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TIME AND METHOD OF FERTILIZER APPLICATION AFFECTING GROWfH AND YIELD BEHAVIOUR OF SUNFLOWER

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The effect of time and method of fertilizer application on sunflower production was determined on a loamy soil having 0.03% N, 7.2 and 147 ppm PzD_S and *KzD,* respectively. Both the NP fertilisers were applied either in bulk at sowing or with first irrigation or through split application. Different techniques like broadcast, side drilling/ dressing and band application below the seed row were also used. The results revealed that the treatment where 1/2 N with full P at sowing (banding below seed row) and remaining N applied with first irrigation as side dressing, showed an edge over regarding leaf area/plant, head size, seed number/head, lOOO-seed weight and yield hat along with higher net returns.

INTRODUCTION

Sunflower is a newly introduced oilseed crop in the country which holds good promise because of having wider adaptation, high seed oil and yield capacity. The role of fertilisers is well recognised in improving crop yield particularly on exhausted soils like ours. Fertilisers are costly input in the agrj-cultural production and hence improving fertiliser use efficiency has become a priority issue.

Various researchcrs : have placed different reports about the time and method of fertilizer application for different crops. Split application of N (1/2 at seeding with P, 1/4 after 21 and 1/4 after 45 days from seeding) was found to be a suitable technique for increasing sunflower yields (Rao *et al.,* 1976) while Yousaf *et al.* (1984) reported that splitting of N into two doses (1/2 N with P at seeding and remaining N applied with first irrigation) produced beller results. Similarly, Ditta (1978) favoured split application of N and banding of lfertilizcn below the seed row at the time of sowing. However, the efficiency of surface applied soluble phosphates on certain crops was found to be greater than previously supposed (Stansford *et al.,* 1950). Moreover, Nelson *et al.* (1949) and Stanford and Nelson (1949) had found that placement in the row or in bands at seed depth was the most efficient method of applying P lfertilizer to corn.

Keeping in view these varied findings, it was contemplated to find out a suitable time and method of fertilizer application for harvesting a good crop of sunflower under our conditions.

MATERIALS AND METHODS

The experiment was conducted on a loamy soil containing 0.03% N, 7.2 and 147 ppm PzD_S and *KzD,* respectively. The experiment was laid in a randomised complete block design with four replications by maintaining a net plot measuring 3.6 x 7 m. sunflower cv. Hysun-33 was planted on September 12, 1989 in 60 cm apart rows. Later. on plant to plant distance was maintained at 22 cm by thinning.

The different treatments were:

T_1 = All P and 1/2 N at sowing and remaining 1/2 N with first irrigation (broadcast).

T_2 = All P and N at sowing (broadcast)

T_3 = All P and N with Ist irrigation (broadcast)

T_4 = All P and N at sowing (banding below seed row)

T_5 = All P and N with Ist irrigation (side dressing)

T_6 = All P with 1/2 N at sowing (broadcast) and remaining 1/2 N with Ist irrigation (side dressing)

T_7 = All P with 1/2 N at sowing (banding below seed row) and remaining 1/2 N with 1.st irrigation (side dressing)

(Steel and Torrie, 1980). The yield data were further put to economic analysis to determine BCR (Benefit Cost Ratio).

RESULTS AND DISCUSSION

The data (Table 1) indicate that leaf area was significantly affected by the treatments under study. The maximum leaf area per plant (7312 cm^2) was recorded in T_7 which, however, remained statistically at par with TJ, T_5 and T_6. Similarly, all the treatments except T_7 did not differ significantly from one another. The treatment (T_7) where all P and 1/2 N at sowing (banding below seed row) and remaining 1/2 N was applied with Ist irrigation through side dressing also produced larger head diameter (21.3 cm)

Table 1. Growth and yield behaviour of sunflower as affected by time and method of fertiliser application

