Response of Sunflower (*Helianthus annuus L.*) to Variable Levels of N P K, Spacing and Plant Population*

M. K. Vijay,† S. N. Joshi§ and M. M. Kabaria**

ABSTRACT

Sunflower sown with row spacing of 60 cm having plant population of 1,00,000 plants per hectare and fertilised with N_{50} P_{50} K_0 kg/ha in rainy season, and 45 cm having plant population of 50,000 plants per hectare combined with N_{100} P_{100} K_{50} kg/ha in winter season were found to be optimum combinations.

INTRODUCTION

As most of area under oilseeds is covered under rainfed conditions a wide fluctuation in yield is experienced. As a measure to stabilize production of oilseeds, short duration crop that can complete its life cycle during the short spell of monsoon need to be introduced and sunflower is one of them. However, very little preliminary work has been reported on agronomic requirements of this crop in India (Jensma, 1972, Anonymous, 1972). Investigations to ascertain optimum plant population, spacing and fertiliser requirements in rainy and winter seasons were taken up at Junagadh during 1971-72 and 1972-73.

METHODS

Sunflower variety 'EC 68414' was planted in a split-split plot design, with 2 replications. Plant populations of 50,000 (P_1), 75,000 (P_2), and 1,00,000 (P_3) comprised main plot; row spacings of 30 cm (S_1), 45 cm (S_2) and 60 cm (S_3) formulated the sub plot. The combination N P K in kg/ha in rainy season where N_0 P_0 K_0 (F_1), N_{25} P_0 K_0 (F_2), N_{25} P_{25} K_0 (F_3) and N_{50} P_{50} K_0 (F_4) and in winter N_0 P_0 K_0 (F_1), N_{50} P_{50} K_{25} (F_2), N_{100} P_{100} K_{50} (F_3) and N_{150} P_{150} K_{75} (F_4) as sub-sub plot.

In rainy season, fertilisers were applied at the time of sowing, while in winter season half of nitrogen was applied at sowing and remaining after one month of sowing. Complete dose of P and K was supplied at the time of sowing.

Different characters were observed on 5 randomly selected plants per entry per plot. Data were analysed as suggested by Snedecor and Cochran (1967).

RESULTS AND DISCUSSIONS

Yield per plant:

Spacing of 60 cm gave significantly higher yield per plant compared to

---

* Part of M.Sc. (Agri.) thesis submitted by Shri M. K. Vijay to Gujarat Agricultural University, 1973.

† 38/A, New Colony, Gumanpura, Kota—1.

§ Principal, College of Agriculture, Junagadh.

** M.Sc. Student, College of Agriculture, Junagadh.

45 cm and 30 cm in rainy season 16.6 per cent and 14.6 per cent, respectively (Table 1). Application of fertilizer gave significantly higher yield per head over no fertilization in rainy season, but in winter season, application of N_{150} P_{150} K_{75} kg/ha gave the highest yield per head. The interaction between plant population and spacing was significant for yield per head during both the years. A combination of 50,000 plants/ha spaced 45 cm and 60 cm between rows was optimum for winter and rainy seasons, respectively.

TABLE—1

Effect of different treatments on yield and other characters.

