INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 5, No. 12, p. 191-196, 2014

RESEARCH PAPER OPEN ACCESS

Effect of micronutrients and varieties on yield and yield component of sunflower

Mohammad Mehdi Rahimi*

Department of Agriculture, Yasooj Branch, Islamic Azad University, Yasooj, Iran

Key words: Sunflower, micronutrients, Fe, Mg, Zn, B, Mn.

http://dx.doi.org/10.12692/ijb/5.12.191-196 Article published on December 15, 2014

Abstract

In order to study the effect of micronutrients on quality and quantity characteristics of 2 Varieties of Sunflower, a split plot design was performed on five treatments in the form of a randomized complete blocks base and in four replications. Main-plot consisted of 2 Sunflower varieties: Golshid99 hybrid and Record variety. Sub-plot consisted of five fertilizer treatments: ($T_{1=}$ NPKMG), (T_2= NPKMg+ Fe), (T_3=NPKMgFe+B), ($T_{4=}$ NPKMgFeB+ Mn), (T_5= NPKgFeBMn+ Zn). Results show that Variety factor had a significant effect on harvest index and cap diameter, linoleic acid, oleic acid, oil yield per ha and the weight of 1000 seeds at the 5% level of significance, but had no significant effect on storic acid., In addition, due to results Fertilizer treatment factor on harvest index, linoleic acid, oleic acid, oil yield per ha and the weight of 1000 seeds at the 5% level of significance. This research showed that, Golsid hybrid was the best record. According to this experiment, interaction of between treatments had a significant effect on oil yield at the 1% level of significance., also had significant effect on cap diameter, the weight of 1000 seeds and Oleic fatty acid at the 5% level.

* **Corresponding Author:** Mohammad Mehdi Rahimi ✉ Rahimi.agronomy@Gmail.com

Introduction

Oily seeds maybe the most valuable crops because of food value and importance and many other things that are not related to our discussion. Oily seeds have absorbed the attraction of many farmers because they can be used in human nutrition, industry and as animal fodder (Gökhan and Gökmen, 2010; Hor, 2005). The intake of microelements in countries with advanced agriculture is about 2- 4% of the total fertilizer consumption, but in Iran is only two grams per ton (Zarghamnejad, 2013). The lack of low-consuming elements is more important but unfortunately, these elements have been forgotten like organic material and Potassium fertilizers. The new policy of the Minister of Agriculture in iran is to address this lack by reducing PH of the soil. This policy is done by using sulphate fertilizers and sulphure,increasing organic materials, producing fertilizers with low-consuming elements and increasing their solutions (Malek, 2010; Seyfi *et al.,* 2011). Sun-flower (Helianthus annuus L) is one of the four oily plants in the world. Annually 80000 ha of Iran are under crop of sun – flower. Fifty percent of Sun - flower seed is formed by oil and this amount is more than many other oily plants. In addition, its oil quality is high and it is refered to one of the best plant oils (). The goals of using micronutrient involve increasing and enhancing quality and quantity of farm product, producing high-powered seeds and decreasing the amount of contaminants like Nitrate and Cadmium. Ramesh et al (1999) showed that seed unction and percent of protein increase significantly with the use of 5mg of Fe for each plant in one Kg soil. Marioti et al (1996) suggested that in green house trials, the weight and the size of the leaf and also the viscosity of Fe and chlorophyll decrease with the use of Fe in diverse amounts. They also confirmed that maize is more sensitive than sun- flower to the lack of Fe and maize needs more amount of Fe .Bergmann (1992) suggested that low - powered seeds of sun-flower are due to the lack of B. Kastori et al in a survey on the effect of B on sun-flower confirmed that the lack of B decreases the weight of stem and root, size of the leaf and amount of chlorophyll. In the trial, photosynthesis decreases because of the lack of B and this lack is followed by the slow transmission of electrons and high amount of glucose in the leaves.

