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Effect of sowing date and irrigation levels on seed yield and quality of Indian mustard (*Brassica juncea*)

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ABSTRACT

A 2-year field experiment conducted to study the effect of sowing date and irrigation on seed yield and quality of Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson] indicated that early sowing (17 and 27 October) gave significantly higher seed, oil and protein yield and N uptake by seed compared with late sowing (6 November), Seed, oil and protein yield, N content and N uptake were significantly higher under 2 irrigation scheduled at pre-flowering and siliqua-development stages than no irrigation. However, oil content was more in unirrigated, while reverse was true for protein content.

Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson] is the second-important oilseed crop in India next to groundnut. Timely sowing of the crop is the most important non-monetary input for higher crop productivity. Irrigation increases the yield as well as nutrient uptake (Singh and Kumar, 1981). As information on double-cropping system in respect of suitable time of sowing with optimum irrigation schedule is meagre, the present investigation was undertaken.

MATERIALS AND METHODS

A field experiment was conducted at Zonal Agricultural Research Station, Morena, during winter (*rabi*) seasons of 1988–89 and 1989–90. Sixteen treatment combinations of 4 sowing dates (17 October, 27 October, 6 November and 16 November) and 4 irrigation levels (no irrigation, 1 irrigation at pre-flowering, 1 irrigation at siliqua development and 2 irrigations at preflowering + siliqua development stages) were tested in a 4-time replicated split-plot design, allocating dates to main plots and irrigation to subplots.

The experimental soil was sandy loam in texture having field capacity 20.7%, bulk density 1.37 g/cc, organic carbon 0.18%, available nitrogen, phosphorus and potash was 227, 7.3 and 399 kg/ha respectively, with pH 7.3. Indian mustard variety 'Pusa Bold' was sown on respective dates at 30 cm apart. A uniform dose of 80 kg N, 40 kg P_2O_5 and 20 kg K_2O/ha was applied a day before each sowing. The seed samples were taken out from each plots to determine oil content using Soxhlet's extraction method and N (%) was estimated by micro-kjeldahl's method (Jackson, 1973). The protein content in seed was obtained by multiplying the N content with a constant factor of 6.25. The total nitrogen uptake was worked out by multiplying the seed and stover yields with respective N content data. The total rainfall received during the crop-

Table 1. Yield of Indian mustard and its oil and protein content as influenced by sowing date and irrigation schedules

Treatment	Seed yield (q/ha)			Oil content (%)		Oil yield (q/ha)		Protein content (%)		Protein yield (q/ha)	
	1988–89	1989–90	Pooled	1988–89	1989–90	1988–89	1989–90	1988–89	1989–90	1988–89	1989–90
Sowing date											
17 October	26.63	18.28	22.45	41.10	39.34	10.94	7.16	19.43	19.08	5.19	3.50
27 October	25.56	17.65	21.60	40.23	38.93	10.27	6.86	19.68	19.46	5.03	3.45
6 November	24.08	13.67	18.81	39.06	37.68	9.40	5.14	20.32	19.84	4.90	2.74
16 November	21.84	11.07	16.45	38.15	36.43	8.33	4.03	20.74	20.13	4.53	2.25
CD (P = 0.05)	2.29	1.76	1.68	0.22	0.16	0.76	0.66	0.19	0.11	0.39	0.38
Irrigation schedule											
No irrigation	22.53	10.70	16.61	40.50	39.14	9.14	4.20	19.39	19.15	4.37	2.04
Irrigation at PF	25.32	17.08	21.21	39.62	38.10	10.06	6.55	20.26	19.85	5.11	3.38
Irrigation at SD	24.60	15.34	19.97	39.64	38.01	9.77	5.86	20.07	19.59	4.92	3.01
2 irrigations at PF + SD	25.69	17.55	21.60	38.78	37.18	9.97	6.58	20.45	19.93	5.24	3.51
CD (P = 0.05)	1.49	1.49	1.03	0.20	0.22	0.60	0.58	0.14	0.11	0.29	0.31

PF, Preflowering; SD, siliqua development

growth period was 6.5 and 18.2 mm during 1988–89 and 1989–90 respectively. A pre-sowing irrigation of 100 mm was applied to each plots before each sowing date to obtain uniform stand of crop.

RESULTS AND DISCUSSION

In general, seed yield was higher during 1988–89 than in 1989–90 due to low incidence of white-rust and alternaria blight.

Effect of sowing date

Sowing date influenced the seed yield significantly (Table 1). Delay in sowing caused a significant reduction in seed yield. The higher seed yield was recorded in 17 October sowing, but the yield difference was not significant in respect of 17 and 27 October sowing in both the seasons. This may be due to the prevalence of favourable temperature at sowing time and longer optimum period for crop growth. The late-planted crop is subjected to relatively lesser time span available for plant growth and development. These findings are in close conformity with those of Rajput *et al.* (1991). Similar trend were noticed for N uptake in seed, oil and protein yield in both the seasons. The oil content was significantly decreased with the delay in sowing. It might be due to the fact that seeds in late-sown crop did not develop fully and also contained more protein (Table 1), which is negatively correlated with the oil content (Noston and Hans 1975).

The N content in seed and stover increased significantly with delay in sowing except stover in 17 and 27 October sowing dates in both the years (Table 2).

Effect of irrigation

Seed yield was significantly higher under 2 irrigations than no irrigation but remained at par with irrigation at PF stage in both the years (Table 1). These results corroborate the findings of Rana *et al.* (1991). similar trend were observed for N uptake in seed

Table 2. Content and uptake of N in Indian mustard as affected by sowing date and irrigation schedules

Treatment	N content (%)				N uptake (kg/ha)			
	1988–89		1989–90		1988–89		1989–90	
	Seed	Stover	Seed	Stover	Seed	Stover	Seed	Stover
Sowing dates								
17 October	3.11	0.84	3.05	0.68	82.92	60.41	55.10	40.86
27 October	3.15	0.85	3.11	0.69	80.69	61.42	55.16	40.72
6 November	3.25	0.93	3.18	0.76	78.33	62.45	43.52	40.80
16 November	3.32	0.96	3.22	0.78	72.44	61.26	35.69	39.60
CD (P = 0.05)	0.033	0.022	0.018	0.028	6.35	NS	5.24	NS
Irrigation schedule								
No irrigation	3.11	0.84	3.06	0.65	69.75	55.01	32.70	30.07
Irrigation at PF	3.24	0.92	3.17	0.75	81.97	63.72	54.05	43.95
Irrigation at SD	3.21	0.90	3.13	0.73	78.81	61.22	47.91	41.71
2 irrigations PF + SD	3.27	0.93	3.19	0.76	83.86	65.59	54.80	46.26
CD (P = 0.05)	0.022	0.015	0.018	0.014	4.97	3.00	5.30	1.42

and stover, oil and protein yield (Tables 1, 2). These parameters were higher in all the irrigation treatments as compared with unirrigated control. It might be due to the higher N concentrations in seed and stover as well as higer seed yield. Rana *et al.* (1991) also reported similar results. The oil content of seed was significantly higher in unirrigated plots than irrigated plots but the differences were non-significant when the irrigation level was increased from 1 to 2. The lowest oil content was recorded with 2 irrigation levels. As the oil content is directly associated with the development of seed, it is likely to be affected by the factors affecting seed formation. Rana *et al.* (1991) also reported that oil content decreased when irrigation was applied. However, for protein content of seed, the trend was just reverse to that of oil content in both the years.

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