SOURCE, RATE AND METHOD OF APPLICATION OF NITROGEN ON GROWTH, YIELD AND CHEMICAL COMPOSITION OF WINTER SUNFLOWER.

R.C. Samui, R.K. Singh and A.N. Dasmahapatra

Department of Agronomy, Bidhan Chandra Krishi Viswavidyalaya, P.O. Krishi Viswavidyalaya, Nadia, West Bengal, India, Pin - 741 252.

SUMMARY

A field experiment on source (NH_4Cl, $Co(NH_2)_2$ and NH_4Cl+$Co(NH_2)_2$ (50:50), rates (40 and 80 kg N/ha) and method of application of N (Basal, Basal + Top dressing) was conducted at the university farm, Bidhan Chandra Krishi Viswavidyalaya, West Bengal during winter season of 1985-1987. The results revealed that there was no significant difference in LAI, dry matter production, head diameter, number of filled seeds/head and oil content in seeds due to different source of N. Seed yield and oil yield were significantly higher when urea was applied as a source of N. Application of 80 kg N/ha significantly increased LAI, dry matter production, 1000 seed weight, head diameter, number of filled seeds seed and oil yields of sunflower. Application of N in split doses was found to increase the seed and oil yield of sunflower. There was not much variation in soil pH after harvest of the crop as compared to value before the start of the experiment. Total N and available K_2O content of the soil was decreased as compared to initial value. Chloride content of the soil was higher when NH_4Cl was used as a source of N. Yield and yield components were lower when no N was applied.

INTRODUCTION

Fertilizer N plays an important role in maximizing the agricultural production in tropical soils. It has been estimated that about 50% of the crop productivity in recent years can be attributed to fertilizer use, Bilzin and Titiz (1972) concluded that sunflower needs adequate nitrogen and specific dose is essential for satisfactory assimilation and yield of final produce but any excess of it decreases the oil yield. Mathers and Stewart (1981) observed that sufficient N upto 84 kg/ha should be provided to sunflower for maximum growth. Morris (1975) and Verghese et al., (1976) reported significant increase in head diameter, number of seeds/head and 1000 seed weight with increasing rate of applied N. Sunflower seed yield was promoted with the application of N fertilizers right upto 180 kg N/ha and the highest yield was 3.9 t/ha (Vicentini and Anelli, 1973). Guseva and Ignat'ev (1977) reported that N fertilization through NH_4Cl at an optimum rate increased Cl^- content in soil and plant.

MATERIALS AND METHODS

A field experiment on winter sunflower involving (a) sources of N - NH_4Cl, $Co(NH_2)_2$ and NH_4Cl+$Co(NH_2)_2$ 50:50 (b) level of N - 40 kg N/ha and 80 kg N/ha, (c) method of application - Basal, Basal+topdressing and control (without N) was conducted in a Asymmetrical Factorial Randomized Block Design with a 3 replications in the university farm during 1985 to 1987. There was 13 treatment combinations. All plots received a basal dose of 40 kg P_2O_5 and 40 kg K_2O/ha. The gross plot size was 5mx4m. The rows and plants were set at 40 cm and 25 cm apart respectively.

RESULTS

Plant height, dry matter production, LAI and yield attributes except 1000 seed weight did not significantly vary due to different source of N. Thousand seed weight was significantly higher when urea was used as a source of N (Table 1). Application of higher

rates of N (80 kg/ha) significantly increased dry matter production, LAI and yield components of sunflower as compared to 40 kg N. Growth and yield attributes were lower when no nitrogen was applied. As regards method of application of N, there was not much difference in yield components between basal application of N and application in 2 splits.

Seed yield and oil yield of sunflower were significantly higher when urea was used as a source of N during 1986 and in pooled data (Table 2). Application of 80 kg N/ha gave significantly higher seed yield and oil yield during 1986 and in pooled data over 40 kg level. Lowest yields were recorded when no nitrogen was applied. Application of N in two splits increased seed yield and oil yield during 1986 and in pooled data as compared to single application as basal dressing.