Materials and methods

This trial was organized for considering the effect of micronutrients on the quality and quantity characteristics of two varieties of sun-flower. According to the goal of the research, this trial was done by the use of split plot design with randomized complete blocks base design and four replications. Main plot consisted of two sun-flower varieties named A1 (record) and A2 (Golshid Hybrid). Sub-plot consisted of five fertilizer treatments included:

T1= N, P, K, Mg,

T2 = N, P, K, Mg + Fe

T3= N, P, K, Mg, Fe + B

T4= N, P, K, Mg, Fe, B + Mn

T5= N, P, K, Mg, Fe, B, Mn + Zn

the number of all designs is (2 × 5 × 4) =40. Four crop lines with the length of 6m were repaired for each design. Each main design had an area about 90m² that was sectored to five sub-design of 18m².The space between main designs was 1m and the space between replications was 2ms. At the beginning of each replication, there was a main brook for watering. Before planting; a trial was done to determine the physical and chemical characteristics of the soil .The samples for this trial were taken to the depth of 60cm and in zigzag manner from different parts of the farm. Before planting process, 200kg K_2So_4 per each ha and 200kg $[Ca(H_2Po_4)]$ had been determined for using in planting process .The required Co $(NH_2)_2$ (350kg/ha) was added to the soil in three stages :planting, eight-leaves and before flowering. The anticipated fertilizer treatments were used in these three stages in this way : the required amount of $MgSo_4$ was determined for each sub-design (18m²) according to the criteria of 100kg/ha.One third of that amount or 1/3 of 180gr was used. $FeSo_4$ was added to all sub- designs.

The use of $FeSo_4$ for each hectar was 200kg. One third of that determined amount, (120gr) was used. After the second fertilizery treatment and for the other next treatments, the amount of 30kg/ha of

H_3Bo was anticipated. One third of this amount for a single design, 54gr, was used. In the fourth treatment, $MnSo_4$ and B,N,P,K,Fe,Mg fertilizers were added to each main design. The added amount was 30kg per each ha and one-third of this amount for a main design, 54gr, was used. Finally in the 5th treatment, 40kg/ha $ZnSo_4$, $7H_2O$ was added to each main design with the presence of Mg, Fe, Mn, K, P, N fertilizers. One third of this amount for a single design, 72gr, was scattered after adding soil in the relation of 1to 5.

Results and discussion

The Percent of Linoleic Fatty Acid

There was a significant difference of 5% among the varieties in the main factors levels and sub factors ones. But there was not any significant difference between different levels of fertilizer treatments effect (table4). Comparing the average of this characteristic in fertilizer treatments confirms this amount decreases in T2 with adding Fe in comparison to T1. The average of this characteristic decreased with adding B to the fertilizer treatment T3 in comparison to T2. By adding Mn to the fertilizer treatment T4, the average of this characteristic increased in comparison to all previous treatments. In other words, T4 has a significant difference in comparing to T2 and T3. In T5 when Zn was added, the average of this characteristic increases in comparison to T4. T5 also was different from T1, T2, T3 by adding Zn. It can be concluded that the two elements, Zn and Mn, probably have some effects on producing special materials that cause to fatty acid linoleic production .The effect of Mn was very significant because the tested soil was very poor about Mn and consuming some MnSo4 had a serious role in increasing amount of linoleic fatty acid (table 1).The same results are reported by others.

Table 1. Comparing the average of factor effects of T (fertilizery treatment) on characteristics with significant differences.

