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STUDIES OF SUNFLOWER FERTILIZATION IN A.R. EGYPT

Sunflower is a new crop for Egypt. The fact that the cultivated area is limited and is always occupied with cotton and other food crops which are needed for country makes it difficult to include sunflower in the rotation. We have two possibilities: (1) to expand sunflower cultivation horizontally in the newly reclaimed lands, or (2) to limit the area and expand the production vertically by means of better varieties and better agronomy. For this last purpose our experiment was carried out to establish the rates and combinations of fertilizers required for the maximum economic yields of sunflower under local conditions.

Caravan (1962) showed that doses of 120, 80 and 160 kg/ha of NPK were the maximum when applied separately. Bilteanu and Rada (1963) found out that insufficient N, P or K during initial growth exerted a strong negative influence on plants which could not be corrected later.

Our experiment was carried out during the season of 1975 at Sakha Research Station.

The soil had a heavy mechanical composition (30.2% of fine earth and 46.1% of clay) and little organic matter (1.0%). There was 2.1% of $CaCO_3$.

The varieties used in the investigation were as follows:

(a) GIZA 1. was first introduced from Turkey in 1956 under the name "Gerasol white". It was adapted to the Egyptian environment until it became the commercial variety. It has a high yield and low oil content.

(b) MAJAK is a Russian variety introduced from Bulgaria in 1965. It has a low yield ability and high oil content when compared with GIZA 1.

Fertilizer treatments were as follows:

A.	$N_oP_oK_o$ (check)	H.	$N_3P_1K_1$
B.	$N_oP_oK_1$	I.	$N_oP_2K_1$
C.	$N_1P_oK_1$	J.	$N_1P_2K_1$
D.	$N_2P_oK_1$	K.	$N_2P_2K_1$
E.	$N_2P_oK_1$	L.	$N_1P_3K_1$
F.	$N_oP_1K_1$	M.	$N_3P_3K_1$
G.	$N_1P_1K_1$	N.	$N_1P_1K_o$

in which N_1, N_2 and N_3 = 15, 30 and 45 kg N/Fed. [x] given as ammonium sulphate

P_1, P_2 and P_3 = 15, 30 and 45 kg P_2O_5/Fed. given as superphosphate, and

K = 24 K_2O/Fed. as potassium sulphate

Six replications were used.

Seed sowing took place on 2 June, 1975. The fertilizers were split and applied 15 and 30 days from planting. Irrigation was practised every 10 days. On 6th September the sunflower in all treatments were already matured, and on this date the sunflower crop was harvested.

It is clear from Table 1 that the plant responded significantly to N when applied alone. In this experiment the increase in yield due to N application ranged from 16.5 to 32.6% and from 8 to 20% for GIZA 1 and MAJAK varieties, respectively, over that obtained from the check treatment. Comparing the levels of N, significant difference was detected between the application of 15 and 30 kg N/fed.

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[x] Feddan = 4200 m^2

Table 1

Response of Sunflower to N, P or K Applied Separately

Level of fertilizer (kg/fed)	Yield in kg/fed[x]		Increase over check (kg/fed)		% increase	
	Giza I	Majak	Giza I	Majak	Giza I	Majak
Check	327.5	225.0	-	-	-	-
N_{15}	381.6	243.0	54.1	18.0	16.5	8.0
N_{30}	434.7	270.0	107.2	45.0	32.6	20.0
N_{15}	461.7	285.0	134.2	60.0	40.9	26.6
P_{30}	450.3	243.0	122.8	18.0	37.5	8.0
K_{24}	333.0	237.0	6.0	12.0	1.6	5.3

[x] Each figure represents a mean of 6 replicates.

Table 1 illustrates the effect of P in different rates on the yield of sunflower plant. The results show that the yield was consistently and significantly increased as a result of P application. Per cent increase in yield over that obtained from the check (unfertilized) treatment amounted to 40.9–37.5% and 26.6–8% for the GIZA 1 and MAJAK varieties respectively. The most effective phosphorus close was 15 kg/fed. Increasing the P rate to 30 kg decreased the yield level in both varieties. This indicates that if P has to be applied alone, high rates are not recommended.

The application of 24 kg/fed. of K gave a yield of 333.0 kg/fed for GIZA 1 and 237.0 kg/fed. for MAJAK, indicating that no significant effect was detected due to K. Previous experiment data proved that Egyptian soils have enough available K to meet the nutritional requirement of plants (Shalaby, 1950 and Hamissa et al., 1969).

The combined effect of N, P and K was stronger on sunflower seed yield.

Table 2 reveals that the application of fertilizers at a rate of $N_{15}P_{30}K_{24}$ increased the seed yield about 28 and 26% for GIZA 1 and MAJAK, respectively.

Increasing N, the increase of seed yield was about 40% for GIZA 1 variety, whereas for MAJAK there was a decrease of 15% compared with $N_{15}P_{30}K_{24}$.

Maximum yield of GIZA 1 variety was obtained from the $N_{15}P_{45}K_{24}$ treatment. At this rate the increase in yield over that obtained from the check treatment amounted to about 72%. Maximum yield of MAJAK variety – 282.9 kg/fed. – was obtained from the treatment $N_{15}P_{30}K_{24}$. At this rate the increase in yield over the check amounted to about 26%. Higher rates of N or P ($N_{45}P_{45}K_{24}$) resulted in negative responses, leading to the lower yields sunflower seeds.

Table 2

Response of Sunflower Plant to NPK in Different Combinations

Level of fertilizer (kg/fed)	Yield in kg/fed		Increase over check (kg/fed)		% increase	
	Giza 1	Majak	Giza 1	Majak	Giza 1	Majak
Check	328.5	225.0	-	-	-	-
$N_{15}P_{15}K_{24}$	333.9	271.0	5.4	46.0	1.6	20.4
$N_{30}P_{15}K_{24}$	370.8	241.0	42.3	16.0	12.8	7.1
$N_{45}P_{15}K_{24}$	429.0	270.0	100.5	45.0	36.3	20.0
$N_{15}P_{30}K_{24}$	422.3	282.9	93.8	57.9	28.2	25.7
$N_{30}P_{30}K_{24}$	551.7	246.0	223.2	21.0	67.9	9.3
$N_{15}P_{45}K_{24}$	567.0	184.5	238.5	-41.5	72.3	-18
$N_{45}P_{45}K_{24}$	421.2	230.4	93.7	5.4	31.2	2.4

Summary

1. When N, P and K were applied separately P had the strongest effect on sunflower yield while K did not increase the yield.

2. The maximum yield was obtained when the three major elements were applied together. The optimum rate of fertilizer application for Giza 1 variety was $N_{15}P_{45}K_{24}$ kg/feddan and for Majak variety $N_{15}P_{30}K_{24}$ kg/feddan. Application of higher doses of NPK did not give further increases in seed yield of sunflower.

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