

Effect of irrigation and nitrogen on Indian mustard (*Brassica juncea*) varieties in Vidharbha region

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ABSTRACT

An experiment was conducted during the winter season of 1994–95 and 1995–96 to study the response of Indian mustard [*Brassica juncea* (L.) Zernj. & Cosson] to irrigation and nitrogen levels. 'Pusa Bold' recorded 15.6 and 14.5% higher seed and oil yields than 'Varuna'. Irrigation scheduling at an 0.8 IW:CPE ratio significantly increased the seed and oil yields over 0.4 and 0.6 IW : CPE. Response to nitrogen was positive up to 120 kg/ha. The yield attributes, siliquae/plant, seeds/silique and 1,000-seed weight, were enhanced by increasing irrigation and nitrogen levels.

Key words : Indian mustard, Irrigation, Nitrogen, Seed yield, Oil content

Among the oilseed crops grown in India, Indian mustard is the second most important winter (*rabi*) crop. It is traditionally grown in northern states of India, but now-a-days farmers in non-traditional states are developing interest towards this crop owing to its better production and low cost of cultivation. Raut (1990) reported seed yield of Indian mustard up to 24.6 q/ha at Akola with 'Varuna' variety under irrigated conditions. Apart from high-yielding varieties, its high yield is mostly dependent on proper irrigation and nitrogen supply. Scheduling of irrigation is primarily a function of soil, plant and atmospheric continue. Therefore, the latest approach based on an IW:CPE ratio envisages all 3 parameters effectively.

Hence the present investigation was carried out to study the effect of irrigation and nitrogen on yield and its attributes of 2 varieties of Indian mustard.

MATERIALS AND METHODS

The field investigation was carried out in split-plot design at Oilseeds Research Unit, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during winter (*rabi*) seasons of 1994–95 and 1995–96. The treatments consisted of 2 varieties ('Pusa Bold' and 'Varuna') and 3 irrigation levels (based on IW:CPE ratio of 0.4, 0.6 and 0.8) assigned to main plots and 4 levels of nitrogen (0, 40, 80 and 120 kg/ha) to sub-plots with 4 replications. The soil of

experimental plot was montmorillonitic, hyperthermic, family of Typic Ustocrepts and had pH 7.8, EC 0.21 mmhos/cm, total N, 0.047% available P 18.94 kg/ha and available K₂O 591 kg/ha.

The crop was sown on 20 and 17 October during 1994–95 and 1995–96 respectively. The nitrogen was applied as urea in 2 equal splits, half at sowing and remaining half 30 days after sowing. A measured quantity of water through 'V' notch (60 mm) at each irrigation was applied to all the treatments. The total number of irrigations including pre-sowing and post-sowing under irrigation schedules of 0.4 (150 mm CPE), 0.6 (100 mm CPE) and 0.8 (75 mm CPE) were 3, 4 and 5 and 4, 5 and 6 in 1994–95 and 1995–96 respectively. Rainfall received during 2 crop seasons was 73.6 and 11.6 mm respectively.

RESULTS AND DISCUSSION

Performance of varieties

'Pusa Bold' Indian mustard recorded significantly higher seed yield than 'Varuna' (Table 1). On average, it gave 15.64% more seed yield than 'Varuna'. Gaur and Bansal (1992) at Udaipur observed 7.7% more yield in 'Pusa Bold' than 'Varuna'. Significant increase in yield was mainly owing to higher values of yield attributes. Oil yield was also significantly more from 'Pusa Bold' than 'Varuna'. Consumptive use and water-use efficiency (WUE) were also higher in 'Pusa Bold' than 'Varuna'.

Effect of irrigation

Seed yield of Indian mustard increased significantly with increasing irrigation level from 0.4 to 0.8 IW : CPE ratio. This was

owing to enhancement in yield attributes such as siliquae/plant, seed yield/plant and 1,000-seed weight. These findings are in agreement with those reported by Bhimani and Patel (1992). Irrigation levels had a significant effect on oil content during 1995–96. With increase in irrigation levels there was significant increase in oil yield to its lower level. This was mainly owing to increase in seed yield. Consumptive use was progressively increase with increase in irrigation levels, but reverse trend was observed in water-use efficiency (WUE).

Effect of nitrogen

Application 120 kg N/ha recorded significantly higher seed yield over its preceding lower levels. The increase in yield was 3.11, 4.94 and 6.10 q/ha at 40, 80 and 120 kg N/ha over the control respectively. Nitrogen application significantly improved yield attributes which resulted in significantly higher seed yield. Shukla and Arvind Kumar (1994) also observed significant response to N application up to 12 kg/ha.

The oil content decreased with increase in the levels of nitrogen but oil yield was significantly increased which was obviously owing to higher seed yield. Mishra and Verma (1994) also reported significant increase of oil yield owing to successive increase in N up to 12 kg/ha. Cumulative use and WUE increased with successive increase in level of nitrogen. The results confirms the findings of Katole and Sharma (1991).

