with pH 8.3.

Top-dressings of 25 kg N/ha at 30 days after sowing gave significantly more yield than no top-dressing (Table 1). However, this treatment was on a par with top-dressing at 45 days after sowing. This indicated necessity of top-dressing with 25 kg N/ha at 30 days after sowing. Spraying with 0.5% $ZnSO_4$ gave significantly higher yield compared than no spraying. However, soil application of 10 kg $ZnSO_4$/ha at sowing gave at par yield with no $ZnSO_4$ application. This indicates that groundnut responds to foliar spray but not to soil application. Ferrous sulphate either applied to soil at sowing or sprayed did not show any significant increase in pod yield over no application of ferrous sulphate.

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Effect of nitrogen and phosphorus fertilizers on yield and nutrient uptake in sunflower (*Helianthus annuus*)

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A field experiment was carried out at Navasari during the winter (*rabi*) 1988–89 to determine the uptake of nitrogen, phosphorus and potash by sunflower (*Helianthus annuus* L.) under different levels on N and P. Treatments comprising 4 levels of both N and P_2O_5 (0, 30, 60 and 90 kg/ha) were tried in randomized block design with 4 replications. Ammonium sulphate, urea and single superphosphate were used as a source of N and P. The soil was clay, having pH 7.7, available N, P_2O_5 and K_2O 227.5, 47 and 327 kg/ha respectively. Sunflower 'EC 68414' was sown at a spacing of 60 cm × 20 cm on 5 December 1988 and harvested on 23 March 1989.

Nitrogen fertilization increased the seed yield, stalk yield and content and uptake of N, P and K up to 90 kg/ha, but significant difference was observed only up to 60 kg/ha. N @ 60 and 90 kg/ha were found statistically at par. Similar results were reported by Singh *et al.* (1988) for yield and by Kalra and Tripathi (1980) for content and uptake of N, P and K.

Phosphorus had no effect on the yield as well as content and uptake of N, P and K. The response trend confirms the nutrient status of soil which was low in N and medium in available P.

It was concluded that sunflower in south Gujarat conditions, especially in black

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Table 1. Content and uptake of N, P and K by sunflower as affected by N and P fertilization

Treatment	Yield (tonnes/ha)		Concentration (%)						Uptake (kg/ha)								
	Stalk	Seed	Stalk and leaf			Seed			Stalk and leaf			Seed			Total		
			N	P	K	N	P	K	N	P	K	N	P	K	N	P	K
N (kg/ha)																	
0	2.6	1.0	0.57	0.32	1.86	2.14	0.60	1.66	15	8	48	22	6	17	37	14	64
30	3.0	1.2	0.81	0.34	2.01	2.24	0.64	1.79	24	10	59	27	8	22	51	18	81
60	3.6	1.4	0.88	0.37	2.19	2.46	0.68	2.01	32	13	77	35	10	29	66	23	106
90	3.6	1.5	0.89	0.37	2.21	2.49	0.68	2.03	32	13	80	37	10	30	68	24	110
CD (P = 0.05)	0.3	0.1	0.03	0.01	0.05	0.07	0.02	0.05	3	1	7	3	1	2	5	2	9
P_2O_5 (kg/ha)																	
0	3.1	1.2	0.78	0.35	2.06	2.30	0.64	1.85	25	11	46	29	8	24	54	19	88
30	3.1	1.3	0.79	0.35	2.06	2.31	0.65	1.87	25	11	65	30	8	24	55	19	89
60	3.2	1.3	0.79	0.35	2.07	2.34	0.65	1.88	26	11	67	31	8	25	57	20	92
90	3.2	1.3	0.80	0.36	2.08	2.36	0.65	1.89	26	12	68	32	9	25	58	20	93
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

cotton soil which is low in N and medium in P, responds to N up to 60 kg/ha.

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Performance of linseed (*Linum usitatissimum*) cultivars under different row spacings in *Rapti diara*

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A field experiment was conducted during the winter season of 1988–89 in *Rapti diara*, Pantaghat, to study the response of linseed (*Linum usitatissimum* L.). Four varieties ('Subra', 'Sweta', 'Mukta', and 'Garima') were tested with 3 spacings (20, 25 and 30 cm) in randomized block design replicated 3 times. The soil was alluvial sandy loam of

Table 1. Yield attributes and yield as affected by linseed cultivers at various spacings

Treatment	Plant height (cm)	Branches/ plant	Capsules/ plant	Seeds/ capsule	1,000-grain weight (g)	Yield (q/ha)
Cultivar						
'Subra'	54.07	4.18	48.22	6.53	7.15	13.68
'Sweta'	54.25	4.88	48.66	6.63	7.20	14.41
'Mukta'	57.03	5.58	59.03	7.82	7.90	17.65
'Garima'	55.06	5.07	53.98	7.42	7.65	15.54
CD (P = 0.05)	0.82	0.45	1.13	0.34	0.32	0.93
Spacing (cm)						
20	54.46	4.23	51.62	6.87	7.42	14.30
25	55.05	4.95	52.57	7.10	7.47	16.90
30	55.80	5.60	53.22	7.33	7.50	15.56
CD (P = 0.05)	0.79	0.39	0.98	0.29	NS	0.80

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