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Effect of pre-sowing seed treatment on growth, yield, quality and nutrient uptake of Indian mustard (*Brassica juncea*) under rainfed condition

S.S. MONDAL, D. ACHARYA, SITANGSHU SARKAR AND A. GHOSH

Department of Agronomy, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal 741 252

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ABSTRACT

A field experiment was conducted at Kalyani, West Bengal 2000–01 and 2001–02 with Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson] using 6 pre-sowing seed treatments, viz. water-soaking, 1% K_2SO_4, 1% KH_2PO_4, 0.25% Na_2HPO_4 and Dithane M-45 along with a control (no seed soaking) under rainfed situation, on sandy-loam alluvial soil of Gangetic West Bengal. The pre-sowing seed treatment with water and different chemicals resulted in an increase of seed yield by 14.18% to 34.05% over the control. The highest yield was observed under Dithane M-45, closely followed by 0.25% Na_2HPO_4 and 1% KH_2PO_4. The crops raised from treated seed accumulated more dry matter and had more siliquae/plant than the control, but differences were not significant in plant height, seeds/siliqua, test weight and oil content. Nutrient uptake by the crop increased owing to different pre-sowing seed treatment.

Key words: Seed treatment, Mustard, Dithane M-45, Na_2HPO_4, KH_2PO_4, KCl, K_2SO_4, Yield, Nutrient uptake

Rainfed agriculture is characterized by limited availability of moisture at critical stages of crop growth. The moisture stored in the rhizosphere soil in areas of scanty rainfall determines the crop growth. If the profile stored soil moisture can be properly exploited by judicious management practices, good yield can be expected. For efficient utilization of stored soil moisture under rainfed condition, pre-sowing seed treatment plays significant role in increasing the yield of greengram (Ahmed, 1999). Treating the seed before sowing encouraging results on germination, vigour and drought tolerance were also obtained in India mustard (Paul *et al.*, 1999). Hence and experiment was conducted to find out the effect of pre-sowing seed treatment on growth, productivity, quality and nutrient uptake of mustard under rainfed condition.

MATERIALS AND METHODS

The field experiment was conducted during 2000–01 and 2001–02 in randomized block design with 7 treatments replicated thrice at upland situation on alluvial soil under sub-humid sub-tropical climatic condition of Kalyani, West Bengal. Soil was alluvial, sandy loam in texture, medium fertility in status (0.059% total N, 6.68 kg/ha available P and 41.61 kg/ha available K) and neutral in reaction (pH 7.2). The treatments were : T_1, control (untreated and unsoaked seed); T_2, water-soaking; T_3, soaking in 1% K_2SO_4; T_4, soaking in 1% KCl; T_5, soaking in 1% KH_2PO_4; T_6, soaking in 0.25% Na_2HPO_4, and T_7, soaking in slurry of Dithane M-45 (8 g/1,000 ml water). The required quantity of seed soaked for 6 hr in the solution of these chemicals and then dried in shade. Indian mustard variety 'B 85' was grown with 40 kg N, 4.5 kg P and 8.5 kg K/ha basal. The rainfall received during the growth season was 6 mm and 35.5 mm in 2000–01 and 2001–02 respectively.

Crop-growth rate was recorded at different growth stages of plant growth. At harvest, observations were recorded on plant height, dry-matter accumulation, siliquae/plant, seeds/siliqua and 1,000-seed weight. Seed yield was recorded from 12 m^2 area on each plot. Oil content was estimated from in a Soxhlet apparatus through petroleum ether extraction method.

RESULTS AND DISCUSSION

Plant height of Indian mustard did not differ significantly with different seed treatments (Table 1). However, dry-matter accumulation was higher when the seed was treated with Dithane M-45. The growth rate was also significantly higher at 45–65 days after sowing with Dithane M-45, but differences in crop-growth rate at 65 days after sowing to harvest were at par.

