EFFECTS OF DIFFERENT ORGANOMINERAL AND INORGANIC COMPOUND FERTILIZERS ON SEED YIELD AND SOME YIELD COMPONENTS OF SUNFLOWER (*HELIANTHUS ANNUUS* L.)

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ABSTRACT

This research was carried out to determine the effects of different organomineral and inorganic compound fertilizers on seed yield and some yield components of sunflower (*Helianthus annuus* L.) in 2013. The experiments were conducted using Tunca MR LG 5580 oil type sunflower hybrid in Randomized Complete Block Design with 4 replications at Trakya Agricultural Research Institute in Edirne, Turkey. In the research, 5 different treatments; 1) Check 0 kg/ha no fertilizer, 2) 250 kgs/ha organomineral fertilizer of Hexaferm® 8.21.0 3) 250 kgs/ha organomineral fertilizer of Hexaferm® 6N.10P.10K 4) 250 kgs/ha inorganic compound granule fertilizer of 15N.15P.15K (farmers apply) and 5) 250 kgs/ha inorganic compound granule fertilizer of 20N.20P.0K kgs/ha (farmers apply) were evaluated. Before sunflower planting, the fertilizers were applied by hand spreading in each plot's surface uniformly and mixed well with the soil. In this research beside seed yield, oil content, oil yield, 1000 seed weight, test weight, plant height, head diameter, time to flowering, and time to physiological maturity were evaluated. The seed yield of sunflower was significantly affected by the different organomineral and inorganic compound fertilizers under natural rainfed conditions. Based on statistical analyses results; the highest sunflower seed yield with mean of 3282 kgs/ha was obtained at 250 kgs/ha the organomineral fertilizer application of Hexaferm® 6N.10P.10K.

Key words: sunflower, organomineral, fertilizer, yield, oil content

INTRODUCTION

Sunflower (*Helianthus annuus* L.) is the important edible vegetable oilseed crop in Turkey and the world. It has strong demand as a healthy vegetable oil due to their low level of saturated fats, making it popular as a cooking vegetable oil and for use in processed foods (Schneiter, 1997; Süzer, 2014).

World sunflower planted area accounts for 25.590.104 ha, production 44.753.264 ton, and yield is about 1750 kg/ha. However, Turkey sunflower planted area accounts for 609.784 ha, production 1.523.000 ton, and yield is about 2500 kg/ha (FAO STAT 2013). Turkey has around 3.4 % ratio of sunflower production comparing to world (Süzer, 2015).

Sunflower is one of the main crops in the rotation system in Trakya region of Turkey and it provides to around 46% of edible vegetable oil. The majority of Turkey's sunflower production area is located in Trakya-Marmara (%75) region and it is also grown in central Anatolia (7 %), the black sea cost (7 %), the Çukurova (7 %), the Aegean coast (3%), and the South East Anatolia (1%) regions of Turkey (Süzer, 2015).

An annual plant, sunflower need to grow such as fertile soil, water, air, light and temperature. Fertile agricultural soils usually have more than 3% organic matter for high yielding sunflower production. In fertile soils, sunflower plants require at least 16 elements

for normal growth and to get high seed and oil yield from per hectare. Therefore some essential plant nutrients need to grow high yielding sunflower such as carbon, oxygen, hydrogen, nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, boron, chlorine, iron, manganese, zinc, copper and molybdenum (Hocking and Steer, 1983; Danke et al., 1992; Schneiter, 1997; Süzer, 1998; Kacar ve Katkat, 1999; Süzer, 2010 a; Süzer, 2012; Süzer, 2013).

These elements used in the largest amounts for growing sunflower crop, carbon, hydrogen and oxygen, are non-mineral elements supplied by air and water and the other 13 elements are taken up by plants only in mineral form from the soil. The sunflower plants need large amounts of nitrogen, phosphorus, potassium and referred to as primary nutrients. Those nutrients are the ones most frequently supplied to grow sunflower plants in fertilizers. The three secondary elements, calcium, magnesium, and sulfur, are required in small amounts than the primary nutrients for growing sunflower. The micronutrients are boron, copper, chlorine, iron, manganese, molybdenum, zinc that occur in very small amounts in both soils and plants, but their roles are equally as important as the primary or secondary nutrients. A deficiency of one or more of the micronutrients on sunflower plant can lead to severe depression in growth, and seed and oil yield (Robinson, 1978; Blamey et al., 1987; Schneiter 1997; Süzer, 2015)

