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EFFECTS OF COMMON VETCH (*Vicia Sativa L.*)GREEN MANURE APPLICATION ON OLIVE YIELD AND SOME SOIL PHYSICAL PROPERTIES UNDER ARID CONDITIONS

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***Abstract*—Organic fertilizers can be increased crop yield and significantly improved the soil physical conditions in dry farming. Green fertilization can be best way for increase olive yield under arid conditions. In this study, different doses common vetch and barley mixtures were applied. Green fertilizer application doses effects were determined on porosity, soil organic matter, soil moisture and yield per tree in 0-30 and 30-60 cm soil depth that is olive farmers' soil tillage depth. The findings compared with conventional application; 10kg common vetch+6kg barley mixture was determined the most suitable dose for olive green fertilization. Soil organic matter and olive yield statistically increased with increasing green manure doses. Green fertilization increased both olive yield and soil organic matter content compared to control application under rain-fed, dry conditions. Soil moisture was increased statistically significant compared to control in soil layers after green fertilizer application. According to the average soil moisture, the lowest soil moisture was obtained in conventional application with 15.89%, while the highest soil moisture was obtained in 15kg with+9kg barley application with 23.15% in 0-30cm soil depth. While the highest total porosity was obtained in highest dose fertilizer application with %49.57, the lowest value was obtained in conventional olive production with 36.12 %. Green manure has improved soil physical conditions and increased olive yield.**

Keywords—Green fertilization, soil porosity, soil moisture, organic matter, olive yield.

I. Introduction

Olive is the most important agricultural product in the southeastern Anatolia region in our country. Kilis olive oil variety has unique features grown in Kilis city in Turkey. It has thin crust, small kernel and very high 35% olive oil content; it is very valuable in terms of flavor and taste in our region. Kilis oil olive produced 30 000 hectares in Kilis that it has bunch form fruit and low acid ratio it's another features from the others. It is resistant to dry conditions. Almost all of the production is rain-fed, organic and established sloping areas. Farmers do not fertilizer in the olive trees, both chemical and organic in this region. Kilis olive oil variety has periodicity. The periodicity effects less experienced. Therefore first year olive trees are full product while second year is fewer products for farmers. Olive and olive oil producers use only soil tillage in production season. The sustainability of agriculture in our country the natural balance between providing deterioration from high adaptability, efficient and raising the quality varieties Besides the implementation of agricultural techniques maintaining the efficiency of our field, productive it is important to use it in some way. Soil conservation is beginning of the measures to be taken to improve the efficiency of productivity in agriculture and paced comes. Plants deficient in nutrients, physical, chemical and biological properties shall be taken if other cultural measures taken to what extent poor soil unsuitable soil properties unless corrected, well, there is no possibility of getting abundant and continuous product. The primary and most important benefit of green fertilization, which helps to increase the yields of the soil and to obtain more and better quality products, is the enrichment of the soil in terms of organic matter. Especially the soil organic matter content of manure green manure where there is significantly less increased. The organic matter in soil physical, chemical, and is one of the most important factors affecting biological properties, improving the structure of soil, aggregate strength, on physical characteristics such as water holding capacity and aeration increase the productivity of the land by direct positive impact. Organic matter is the source of all nutrients characterized by the constant nitrogen in the soil and not easily washed. Therefore, soil organic matter is used as the most important indicator of nitrogen in the soil (Kuzucu, 2017). At the same time with green fertilization; significant amounts of nitrogen are given to the soil depending on the nitrogen content of the plant used. When using this amount of green manure, especially leguminous plants much more. The investigations have shown that forage fertilization of cropped forage crops yields about 10-30 kg of N (nitrogen). Soils biological activity; soil structure, pore size and distribution, influencing some basic physical properties such as infiltration, favorable conditions for plant development. Especially climate

becomes effective on organic matter by affecting the activity of microorganisms. The temperature increase due to increased rate of disintegration of the organic material decreases soil organic matter content, due to increased precipitation and moisture increase of the flora potentially increases the amount of organic matter. Especially in the fast disappearance of the soil release annealing it creates a large problem in arid regions. The soil fertilization becomes very easy and the soil structure becomes very suitable for plant development since green fertilizer plants continue to increase bacterial activity in the upper layer thanks to the shadow created by covering the top surface of the soil. Green fertilizer applications have a positive effect on the physical chemical and microbiological properties of soil (Fischler et al.1999). Common vetch farming is the most common type of vetch. Green grass contains 3-4%, over 20% crude protein. The common vetch, a single-year-old leguminous fodder plant, is one of the most suitable plants within the cropping season. Abundant amounts of organic matter in the soil. Medium and heavy soils with good water holding capacity are suitable for the cultivation of common vetch. It is best if the soil pH is neutral or slightly alkaline. Organic matter content is very low value in Turkey because of our farmers who especially apply dry agriculture production should use organic fertilizer (Bellitürk et. al. 2012). Many times soil tillage using reduces soil moisture and crop yield in dry conditions. Different tillage methods have been applied in the production of silage maize and in this study, the highest yield of silage maize was obtained from traditional tillage method (Baran et al. 2014).
In our city, the farmers have produced olive without fertilizer. They receive continuous productivity each year by soil tillage applications. Over the years the yield has been decreasing and the olive trees have remained weak. By only tillage organic material decreases and the yield is reduced. In this study, it is aimed to increase the fertility and fertility of the soil organic matter by making common vetch green fertilization.