Fertilizery treatment	Linoleic fatty acid (%)	oleic fatty acid (%)	Staric fatty acid (%)	Oil yield per ha (kg)	Harvest index (HI)	The weight of 1000 seeds (gr)	Cap diameter (Cm)
T1	54.70bc	33.61b	4.95a	854.81b	18.47c	42.41c	14.63a
T2	45.35ab	34.29ab	5.24a	969.37b	22.07b	43.44c	14.49a
T3	51.76c	38.22a	4.62a	114.79a	22.8 ab	48.1ab	14.12a
T4	59.13ab	30.18b	5.37a	123.48a	25a	44.3bc	14.68a
T5	60.04a	31.47b	3.29b	125.6a	23ab	48.64a	14.77a

The percent of oleic fatty acid there was not any significant difference among the varieties of the main factors levels and sub factors ones (table 4). It was observed that in different fertilizer treatments, the average amount of this characteristic increases in T2 with adding Fe in comparison to T1. T3 had a significant difference by this addition in comparison to T1. By adding Mn in T4, the average amount of this characteristic decreased in comparison to T3. Average of this characteristic increased by adding Zn in compared to T4. The percent of palmetic fatty acid there was a significant difference of 5% among the varieties in the main factors levels and sub factors ones. But there was not any significant difference between different levels of fertilizer treatments affect (table 4).Comparing the average amount of this characteristic shows that in T2 this amount decreases by adding Fe in comparison to T1. By adding B to T3, the average amount of this characteristic decreased in comparison to T2. T3 had a significant difference by this adding in comparison to T1. In comparison to T3, by adding Mn to T4, the average amount of this characteristic deceased. The presence of Zn in T5 decreased this amount in comparison to T4. T5 had a significant difference with this shortage in comparison to T1 and T2.

The percent of storic fatty acid

There was not any significant difference among the varieties in main factors levels and sub factors ones. But, between different levels of subfactor, there was a significant difference of 5% (table 4).The average

amount of this characteristic increased by adding Fe to T2 in comparison to T1 .In T3, by adding B, the average amount decreased in comparison to T1 and T2.By adding Mn in T4 this average amount increased in comparison to T2 and T3 and by adding Zn in T5, the average amount decreased in comparison to the previous treatments (table 1) . The same results were reported by others.

Table 2. The average amount of considered characteristics of two varieties.

Cap diameter(cm)	75/81a	12/27b
The weight of 1000seeds (gr)	52/28a	38/50b
Harvest index (HI)	24/64a	19/96b
Oil yield per ha (kg)	1282/01a	903/61b
Staric FattyAcid (%)	4/21a	5/17a
Oleic FattyAcid(%)	30/9a	36/2a
Linoleic Fatty Acid(%)	58/62a	53/36b
Variety	A1	A2

Oil yield

There was a significant difference among two varieties in relation to main factor levels and difference levels of alternate traces of fertilizer treatments .But, between sub factor levels, the high difference of 5% was not observed (table 4). Alternate traces of fertilizer treatment in T3 and in Golshid-Hybrid that had the highest amount of this characteristic became more serious in T1, T2, T3 and T4. Alternate traces in T2 and in Record variety that had the lowest amount of this characteristics, had a significant difference in comparison to all treatment levels except T1 in Golshid-Hybrid and T3 and T4 in Record (table 3). The same result reported by others confirms our findings.

Harvest Index (HI)

Between main factor levels and also different levels of subfactor , high difference was observed in two varieties . But there is not any significant difference between different levels of fertilizery treatment alternate traces (table 4).The average amount of this characteristic increased by adding Fe in T2 in comparisonto T1. By this addition, T2 become significantly different from T1. By adding B inT3, the average amount of this characteristic increased in comparison to T2. T3 became significantly different from T1 by this addition. The average amount in T4 increased by adding Mn in compared to T3. T4 showed a more significant difference in relation to T2 as result of this addition. By adding Zn inT5, the average amount of this characteristic decreased in comparison to T4 and increased in comparison to T3 (table 1).The othersresult confirms our findings.

Table 3. Comparing the average amount of alternate traces (AT) on characteristics having significant difference (about 5%).

