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Response of Indian Mustard (*Brassica juncea* L.) to Herbicides and Fertilization

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Abstract

This study was conducted to determine suitable herbicides and fertilizer levels for higher yield of Indian mustard crop sixteen treatments comprosing four levels each of weed control and four fertilizer levels were used in the study. The fields were infested with grassy and broad leaf weeds. Application of onadiazon was found to be superior to all other treatments in reducing weed density, in increasing seed and stover yield at 30 and 60 DAS.

Key words : Herbicides, Fertilizers, Yield, Uptake, Indian mustard.

Indian mustard can be grown under wide range of agro-climatic conditions with various agronomic management practices. Unlike other oilseed crops, Indian mustard suffers more from weed competition in early growth stages. Yield losses due to weeds varied from 25 to 45%, depending on the type of weed flora and their intensity, stage, nature and duration of crop-weed competition (1). *Brassicas* respond to N, P and S nutrients positively in term of growth and yield (2). The light textured soil of Aligarh region are deficient in nutrients due to low organic carbon content. Since information on fertilizer management and weed control in mustard on light soils of this region is lacking, the present investigation was undertaken for determining the suitable herbicide and fertilization levels for Indian mustard crop.

Methods

A field experiment was carried out at Agricultural Research Farm of CCS-SDS (PG) Collage lglas, Aligarh, during winter (rabi) season of 2003-2004. The soil of the experimental site was sandy loam in texture having pH 7.8, organic matter 0.20%, available nitrogen 118 kg/ha, available phosphorus 13.4 kg/ha, available potassium 224 kg/ha and available sulfur 17.48 kg/ha. Sixteen treatments comprising fours level each of weed control (weedy check, pendimethalin 0.75, fluchloralin 0.75 and oxadiazon 0.50 kg/ha) and four fertilization levels (0, 50, 75 and 100% RFD) of NPS, were replicated four times in factorial randomization block design.

Test variety Bio-902 of Indian mustard was sown on 18 October 2003 and harvested in first week of March 2004. Seed were sown in row 45 cm apart and thinned 21 days after sowing. Herbicides were sprayed using volume spray of 600 litters/ha with knap-sack sprayer fitted with flat-fan nozzle. An uniform fertilizer dose of 40 kg K_2O was given to the crop. N, P_2O_5 and sulfur based on treatments were drilled in crop rows. Half dose of N was applied basal at sowing and remaining was top dressed 30 DAS. Urea, DAP, MOP and finely ground gypsum were used as the source of N, P, K and S, respectively.

Results and Discussion

Weed Spectrum

The experimental field was infested with grassy and broad leaf weeds. *Chenopodium album* L., *Chenopodium murale* L., *Melilotus indica* L., *Coronopus dydymus* (L.) Sm., *Spergula aryensis* L., *Anagallis arvensis* L., and *Phalaris minor* Retz. were the most prominent weed in the experimental plots.

Effect of Weed Control

All the weed control treatments reduced the weed density and dry weight of weed significantly in comparison to weedy check. Application of oxadiazon

Table 1. Effect of herbicides and fertilization levels on weed and yield and yield attributes of Indian mustard.

Treatments	Weed density 30 DAS	Weed density 60 DAS	Weed dry matter (kg/ha)	Plant height (cm)	Primary branches/ plant	Siliqua/ plant	Seeds/ siliqua	Test weight (g)	Seed/ yield (q/ha)	Stover yield (q/ha)
Weedy check	6.50 (41.78)	7.26 (52.25)	713.86	161.71	6.57	243.83	12.99	4.92	11.75	32.08
Pendimathalin	4.97 (24.25)	5.17 (26.24)	366.95	168.51	7.43	264.89	14.81	5.48	17.60	43.26
Fluchloralin	5.85 (33.73)	5.75 (32.54)	410.67	165.20	7.11	262.54	14.23	5.86	16.09	40.40
Oxadiazon	4.44 (19.23)	2.85 (7.61)	176.45	174.34	7.98	285.97	15.45	5.85	19.66	47.45
SE ±	0.121	0.150	7.15	3.92	0.127	6.33	0.226	0.073	0.41	0.95
CD (P = 0.05)	0.344	0.427	20.37	11.17	0.362	18.03	0.643	0.208	1.16	2.72
Control	5.35 (28.17)	5.38 (28.44)	361.78	142.13	6.26	226.98	12.20	4.67	12.20	33.20
50% RFD of NPS	5.45 (29.24)	5.51 (29.85)	394.31	163.07	7.06	258.79	13.95	5.29	15.29	39.50
75% RFD of NPS	5.55 (30.32)	5.48 (29.54)	431.29	176.35	7.68	271.81	15.23	5.71	17.59	43.18
100% RFD of NPS	5.64 (31.28)	5.60 (30.90)	480.54	188.20	8.11	294.64	16.10	5.95	20.02	47.31
SE ±	0.121	0.150	7.15	3.92	0.127	6.33	0.226	0.073	0.41	0.95
CD (P = 0.05)	0.344	0.427	20.37	11.17	0.362	18.03	0.643	0.208	1.16	2.72

was found to be superior to all other treatments in reducing weed density at 30 and 60 DAS and dry weight of weed at harvest. This might be due to longer persistence of oxadiazon in the soil compared to other harbicides could be ascribed as possible reason for its superiority. Superiority of oxadiazon as a potent herbicide in rapeseed and mustard under varying climatic and edaphic conditions of the country is well documented by Mishra and Kurchania (3).