II. MATERIAL METHOD

Kilis province summers are hot and arid, winters are rainy and has semi-arid climate. Long term average rainfall is 400 mm and temperature is 18^{o}C in research area. Total 358.6 kg/m^{2} precipitation and total 460.3 kg/m^{2} precipitation was measured in this research area. Kilis province has reddish brown soil. Generally region soils lime content is high, organic matter is low and agricultural production is carried out non irrigation in most of agriculture areas. Research area soil properties are shown in Table 1.

Table 1. Some Soil Properties of Research Area

Depth (cm)	pH	EC dS/m	($CaCO_3$) (%)	Organic matter (%)	Texture	Bulk density (g/cm^3)	(N) (%)	(P_2O_5) (kg/da)	(K_2O) (kg/da)
0 - 30	7.70	2.85	34.00	1.02	clay loam	1.27	0.10	4.22	123.1
30 - 60	7.74	3.22	35.20	0.98	clay	1.26	0.09	1.35	51.8
60 - 90	7.85	1.24	29.30	0.88	clay loam	1.26	0.07	2.87	41.0

The study was carried out between 2014-2015 product years in olive garden that it includes 14-years old trees of Kilis province. Different doses of vetch barley mixture were applied one decares area in traditional production olive orchard (Fig 1). Applications are given below.

A1: Conventional application, control.
A2: 5kg common vetch+3kg barley application
A3: 10kg common vetch+6kg barley application
A4: 15kg common vetch+9kg barley application

Figure 1. Common Vetch and Barley Green Manure

Trials were conducted according to randomized parcels with 3 replications. Each application was carried out in one decares area. Total 12 da olive orchard was used in this research. Vetch and barley seeds were sown in October, in autumn. Green fertilizer plants were planted in row and inter row in research olive orchard (Fig 2).

Figure 2. Green Manure Plants in Olive Orchard

While the vetch was 80% flowering, it was tillage and mixed to the soil at the beginning of April (Fig 3). These green fertilization applications were repeated for two years.

Figure 3. Green Manure Mixing into the Soil

For all analyzes soil samples were taken from 3 different points in each parcel for soil organic matter analyses in Jun after green fertilization.

Organic Matter: Walkly Black Method. Organic matter is determined taken soil samples in 0-30 cm soil depth (Tüzüner, 1990).

Soil texture: Bouycous method. Richards,1954 (Tüzüner, 1990).

Porosity: Soil samples were taken from 3 different points in each parcel and taken from both depths of the soil (0-30, 30-60) in Jun after green fertilization.

% n= (1-db/dp) x 100 (Bahtiyar, 1996).

db: Soil bulk density, g/cm^3

dp: specific soil gravity, g/cm^3

Soil Moisture: Gravimetric soil moisture analysis. Richards, 1954 (Tüzüner, 1990).

SM: [(wet weight-dry weight)/dry weight] x100

Statistical analyses: SPSS variance analysis was performed for each parameter in this research.

III. RESULTS AND DISCUSSIONS

Soil Organic Matter

Soil organic matter (SOM) was measured each year before in September and in Jun after green fertilization. SOM analysis was performed in soil samples taken from 3 points to represent the each plot. It was determined in 0-30 cm soil depth. In 2014 production year, soil organic matter content was low before green fertilization in both layers. Organic matter has increased in all applications except the control subject after the green manure using. The highest value was 2.12% in A4 in 2015, while the lowest value was obtained in A1 with 0.82% in 2014 (Table 2).