However in sunflower production areas, some soils do not contain sufficient amounts of these nutrients to meet the plant's requirements for good growth, seed and oil yield from per hectare. In such cases, supplemental nutrient applications in the form of organomineral and inorganic compound fertilizers applications must be made to get high seed and oil yield from per hectare. But, it's continuous using of inorganic fertilizers can cause nutrient in-balance and soil pH level. Only using of either organic or inorganic fertilizers cannot met the expected in increasing crop yield. In this aspect, the combined use of in organic chemical fertilizers and organomineral fertilizer can be suggested in sunflower production in order to increase seed and oil yield from per hectare. Therefore it is essential that the combined use of organic and inorganic fertilizers (organomineral fertilizer) should be encouraged and introduced to farmers in order to achieve their yield expectancy of their sunflower crop production (Schneiter, 1997; Makinde et al., 2010; Olaniyi et al., 2010; Süzer, 2010a, 2010b; Süzer, 2012; Süzer, 2013; Süzer, 2014; Süzer 2015)

Because of the importance of sunflower as one of the major oilseed crop in Turkey, the objective of this research was to determine the responses of sunflower to different organomineral and inorganic compound fertilizers.

MATERIALS AND METHODS

This experiment was carried out in rotation with wheat crop under rain fed conditions during the 2013 sunflower growing season. The experiment field is located on latitude 41.68° N and longitude 26.56° at elevation 62 meters above sea level in Edirne, Turkey. Main properties of soil used in the field experiments are presented in Table 1. As seen in Table 1, soil texture was silty clay and organic matter was low. Edirne's climate is classified as warm and temperate, slightly continental. The average annual temperature of Edirne is 13.5 °C and the rainfall averages 597 mm. Climate data of Edirne during sunflower growing season in 2013 are presented in Table 2.

The experiments were conducted using Tunca MR LG 5580 oil type sunflower hybrid in Randomized Complete Block Design with 4 replications at Trakya Agricultural Research Institute in Edirne. In the research, 5 different treatments; **1)** Check 0 kg/ha no fertilizer, **2)** 250 kgs/ha organomineral fertilizer of Hexaferm® 8N.21P.0K **3)** 250 kgs/ha organomineral fertilizer of Hexaferm® 6N.10P.10K **4)** 250 kgs/ha inorganic compound fertilizer of

15N.15P.15K (farmers apply) and **5)** 250 kgs/ha inorganic compound fertilizer of 20N.20P.0K (farmers apply) were evaluated.

Table 1. Soil analyses data of experiment field Edirne in 2013.

Year	Depth (cm)	PH	CaCO3 (%)	P2O5 (kg/Ha)	K2O Available (kg/ha)	Total Salt (%)	Sand (%)	Silt (%)	Clay (%)	Organic Matter (%)	Texture Class
2013	0-20	6.30	1.62	320.0	674.0	0.040	36.2	36.6	27.2	1.4	Silty
	20-40	6.25	1.44	270.0	586.0	0.035	32.5	38.4	29.1	1.2	clay

*: Soil tests are done by Edirne commodity exchange.

Table 2. Climate data of Edirne during the 2013 sunflower growing season.

Month	Rain (mm)	Rainy days	Humidity level (%)	Temperature (ºC)		
				Minimum	Maximum	Mean
April 2013	51,0	9	73,2	4,0	32,0	12,7
May 2013	11,0	3	66,7	4,9	32,9	20,8
June 2013	26,6	7	70,1	11,4	36,2	23,3
July 2013	14,4	4	53,6	15,0	36,1	25,5
August 2013	0,0	0	48,7	16,6	36,9	26,7
Total	103.0	23	62.46	4,0	36,9	21,8

*: Climate data is received from Edirne's meteorological station.

Plot size in planting 7 .5 x 2.8 m = 21.0 m^2, and plot size in harvest 1.4 x 4.4 m = 6.1 m^2. The intro-row spacing was 30 cm, in rows spaced 70 cm apart. Before sunflower planting, the fertilizers were applied by hand spreading in each plot's surface uniformly and mixed well with the soil. The experiments were sown in the first week of May in three years. The seeds were over planted per hill and thinned to one plant per hill three weeks after sowing. Weed control was accomplished by using both chemicals and cultural practices.

In this research beside seed yield, oil content, oil yield, 1000 seed weight, test weight, plant height, head diameter, time to flowering, and time to physiological maturity were evaluated and analyzed using ANAVO. All statistical analyses of data were performed using the JMP 5.0.1 statistical software package (SAS Institute, 2002), and the differences between means were compared using a least significant difference (LSD) test at the 0.05 probability level (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The effects of different organomineral and inorganic compound fertilizers on seed yield and some yield components of sunflower are presented in Table 3. As seen in Table 3, all different organomineral and inorganic compound fertilizers affected significantly sunflower seed yield. In the experiment, Hexaferm® 6N.10P.10K organomineral fertilizer of 250 kgs/ha application gave the first rank highest seed yield (3282 kgs/ha) and oil yield (1438 kgs/ha) comparing the other four different organomineral and inorganic compound fertilizers. The other Hexaferm® 8N.21P.0K organomineral fertilizer of 250 kgs/ha application gave the second rank highest seed yield (3145 kgs/ha) and oil yield (1358 kgs/ha) in the experiment.

