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Survey on orchard management practices applied in two olive growing areas of Crete, as compared to the approach proposed by LIFE AgroClimaWater project



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Introduction

The project LIFE AgroClimaWater aims to promote water efficiency and support the shift towards climate resilient agriculture in Mediterranean countries, through the development of water management adaptation strategies, in three Farmer's Organizations (FORs) in two areas of Crete, Greece (Platanias and Merabello) and one in Basilicata, Italy (Metapontino). Important part of the project is governance actions that need to take place in FORs in order to achieve equitable and transparent water governance. At the same time, demonstration practices at local farms will take place in order to promote practices that, in the long run, will enhance water use efficiency, by improving water storage and reducing water losses at farm scale. More information about activities of LIFE AgroClimaWater project could be found at the website: www.lifeagroclimawater.eu

Although several tree crops are included in the project actions (olive, citrus, peach, apricot), the focus in Cretan pilot sites is given to olive trees, due to the importance of the crop for the area and the degree of impact that possible ameliorations may have. A set of agricultural practices has been proposed for application in pilot olive orchards in both Cretan sites. Key aims include: increase of soil organic matter (application of compost, shredding of pruned wood), maintain and enrich existing flora during winter time (weed conservation and cover crops), reduce evapotranspiration losses (mulching, winter and summer pruning and summer application of kaolin), apply deficit irrigation based on actual crop water needs and use of fertigation and foliar application of mineral nutrients in order to develop a fertilizing strategy according to the specific climate conditions of each growing season.

At the early stages of the project, a recording of the current status in local olive orchards took place in both pilot areas, as related to application of proposed practices. In total, 101 olive orchards in Merabello and 91 in Platanias were included in the survey. The results for the two areas are reported below.

Table 1. Recording on number of orchards as related to application of different agricultural practices in Platanias pilot area

Parameter	All orchards	Conventional	Organic	Irrigated	Rainfed
Number of orchards	91	75	16	47	44
Soil cultivation applied	17	14	3	9	8
Weed mowing	50	34	16	21	29
Use of cover crops	0	0	0	0	0
Grazing	0	0	0	0	0
Pruning applied	91	75	16	47	44
Summer pruning	0	0	0	0	0
Burning of prunings	79	69	10	41	38
Shredding of prunings	12	6	6	6	6
Use of kaolin	0	0	0	0	0
Fertigation	0	0	0	0	0
Application of organic material	11	5	6	1	10

Table 2. Recording of irrigation water use and irrigation events in Platanias area

Parameter	Average value	Max value	Min value
Water use (mm/year)	63	334	17
Number of irrigation events/ year	2	10	1

Survey results for Platanias

The vast majority of the orchards were fully productive, with only 5 of them including trees less than 15-years-old and none of them with trees less than 5-years-old. The mean reported annual productivity of the orchards was 7,85 tn of fruit per ha, which is considered reasonable. Irrigated orchards had a mean annual yield of 8,25 tn/ha, which, as expected, was higher than that of rainfed orchards (7,41 tn/ha), but not as high (in average values) as the typical productivity of a fully irrigated orchard. The mean reported density was 210 trees/ha, which is also considered as typical for the area, although there was not an expected differentiation on planting densities among irrigated and non-irrigated orchards.

Soil cultivation was applied once per year to 17 orchards (18.7%), a practice that, depending on the slope of the area, may have a negative impact on soil erosion and soil fertility. Weed mowing was applied once or twice per year in 50 orchards (54.9%), while cover crops were not grown during winter in none of the orchards. Pruning is a typical practice applied in all orchards once per year (winter time). However, no summer pruning is applied in the area, in contrast to other olive growing areas in Greece. Considering the management of pruning wood, burning is the practice applied by the vast majority of farmers, with 82.4% burning it at the orchard and 4.4% use it for heating (fireplace). Shredding of prunings and dispersion to the orchard is limited to 13.1% of the orchards. Therefore, a potential source of organic material that could be used for mulching and for increasing soil organic matter is wasted in 86.9% of the orchards. Considering the application of organic material from external sources, this is also quite low in olive orchards, with manure applied in only 8 orchards (8.8%) and compost in 3 (3.3%) of them. It is worth mentioning that manure and compost application is at low percentages even in organic orchards, with 3 cases in 16 orchards for each material, i.e. a percentage of 18.7%. Concerning the irrigation of olive orchards, the provided data present a significant deviation from what is considered as typical irrigation water requirements for olive trees in the area. Depending on climatic factors, full irrigation of olive orchards in North-Western Crete typically requires 228-270 mm of water. However, according to farmers' interview data, the average annual application of irrigation water was only 63 mm, ranging from 17 to 334 mm. The distribution of reported values was skewed towards the lower end, with 40 out of 47 orchards (85%) reporting an average application of less than 100 mm of water per year. Therefore, the reported values were lower, even from a deficit irrigation schedule. Reducing the irrigation water amounts under this scheme is not possible and only interventions on timing and amount of water per irrigation could be applied.

