

Integrated Weed Management in Indian Mustard and its Residual Effect on Succeeding Fodder Pearl Millet

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ABSTRACT

A field experiment was conducted at the Agronomy Farm, ARS, Durgapura, Jaipur during 2003-05 on loamy sand soils analyzing low in available N and S and medium in available P and K. The increasing rates of S did not influence the weed density by markedly increasing the dry matter of weeds. Hand weeding twice showed the maximum control of weeds, which was significantly superior to other treatments. The successive rates of S nutrition upto 60 kg S/ha markedly enhanced the dry matter, siliquae, seeds/siliqua and seed yield plant in both the years. However, plant height and 1000-seed weight showed significant response only upto 40 kg S/ha and remained at par with higher levels of S nutrition. The yield of succeeding fodder pearl millet was highest (370.0 q/ha) weed control measures brought about measurable improvement in growth and yield attributes, and yield of mustard compared with the weedy check. The two HW being at par with the herbicides coupled with HW increased the pooled mean seed yield of mustard significantly by 46.3% over weedy check. The application of 60 kg S/ha recorded significantly highest (Rs. 21077/ha) pooled mean, net return and B : C ratio (2.51) of mustard over lower levels. Two HW being at par with both the herbicides coupled with HW gave highest net return (Rs. 20050/ha), whereas B : C ratio was significantly higher under isoproturon @ 0.50 kg/ha with 60 kg S/ha.

Key words : Mustard, fodder pearl millet, integrated weed management, nitrogen, sulphur

INTRODUCTION

Indian mustard [*Brassica juncea* (L.) Czern & Coss.] is the principal oil seed crop of the state of Rajasthan. The problem of low productivity continues to be a major issue for agricultural planners and researchers. The best way to increase the productivity of mustard is by improving crops' nutrition through balanced fertilization. Besides NPK, mustard has an additional requirement of S due to presence of several natural volatile S and N compounds (Seiji and Kameoka, 1985) and for normal growth of plant plays an important role in production of protein and activation of enzymatic and metabolic process during active plant growth.

Weeds are regarded as one of the major negative factors of crop produce loss due to competition for nutrients, moisture, light and space which have been reported as high as 30-70% (Tiwari *et al.*, 1998) costly and difficult affair as the operation coincides with sowing of other **rabi** crops. Moreover, wages are shooting high these days. An experiment was, therefore, conducted to

study the effect of sulphur and integrated weed management on Indian mustard and succeeding fodder pearl millet.

MATERIALS AND METHODS

A field experiment was conducted at the Agronomy Farm, ARS, Durgapura, Jaipur during 2003-05 on loamy sand having organic carbon 0.16%, available N 121.3 kg/ha, available P 11.50 kg/ha, available K 148.5 kg/ha and available S 8.3 kg/ha, with pH 8.3. The main plot treatments comprised four levels of sulphur (control, 20, 40 and 60 kg/ha) and seven weed control measures (weedy check, 1 HW at 25 DAS, 2 HW at 25 and 45 DAS, fluchloralin @ 1.0 kg/ha (PPI), fluchloralin @ 1.0 kg/ha as PPI with HW at 45 DAS, isoproturon @ 0.5 kg/ha as PE and isoproturon @ 0.5 kg/ha as PPI with HW at 45 DAS as sub-plots, replicated thrice in the split plot design. The sulphur was applied three weeks before sowing as per treatment and the herbicide fluchloralin was sprayed one day before sowing as PPI and

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isoproturon two days after sowing as pre-emergence with the help of knapsack sprayer using 800 litres of water per hectare. Hand weeding treatments were applied as per treatment. A uniform dose of 60 kg N/ha and 30 kg P₂O₅/ha was applied through urea and DAP.

'Pusa Jai Kisan' Indian mustard was sown in the last week of October and the following 'Raj Bajra Chari-2' fodder pearl millet was sown in the third week of March during both the years (2003-04 and 2004-05). Other management practices were adopted as per recommendations of the crops.

RESULTS AND DISCUSSION

Effect on Weeds

The weed flora in the experimental field consisted of mixed population of grasses viz., *Cynodon dactylon* (L.) Pers., *Phalaris minor* Retz. and broad-leaf weeds viz., *Anagallis arvensis* L., *Cichorium intybus* L., *Convolvulus arvensis* L., *Coronopus didymus* (L.) Sm., *Fumaria parviflora* Lam., *Melilotus indica* L., *Parthenium hysterophorus* L. and *Spergula arvensis* L.

The results of the investigation revealed that application of increasing levels of sulphur did not influence the weed density. However, sulphur nutrition tended to increase the dry matter of weeds (Table 1). Put full slab at right plant into the profound influence of S on weed dry matter seems to be the results of its unique role in growth and development of plants. Weed control had noticeable effect on population as well as dry weight of weeds as compared to the weedy check. Hand weeding twice showed the maximum control of weeds which was significantly superior to other treatments but the weed density being at par with fluchloralin+HW and isoproturon+HW in both the years of study. The weed dry matter was found to reduce significantly where both the herbicides were supplemented with one hand weeding.

