The effectiveness of soil moisture in the cultivation of olive trees

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INTRODUCTION

Olive tree cultivation is considered to have a great economic and social importance for Greece. More than 130 million of olive trees have been cultivated up to now for the production of oil and table olives.

Greece can be characterized as a water limited region and as a part of the Mediterranean area is extremely vulnerable to erosion due to long and intense dry periods and the high frequency of heavy erosive rainfalls that cause extensive soil losses. The high fruit harvesting costs and the low yields are the main problems coming up from olive cultivation in Greece. There are a lot of factors that have a limiting effect on olive oil yields and are related to low fruit set (often leading to total barrenness), such as the lack of low temperatures in winter, the existence of various pests and diseases, incomplete flowering, poor plant nutrition, lack of soil moisture etc.

The aim of this paper was to explore the top soil moisture dynamics in Mediterranean olive trees rhizosphere and the consequent effects on yield. Measurements of soil moisture and olive fruit yield are assessed comparatively.

MATERIALS AND METHODS

The present study was implemented in two areas of Greece, Merambello in eastern Crete with arid Mediterranean climate and the Trifilia in south west Peloponnese with wet Mediterranean climate. The soil moisture was systematically monitored at monthly intervals in twelve fields at each area, for a three years period (2013 – 2015). For each area, six of the monitored fields were irrigated and six rainfed groves were employed. Soil samples of every field were collected and analyzed their structure. Soil samples for Merambello area were classified as medium and less of them as heavy soil and for Trifilia as medium soil according to the textural triangle of the United States Department of Agriculture.

Soil moisture was systematically monitored using the measurement system with HH-2 device and PR-2 sensors. Special pipelines had to be placed into the ground. Three pipelines were placed in each selected field and soil moisture has been monitored at monthly or half-month intervals, in depths 0-10 cm, 10-20 cm, 20-30 cm and 30-40 cm from the soil surface. The slope of the fields was light and the tubes were placed under the canopy of trees, at 3/4 of the canopy radius from the trunk and at representative points of the field in terms of crop growth.

RESULTS AND DISCUSSION

The soil moisture in root zone is presented for two periods every year, one period is from May to October (dry period requiring irrigation) and the other from November to April (rainfall period) in figures 1 and 2.

The time period of May to October was selected, because it is dry period and required irrigation. The difference of average soil moisture values is 3% approximately. This difference between two areas is explained because in Trifilia there is higher all year precipitation as well as more available water for irrigation and the usage is significantly cheaper.

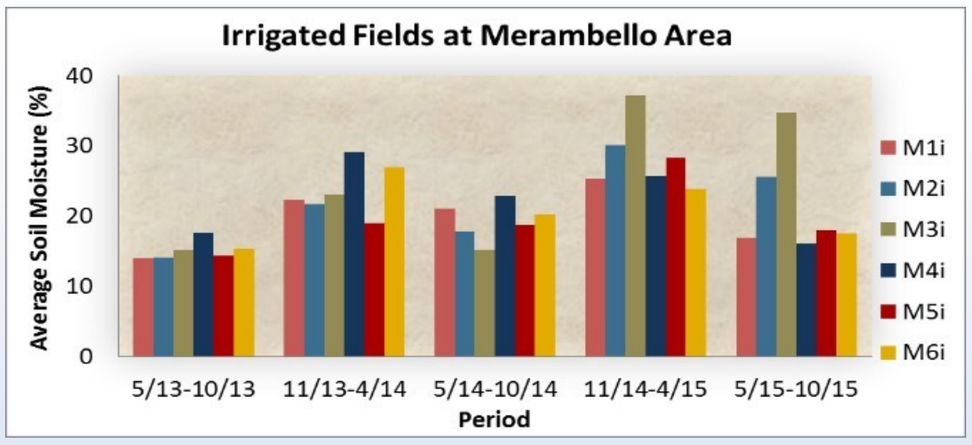
The second period (November to April) was selected, because it is a rainfall period and olives are not irrigated. So the average soil moisture values are similar. The soil moisture is higher in Trifilia area than Merambello due to the different climate conditions.

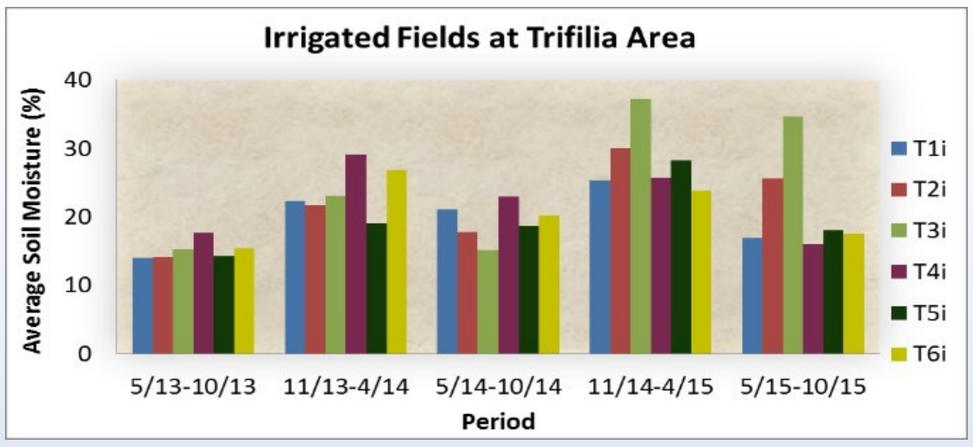
The average of soil moisture in Trifilia area was about 30% in examined period, 22% to 23% in summer period and 37% to 40% in winter period at irrigated fields and 27% in examined period, 18% to 22% in summer period and 37% to 39% in winter period at rainfed fields. Additionally, the average of soil moisture in Merambello area was about 21% in examined period, 15% to 21% in summer period and 24% to 28% in winter period at irrigated fields and 20% in examined period, 15% to 20% in summer period and 23% to 27% in winter period at rainfed fields.