	Rainy Season 1971			*Winter Season 1972*		
Treatments	*Yield per head* g	*Wt. of seed/head* g	*1000 seed weight* g	*Yield per head* g	*Wt. of seed/head* g	*1000 seed weight* g
Levels of plant population						
50,000 plants/ha	23.54	22.39	46.37	27.46	26.44	55.84
75,000 plants/ha	24.27	23.00	45.23	20.20	19.33	49.23
1,00,000 plants/ha	20.47	19.28	44.60	19.83	18.82	47.42
'F' test	NS	NS	NS	NS	NS	NS
SEm ±	1.438	1.356	1.640	1.641	5.315	2.710
Spacings						
30 cm	21.82	20.75	45.51	21.54	20.57	50.44
45 cm	21.45	20.33	43.68	22.99	21.97	51.47
60 cm	25.02	23.63	43.01	22.95	21.06	50.58
'F' test	*	*	NS	NS	NS	NS
SEm	0.754	0.678	0.835	0.611	0.514	1.508
CD at 5%	2.609	2.345				
Fertilizer treatments						
N_0 P_0 K_0	18.61	17.66	42.02	20.34	19.21	50.41
N_{25} P_0 K_0	23.16	22.10	45.49			
N_{25} P_{25} K_0	24.30	22.85	48.36			
N_{50} P_{50} K_0	24.98	23.67	45.73			
N_{50} P_{50} N_{25}				21.54	20.74	47.52
N_{100} P_{100} K_{50}				22.39	21.27	51.83
N_{150} P_{150} K_{75}				25.10	24.91	53.36
'F' test	†	*	*	†	†	
SEm ±	1.252	1.252	1.410	0.891	0.880	1.297
CD at 5%	3.633	3.633	4.091	2.584	2.553	3.763

*Significant at P=.05 level,† Significant at P=.01 level, NS=Not significant.

Weight of filled seed:

Significantly higher yield of filled seed was obtained with 60 cm rows to 45 cm (16.2 per cent) and 30 cm (13.8 per cent) in rainy season. Application of N_{50} P_{50} K_0 kg/ha gave significantly higher weight over no fertilization, but did not differ significantly over others in rainy season, whereas in winter season N_{150} P_{150} K_{75} kg/ha resulted in significantly greater seed weight than N_{50} P_{50} K_{25} kg/ha and no fertilization. Application of N_{100} P_{100} K_{50} and N_{150} P_{150} K_{75} kg/ha were at par. Interaction between spacing and fertilizer in rainy season was significant for seed weight and combination of 60 cm row with N_{25} P_{25} K_0 kg/ha gave the highest seed weight (54.1 g).

