

## EFFECT OF NITROGEN AND PHOSPHORUS ON YIELD ATTRIBUTES, SEED YIELD AND OIL CONTENT OF IRRIGATED SAFFLOWER IN LATERITE SOIL

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### ABSTRACT

Effect of nitrogen (0, 60 and 120 kg/ha) and phosphorus (0, 40 and 80 kg/ha) on the performance of safflower in laterite soil was studied. Application of 120 kg N and 40 kg  $P_2O_5$ /ha significantly improved the growth and yield components and increased the seed yield of safflower. Oil percentage in seeds reduced significantly with nitrogen more than 60 kg/ha but higher levels of phosphorus improved the oil content.

### INTRODUCTION

Safflower (*Carthamus tinctorius* L) can successfully be grown as a second crop in many monocropped areas in arid and semi-arid regions with limited availability of irrigation water. It is a new introduction in the lateritic tract of West Bengal. The present investigations were carried out to study the effect of nitrogen and phosphorus on yield components, seed yield and oil content in seeds of safflower under limited moisture supply.

### MATERIAL AND METHODS

A field experiment was conducted at the Regional Research Farm of Bidhan Chandra Krishi Viswavidyalaya, at Jhargram in the lateritic tract of West Bengal during rabi seasons of 1983-84 and 1984-85. There were three levels of nitrogen (0, 60 and 120 kg N/ha) in main plots and three levels of phosphorus (0, 40 and 80 kg  $P_2O_5$ /ha) in sub-plots, laid out in split plot design with three replications. The soil (an oxisol) was sandy loam in texture (sand 49%, silt 29% and clay 22%) and acidic (pH 5.7 for 1:2 soil-water suspension) having 0.32% organic carbon, 33 kg available  $P_2O_5$  and 110 kg exchangeable  $K_2O$ /ha. The soil moisture was measured gravimetrically from the layers 0-15, 15-30, 30-60 and 60-90 cm before sowing and the average values were 10, 53, 11.38, 12.10 and 14.00 % in 1983-84 and 13.18, 13.52, 13.28 and 14.98 % in 1984-85 with bulk densities 1.54, 1.51, 1.61 and 1.58 g/cc, respectively. The moisture content in seedling zone (upto 90 cm soil depth) was 17.49 and 19.62 cm in respective seasons.

Safflower cv A 300 was sown with a seed rate of 20 kg/ha with 50 x 20 cm spacing taking advantage of 197 and 58 mm rainfall during second fortnight of Octo-

ber in the respective years. The crop received 30.6 and 10.0 mm of rainfall during respective growing periods in addition to three irrigations of 50 mm depth each at branching, flowering and seed development stages (40, 100 and 130 days after sowing, respectively). Half of nitrogen (as urea), entire dose of phosphorus (as single super phosphate) along with muriate of potash (40 kg  $K_2O$ /ha) respectively were applied basally and remaining half of nitrogen was top-dressed at first irrigation. Nitrogen and phosphorus were applied in accordance with the treatments. In between two safflower crops, a direct seeded rice was taken to remove the residual effect of nitrogen and phosphorus as far as practicable. The crop was harvested in last week of March at about 160 days maturity.

## RESULTS AND DISCUSSION

### Effect of nitrogen

Nitrogen fertilisation at the rate of 120 kg N/ha gave the highest seed yield of safflower which was significantly more than control and also superior to 60 kg N/ha in both the seasons. The stalk yield also followed the similar trend (Table 1). The increase in seed and stalk yield was due to increase in plant height, spread (primary and secondary branches), flower heads plant, seeds/flower head and 100-seed weight resulting from the application of higher doses of nitrogen. Jones and Tucker (1968) and Singh and Singh (1980) also reported the similar findings on response of safflower to higher doses of nitrogen. The increase in seed yield due to 60 and 120 kg N/ha was 23% and 55 % respectively over control, on pooled basis. The increment in kg seed/kg of applied nitrogen was profound with 120 kg N/ha than that obtained with 60 kg N/ha (Table 2). This might be due to higher requirement of nitrogenous fertiliser for the crop under irrigated condition in laterite soil with inherently poor in fertility status. Godin and Spensley (1971) and Zaman (1986) also reported the higher doses of nitrogen for safflower under irrigated condition. Nitrogen increased oil content in seed particularly upto 60 kg/ha. The per cent oil content was significantly reduced beyond this level with 120 kg N/ha (Table 1). Dasgupta et al. (1969) also reported that the per cent oil content in seed of safflower increased with nitrogen application upto 40 kg/ha. Jones and Tucker (1968) found that nitrogen levels increased the seed yield of safflower but depressed the oil content in seed.

