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Effect of different levels of nitrogen and potassium on yield, yield components and oil content of sunflower

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ABSTRACT: To study the effect of different doses of nitrogen and potassium on yield and yield components of sunflower in Sistan region was carried out an experiment as split plot based on randomized complete block with three replications in Agricultural Research Station of Zahak at spring of 2012. Experimental treatments was included from four levels of nitrogen: 0, 75, 150 and 225 kg/ha as main factor, and three levels of potassium: 0, 100 and 150 kg/ha as sub factor. The results of variance analysis showed that the amounts of nitrogen and potassium fertilizers had significant effect on plant height, biological yield, seed yield and seed oil content. The highest amounts of all measured factors obtained from treatment of 225 kg/ha nitrogen and 150 kg/ha potassium. Generally results indicate that use of nitrogen and potassium fertilizers improves quantitative and qualitative characteristics of sunflower.

***Keywords*:** Sunflower, Nitrogen, Potassium, Yield, Oil content

INTRODUCTION

Sunflower (Helianthus annus) is the second most important oil seed crop in the world. It is adapted to a wide range of climatic conditions (temperate, sub tropical and tropical).

One of yield increase methods in sunflower is optimum fertilizer (nitrogen and potassium) consumption (Sadiq et al., 2000). But overfertilization with nitrogen and potassium is one of the main causes of ground water contamination (Javier et al., 2002; Sadiq et al., 2000). In order to avoid a negative environmental impact, it is necessary to develop sound diagnosis and recommendation program, that adjust fertilizer rates to crop requirements (Javier et al., 2002). Excessive nitrogen and potassium fertilization of sunflower not only generates that environmental risk, it may also affect the grain quality, decreasing its oil content and reduce yield through an increase of plant lodging (Javier et al., 2002; Sadiq et al., 2000).

Sunflower nutritional studies indicated that the economic optimum level of fertilizer for irrigated crop at (Sennar, is 40 N kg/fed (as urea) + 20kg P/fed (as triple super phosphate), (Khashmelmous, 2004). However, Mohamed *et* al*.,* 2003) reported that at Gezira, increasing N- levels, increased seed yield of sunflower. Also, in the Gezira environment, sunflower was more responses to higher rate of N in the form of urea (Mohamed, 1989; Hasan and Mukhtar, 2000). The same results were recorded at different environments (Karami, 1980; Belamey and Chapman, 1981). At New Halfa, Ali (2000) reported that the addition of ½N, 1N, 1½N and 2N resulted in 55, 93,120 and 153% yield increase compared to the control. In rain-fed, sunflower yield increase was resulted from the application of 20 kg N/fed (Khalifa, 1980).

The objective of this study was to determine the suitable fertilizer (nitrogen and potassium) amount of sunflower in Sistan region.

MATERIALS AND METHODS

In order to study the effect of different doses of nitrogen and potassium on yield and yield components of sunflower in Sistan was carried out an experiment as split plot based on randomized complete block with three replications in Agricultural Research Station of Zahak at spring of 2012. Experimental treatments was included from four levels of Nitrogen fertilizer: 0, 75, 150 and 225 kg/ha as main factor, and three levels of potassium: 0, 100 and 150 kg/ha as sub factor.

Each block was including 12 plots. The size of each plot was 2m×5m, and there were 4 rows in each plot, with a distance of 50 cm from each other. The distance between plots was selected 100 cm, and the distance between blocks was selected 2 m. After plotting and before the planting, sulfate of potassium (according to experimental treatments) and 200 kg/ha triple super phosphate was supplied to experimental plots. And also nitrogen fertilizer from urea source was added to plots according to experimental treatments. The consumption of nitrogen fertilizer was divided in three equal parts and three stages (Planting, 10 leafy and flowering). Nitrogen fertilizer was consumed according to experimental treatments.

Two seeds were sown in each position and the plots thinned to the desired plant population when the seedlings reached the first leaf fully emerged stage. Weeds were removed by hand. The yield (g/m^2) was recorded at harvest time at Juan 2012.In this experiment, factors of plant height, biological yield, seed yield and seed oil content.

