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Determining a Suitable Rate and Source of Nitrogen for Realizing the Higher Economic Returns from Autumn Sown Sunflower

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ABSTRACT

An experiment to evaluate the effect of different levels (control, 75 and 100 kg ha^{-1}) and sources (Urea and Ammonium Sulphate) of N application along with 75 kg P_2O_5 ha^{-1} on the growth and yield components of sunflower cultivar "HYSUN-33" was conducted at Agronomic Research Area, University of Agriculture, Faisalabad, during 1996. Randomized Complete Block Design with four replications was used by maintaining a net plot size as 3m x 5m. The results revealed that plant parameters like stem girth, head diameter, number of seeds per head, 1000-seed weight, seed yield and seed oil content were significantly affected by different levels and sources of N application. The treatment 100–75 kg N P ha^{-1} (Ammonium Sulphate for N source) produced the maximum yield ha^{-1}. However, the oil contents were highest in the treatment 100–75 kg NP ha^{-1}, where urea was the source of N.

Key Words: Sunflower; Nitrogen; Economic return

INTRODUCTION

Sunflower (*Halianthus annuus* L.) is the world's second important edible oilseed crop next to soybean. It is rich in oil content (35–50%) and being a short duration crop (90–100 days) has the tremendous potential to be grown twice a year. As our soils have gone deficient in plant food nutrients because of intensive cropping system, hence good harvest of a crop is only possible with the use of proper level of fertilizers. Among different nutrients applied, nitrogen is one of the most essential element for plant growth. Besides the rate of Nitrogen, the source of nitrogen is also important for the growth and yield of some crops under some situations. Kamel *et al.* (1980) observed that N fertilization significantly increased head diameter, number and weight of seeds $head^{-1}$ and 1000–seed weight in sunflower, while Chaudhary and Patrude (1981) found that 75 kg N along with 30 kg P_2O_5 ha^{-1} was the optimum dose for having increased yield of sunflower. Sarwar (1987) studied various doses of N (0, 100, 150, 200 kg ha^{-1}) and concluded that N had significant effect on stem girth, number of seeds $head^{-1}$, 1000–seed weight, grain yield and oil contents. Munir (1990) reported that stem girth, head diameter, percentage of filled seeds $head^{-1}$ and 1000-seed weight of sunflower were significantly affected by nitrogen application with Phosphorous. He further stated that the fertilizer treatment of 100–75 kg NP ha^{-1} produced the highest seed oil contents of 44.52%. Similarly, Rasul (1992) found that stem girth, head diameter, number of seeds $head^{-1}$, 1000-seed weight and seed yield was highest with 100–75 kg NP ha^{-1}.

The yield components were also significantly affected by different N sources. Anderson *et al.* (1946) and Chang *et al.* (1953) found ammonium Sulphate superior to urea and ammonium nitrate. Stephen and Waid (1963) in an experiment on various crops found that the response from urea was lower than that of ammonium Sulphate especially at higher rates of applied nitrogen. Fox and Hoffman (1981) found that ammonium sulphate gave significantly higher yields than the other N sources. Moreover, Al-Gharbi and Yousaf (1989) conducted an experiment on sunflower and found that urea as N source gave the highest growth rate and oil content.

Present experiment therefore was planned to evaluate the optimum level and suitable source of Nitrogen to be applied with phosphorus for harvesting better returns of sunflower hybrid "HYSUN-33".

MATERIALS AND METHODS

The present study was carried out during 1996 at the Agronomic Research Area, University of Agriculture, Faisalabad, on a Sandy clay Loam soil containing on an average 0.042 per-cent Nitrogen, 6.20 ppm available phosphorus and 167 ppm potash. The experiment was laid out using Randomized Complete Block Design with four replications having a net plot size of 3m x 5m. Sunflower variety "HYSUN-33" was planted in 60 cm apart rows with the help of single row hand drill in the second week of Sept. 1996. The experimental treatments were control, 75–0, 75–75, 100–75 kg NP ha^{-1} (Urea and Ammonium Sulphate were used as sources of Nitrogen). Whole of P and

half of N was side drilled immediately after seeding while remaining half of N was applied with first irrigation. Inter plant distance of 22 cm was maintained by thinning at 5–6 leaf stage. The crop was kept free from weeds by hoeings. Observations were recorded on plant parameters like stem girth, head diameter, Number of filled seeds head^{-1}, 1000-seed weight, seed yield and seed oil contents.

The data recorded on various growth and yield parameters were analyzed by Fisher's analysis of Variance techniques and treatment means were compared by using LSD test at 0.05 probability level. (Steel & Torrie, 1980).

The Experimental data was further put to economic analysis by using the methodology described in by Parren *et al.* (1988). The purpose of this analysis was to evaluate the differences in costs and benefits for different treatments for determining the net benefits.

