

Effect of weed control and sulphur on yield of Indian mustard (*Brassica juncea*) and their residual effect on summer greengram (*Phaseolus radiatus*)

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ABSTRACT

An experiment was conducted during 1993–94 and 1994–95 to study the effect of weed control and sulphur levels on yield of Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson] and their residual effect on succeeding summer greengram (*Phaseolus radiatus* L.). All weed-control practices resulted in significantly reduced density and dry matter of weeds infesting crop of Indian mustard. Pre-emergence application of oxadiazon 0.5, oxyflurofen 0.125 pendimethalin 0.75, isoproturon 0.5 kg/ha and hand-weeding 30 days after sowing increased seed yield by 72.3, 59.6, 55.3, 45.7 and 59.6% during 1993–94 and by 67.4, 55.6, 50.0, 42.4 and 55.6% during 1994–95 over the weedy check (9.4 and 10.6 q/ha respectively). Application of sulphur @ 60 kg/ha increased the seed yield by 22.9 and 29.7% over the control (12.2 and 12.8 q/ha) during 2 years. Weed dry matter at 30 days, yield attributes and yield of succeeding summer greengram crop remained unaffected by weed-control practices of preceding crop. Application of 60 kg S/ha to Indian mustard resulted in 19.3 and 30.0% increase in yield of succeeding greengram over the control (9.25 and 8.29 q/ha).

Key words : Weed control, Sulphur, Indian mustard, Summer greengram, Residual effect

Indian mustard is grown in winter season of India and about two-thirds area under this crop is irrigated wherein weed infestation causes considerable loss of yield. In Indian mustard, weeds cause maximum damage in the initial 20–40 days (Bhan and Mishra, 1993). At later stages shading caused by plant height and broad

dorsoventral leaves help suppress weed growth (Chakhaiyar and Ambasht, 1990). Therefore, it is essential to control weeds during the initial growth period. Presently sulphur is being increasingly recognized as fourth major nutrient after N, P and K. Indian mustard responds to sulphur because of its pivotal role in various formative and

metabolic processes in plants (Goswami, 1988).

Fertilizers are applied to crops without taking into consideration their residual response. Sulphur, which is mostly applied to oilseeds, might benefit more than one crop in sequence due to its significant residual response (Tandon, 1991). However, studies are lacking on residual responses of herbicides and sulphur in Rajasthan. Therefore the present investigation was carried out to find out a suitable weed-control practice and sulphur level to boost the productivity of Indian mustard and to assess their residual effect on succeeding greengram.

MATERIALS AND METHODS

A field experiment was conducted during winter season of 1993-94 and 1994-95 at Research Farm of Rajasthan College of Agriculture, Udaipur. Twenty-four treatment combinations consisting of 6 weed-control practices (weedy check, oxadiazon 0.5, oxyfluorfen 0.125, pendimethalin 0.75, isoproturon 0.5 kg/ha and 1 hand-weeding 30 days after sowing) and 4 levels of sulphur (0, 30, 60 and 90 kg/ha) were tested in randomized block design with 4 replications. The soil of experimental site was clay loam in texture, and alkaline in reaction (pH 8.3). The soil was medium in available N and high in available P and K. The SO_4^{2-} content of the soil was 9.4 and 9.8 ppm during the 2 respective years which was less than the average critical limit of 10.4 ppm (Tandon, 1991). The herbicides were sprayed with knap-sac sprayer fitted with flat-fan nozzle, using 800 litres water/ha. A uniform dose

of 60 kg N/ha and 40 kg P_2O_5 /ha was given to the crop. Sulphur was drilled in crop rows as per treatment through finely ground mineral gypsum. Indian mustard 'Pusa Bold' was sown on 16 and 15 October and harvested on 2 and 4 March during 1993-94 and 1994-95 respectively. At harvest, all weeds of net plot were harvested and sun-dried. The dry matter was then expressed as kg/ha. In mustard siliquae/plant, seeds/silique and test weight were recorded from 5 random plants in each plot, while the seed yield was obtained after threshing and cleaning of seed weight of net plot which was expressed as q/ha.