Heads of the two inner ridges of each plot were harvested and left 10 days until fully air dried by sunshine and seed yield, 100-achene weight and seed hollowness were estimated. Also, six plants from each plot were selected at random and plant height was measured and average was calculated from those six measured values. Seed oil content was determined according to(A.O.A.C. ,1990) using soxhlet apparatus and diethyl ether as a solvent.

Finally data obtained in this experiment were analyzed using SAS and MSTATC software; mean comparison was done using Duncan Multiple Comparison at 5% probability level.

RESULTS AND DISCUSSION

Plant height

Result of variance analysis showed that effect of nitrogen and potassium fertilizers was significant at 1% probability level on plant height (Table 1). Interrace nitrogen treatments, the highest plant height (140.51 cm) obtained from consumption of 225 kg/ha nitrogen and there was significant different between this treatment with control treatment (Table 2). Nitrogen via improving vegetative growth led to increase of plant height (Hasanzade, 2002). The results similar to this research reported by (Halvorson et al., 1999). Different levels of potassium fertilizer indicated that the highest plant height (142.91 cm) obtained from consumption of 150 kg/ha potassium (Table 2). With increasing potassium amount, CO_2 fixation because of better conductivity of stomata would improve, and this subject increase carbohydrate production in plant and finally led to plant height increase (Marschner, 1995).

Seed yield

Effect of nitrogen and potassium fertilizers was significant at 1% probability level on seed yield (Table 1). So that the most seed yield (1825 kg/ha) obtained from treatment of 225 kg/ha nitrogen and had significant different with control treatment (Table 2). Interrace potassium treatments, the highest seed yield (2026.25 kg/ha) obtained from consumption of 150 kg/ha potassium (Table 2). (De Datta and Gumez ,1980) reported application of nitrogen and potassium led to yield increase in rice.

Biological yield

Result of variance analysis showed that effect of nitrogen fertilizer was significant at 5% probability level on biological yield (Table 1). According to table of mean comparison, the most biological yield (1519.33 kg/ha) obtained from treatment of 225 kg/ha nitrogen and had significant different with control treatment (Table 2). Dhiphal and jolliff ,1986) reported that consumption of nitrogen led to seed and biological yield of sunflower.

Different potassium levels had significant effect on biological yield (Table 1). So that the highest biological yield (2026.25 cm) obtained from consumption of 150 kg/ha potassium (Table 2). With increasing potassium amount would increase carbohydrate production in plant and finally led to improving biological yield (Soleiman zadeh et al., 2010).

Oil content in seed

Result of variance analysis showed that effect of nitrogen and potassium fertilizers was significant at 5% probability level on oil content (Table 1). Mean comparison of different nitrogen amounts showed that the highest oil content (41.90%) obtained from consumption of 225 kg/ha nitrogen and there was significant different between this treatment with control treatment (Table 2). Nitrogen can increase oil content in seed via increasing vegetative growth and higher production of carbohydrate in plant and transferring to seeds (Hasanzade, 2002). (Halvorson et al., 1999) reported results similar to this research. Interrace different levels of potassium fertilizer, the highest oil content (43.08%) obtained from consumption of 150 kg/ha potassium (Table 2). (Christ and Drabbel ,1984) reported that application of potassium fertilizer as on time can led to increase of oil content in seed. (Soleiman zadeh et al., 2010) showed that application of potassium led to increase of oil content in sunflower seeds.

Table 1. Variance analysis of measured factors under effect of nitrogen and potassium fertilizers

S.O.V	df	Plant height	Seed yield	Biological yield	Oil content
replication	2	5.14^{ns}	15411.58^{ns}	501229.45^{ns}	0.87^{ns}
Nitrogen	3	22.86^{**}	151474.85^{**}	10286839.44^{**}	7.81^{**}
Potassium	2	274.88^{**}	1917063.25^{**}	92590951.46^{**}	74.17^{**}
Nitrogen×Potassium	6	1.08^{ns}	6169.43^{ns}	1186511.73^{ns}	0.99^{ns}
Error	22	0.74	875.0	44021.48	0.08
C.V (%)	-	0.62	1.76	1.73	0.73

*, ** Significant at the 5 and 1% levels of probability respectively and n.s (non significant)

Table 2. Mean comparison of measured factors under effect of nitrogen and potassium fertilizers