### Effect of phosphorus

Phosphorus application upto 80 kg/ha produced highest seed yield of safflower which was statistically at par with 40 kg  $P_2O_5$ /ha and significantly higher than control on both. However, the phosphorus levels increased the stalk yield and oil content per cent in seed significantly upto 80 kg  $P_2O_5$ /ha (Table 1). Yield components like plant height, spread (primary and secondary branches), flower heads/plant and seeds/flower head were found to be at par with 40 and 80 kg  $P_2O_5$ /ha however, 100-seed weight

Table 1. Seed and stalk yield and oil content in seed of safflower as influenced by levels of nitrogen and phosphorus

Treatment	Seed yield (kg/ha)			Stalk yield (kg/ha)			Oil content (%) in seed		
	1983-84	1984-85	Pooled	1983-84	1984-85	Pooled	1983-84	1984-85	Pooled
<b>N-levels (kg/ha)</b>									
0	1078	1123	1101	2227	2282	2252	29.26	29.58	29.42
60	1305	1412	1359	3005	3149	3077	29.53	29.74	29.64
120	1681	1741	1711	4193	4402	4300	29.41	29.66	29.54
SEm (±)	14.6	5.0	10.9	33.2	34.9	34.0	0.02	0.03	0.02
CD at 5%	57.0	19.6	35.4	130.2	137.0	111.0	0.08	0.11	0.08
<b>P<sub>2</sub>O<sub>5</sub> levels (kg/ha)</b>									
0	997	1063	1030	2060	2187	2124	29.07	29.46	29.26
40	1509	1595	1552	3482	3635	3559	29.44	29.69	29.57
80	1559	1618	1588	3887	4011	3949	29.69	29.83	29.76
SEm (±)	16.4	8.1	13.2	38.1	25.8	32.5	0.03	0.04	0.04
CD at 5%	50.7	25.0	37.8	117.8	79.4	94.8	0.10	0.13	0.11

improved significantly upto 80 kg P<sub>2</sub>O<sub>5</sub>/ha in both the years. The increase in seed with 40 and 80 kg p<sub>2</sub>O<sub>5</sub>/ha was 51 and 54 %, respectively over control on pooled basis. The increment in kg seed/kg of applied phosphorus was maximum with 40 kg p<sub>2</sub>O<sub>5</sub>/ha (Table 2). Thus a dose of 40 kg p<sub>2</sub>O<sub>5</sub>/ha appeared to be beneficial for growth and seed yield of safflower. Sharma and Verma (1982) and Veeranna and Channappa (1981) also reported the similar response of safflower to phosphorus application. Bhatti and Loneragan (1970) stated that higher levels of phosphorus might have deleterious effect on seed yield beyond certain limit because it might be caused higher uptake of phosphorus to disturb the water relations of leaf cells and depressed the growth and seed yield

Table 2 Increment of seed yield of safflower due to application of nitrogen and phosphorus

Treatment (kg/ha)	kg-seed/kg of applied nutrient			% increase over control
	1983-84	1984-85	Average	
N levels				
60	3.78	4.82	4.30	23.43
120	6.27	5.48	5.87	55.40
P <sub>2</sub> O <sub>5</sub> levels				
40	12.80	13.30	13.05	50.68
80	1.25	0.58	0.90	54.17

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