of the total orchards included in this study PPPs were applied. From those, 122 are olive orchards (58.9% of the total olive orchards or 122 out of 207), 26 are citrus orchards (96.3% of the total citrus orchards or 26 out of 27), 45 peach (94% of the total peach orchards or 45 out of 48) and 17 apricot orchards (94% of the total apricot orchards or 17 out of 18).
- Only 10% (4 out of 40) of the total PPPs used in the three pilot areas consisted of substances that have been characterized as "priority substances" according to the European legislation. More specific, two active substances were detected in the composition of PPPs as priority substances: "Chlorpyrifos-ethyl" and "Naphthalene". 4 PPPs containing *Chlorpyrifos-ethyl* are utilized in all three pilot areas in a total of 61 orchards (olive, citrus and apricot) while 1 PPP containing *Naphthalene* is used in 3 olive orchards in Mirabello and in 43 orchards in Metapontino, 7 of which are citrus and the other 36 are apricot orchards.
- As far as specific pollutants are concerned, according to European legislation, two specific pollutants, dimethoate and copper, were identified in the 5% (2 out of 40) of the total PPPs which are used in the three pilot areas. *Dimethoate* is one the main components of a PPP, which is used as insecticide both in Platanias and Mirabello. In Platanias it is used in 50 orchards, 47 of which are olive orchards and the other 3 are citrus orchards, while in Mirabello it is used in 10 olive orchards. *Copper* is used as insecticide both in Platanias and Mirabello. In Platanias it is used in 10 orchards, 9 of which are olive orchards and 1 is citrus orchard, while in Mirabello it is used in 14 olive orchards.
- Finally, based on the CLP (EC 1272/2008) labels of the products used in the three pilot areas, the 70% of the used PPPs (28 out of 40) contain hazardous to the aquatic environment substances that cause acute or chronic aquatic toxicity. In the 65% (196 out of 300) of the registered orchards such kind of PPPs are used.

Fertilizers used in the AgroClimaWater registered orchards

- The 218 (72.6%) out of the 300 orchards that included in this study are fertilized. From those 126 are olive orchards (61% of the total olive orchards), 27 citrus orchards (100% of the total citrus orchards), 47 peach (98% of the total peach orchards) and 18 apricot orchards (100% of the total apricot orchards).
- A total of 37 types of fertilizers are applied in the pilot areas. In Platanias area 20 distinct types of fertilizers are applied. The 85% of them (17 out of 20) are inorganic while the rest of them (15% or 3 out of 20) are composite organic fertilizers. In Mirabello area 12 distinct types of fertilizers are applied. The 83% of them (10 out of 12) are inorganic while the rest of them (17% or 2 out of 12) are composite organic fertilizers. In Metapontino area 21 distinct types of fertilizers are applied and all of them are inorganic.
- The substances used in the fertilizers are in most cases not hazardous for the aquatic environment, when utilized properly. The only exception is the *Ammonium Sulphate*, utilized in all three pilot areas, as the classification provided by companies to ECHA in CLP notifications identifies that this substance is toxic to aquatic life with long lasting effects (H411). Ammonium Sulphate is applied in Greece only in olive orchards, while in the Italian pilot area this fertilizer is used

only in citrus orchards. More in specific, in Platanias and Mirabello pilot areas it is applied in 11% (10 out of 91) and 7.9% (8 out of 101) of olive orchards, respectively, while in Metapontino area it is utilized in 36.8% (7 out of 19) of citrus orchards, meaning 8% of the total registered orchards.

- Substances that have been characterized as specific pollutants according to the Greek legislation have been detected among the main components of one fertilizer that contains both Molybdenum (Mo) and Zinc (Zn) and it is utilized in 11% (10 out of 91) of olive and in 12.5% (1 out of 8) citrus orchards in Platanias pilot area.

6 References

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