Treatment	Plant height (cm)	Seed yield (kg/ha)	Biological yield (kg/ha)	Oil content (%)
Nitrogen fertilizer (kg/ha)				
0	136.71d	1519.33d	10919d	39.70d
75	137.97c	1638.56c	11594.3c	40.61c
150	138.82b	1724.44b	12565.8b	41.21b
225	140.51a	1825.00a	13349.7a	41.90a
Potassium fertilizer (kg/ha)				
0	133.41c	1241.00c	9431.13c	38.17c
100	139.18b	1763.25b	11914.01b	41.31b
150	142.91a	2026.25a	14976.55a	43.08a

Mean followed by similar letters in each column, are not significant at the 5% level of probability

REFERENCES

AOAC. 1990. Assoc. Office. Agri. Chemists, 'Official methods of analysis', Editor Hormitz, W. 10th edition, Washington DC, USA, PP: 129.

Ali MS. 2000. The response of sunflower cultivars to nitrogen fertilizer. Annual Report (2000-01). Oil Seed Crops Research Program. Wad Medani, Sudan.

Christ JV.and Drabbel JC.1984. effect of row spacing and seeding rate on rapeseed yield in northwest Alberta .J.Plant and Soil 131:241-250

Belamey, F. C. and Chapman, J. (1981). Protein, oil and energy yields of sunflower as affected by nitrogen and phosphorous fertilization. Agronomy Journal; 73, 583- 587.

Dahiphal VV and KR Pawar. 1992. Studies on energy requirement of rabi sunflower crop production. J. Maharashtra Agric. Univ, 17: 443-445.

De Datta, S K and KA Gumez. 1980. Changes in phosphorus and potassium response in wetland rice soils in south and South-East Asia. International Rice Research Institute. Los Banos, Philippines.

Halvorson Ardell D, Akfred LB ,Joseph MK ,Stephen DM and Donald LT. 1999. Sunflower response to tillage and nitrogen fertilization under intensive cropping in a wheat rotation. Agron. J. 91: 637-642.

Hasan MK and Mukhtar NO. 2000. Response of sunflower hybrid variety to N and P. Annual Report (2000-01). Oil Seed Crops Research Program, Wad Medani, Sudan.

Hasanzade A. 2002. The effect of different amounts of Nitrogen fertilizer on yield and yield component and grain oil of sunflower. Uremia. Agri. Sci. Research, 2: 1. 25-33.

Javier D, Scheiner, Flavio H, Gutie´rrez-Boem and Rau´l S. Lavado. 2002. Sunflower nitrogen requirement and 15N fertilizer recovery in Western Pampas, Argentina. European Journal of Agronomy 17: 73–79.

Karami E. 1980. Effect of nitrogen rate and the density of plant population on yield and yield components of sunflower. Indian Journal of Agricultural Science; 50 (9), 660- 666.

Khalifa FM. 1980. Effect of N and P fertilizer, and plant density on sunflower. Kenana Research Station (1979-80). Abu Naama, Sudan.

Khasmalmous AE. 2004. Effect f nitrogen, phosphorous and plant density on growth and yield of irrigated sunflower. Proc. Of the National crop husbandry Committee Meeting; 2003. ARC. Wad Medani, Sudan

Marschner H. 1995. Mineral nutrition of higher plants, 2nd Ed. Academic Press. London. Pp: 889.

Mishra A, Dash P and Paikaray RK. 1995. Yield and nutrient uptake by winter sunflower (Helianthus annuus) as influenced by nitrogen and phosphorus. Indian Journal of Agronomy, 40: 137-138.

Mohamed AA, Nour AM, Ali AA and Mohamed AE. 2003. Response of sunflower to different forms of fertilizer in the Gezira. Proc. Of the National Crop Husbandry Committee Meeting; 2003. ARC. Wad Medani, Sudan.

Sadiq SA, M Shahid, A Jan and S Noor-Ud-Din. 2000. Effect of various levels of nitrogen, phosphorous and potassium (NPK) on growth, yield and yield components of sunflower. Pakistan Journal of Biological Sciences, 3(2): 338-339.

Soleimanzadeh H, Habibi D, Ardakani MR, Paknejad F and Rejali F. 2010. Response of sunflower (Helianthus Annuus L.) to drought stress under different potassium levels. World Applied Sciences Journal. 8(4): 443-448.