RESULTS AND DISCUSSION

Stem girth was affected significantly by varying levels and sources of Nitrogen. Both the levels of N (75 or 100 kg ha^{-1}) from both the sources when applied along with P produced significantly thicker stem of sunflower than that of control. The stem girth increased with increasing rate of nitrogen and was maximum (6.36 cm) in case of treatment 100–75 kg NP ha^{-1} (Ammonium Sulphate as a source of Nitrogen). These results are in agreement with those of Sarwar (1987), Munir (1990) and Rasul (1992).

Table I further shows that all the fertilizer treatments produced higher head diameter from that of control. The maximum head size was observed in case of treatment 100–75 kg NP ha^{-1}. However, at each level of fertilizer, the sources (Urea and Ammonium Sulphate) produced statistically same results. These results are quite in line with those of Rasul (1992).

The data regarding number of filled seeds head^{-1} indicate that highest number of filled seeds head^{-1} (862.55) was in treatment 100–75 kg NP ha^{-1}, (Nitrogen source Ammonium Sulphate) which differed significantly from all other treatments. Similar results were also recorded by Fox and Hoffman (1981).

The data in the Table I further show highly significant increase in the 1000-seed weight by the application of N over control. Application of 100–75 kg NP ha^{-1} (ammonium Sulphate N source) produced highest 1000-seed weight (57.78 g) and differed significantly from all other treatments. The lowest 1000-seed weight (49.21 g) was obtained in control plots. These findings are similar to those of Stephen and Waid (1963).

Seed yield was significantly affected by the application of various rates and source of Nitrogen. The highest seed yield (2308.33 kg ha^{-1}) was obtained in plots treated with 100–75 kg N P ha^{-1} (Ammonium Sulphate N Source). Fox and Hoffman (1981) have also reported increase in seed yield of sunflower with varying rates and source of Nitrogen application.

Oil contents were also significantly influenced by N application. The highest seed oil contents (44.53%) were obtained in plots treated with 100–75 kg NP ha^{-1} (Urea N source) which differed significantly from rest of all the treatments. This may be because of a balanced form of nitrogen and phosphorus which lead to better utilization of these elements by the plants. These results are in agreement with those presented by Al-Gharbi and Yousaf (1989).

ECONOMIC ANALYSIS

Economic analysis given in Table II reveal that treatment (100–75 kg NP ha^{-1}) where Ammonium Sulphate was the source of Nitrogen, gave the maximum/highest net returns in the form of net income ha^{-1} (Rs. 15493.14) which was 85.93% higher

Table I. Growth and yield of autumn sunflower as influenced by the rate and source of applied nitrogen

Treatments (kg ha^{-1}) N	P_2O_5		Stem girth (cm)	Head diameter (cm)	No. of filled seeds head^{-1}	1000-seed wt.	Seed yield (kg ha^{-1})	Seed oil contents (%)
0	0	Control	5.06 c	13.32 d	423.32 e	49.21 e	1349.74 d	38.42 g
75	0	Urea	5.55 c	14.89 c	560.19 d	50.47 d	1766.66 c	40.35 e
75	0	Ammonium sulphate	5.57 c	14.69 c	632.33 c	50.93 d	1874.99 bc	39.30 f
75	75	Urea	5.94 b	15.52 bc	677.02 c	52.41 c	1999.99 abc	42.05 c
75	75	Ammonium sulphate	5.83 b	16.38 b	671.58 c	53.43 c	2124.99 ab	40.92 d
100	75	Urea	6.19 a	17.76 a	781.41 b	55.62 b	2158.33 ab	44.53 a
100	75	Ammonium sulphate	6.36 a	18.76 a	862.55 a	57.78 a	2308.33 a	42.40 b

Table II. Economic analysis

Treatments (Kg ha^{-1})			Yield (kg ha^{-1})	Gross income (Rs. ha^{-1})	Total expenditure (Rs. ha^{-1})	Net income (Rs. ha^{-1})	% increase in net-income over control
N	P_2O_5						
0	0	Control	1349.74	15184.57	6581.78	8332.79	-
75	0	Urea	1766.66	19874.93	7973.50	11901.43	42.82
75	0	Ammonium sulphate	1874.99	21093.64	8344.63	12749.01	52.99
75	75	Urea	1999.99	22499.88	9606.83	12893.05	54.72
75	75	Ammonium sulphate	2124.99	23906.14	9977.94	13928.2	67.15
100	75	Urea	2158.33	24281.22	9980.74	14300.48	71.62
100	75	Ammonium sulphate	2308.33	25968.7	10475.56	15493.14	85.93

Foot Note:

1. Grain values Rs. 450/40kg
2. Fertilizers: i. Urea Rs.344/bag ii. Ammonium sulphate: Rs. 209/bag.
3. Fertilizer application charges: 2 M.D., Rs. 5/MD.: Rs. 100

than the control treatment.

CONCLUSION

It can thus be concluded from the given situation that a fertilizer dose 100–75 kg NP ha^{-1} was the most suitable level with particularly Ammonium Sulphate the source of Nitrogen for obtaining the maximum net benefits.

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