

Physiological Development of Sunflower as Affected by Increasing Levels of Nitrogen

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Abstract: It was observed that all the physiological parameters of sunflower were significantly effected by the various levels of N. Maximum plant height, number of leaves plant⁻¹, leaf area and head diameter were obtained from the plots where N:P:K was applied @ 120:75:50 kg ha⁻¹. However, maximum germination (82.7 %) was recorded in control treatment as well as where N alone @ 75 kg ha⁻¹ was applied.

Key words: Sunflower, nitrogen, physiological development

Introduction

Sunflower is an important oil seed crop which can be successfully grown in arid and semi arid areas of the world. It is a short duration crop and can be cultivated twice a year as spring and autumn crop. There are several factors which play an important role in increasing per acre yield of sunflower but the use of proper kind and quantity of fertilizer play a remarkable role in boosting up its production. Increase in plant height, plant weight, head diameter and 1000 seed weight has been obtained with increase in levels of applied N and P (Roga *et al.*, 1984; Cheng Shuang, 1989). It has also been investigated that sunflower produced higher yield with 120 kg N ha⁻¹ as compared with 60 kg N ha⁻¹. While application of 110 kg N ha⁻¹ was found as optimum and economical dose (Singh and Quadri, 1984; Singh *et al.*, 1987). Robinson (1978) while studying the effect of different levels of NPK on the seed yield of sunflower observed that it increased to 200 kg ha⁻¹ with increasing rate of N. In another experiment he reported more increase in seed yield with P than K fertilizer. Mahswarappa *et al.* (1985) reported that 120 kg N, 90 kg P₂O₅ and 40 kg K₂O ha⁻¹ were required to increase the seed yield, protein and oil content of sunflower.

The present research work was, therefore, carried out in order to study the effect of increasing levels of N in combination with P and K on the physiological development of sunflower and to recommend a suitable dose of the fertilizer to the farming community.

Materials and Methods

A field experiment was laid out to study the effect of increasing levels of nitrogen alone and in combination with P and K at Agricultural Research station Serai Naurang, District Bannu. It was laid out in a Randomized Complete Block Design with 4 replication. The soil was thoroughly prepared before sowing and the sunflower variety "SMT" was planted on March 6, 1998 using 5 kg seed ha⁻¹. Full dose of P and K were applied at sowing time while half dose of N of each treatment was applied at sowing and half during earthing up. Other recommended cultural practices were kept constant and followed throughout the experiment. The combination of the treatments was as under:

Treatment	Fertilizer Level (Kg ha ⁻¹)		
	N	P ₂ O ₅	K ₂ O
T1	0	0	0
T2	75	0	0
T3	100	0	0
T4	120	0	0
T5	75	75	0
T6	100	75	0
T7	120	75	0
T8	75	75	50
T9	100	75	50
T10	120	75	50

Data on % germination, Plant height, Number of leaves plant⁻¹, leaf Area and head diameter were recorded during the course of the study. The data obtained were statistically analysed using standard method of analysis (Steel and Torrie, 1980).

Soil of the experimental site was also analysed for its physico-chemical characteristics before sowing of crop according to the methods proposed by Page *et al.* (1982) which are presented in Table 1.

Table 1: Physio-chemical characteristics of the soil

Properties	Unit	Quantity
Clay	%	17.0
Silt	%	27.0
Sand	%	56.0
Textural Class		Sandy loam
Organic matter	%	0.94
pH		7.8
ECe	mmhos/cm	2.8
CEC	meq/100g	13.25
Total N	%	0.04
Available P	ppm	15.00
Available K	ppm	130.00

Results and Discussion

Germination %: Data on % germination of sunflower are shown in Table 2. It revealed that differences due to levels of N fertilizer were significant. The highest germination % of (82.7) was obtained from control plot and where N was applied at the rate of 75 kg ha⁻¹ while minimum % germination (64.4) was recorded in plots treated with fertilizers at the rate of 100:0:0 and 100:75:50 kg NPK ha⁻¹. The decrease in % germinations at increased level of fertilizer may be due to the injurious effect of high dose of N at the time of seed sprouting or poor viability of the seed used in the trial.