Table 2. Average Soil Organic Matter (%)

Applications	Sampling time	2014	2015
A1= control.		0.82e	0.98e
A2= 5kg Cv+3kg B application	BF	1.24c	1.36b
	AF	1.16d	1.28c
A3= 10kg Cv+6kg B application	BF	1.46b	2.07a
	AF	1.42b	1.98a
A4= 15kg Cv+9kg B application	BF	2.02a	2.12a
	AF	1.96a	2.04a
CV(%)		2,3	1,8
LSD		0,57**	0,58**

**P<0.01 There is no difference between the same letter.
BF: before fertilization AF: after fertilization Cv: Common vetch B:barley

Soil organic matter content was found higher in 2015, than 2014. This is thought to organic matter decomposition in the soil year to year. Although the numerical A4 application is high values; In terms of organic matter content, A4 and A3 values statistically have included in the same group. The most important goal is to increase soil fertility and yield with organic fertilizers using in arid agriculture areas. Organic fertilizers uses has been increased crop yield in conventional agricultural products (Bellitürk et. al.

2017), (Sakin et. al. 2018). Organic manure is so important to increase soil fertility. Sometimes plants add organic materials into the soil. Sage (Salvia officinalis) plant was found to add more organic wastes into the soil (Çelik and Sakin 2017).

Olive Yield

Olive is a species that exhibit periodicity. This is a special case for olive trees as pistachio trees. For this reason one year full give olive fruit when the second year does not give olive fruit or gives very little. 2014 is full efficiency year. In terms of yield, the highest olive yield values were obtained in this year. 2015 is the periodicity year. Olive yield is very low (Table 3).

Table 3. Average Olive Yield (kg/tree)

Applications	2014 olive production year	2015 olive periodicity year
A1 =control.	9.2c	6.5c
A2 =5kg Cv+3kg B application	12.45b	9.8b
A3=10kg Cv+6kg B application	16.15a	10.18a
A4 =15kg Cv+9kg B application	17.52a	10.20a
Average	13.83	9.17
CV(%)	2,3	1,8
LSD	1,17**	1,34**

**P<0.01 There is no difference between the same letter.
Cv:Common vetch B:barley

According to the results, the highest olive yield was obtained from the A4 application in two research years. 10kgcommon vetch/6kg barley applications and 15 kg common vetch/9kg barley applications olive yield results were found be statistically insignificant and it was included in the same group. The lowest olive yield values were obtained from control application with an average 9.2kg/tree in 2014 and 6.5kg/tree in 2015 periodicity year. In order to gain profit in agricultural production expenses should be controlled (Baran et. al. 2017).

Soil Moisture and Total Porosity

Soil samples were taken in Jun after green fertilization. The highest porosity values were found at 0-30 cm depth in all applications. Green manure has increased soil porosity values 0-30 cm soil depth. When subsoil porosity was not affected from green fertilization, only surface soil porosity increased in 2014. Organic matter addition positively affected soil porosity in 30-60 cm in second research year (Table 4).

Table 4. Average Soil Moisture and Total Porosity

		2014 year		2015 year	
Applications	Soil Depth (cm)	Total Porosity (%)	Soil Moisture (%)	Total Porosity (%)	Soil Moisture (%)
A1 control.	0-30 30-60	37.22c 36.12c	16.25c 16.78c	39.12c 37.45c	15.89c 16.20c
A2 5kg Cv+3kg B application	0-30 30-60	43.50b 41.26b	17.22c 17.89c	42.63b 44.18b	18.42c 18.68c
A310kg Cv+6kg B application	0-30 30-60	44.62b 42.23b	20.36b 21.75a	44.72b 43.10b	21.56a 22.84a
A4 15kg Cv+9kg B application	0-30 30-60	48.16a 46.98a	20,25b 22.12a	49.86a 48.57a	20,12b 23,15a
CV(%)		3.56	1.76	2.44	2.72
LSD		3.95**	0.56**	2.63**	0.61**

**P<0.01Differences are important between different values
Cv: Common vetch, B: barley

Soil moisture was higher 30-60cm than 0-30cm soil depth. That's reason; thought to with addition organic matter increase the soil porosity and therefore high evaporation occurred from soil surface in 0-30cm soil depth.

IV. CONCLUSION AND SUGGESTIONS

At the end of this study, it has been determined that green fertilization applications improve soil physical conditions. 10kg common vetch+6kg barley dose and 15kg common vetch+9kg barley dose have affected similar degree on soil moisture and soil organic matter content. Similar results were obtained between these two applications. 15kg common vetch+9kg barley dose was found best in total porosity values in two research years. Soil tillage frequency and depth has affected negatively soil total porosity. As green fertilizer doses increases, soil porosity values have also increased. There is little difference between A3 and A4 green manure doses. The importance of organic fertilizer has appeared once again by this study. Olive producers can increase of soil sustainability with organic fertilizers applications. While farmers can maintain soil fertility and increase olive yield and can improve their economic conditions. This region's farmer is economically poor and needs help agricultural labor. Therefore we recommend 10kg common vetch+6kg barley green manure dose which is more economical to our farmers.

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