Source, levels and method of application of N had some influence on soil chemical properties after harvest of the crop (Table 3). There was no appreciable change in soil pH and available P_2O_5 content after harvest of the crop as compared to initial value. Total N content and available K_2O content of soil were less after harvest of the crop as compared to start of the experiment. Organic carbon and available P_2O_5 content were slightly higher when urea was used as a source of N. Chloride content in soil was higher when NH_4Cl was used as a source of N either single or in combination with urea. Organic carbon content and total N and Cl^- content of soil were more when higher rates of N (80 kg/ha) was applied. Application of N in split doses gave higher organic carbon content and N content in soil as compared to single application.

DISCUSSION

Urea was found to be a better source of N so far as dry matter production, LAI, 1000 seed weight are concerned. Seed and oil yields were more when urea was used as a source of N. Application of 80 kg N/ha gave more dry matter, LAI, 1000 seed weight, number

Table 1. Effect of sources, levels and methoed of application of N on growth and yield compontents of winter Sunflower (mean value of 3 years).

Treatment	Plant height (cm)	Dry matter production (g/m^2)	LAI	Head diameters (cm)	No.of filled seeds/head	1000 seed wt (g)
Source						
NH_4Cl	103.8	429.2	1.93	12.4	408.0	49.6
Urea	109.1	450.7	2.20	12.8	439.5	52.8
NH_4Cl + urea	109.4	434.1	2.18	12.5	402.4	51.4
SEm±	1.77	15.06	.10	0.19	12.96	0.87
CD 5%	NS	NS	NS	NS	NS	2.45
Level of N						
40 kg/ha	106.1	408.7	1.93	12.2	398.7	49.2
80 kg/ha	108.8	467.3	2.27	12.9	434.5	53.3
SEm±	1.45	12.30	.09	0.16	10.58	0.71
CD 5%	NS	35.92	.26	0.45	29.86	2.00
Method						
Basal	105.6	436.9	2.25	12.5	413.8	51.6
2 splits	109.3	439.0	1.95	12.6	419.6	50.8
SEm±	1.45	12.30	0.09	0.16	10.58	0.71
CD 5%	NS	NS	.26	NS	NS	NS
Control (without N)	85.5	179.8	1.01	9.26	317.5	33.6

Table 2. Effect of source level and method of application of N on seed yield, oil content and oil yield of winter Sunflower

Treatments	Seed yield (q/ha)				Oil yield (q/ha)			
	1985	1986	1987	Pooled	1985	1986	1987	Pooled
Source of N								
NH_4Cl	16.4	26.4	11.0	17.9	4.91	9.63	4.15	6.23
Urea	18.8	28.8	10.4	19.3	5.60	11.56	3.43	6.86
NH_4Cl + urea	17.3	25.8	9.9	17.7	5.14	9.58	3.61	6.11
SEm±	0.78	0.73	0.75	0.43	.24	.29	.25	1.25
CD 5%	NS	2.13	NS	1.21	NS	.84	NS	4.25
Level of N								
40 kg/ha	16.6	22.4	10.3	16.4	4.73	8.64	3.93	5.77
80 kg/ha	18.4	31.6	10.6	20.2	5.70	11.88	3.53	7.04
SEm±	0.64	0.60	0.61	0.35	1.95	.24	.20	.12
CD 5%	NS	1.75	NS	.98	5.68	.68	NS	.35
Method								
Basal	16.6	25.7	10.5	17.6	5.19	9.76	3.73	6.23
2 Splits	18.4	28.3	10.4	19.0	5.24	10.76	3.73	6.58
SEm±	0.64	0.60	0.61	0.35	1.95	0.24	.21	1.23
CD 5%	NS	1.75	NS	0.98	NS	0.68	NS	3.47
Control	6.8	7.5	4.1	6.1	1.62	2.35	1.02	1.66

Table 3. Effect of source, level and method of application of N on soil chemical properties (mean value of 1985 and 1986).