Plant height and branches/plant increased significantly under weed free condition in compression to weedy check, might be due to direct effect of clean crop culture where in greater penetration of solar radiation in canopy can be rendered for greater photosynthetic rates.

Application of herbicide significantly increased the seed and stover yield (Table 1). The most effective herbicide in this regard was oxadiazon application followed by pendimethalin and fluchlorelin. Increase in seed and stover yields were obviously result of better weed control which rendered favorable conditions like increased availability of nutrients, moisture, light and space to the crop plants for their vegetative and reproductive growth. This resulted in more number of siliqua/plant, seed/siliqua and test weight. The resulted in more number of siliqua/plant, seed/siliqua and test weight. The expression of significantly higher yield was chiefly a product of these increase attributes. The findings are in close conformity with those of Mishra and Kurchnia (3) and Nepalia and Jain (4). The oil and protein content of mustard seed was not influenced by weed control but significant

Table 2. Effect of herbicides and fertilization levels on oil and protein content and nutrient uptake.

Treatments	Oil content (%)	Protein content (%)	Nitrogen uptake (kg/ha) Seed	Nitrogen uptake (kg/ha) Stover	Phosphorus uptake (kg/ha) Seed	Phosphorus uptake (kg/ha) Stover	Potassium uptake (kg/ha) Seed	Potassium uptake (kg/ha) Stover	Sulphur uptake (kg/ha) Seed	Sulphur uptake (kg/ha) Stover
Weedy check	39.43	19.12	35.96	25.98	6.46	6.67	8.81	32.40	12.45	12.38
Pendimathalin	39.86	19.31	54.38	35.47	9.85	9.43	13.37	44.12	19.01	17.13
Fluchloralin	39.74	19.31	49.72	32.72	9.01	8.81	12.23	41.21	17.21	15.59
Oxadiazon	40.09	19.31	60.75	39.38	11.01	10.34	15.14	48.87	21.43	18.31
SE ±	0.26	0.50	1.37	1.92	0.252	0.238	0.354	1.19	0.495	0.410
CD (P = 0.05)	NS	1.43	3.91	2.62	0.718	0.678	1.01	3.39	1.410	1.168
Control	38.04	18.19	35.50	25.90	6.22	6.24	9.15	33.53	12.32	11.82
50% RFD of NPS	37.94	19.00	46.48	31.99	8.41	8.61	11.62	40.29	16.21	14.85
75% RFD of NPS	40.45	19.69	55.41	36.27	10.03	9.84	13.54	44.47	19.35	17.09
100% RDF of NPS	41.69	20.12	64.46	40.21	11.81	11.26	15.41	48.73	22.62	20.15
SE ±	0.26	0.50	1.37	0.92	0.252	0.238	0.354	1.19	0.495	0.410
CD (P = 0.05)	NS	1.43	3.91	2.62	0.718	0.678	1.01	3.39	1.410	1.168

increase in the N, P, K and S uptake by seeds and stover was recorded (Table 2). The uptake of nutrients is the product of its content and yield. The increased uptake by seeds can therefore be ascribed to proportionate increase in seed yield due to weed control through oxadiazon, pendimethaline and fluchloralin. Similarly increased uptake of N P K and S by stover can be attributed to increase in stover yield due to weed control. Significant increase in uptake of nutrient with weed control has also been reported by Nepalia and Jain (5).

Effect of Fertilization

Application of fertilizers had no effect on weed density at 30 and DAS (Table 1). However fertilization tended to enhance dry matter of weeds. The profound effect of nutrient application might be due to enhanced metabolic activity and photosynthetic roles accounting for higher biomass production. Application of nutrient elements (80: 40: 40 kg NPS/ha) improved plant height and dry matter accumulated. In general improvement in crop growth under optimum nutrition seems to be on account of their potential role in modifying soil and plant environment conducive for better development of morphological and biochemical components of plant growth. The results are in agreement with those reported by Singh et al. (6).

An increase in various yield components viz. siliquae/plant, seeds/siliqua and test weight improved significantly by fertilization and was maximum with 80:40:40 kg NPS/ha level. This might be due to enhanced morphological and physiological parameters which were reflected in terms of higher values of yield attributes. The net impact of all these was significant increase in seed yield. The increase in stover yield due to the 100% fertilization of NPS could be attributed to the increased vegetative growth possibly a result of the effective uptake and utilization of nutrients absorbed through its extensive root system developed under the influence of fertilization. Similar results has been observed by Singh et al. (6) and Singh et al. (7).

Marked increase in seed oil and protein content was observed with increasing level of NPS application (Table 2). The higher oil and protein content could be attributed to formation of more lactithin and amino acid. This might have be favored by phosphorous, nitrogen and sulfur fertilization (6).

Fertilization significantly increased the N, P, K and S uptake by seed and stover (Table 2). The uptake was maximum of 100% fertilization level. The nutrient uptake is the net out come of nutrient concentration and the yield. Therefore increased N, P, K and S uptake by the crop can be explained in terms of increased seed and stover yield and increased N, P, K and S content under the effect of fertilization. The results are in close conformity with these of Nepolia and Jain (5) and Singh et al. (7).

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