After harvesting of main crop (Indian mustard), the field was irrigated and experimental plots were prepared. Greengram 'K 851' was sown on 22 March 1994 and 20 March 1995 and harvested on 28 May and 30 May 1995.

RESULTS AND DISCUSSION

The major weeds of experimental site were lambsquarter (*Chenopodium album* L.), goose foot (*Chenopodium murale* L.), sweet clover (*Melilotus indica* L.), chicory (*Cichorium intybus* L.), swinecress [*Coronopus didymus* (L.) Sm.], corn spurry (*Spergula arvensis* L.), scarlet pimpernel (*Anagallis arvensis* L.), carrot grass (*Parthenium hysterophorus* L.) and small canarygrass (*Phalaris minor* Retz.).

Effect of weeds

All the weed-control treatments reduced the weed density significantly in comparison to weedy check. Oxadiazon application was superior to all other treatments in reducing weed density. All

Table 1. Effect of weed control and sulphur on weed dry matter, yield attributes and yield of Indian mustard

Treatment	Weeds/0.25m ² at harvest		Weed dry matter at harvest (kg/ha)		Siliquae/ plant		Seeds/ silique		Test weight (g)		Seed yield (q/ha)	
	1993- 94	1994- 95	1993- 94	1994- 95	1993- 94	1994- 95	1993- 94	1994- 95	1993- 94	1994- 95	1993- 94	1994- 95
<i>Weed management</i>												
Weedy check	08.30 (68.50)	08.34 (69.30)	666.1	564.1	203.1	218.9	11.4	11.9	4.77	4.79	9.4	10.6
Oxadiazon (0.5 kg/ha)	03.22 (10.20)	03.83 (14.50)	139.2	184.0	323.6	340.4	14.5	14.9	5.39	5.53	16.2	17.8
Oxyfluorfen (0.125 kg/ha)	0.463 (21.00)	05.01 (24.90)	203.3	180.6	299.3	308.5	14.2	14.4	5.33	5.46	15.0	16.5
Pendimethalin (0.75 kg/ha)	05.76 (33.60)	06.47 (42.40)	390.8	287.0	286.4	288.3	14.2	14.1	5.34	5.36	14.6	15.9
Isoprotum (0.5 kg/ha)	06.61 (43.40)	06.80 (46.00)	416.9	327.5	278.9	277.8	13.5	13.4	5.33	5.29	13.7	15.1
Hand-weeding (30 DAS)	04.19 (17.10)	04.88 (23.50)	207.3	184.8	308.5	321.4	14.0	14.2	5.36	5.49	15.0	16.5
CD (P=0.05)	00.33	00.36	28.0	27.2	23.0	20.6	1.0	0.9	0.02	0.11	1.1	1.3
<i>Sulphur (kg/ha)</i>												
0	05.38 (31.60)	05.92 (36.80)	285.7	204.5	239.4	261.7	12.0	12.4	4.75	4.49	12.2	12.8
30	05.41 (32.30)	05.88 (36.30)	327.7	283.7	276.5	288.0	13.2	13.5	5.25	5.38	13.6	15.1
60	05.54 (33.00)	05.92 (36.90)	361.7	330.2	305.1	308.2	14.5	14.5	5.50	5.70	15.0	16.6
90	05.47 (32.20)	05.84 (36.70)	373.8	333.6	312.2	312.3	14.8	14.9	5.52	5.73	15.2	17.1
CD (P = 0.05)	NS	NS	22.8	22.2	18.8	16.8	0.8	0.7	0.02	0.09	0.9	1.0

* $\sqrt{x + 0.5}$ transformed values

Data in parentheses are original values

Table 2. Residual effect of weed control and sulphur on succeeding summer greengram crop

