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Effect of Various Levels of Nitrogen, Phosphorus and Potassium (NPK) on Growth, Yield and Yield Components of Sunflower

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Abstract: The increase in levels of NPK increased days to flowering and maturity, plant height, head diameter and number of grains per disc. However, the increase in 1000 grain weight and grain yield per hectare was upto 80:50:50 kg/ha NPK level after which it dropped. On the basis of these findings, application of 80:50:50 kg NPK/ha is recommended for sunflower crop to obtain maximum grain yield under irrigated conditions.

Key words: Sunflower, *Helianthus annuus* L., NPK levels, yield

Introduction

In Pakistan oilseed crops were grown on 523000 hectares (2% of the total cropped area) during the year 1991-92 with the edible oil production of 338 thousand tones which was only 30 percent of the total requirements of 1262 thousand tones (Anonymous, 1992). Thus, the demand was met through import worth Rs. 10025.2 million (Hatim and Abbasi, 1994). Therefore, efforts have been intensified to increase the area and production of oilseed crops in the country.

Sunflower (*Helianthus annuus* L.) is considered to be the most important oilseed crop of the world due to its wide range of adaptability and highest seed oil contents (40-50%). Research trials show that the soil and climatic conditions of Pakistan are quite suitable for the cultivation of sunflower. Moreover, it is a short duration crop and can be grown twice a year successfully (Bakhsh *et al*., 1999). Accurately quantifying the optimum fertilizer rate is essential to maximize profitability and minimize potential negative environmental impact (Chaudhry and Sarwar, 1999).

It is reported that optimum fertilization with NPK increased head size, plant height, 1000 seed weight and seed yield of sunflower. Harmati (1993) reported that sunflower hybrids were given 0-150 kg N, 0-150 kg P_2O_5 and 0-180 kg K_2O/ha. Increasing nitrogen application rates slightly increased yield. Optimum yields were obtained with 30-60 kg P_2O_5 and 60 kg K_2O/ha.

Based on these findings, the present studies were taken up with the objectives to study the effect of NPK levels on yield and yield components of sunflower and identify optimum NPK level for maximum productivity.

Materials and Methods

The study was conducted at Malakandher Research Farm, NWFP Agricultural University Peshawar during the year 1997. The experiment was laid out in Randomized Complete Block Design with four replications. Hybrid "Aritar" was planted on March 10, 1997 in a plot size of 5×3 m^2 having row to row and plant to plant distances as 75 and 25 cms respectively. The experiment comprised the nitrogen, phosphorus and potassium (NPK) levels as follows:

Treatments	N	P	K
	---------- Kg/ha ----------		
T_1	0	0	0 (control)
T_2	10	10	10
T_3	20	20	20
T_4	40	30	30
T_5	80	50	50
T_6	100	60	60

The fertilizer used were Urea, Triple Super phosphate (TSP) and sulphate of potash (SOP). All the TSP and SOP and half of urea were applied at sowing and the remaining half of urea was top dressed after one month. First irrigation was applied after 30 days of sowing. Subsequent irrigations were applied whenever needed. All the plant protection measures and cultural practices were performed as usual.

Data regarding days to flowering and maturity, plant height, head diameter, number of grains per disc, 1000 grain weight and grain yield per hectare were recorded for each of the treatments. The entire data were subjected to analysis of variance technique, (Gomez and Gomez, 1984) and means were compared by using Least Significant Difference (LSD) test.

Results and Discussion

The data presented in Table 1 revealed that different NPK levels significantly affected the days to flowering. The increase in the NPK dose increased number of days to flowering (Table 2). Maximum days to flowering were recorded for plots fertilized with 100:60:60 kg NPK/ha followed by 80:50:50 NPK/ha. Minimum days to flowering were recorded for plots which received no fertilizer and 10:10:10 kg NPK/ha. Increasing NPK doses accelerated vegetative growth which could be responsible for their respective delay in flowering. These results tally to the work of Nagar and Allam (1991).