On the other hand compound 15N.15P.15K inorganic fertilizer of 250 kgs/ha farmers apply gave the third rank highest seed yield (3034 kgs/ha) and oil yield (1314 kgs/ha) comparing the other four different organomineral and inorganic compound fertilizers. Compound 20.20.0 inorganic granule fertilizer of 250 kgs/ha application also gave the fourth

rank highest seed yield (3004 kgs/ha) and oil yield (1328 kgs/ha) comparing the other four different organomineral and inorganic compound fertilizers. The last check 0 kg/ha no fertilizer gave the fifth rank seed yield (2609 kgs/ha) and oil yield (1124 kgs/ha) comparing the other four different organomineral and inorganic compound fertilizers.

Table 3. Mean seed yield and yield components of sunflower as affected by five different organomineral and inorganic compound fertilizers.

Entry No	Aplications	Seed Yield (kg/ha)	Oil In Seed (%)	Oil Yield (kg/ha)	Plant Height (cm)	Head Dia-meter (cm)	Time To Flowe-Ring	Time To Phsiolo-gical Maturity	1000 Seed Weight (g)	Volume Weight (kg/hl)
1	Kontrol (No fertilizer)	2609 B	43.1	1124	155	16	8.07.2013	15.08.2013	48.9	39.6
2	Hexaferm 8.21.0 250 kgs/ha	3145 A	43.2	1358	160	19	8.07.2013	15.08.2013	50.1	39.9
3	Hexaferm 6.10.10 250 kgs/ha	3282 A	43.8	1438	160	19	8.07.2013	15.08.2013	50.0	39.8
4	15.15.15 250 kgs/ha	3034 A	43.3	1314	160	17	8.07.2013	15.08.2013	49.3	39.0
5	20.20.0 250 kgs/ha	3004 A	44.2	1328	160	17	8.07.2013	15.08.2013	50.3	38.7
	LSD (0.05)	309.4**								
	C.V. (%)	6.66								

**: 0.01 different significantly at 1 % probability level.

The result of the seed and oil yield of sunflower as affected by the inorganic and organomineral fertilizer applications are presented in Table 3. The response of sunflower to the four different organomineral and inorganic compound fertilizers varied slightly for the seed and oil yield. However, the sole application of 250 kgs/ha Hexaferm® 6N.10P.10K organomineral fertilizer performed favorably well in terms of seed and oil yield of sunflower.

Despite the environmental and other yield constraints encountered by the crop during the growth production period, the overall assessment showed that it is essential to considered the main commercial fraction like the seed yield performance of sunflower in choosing the level of organomineral and inorganic fertilizers for use in sunflower production. But, it's continuous using of inorganic fertilizers can cause nutrient in-balance and soil pH level. Only using of either organic or inorganic fertilizers cannot met the expected in increasing crop yield. In this aspect, the combined use of in organic chemical fertilizers and organomineral fertilizer can be suggested in sunflower production in order to increase seed and oil yield from per hectare (Schneiter, 1997; Makinde et al., 2010; Olaniyi et al., 2010; Süzer, 2010a; Süzer, 2012; Süzer, 2013; Süzer, 2014).

CONCLUSIONS

Sunflower is the important edible vegetable oilseed crop in Turkey and the world. In the current drive by Turkey to achieve vegetable oil sufficiency in sunflower production in near future, improved yield could be achieved by the use of organomineral and inorganic fertilizers. The results of this research showed a positive influence of organomineral and inorganic fertilizers on growth and yield components of sunflower plant over the control. Yield parameters in terms of seed yield and 1000 seed weight were found to be higher at all

organomineral and inorganic fertilizers' treatment application than the control. Consequently, considerable increase in term of grain yield was brought about by applying before planting the sole application of 250 kgs Hexaferm® 6N.10P.10K organomineral fertilizer performed favorably well in terms of seed and oil yield of sunflower in dry land conditions in Edirne-Turkey. On the other hand, for balanced fertilization in sunflower the combined use of in organic chemical fertilizers and organomineral fertilizer can be suggested in sunflower production in order to increase seed and oil yield from per hectare.

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