Treatment	Weed dry matter 30 DAS (kg/ha)		Pods/ plant		Seeds/ pod		Test weight (g)		Seed yield (q/ha)	
	1993-94	1994-95	1993-94	1994-95	1993-94	1994-95	1993-94	1994-95	1993-94	1994-95
<i>Weed management</i>										
Weedy check	215.6	254.0	15.0	13.2	12.0	11.7	37.23	36.71	10.29	9.90
Oxadiazon	215.2	254.4	15.1	13.2	11.8	11.8	37.11	36.75	10.31	9.89
Oxyfluorfen	214.8	255.2	15.6	13.2	12.1	11.9	37.33	36.66	10.31	9.85
Pendimethalin	215.6	253.2	15.7	13.3	19.9	12.0	37.10	36.80	10.31	9.87
Isoproturon	214.8	253.6	15.2	13.6	12.0	11.7	37.50	36.66	10.31	9.86
Hand-weeding	215.6	254.8	15.9	13.5	11.9	11.7	37.23	36.64	10.30	9.89
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
<i>Sulphur (kg/ha)</i>										
0	180.8	220.0	12.5	10.5	11.8	11.7	35.60	34.81	9.25	8.29
30	207.6	244.8	12.6	13.2	11.9	11.9	36.86	36.30	9.85	9.52
60	232.4	274.4	16.6	14.6	12.0	11.8	38.24	37.75	11.04	10.78
90	240.0	277.6	17.1	15.0	12.0	11.8	38.29	37.95	11.09	10.92
CD (P = 0.05)	31.6	26.4	1.1	0.9	NS	NS	0.35	1.62	0.75	0.88

the weed-control treatments resulted in significant reduction in weed dry matter. In 1993–94, oxadiazon was superior to rest of the weed-control treatments while in 1994–95 it stood at par with oxyfluorfen and hand-weeding (Table 1). Yield-attributing characters, viz. silique/plant, seeds/silique and test weight, of Indian mustard registered significant increase with weed control. All the weed-control practices resulted in significantly higher seed yield over weedy check. During both the years oxadiazon gave highest seed yield. Under relatively weed-free environment, greater photosynthetic rate and dry-matter accumulation can be reasoned for greater values of yield-attributing characters which were ultimately responsible for higher yield. Reduction in possible adverse effects of weeds on crop plants can also be reasoned for increased yield under weed-control treatments. Biological yield also exhibited similar trends. Highest net returns were also registered with oxadiazon. Beneficial effects of weed control in Indian mustard were also reported by Singh and Sharma (1992).

Effect of sulphur

All the yield attributes, viz. silique/plant, seeds/silique and test weight, increased significantly in both the years with 60 kg S/ha except test weight which increased significantly up to 90 kg/ha in 1993–94. Application of 60 kg S/ha also resulted in significantly enhanced seed yield. It accounted for 22.9 and 29.7% increase in yield over no sulphur application in the 2 respective years. Saran and Giri (1990) also reported beneficial results of S application on Indian mustard.

Residual effect of weed control

The major weeds in summer greengram were carpet weed (*Trianthema portulacastrum* L.), and bermuda grass [*Cynodon dactylon* (L.) Pers]. All the weed-control practices adopted in preceding Indian mustard crop had no significant effect on dry matter of weeds in summer greengram at 30 days. It indicated degradation of all the herbicides either completely or below certain level which did not influence weeds in succeeding crop longevity, all of them might have degraded before sowing of succeeding summer greengram (Beste *et al.*, 1983). Pods/plant, seeds/pod and test weight and seed yield of succeeding summer greengram were not significantly affected by adopting different weed-control practices in preceding crop of Indian mustard. Oxadiazon, oxyfluorfen, pendimethalin and isoproturon carry no effect on the yield of succeeding crop in various rotations (Dhindwal *et al.*, 1989; Singh *et al.*, 1991; Yaduraju *et al.*, 1993).

Residual effect of sulphur

Application of 60 kg S/ha to preceding Indian mustard crop resulted in significantly higher dry matter of weeds. In both years, application of 60 kg S/ha to previous crop resulted in significantly more pods/plant and test weight of greengram. However, seeds/pod remained unaffected by residual sulphur. Seed yield of succeeding crop during both the years increased significantly up to 60 kg s/ha to preceding Indian mustard crop. The significant increase in yield of succeeding greengram seems to be due to enhancement of SO_4^{2-} content of soil (Tandon, 1991). The present result of increased yield of

greengram under the influence of residual S are in close agreement with those of Sachdev and Deb (1990).

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