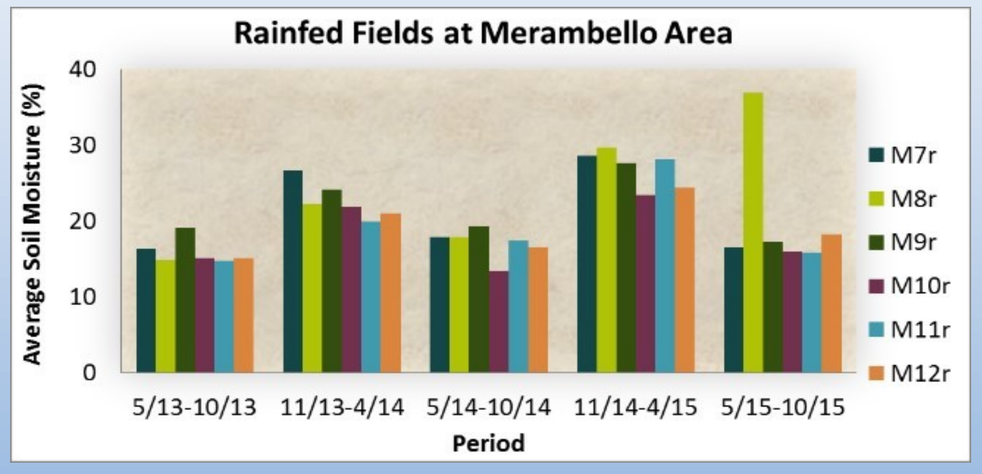
The production was extremely low at Merambello area in 2013. This year low fruit set and an intense shotberries incidence was recorded and this resulted in total loss of the crop. The production in fruit was almost the same in both irrigated and rainfed fields during the other years. The production of olive fruit in Trifilia was higher in irrigated than in rainfed fields.

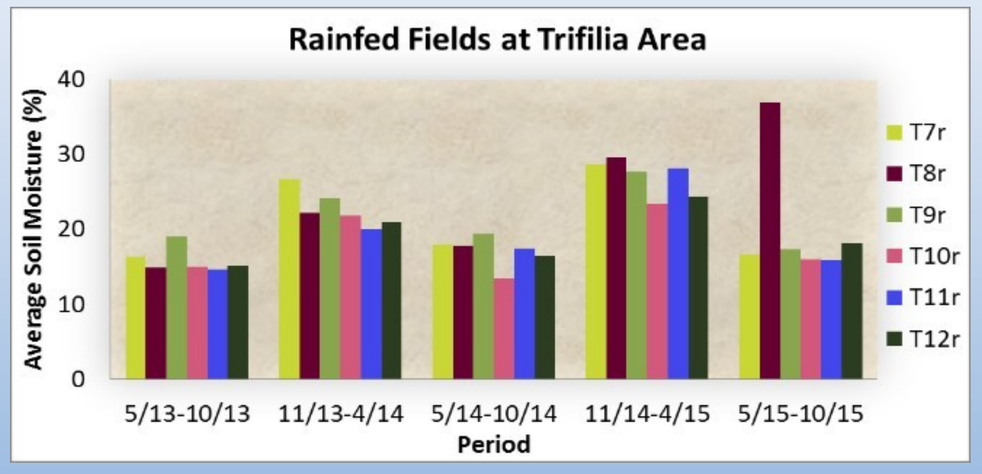
Table 1. Average values of olive fruit yield per tree at examined areas

	Merambello olive fruit (Kg)/tree			Trifilia olive fruit (Kg)/tree		
	2013	**2014**	**2015**	**2013**	**2014**	**2015**
Irrigated Fields	0.00	18.17	9.13	25.46	37.04	34.51
Rainfed Fields	0.00	20.53	8.16	24.49	28.49	39.42









CONCLUSIONS

The cultivation of olive trees has better production in areas with wet Mediterranean climate relative to arid Mediterranean climate due to increased soil moisture throughout the year. Significant difference in fruit yields was not observed between irrigated and rainfed fields in areas where systematic irrigation is not applied during summer, irrespectively of production year. The relation between efficiency of olive fruit production and soil moisture (winter and irrigation period) requires deeper and time consuming study in order to reach definite conclusions. Also, the quantity and quality of the olive fruit between irrigated and rainfed fields should be studied.

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