Treatment	Leaf area plant^{-1} (cm^2)	Head size (cm)	Number of seeds per head	1000-seed weight (g)	Seed yield (kg ha^{-1})
T_1	5144 ab	17.1 c	912 b	75.0 ab	2733 b
T_2	5016 b	18.5 b	1023 b	51.6 c	1827 e
T_3	3455 b	18.7 b	1005 b	67.3 b	2231 d
T_4	5055 b	18.7b	998 b	67.2 b	2437 c
T_5	5876 ab	19.2 b	1067 b	n.Ob	2539 c
T_6	5806 ab	19.7 b	1092 ab	76.5 ab	2839 b
T_7	7312 a	21.3 a	1212 a	82.3 a	3242 a

Means not sharing a letter in common differ significantly at 5% probability

A recommended dose of fertilizer i.e, 75-50 kg ha^{-1} of NP in the form of urea and single superphosphate was used. Observations were recorded on leaf area, head size, seed number per head, WOO-seed weight and seed yield ha^{-1}. The data collected were analysed using analysis of variance technique and differed significantly from rest of all the treatments (Table 1). It was followed by T_2, T_3, T_4, T_5 and T_6 which differed non-statistically. The smaller sized heads were recorded in T_1. Maximum number of seeds/head (1212) were recorded in T_7 and were at par with T6 but differed significantly from rest

of the treatments. The treatment T_7 produced the heaviest seeds (82.3 g 1000-seed). This treatment was, however, found to be statistically similar to T_1 and T_6. The treatments T_2, T_3, T_4, T_5 and T_6 also remained statistically alike whereas the lightest seeds (51.6 g per 1000-seed) were produced by T_2.

The increased leaf area, head size, seed number, seed weight and seed yield in treatments where fertilizer was banded below seed row or side dressed can be attributed to increased efficiency of fertilizer because of decreased chances of losses and hence more availability in the immediate vicinity of roots. The relatively low leaf area plant^{-1} recorded in treatments where fertiliser was broadcasted may be due to the losses which usually occur in the form of volatalisation and because of low fertilizer use efficiency due to fixation in the soil complex. These results support the findings of earlier researchers, like Nelson *et al.* (1950), Rao *et al.* (1976) and Yousaf *et al.* (1984).

Table 2. Agro-economic analysis of sunflower response to time and method of fertiliser application

Treatment	Yield (kg ha^{-1})	Fertiliser application	expenditures Wages	Gross (Rs. ha^{-1})	Gross	Net return	OCR
Tt	2733	1105	75	5572	13665	8093	2.5
T_2	1827	1080	50	5547	9135	3588	1.6
T_3	2231	1080	50	5547	11155	5608	2.0
T_4	2437	1155	125	5622	12185	6563	2.2
T_5	2539	1130	100	5597	12695	7098	2.3
T_6	2839	1180	150	5647	14195	8548	2.5
T_7	3242	1255	225	5722	16210	10488	2.8

Rate/bag.urea = Rs. 185/-, SSP = Rs.78/-
Rate/kg sunflower = Rs. 5/- and
Cost of production of sunflower = Rs. 4467 per ha^{-1} (without fertiliser)

The treatments also showed a significant effect on the seed yield ha^{-1} where T_7 produced the highest seed yield (3242 kg ha^{-1}). It was followed by T_5 and T_6 where the later treatments produced statistically similar results. The lowest seed yield (1827 kg ha^{-1}) was recorded in T_2 where all P and N were applied at sowing though broadcast. The economic analysis (Table 2) reveals that, though the cost of fertilizer was more amounting to Rs. 1255 ha^{-1} in case of T_7, yet the BCR value was higher (2.8). It was followed by T_6 and T_1 giving BCR values (2.5). The lowest BCR (1.6) was recorded in T_2 where all the P and N was applied at sowing through broadcast.

It can be concluded from the results that for increasing fertilizer use efficiency in sunflower, all the P and 1/2 of N dose should be banded below seed row and remaining 1/2 N be applied with first irrigation through side dressing.

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