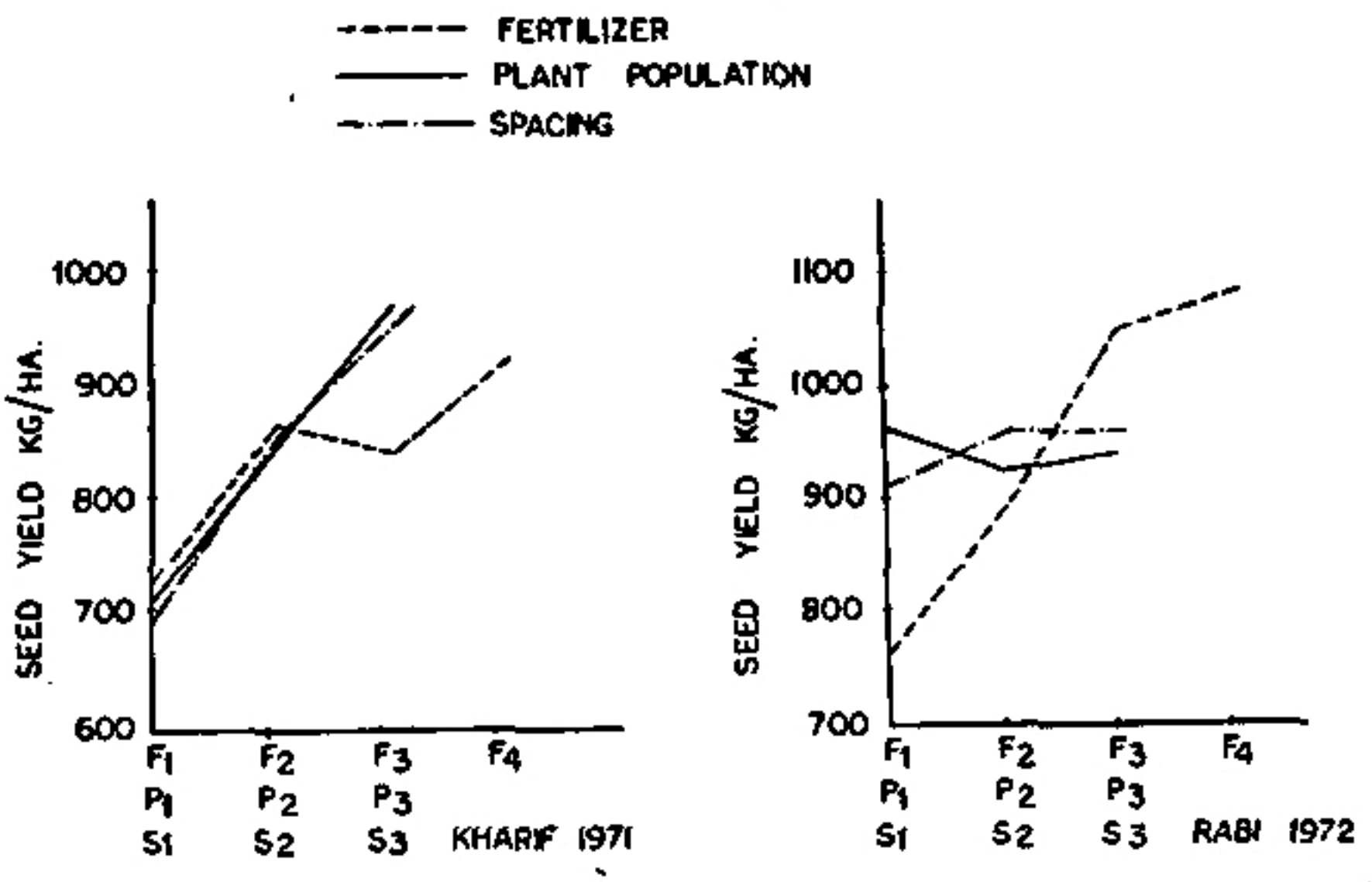
Oil content:

No significant differences were observed due to population, spacing and fertilizers alone and their combinations on oil content in any of the seasons.

Yield of seeds per hectare:

In rainy season N_{50} P_{50} K_0 kg/ha gave significantly highest yield (25-2 per cent) over no application but was at par with N_{25} P_0 K_0 kg/ha and N_{25} P_{25} K_0 kg/ha whereas in winter season N_{150} P_{150} K_{75} kg/ha was significantly superior to N_{50} P_{50} K_{25} kg/ha and no application. It did not differ significantly from the treatment of N_{100} P_{100} K_{50} kg/ha (Fig. 1). It was also observed

Fig. 1. Yield trend to variable levels of N P K, plant population and spacing.



that applications of N_{150} P_{150} K_{75} kg/ha which costs Rs. 200/- more than N_{100} P_{100} K_{50} kg/ha, realised only 34 kg more yield which is not economical, hence the optimum dose was N_{100} P_{100} K_{50} kg/ha. Interaction of fertilizer × plant population and fertilizer × spacing gave the highest yield/ha in a combination of 1,00,000 plants with N_{25} P_0 K_0 kg/ha spacing of 45 cm rows with N_{50} P_{50} K_0 kg/ha in rainy season.

ACKNOWLEDGEMENT

Thanks are due to the financial assistance of Vanaspati Manufacturers' Association of India.

REFERENCES

Anonymous, 1972. (a) A report on All-India Co-ordinated Research Project on oil-seeds, yields from sunflower feasibility trials 1969-71. (b) A report of seminar on sunflower development and reserarch needs. Directorate of Oilseeds Development, Hyderabad-29 (AP).

Junsma, J. R. 1972. Sunflower growing in India, Research Division, Netherlands.

Snedecor, G. N. and W.G. Cochran 1967. Statistical methods, Iowa State University Press, Ames, Iowa, USA, 6th Ed. p. 370-72.