Plant height: The data given in Table 2 indicated that the effect of N fertilizer alone and in combination with P and K

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Table 2: Biological characteristics of sunflower as affected by increasing levels of N fertilizer

Treatments N:P:K	Germination (%)	Plant Height (cm)	No of Leaves Plant ⁻¹	Leaf Area (cm ²)	Head Diameter(cm)
0:0:0	82.7a	80.5d	19.7c	2560e	9.0c
75:0:0	82.7a	106.0c	21.0b	2992d	10.7b
100:0:0	64.4b	110.1bc	22.0ab	3076d	10.7b
120:0:0	74.4ab	114.0b	22.0ab	3178c	11.7ab
75:75:0	77.7ab	110.0bc	22.0ab	3215c	11.2ab
100:75:0	71.1ab	115.0b	21.7ab	3206c	11.7ab
120:75:0	66.9b	118.1b	21.7ab	3352b	11.5ab
75:75:50	66.6b	110.3bc	21.0b	3211c	11.2ab
100:75:50	64.4b	120.0b	21.7ab	3402b	12.2ab
120:75:50	66.9b	128.2a	22.7a	3827a	12.8a

Means sharing different letters differ significantly at 5% probability level.

had a significant effect on plant height. Maximum plant height of 128.2 cm was recorded in treatment where N:P:K was applied at the rate of 120:75:50 kg ha⁻¹ and the lowest (80.3 cm) was obtained from control treatment. The increase in plant height due to increasing levels of N along with P and K might be the result of availability of major nutrients to the plants in a balanced form which caused a favourable effect on the growth of the crop. Suliman *et al.* (1981) also found that with an increase in N levels, there was an increase in vegetative growth and hence more plant height.

Number of leaves plant⁻¹: The data in Table 2 showed that the number of leaves plant⁻¹ were significantly affected by the levels of N alone and in combination with P and K fertilizers. It is obvious from the Table that maximum number of leaves plant⁻¹ (22.7) were obtained from plots treated with 120:75:50 kg ha⁻¹ of N:P:K while minimum (19.7) were recorded in control treatment. The maximum number of leaves plant⁻¹ obtained at high level of N may be the result of its effect on boosting the vegetative efficiency of the crop plants. The results support the findings of Narwal and Malik (1986) who found that increasing N application rates from 60 to 90 kg ha⁻¹ resulted in increased plant height, No of leaves plant⁻¹ and yield of sunflower.

Leaf area: Leaf area is the major physiological parameter which determine the yield of the crop. The data regarding leaf area plant⁻¹ were taken after the plants attained full height. Statistical analysis of the data in Table 2 showed that the leaf area was significantly effected by the various levels of N. Maximum leaf area of 3827 cm² was obtained from the plots where N:P:K level was applied at the rate of 120:75:50 kg ha⁻¹ and the minimum (2560 cm²) was recorded in control treatment. The results suggested that N alone does not contribute much to the vegetative growth of plants as compared to that where it is applied in combination with P and K. These results corroborate the findings of Mahswarappa *et al.* (1985) who reported that 120 kg N, 90 kg P₂O₅ and 40 kg K₂O ha⁻¹ were required to get maximum leaf area of sunflower crop.

Head diameter: Head diameter is the final goal of the research workers which contribute to the economic yield of sunflower. Statistical analysis of the data presented in Table 2 revealed that the head diameter of sunflower was significantly effected by different levels of N. Treatments receiving N:P:K level at the rate of 120:75:50 kg ha⁻¹

produced the highest head diameter (12.75 cm) which was followed by treatments receiving N:P:K dose at the rate of 100:75:50 and 120:75:0 kg ha⁻¹ while decreased head diameter was observed in case of control treatment. The results suggested that the increase in head diameter with N in combination with P and K may be due to increase in the photosynthetic activities of the crop plants which resulted in favourable effect on the physiological development of plant.

It could be concluded from the present findings that application of N alone may not yield positive results as far as agronomic characters of sunflower crop are concerned. However, application of N in combination with P and K may contribute in achieving the desired results.

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