Sources of variation	df	R	Variety A	Error of trials Ea	Fertilizer T	Interaction variety on fertilizer	Error of trials	Cv%
Degree of freedom	s.o.v	3	1	3	4	4	24	-
The squired average	Cap diameter	1.09ns	64.06*	1.94	0.516ns	2.95*	0.56	5.17
	The weight of 1000 seeds	46.39ns	1898.4*	36.95	63.3*	82.71*	13.33	8.04
	Harvest index	6.9ns	291.3*	8.5	45.84*	5.258ns	4.59	9.61
	Oil yield	171297.4ns	1431914.9*	31274.1	243231.6*	77721.8**	23313.3	13.92
	Staric fatty acid	1.705ns	9.312ns	2.825	5.597*	2.432ns	1.068	22.02
	Oleic fatty acid	10.76ns	280.053*	1.198	76.057*	43.467*	15.36	11.68
	Linoleic fatty acid	2.125ns	277.044*	4.553	97.158*	47.698ns	19.298	7.84

(ns)the difference is not significant .(**) is significant in 1%. (*) is significant in 5%.

The weight of thousand kernel

Significant differences were observed between main-factor levels, sub-factor levels and also different levels of fertilizery treatment alternate traces in each variety (table 4).The average amount of this characteristic in T2 increased by adding Fe in comparison to T1. By adding B in T3, the average amount increased in comparison toT2. T3 showed a more significant

difference in comparison to T2. By adding Mn inT4, the average amount of this characteristic decreased in comparison to T3 and increased in comparison to T2. In T5, by adding Zn, the average amount increased in comparison to all previous treatments. T5 became more different from T4 by this addition (table 1). The same result reported by others confirms our findings.

Table 4. The results summary of variation synthesis and variations coefficients in which the squired average of characteristics are shown.

Cap diameter (cm)	15ab	16a	16a	16/2a	15/6a	14/2b	12/9d	12/1e	13/1c	13/8c
The weight of 1000 seeds (gr)	45/8b	48/2b	58/2a	54/8a	54/3a	38/9cd	38/6cd	37/9cd	33/8d	43/3bc
Harvest index (HI)	21/25a	23/27a	26/24a	27/32a	25/1a	15/6a	20/86a	19/5a	22/69a	21/03a
Oil yield per ha (kg)	941/9cd	1150/2bc	1456/4a	1507/4a	1353/9ab	767/69d	788/51d	843/12d	965/52cd	1153/1bc
Staric fatty acid (%)	4/54a	4/1a	4/7a	4/43a	3/18a	5/37a	6/37a	4/43a	6/31a	3/39a
oleic fatty acid (%)	30/03cd	31/75bc	38/32a	28/32cd	25/65d	37/19ab	36/80ab	37/68ab	32/03bc	37/29ab
Linoleic fatty acid (%)	58/63a	57/57a	50/35a	61/55a	65/02a	50/77a	51/1a	53/16a	56/75a	55/07a
Fertilizery treatment	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
Variety	A1	A1	A1	A1	A1	A2	A2	A2	A2	A2

The cap Diameter

In each variety, there was a significant difference between main-factor levels and different levels of fertilizery treatment alternate traces . But, the difference of 5% was not observed between sub-factor levels (table 4) .The alternate traces of T4 in Golshid-Hybrid having the highest amount of this characteristic became more different from T1, T2, T3, T4 and T5 in Record variety. The alternate traces of T3 in Record having the lowest amount of this characteristic showed a significant difference in all treatments except T2 and T4 (table 3).The achieved result by others confirms our findings.

Conclusion

Based on the results, Variety factor had a significant effect on harvest index and cap diameter, linoleic acid, oleic acid, oil yield per ha and the weight of 1000 seeds at the 5% level of significance, had no significant effect on storic acid., More ever due to results Fertilizer treatment factor on harvest index, linoleic acid, oleic acid, oil yield per ha and the weight of 1000 seeds at the 5% level of significance. This research showed that, Golshid hybrid was the best record. According to this experiment, interaction of between treatments had a significant effect on oil yield at the 1% level of significance., also had significant effect on cap diameter, the weight of 1000 seeds and Oleic fatty acid at the 5% level.

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