Table 3. Recording on number of orchards as related to application of different agricultural practices in Merabello pilot area

Parameter	All orchards	Conventional	Organic	Irrigated	Rainfed
Number of orchards	101	90	11	13	88
Soil cultivation applied	12	11	1	0	12
Weed mowing	46	39	7	10	36
Use of cover crops	6	5	1	0	6
Grazing	23	19	4	3	20
Pruning applied	74	65	9	10	64
Summer pruning	0	0	0	0	0
Burning of prunings	67	64	3	10	57
Shredding of prunings	2	1	1	0	2
Use of kaolin	1	0	1	0	1
Fertigation	0	0	0	0	0
Application of organic material	3	3	0	1	2

Table 4. Recording of irrigation water use and irrigation events in Merabello area

Parameter	Average value	Max value	Min value
Water use (mm/year)	271	625	60
Number of irrigation events per year	5.6	8	3

Survey results for Merabello

The vast majority of the orchards were fully productive, with 49 of them being more than 50-years-old, therefore increasing the average tree age for the area to 82 years. The mean reported annual productivity of the orchards was 4.6 tn of fruit per ha, which is significantly lower than that of Platanias, but reasonable given the low water availability and the drier climatic conditions of Eastern Crete. This is highlighted by the fact that irrigated orchards had a higher mean annual yield (5.6 tn/ha), as compared to rainfed orchards (4.5 tn/ha).

Soil cultivation was applied once per year or every 2 to 3 years to 12 orchards (11.9%). Apart from the fact that soil cultivation may have a negative impact on soil erosion and soil fertility, the periodical application may destroy the active part of the root system increasing tree water stress. Weed mowing was applied once per year in 46 orchards (45.5%), while the use of cover crops during winter was only applied in 6 orchards (5.9%). A positive fact is that chemical control of weeds was limited to 2 orchards (2%), while grazing by livestock was applied in a significant percentage of orchards (22.7%), in contrast with the typical situation in Western Crete. A significant differentiation, as compared to Platanias area, is that pruning is only applied to 73.3% of the orchards, while in 39.6% of them pruning is applied periodically and not on an annual basis. In all cases, no summer pruning was applied in the area. In the majority of cases (67 out of 74 orchards, or more than 90%) prunings were burned in the field. Shredding of pruned wood was reported in only 2 orchards (2%). Considering the application of organic material from external sources, this is also quite low, with manure applied in only 3 orchards. It is worth mentioning that manure was not applied in organic olive orchards.

As compared to the data reported by farmers in the area of Platanias, the Merabello data are definitely closer to the actual olive tree irrigation requirements in the area of Crete. Actual irrigation water requirements are higher in Eastern Crete due to significantly lower precipitation as compared to the North-Western part of the island. A rough estimate, since there is no availability of experimental data, would be around 300 mm of water, the upper limit set by the Decentralized Administration of Crete. According to farmers' interviews, the average annual application of irrigation water was 271 mm, but ranging from 60 to 625 mm. Application rates above 600 mm are definitely beyond the actual crop requirements. Application rates per event seemed to be higher than recommended and this is probably due to farmer's approach to leach salts, since irrigation water quality in this area is low.

Conclusions

Despite the fact that the proposed cultural practices by AgroClimaWater are well-proved within the scientific community, their acceptance and application by farmers is still ranging in very low percentages. Indicatively, winter pruning is applied at a rate of only 45% in Merabello, while the rate of summer pruning is zero in both regions. Application of mulching ranges between 2-13%, use of organic matter at 3-12% and the application of cover crops at 0-6% in the two pilot areas. There was no olive grower applying fertigation, while olive orchards with no application of fertilizers reached 23% in Platanias and 66% at Merabello areas. Concerning the irrigation strategy followed, all farmers irrigate empirically, with average annual irrigation water consumption much lower than the typical olive crop requirements. However, the quantities of water per irrigation event are higher than the indicated and in combination with the application of irrigation in periods that are not critical for the crop, leads to a non-proper use of water.

From the above-mentioned, it can be concluded that resources management and yield of olive orchards, in the two pilot areas, can be optimizing by adopting an alternative scheme of orchard management.

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