Interaction effects

The seed yield was significantly influenced by interaction of varieties and irrigation levels (V × I) in both the years

Table 1. Yield and yield attributes of Indian mustard varieties as influenced by irrigation and nitrogen level

Treatment	Siliquae/ plant		Seed yield/ plant (g)		1,000-seed weight (g)		Seeds/siliqua (No.)		Seed yield (q/ha)		Pooled mean
	1994-95	1995-96	1994-95	1995-96	1994-95	1995-96	1994-95	1995-96	1994-95	1995-96	
<i>Varities</i>											
‘Pusa Bold’	114.9	76.4	7.25	4.08	5.41	4.97	11.40	22.27	9.41	5.23	7.32
‘Varuna’	111.4	66.3	6.04	3.43	4.96	4.77	11.39	10.72	8.29	4.37	6.33
CD (P=0.05)	2.9	1.6	0.20	0.10	0.12	NS	NS	0.26	0.27	0.16	0.18
<i>Irrigation (IW : CPE ratio)</i>											
0.4	104.5	58.1	5.68	2.70	5.08	4.65	11.10	10.52	7.72	3.52	5.62
0.6	108.2	66.4	6.31	3.39	5.19	4.87	11.41	11.00	8.54	4.29	6.42
0.8	126.8	89.7	7.94	5.17	5.29	5.10	11.69	11.45	10.30	6.60	8.45
CD (P=0.05)	3.6	2.0	0.25	0.12	0.15	0.29	NS	0.32	0.33	0.19	0.21
<i>Nitrogen (kg/ha)</i>											
0	60.7	49.7	3.13	2.09	5.03	4.52	10.18	10.08	4.10	2.48	3.29
40	113.7	68.5	6.28	3.41	5.09	4.77	11.46	10.83	8.28	4.52	6.40
80	127.8	80.7	7.67	4.47	5.28	5.00	11.78	11.34	10.69	5.77	8.23
120	150.4	83.7	9.49	5.04	5.34	5.20	12.17	11.73	12.33	6.45	9.39
CD (P=0.05)	4.4	1.9	0.28	0.23	0.15	0.21	0.32	0.42	0.58	0.22	0.27

IW : CPE, Irrigation water : cumulative pan evaporation

Table 2. Oil content, oil yield, consumptive use and water-use efficiency in Indian mustard as influenced by varieties and irrigation levels

Treatment	Oil content (%)		Oil yield (q/ha)		Consumptive use (mm)		Water efficiency (kg/mm/ha)	
	1994-95	1995-96	1994-95	1995-96	1994-95	1995-96	1994-95	1995-96
<i>Varities</i>								
'Pusa Bold'	34.93	31.02	3.28	1.62	241.68	259.16	3.89	2.02
'Varuna'	35.40	30.82	2.94	1.35	224.77	241.21	3.68	1.81
CD (P=0.05)	0.12	NS	0.10	0.04				
<i>Irrigation (IW : CPE ratio)</i>								
0.4	35.08	30.17	2.70	1.07	182.96	176.25	4.22	1.99
0.6	35.18	30.18	3.00	1.29	224.81	228.86	3.80	1.87
0.8	35.25	31.89	3.61	2.09	291.92	345.45	3.53	1.91
CD (P=0.05)	NS	0.39	0.12	0.06				
<i>Nitrogen (kg/ha)</i>								
0	35.37	31.88	1.45	0.79	211.41	223.99	1.94	1.11
40	35.34	31.03	2.92	1.41	227.54	245.98	3.64	1.84
80	35.08	30.58	3.75	1.75	237.44	256.83	4.50	2.25
120	34.98	30.50	4.31	1.97	256.52	273.94	4.81	2.35
CD (P=0.05)	0.16	0.41	0.21	0.08				

IW : CPE, Irrigation water : cumulative pan evaporation

Table 3. Seed yield (q/ha) as influenced by varieties × irrigation interaction and irrigation × nitrogen levels interaction

Treatment	Irrigation (IW : CPE ratio)											
	1994-95			1995-96			Pooled					
	0.4	0.6	0.8	0.4	0.6	0.8	0.4	0.6	0.8			
<i>Variety</i>												
'Pusa Bold'	8.06	9.07	11.11	3.73	4.43	7.51	5.90	6.76	9.31			
'Varuna'	7.37	8.03	9.49	3.30	4.13	5.69	5.33	6.08	7.58			
CD (P=0.05)		0.46			0.27			0.30				
<i>Nitrogen (kg/ha)</i>												
	0	40	80	120	0	40	80	120	0	40	80	120
<i>Irrigation</i>												
0.4	3.61	7.42	9.12	10.70	1.97	3.43	4.01	4.61	2.79	5.43	6.58	7.65
0.6	4.20	8.45	10.07	11.47	2.18	4.02	5.17	5.81	3.19	6.23	7.62	8.64
0.8	4.50	8.99	12.83	14.83	3.27	6.11	8.10	8.91	3.88	7.54	10.50	11.88
CD (P=0.05)		1.01				0.37				0.48		

and in pooled analysis (Table 3). Both the varieties responded significantly to higher irrigation levels. 'Pusa Bold' with irrigation at 0.8 IW : CPE ratio recorded significantly higher seed yield than other treatment combinations. Varietal differences were more at 0.8 IW : CPE irrigation compared to 0.4 and 0.6 IW:CPE.

Indian responded significantly with increase in irrigation level at all nitrogen levels except the control. Irrigation at 0.8 IW : CPE ratio with 120 kg N/ha recorded significantly highest seed yield than all other treatment combinations (Table 3).

It may be concluded from this study that 'Pusa Bold' Indian mustard should be irrigated at 0.8 IW : CPE ratio (75 mm CPE) and fertilized with 120 kg N/ha for obtaining higher seed and oil yield.

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