Siliquae/plant improved significantly with seed soaking, the highest being under Dithane M-45, closely followed by 0.25 % Na_2HPO_4 and 1% KH_2PO_4. The highest seed yield

Table 1. Effect of pre-sowing seed treatments on field emergence percentage, plant height, dry matter accumulation and crop growth rate of Indian mustard (mean data of 2 years)

Treatment	Field emergence (%)	Plant height (cm)	Dry-matter accumulation (g/m^2)	Crop-growth rate (g/m^2/day)	
				45–65 DAS	65 DAS to at harvest
T_1 (no seed soaking)	72.1	119.86	315.59	4.50	2.48
T_2 (water soaking)	75.9	120.28	336.16	4.82	2.49
T_3 (1% K_2SO_4)	77.1	119.54	342.18	5.15	2.55
T_4 (1% KCl)	79.4	120.32	340.46	5.01	2.54
T_5 (1% KH_2PO_4)	82.7	121.23	365.34	5.71	2.64
T_6 (0.25% Na_2HPO_4)	84.0	123.34	372.09	5.82	2.75
T_7 (Dithane M-45)	86.2	125.54	380.92	5.94	2.84
CD (P=0.05)	4.1	NS	19.89	0.39	NS

Table 2. Effect of pre-sowing seed treatments on field components, yield of both seed and oil and nutrient uptake by Indian mustard (mean data of 2 years)

Treatment	Yield components			Seed yield (kg/ha)	Stover yield (kg/ha)	Oil yield (kg/ha)	Oil content (%)	Nutrient uptake (kg/ha)		
	Siliquae/ plant	Seeds/ siliqua	Test weight (g)					N	P	K
T_1 (no seed soaking)	72.87	120.5	3.12	616.02	2,540.1	208.49	33.86	20.99	6.25	40.68
T_2 (water soaking)	88.89	12.53	3.14	703.35	2,658.2	240.84	34.24	23.98	7.09	43.57
T_3 (1% K_2SO_4)	94.00	12.53	3.16	726.16	2,695.6	251.05	34.65	25.27	7.89	44.96
T_4 (1% KCl)	92.27	12.47	3.10	720.08	2,684.4	246.46	34.20	25.51	7.87	44.76
T_5 (1% KH_2PO_4)	98.29	12.93	3.32	768.04	2,884.9	265.59	34.59	27.64	8.05	47.06
T_6 (0.25% Na_2HPO_4)	104.33	12.96	3.38	805.31	2,915.5	277.81	34.53	29.78	8.78	48.86
T_7 (Dithane M-45)	109.88	13.02	3.42	825.76	2,983.4	334.69	34.49	31.23	8.94	50.02
CD (P=0.05)	13.36	NS	NS	85.90	176.9	27.67	NS	3.36	0.94	2.69

of Indian mustard was obtained with Dithane M-45 seed treatment which was at par with 0.25% Na_2HPO_4 and 1% KH_2PO_4 (Table 2). Higher yield was also recorded when the seed was treated with 1% KCl or 1% K_2SO_4 or water than the untreated or unsoaked seed. Increase in seed yield after treatment with these chemicals might be due to increase in field emergence percentage by improvement in seed viability by preventing catabolic activity under stress condition, water absorption of seed by greater membrane permeability and translocation of sugars from seed to young growing point (Balasubramaniyan and Palaniappan, 2002).

The seed yield of Indian mustard was reduced drastically when the seed was sown without soaking in either water or any chemicals. Stover yield also showed similar trend as in seed yield (Table 2). These results are in conformity with those reported by Paul *et al.* (1999).

Oil content of Indian mustard did not differ significantly with different seed treatments. But oil yield increased significantly with Dithane M-45 and at par 0.25% Na_2HPO_4 and 1% KH_2PO_4 (Table 2). Uptake of N, P and K was associated with yield under different seed treatments. The highest amount of N, P and K was observed in the plants raised from seeds treated with Dithane M-45. Higher nutrient uptake was also observed when seed treatment with 0.25% Na_2HPO_4 or 1% KH_2PO_4 or 1% KCl or 1% K_2SO_4 or in water-soaking treatment.

Thus it may be concluded that pre-sowing seed treatments with Dithane M-45 or 0.25% Na_2HPO_4 or 1% KH_2PO_4 improve dry-matter accumulation, siliquae/plant, nutrient uptake and overall seed as well as oil yields. This useful technique that can be easily adopted by the farmers to increase the productivity of Indian mustard under rainfed condition.

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