Table 2 indicated that NPK levels significantly affected days to maturity. Maximum days to maturity were documented in plots fertilized with 100:60:60 NPK/ha followed by plots receiving 80:50:50 NPK kg/ha. Minimum days to maturity were registered for plots which received no fertilizer. Over fertilization resulted in excessive vegetative growth which ultimately delayed maturity. Identical results were reported by Supak *et al*. (1975).

The perusal of data in Table 2 revealed that plant height was significantly affected by NPK levels. Taller plants were observed in plots which received 100:60:60 kg NPK/ha. Dwarf plants were observed in control plots. High NPK doses extended growth period and thus increased plant height. Similar findings were also reported by Robinson *et al*. (1979).

Head diameter was significantly affected by NPK levels at 1 per cent probability level (Table 1). A reference to Table 2 shows that head diameter increased with increasing NPK levels. The highest head diameter was recorded for plants which received 100:60:60 and 80:50:50 kg NPK/ha whereas lowest head diameter was documented in plots receiving no and 10:10:10 kg NPK/ha. Inclusion of high phosphorus and potassium in fertilizer combinations increased the effectiveness of nitrogen which could be responsible for increased head diameter.

Table 1: F-values of various characters of sunflower

S.O.V	D.F	F-values						
		Days to flowering	Days to maturity	Plant height (cm)	Head diameter (cm)	No. of grains per disc	1000 grain weight	Grain yield Kg/ha
Replications	3	0.71 ns	1.79 ns	0.46 ns	1.31 ns	46.34 *	0.94 ns	2.58 ns
NPK levels	5	31.37 *	31.13 *	8.80 *	14.28 *	69.92 *	7.55 *	13.19 *

ns = Non-significant, * = Significant at 1% probability level

Table 2: Results of LSD test

S.O.V	D.F	F-values						
		Days to flowering	Days to maturity	Plant height (cm)	Head diameter (cm)	No. of grains per disc	1000 grain weight	Grain yield Kg/ha
0:0:0		57.25 D	92.5 D	142.8 B	10.2 C	765.8 E	49.0 D	1499 E
10:10:10		58.25 D	94.5 C	145.8 B	11.2 C	817.3 D	50.5 CD	1603 D
20:20:20		62.25 C	94.5 C	146.8 B	12.5 B	873.5 C	51.7 CD	1622 CD
40:30:30		64.50 BC	96.5 B	157.5 A	13.2 AB	903.5 B	53.5 BC	1700 BC
80:50:50		65.508 B	98.0 B	161.0 A	14.1 A	908.8 B	57.0 A	1801 A
100:60:60		68.50 A	101.0 A	165.8 A	14.2 A	959.5 A	55.0 AB	1739 AB

Mean followed by different letters differ significantly at 5% level of probability

Table 1 shows that NPK levels significantly affected number of grains per disc. A contemplation to Table 2 reveals that number of grains per disc increased with increasing NPK levels. Maximum number of grains per disc was produced by plants which received 100:60:60 kg NPK/ha. Minimum number of grains per disc was registered in control plots. These results are in line with those of Weiss (1967).

The response of 1000 grain weight to NPK levels was significant (Table 1). Results of LDS test (Table 2) indicated that heavier grains were produced by plants which received 80:50:50 kg NPK/ha. Highest level of 100:60:60 kg NPK/ha did not bring any increase in 1000 grain weight due to the presence of unfilled grains. Minimum 1000 grain weight was documented in control plots. These results are supported by the view of Mishra *et al*. (1995).

Table 1 indicates that different levels of NPK significantly affected the grain yield of sunflower. A probe to Table 2 indicates that maximum grain yield was recorded for plots which received 80:50:50 kg NPK/ha whereas minimum grain yield was registered for control plots. No further increase in yield was noticed for plots which received 100:60:60 kg NPK/ha due to the presence of unfilled grains. These results are in conformity with those of Supak *et al*. (1975), Stulin (1991), Nagar and Allam (1991) and Sathiyavelu *et al*. (1994).

From these results an increase in the magnitude of almost all characters of sunflower studied with the increasing levels of NPK. However, the increase in 1000 grain weight and grain yield per hectare was upto 80:50:50 kg/ha NPK level. Nevertheless, application of 80:50:50 kg NPK/ha is recommended to enhance top productivity of sunflower.

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