Treatments	pH	organic carbon(%)	Total N %	Available P_2O_5(Kg/ha)	Available K_2O(Kg/ha)	Cl^-(PPm)
Source of N						
NH_4Cl	7.2	0.63	.056	43.6	178.8	12.9
urea	7.3	0.83	.055	46.4	179.0	8.3
NH_4Cl + urea	7.3	0.66	.054	37.3	185.0	11.1
Level of N						
40 kg/ha	7.3	0.67	.053	42.6	185.3	8.5
80 kg/ha	7.3	0.74	.056	42.2	179.6	11.0
Method						
Basal	7.3	0.67	.054	44.9	180.2	7.3
2 Splits	7.2	0.74	.056	39.9	181.6	9.7
Control	7.4	0.50	.055	52.8	155.4	9.9
Initial	7.5	0.62	.080	41.2	205.5	7.0

of filled seeds and seed and oil yield. Varghese et al., (1976) and Mathers and Stewart (1981) reported that application of N at higher rates gave more dry matter, LAI, increased 1000 seed weight, number or filled seeds and head diameter of sunflower. Application of nitrogen in two splits produced significantly higher seed yield and oil yield over basal application. Steer and Hocking (1985) *reported that nitrogen may be applied most effectively to sunflower* crop just before floret initation occurs, about 20-30 days after sowing. This application supports the production of large number of florets per capitulum. A second N application just before anthesis supports the development of large single seed weights. The result of the experiment also confirm the above finding. Sunflower being exhaustive crop depleted more N and K_2O from the soil as is observed from the soil data after harvest of the crop. However, there was little variation in pH and available P_2O_5. Chloride content of soil was relatively increased over initial status of the soil when nitrogen was used as NH_4Cl or $NH_4Cl+Co(NH_2)_2$. The result corroborate the findings of Guseva and Ignat'ev (1977) who reported increased Cl content through N aplication in the form of NH_4Cl.

CONCLUSION

As a source of N urea may be used as it significantly influenced yield and yield attributes. Eighty Kg nitrogen in split doses may be applied to sunflower for higher yield. When NH_4Cl was used as a source of N the Cl^- content of soil increased.

ACKNOWLEDGEMENT

The authors are thankful to the Bidhan Chandra Krishi Viswavidyalaya, West Bengal, India for providing necessary facilities in course of investigation.

REFERENCES

Bilzin, Y. and Titiz, S. 1972 Biosynthesis of oil in Sunflower seeds and its relation to the nutrition of the plant. Seker 10 : 13-20.

Guseva, T.E. and Ignat'ev, B.K. 1977. Ammonium Chloride effect on growth, development and productivity of sunflower and safflower. Byuttelen' Nauchnotekhnicheskoi informatsii po Mastichnym kneturam 1 : 51-55.

Mathers, A.C. and stewart, B.A. 1981. Sunflower nutrient uptake, growth and yield as affected by nitrogen fertilization and plant population. Agron. Abs. 73rd annual meeting, Amer. Soc. Agron. 183.

Morris, A. 1975. Effect of nitrogen on sunflower Rhodesia agric. J. 72 : 149.

Steer, B.T. and Hocking, P. (1985). The optimum timing of nitrogen application to irrigated sunflowers. Proc. 11th. International Sunflower Conference, Argentina PP. 221-226.

Varghese, P.I., Sadanandan, N and Nair, R.V. 1976. Effect of different levels of N and P on the uptake of N and P at various stages of growth of sunflower variety Peredovik. Agric. Res. J. Kerela 14 : 105-108.

Vicentini, G. and Anelli, G. 1973. The effect of various rates of N and P_2O_5 on the productivity and oil composition of sunflower Agricoltura Italiana Pisa. 73 : 175-187.