Effect on Crop

Growth and yield attributes of Indian mustard viz., plant height, siliquae/plant, seeds/siliqua and 1000-seed weight varied significantly due to S nutrition in both the years (Table 1). The increasing rates of S fertilization upto 60 kg/ha markedly enhanced the siliquae/plant and seeds/siliqua in both the years of experimentation. However, plant height and 1000-seed

weight showed significant response only upto 40 kg S/ha and remained at par with the higher levels of S nutrition during both the years of study. The improvement in growth and yield attributes with S application may be ascribed to its role in altering physico-chemical properties of soil and a balanced nutritional environment conducive for better growth and development of the crop. These results are in line with the findings of Saha and Mandal (2000).

Weed control measures brought about measurable improvement in growth and yield attributes of Indian mustard viz., plant height, siliquae/plant, seeds/siliqua and 1000-seed weight compared with the weedy check (Table 1). Hand weeding twice recorded maximum increase in all these attributes. Hand weeding twice and both the herbicides coupled with HW maintained superiority over other control measures. The contribution of weed control measures towards the improvement of yield attributes could be owing to their effect on reducing crop-weed competition and hence better utilization of inputs by crop plant (Duncan, 1971).

The pooled mean seed yield of mustard increased significantly under 60 kg S/ha by 29.6, 11.4 and 3.8% as compared to control, 20 and 40 kg S/ha, respectively (Table 1). The direct effect of improved yield attributes was reflected in increased seed yield of mustard with S fertilization. The positive correlation between seed yield and siliquae/plant ($r = 0.96$), seeds/siliqua ($r = 0.91$) and 1000-seed weight ($r = 0.94$) also reflected profound influence on yield. Similar results in mustard with S nutrition at varying levels were also reported by Mondal (2000). Weed control greatly increased seed yield of mustard compared with weedy check. The two HW being at par with both the herbicides coupled with HW increased the pooled mean seed yield of mustard significantly by 46.3, 7.8, 8.7 and 8.7% over weedy check, one HW, fluchloralin and isoproturon, respectively (Table 1).

Oil Content and Oil Yield

The application of 60 kg S/ha brought significant improvement in oil content of seed over control registering an increase of 7.47% (Table 1). The application of 60 kg S/ha recorded highest oil yield which was 37.31, 21.22 and 10.70% higher as compared to control, 20 kg and 40 kg S/ha, respectively. Whereas 40 kg S/ha increased oil yield of mustard by 24.03 and 9.50% over control and 20 kg S/ha. Among the weed

Table 1. Effect of sulphur and integrated weed management on growth, weed density, weed dry matter, yield attributes, yield, quality parameters and economics of Indian mustard (Pooled over two seasons)

Treatments	Plant height (cm)	Weed density (0.25/m ²)	Weed dry matter (kg/ha)	Siliquae/plant	Seeds/siliqua	1000-weight (g)	Seed yield (q/ha)	Net return (Rs./ha)	B : C ratio	Oil content (%)	Oil yield (q/ha)
Sulphur levels (kg/ha)											
Control	139.3	6.17 (23.97)	158.5	241.8	10.4	4.3	14.9	15280	1.9	38.7	5.9
20	144.2	6.20 (23.93)	201.0	262.5	11.4	4.8	17.4	17420	2.2	39.7	6.7
40	149.5	6.20 (24.14)	228.4	287.7	12.3	4.9	18.6	19156	2.3	40.3	7.4
60	150.2	6.19 (24.46)	239.2	312.8	13.0	5.1	19.4	21077	2.5	41.4	8.2
LSD (P=0.05)	4.8	NS	18.5	11.4	0.4	0.2	0.7	1121	0.2	2.0	0.6
Integrated weed management											
Weedy check	13.40	10.85 (65.73)	528.4	197.4	9.0	4.3	13.1	12289	1.6	39.7	5.2
One HW 25 DAS	144.5	5.21 (13.47)	238.0	266.5	11.0	4.8	17.8	185.69	2.2	39.9	7.1
Two HW 25 & 45 DAS	150.6	3.35 (5.21)	70.5	313.9	13.3	5.0	19.2	20050	2.3	40.4	7.8
Fluchloralin 1.0 kg/ha	144.1	8.19 (35.21)	203.0	275.5	11.6	4.9	17.7	186.96	2.4	39.8	7.0
Fluchloralin 1.0 kg/ha+HW 45 DAS	150.0	3.76 (6.50)	110.2	312.0	13.1	4.9	18.8	196.87	2.3	40.0	7.5
Isoproturon 0.5 kg/ha PE	145.7	8.25 (36.61)	188.1	267.9	11.2	4.8	17.7	18802	2.4	40.0	7.1
Isoproturon 0.5 kg/ha PPI+HW 45 DAS	150.4	3.72 (6.16)	109.1	305.4	13.1	4.9	18.6	19541	2.3	40.0	7.5
LSD (P=0.05)	6.6	0.29	18.2	15.4	0.5	4.2	0.7	101	0.1	NS	0.7

NS–Not Significant.

management treatments, the two HW treatments recorded significantly higher oil yield as compared to both the herbicides and the increase in oil yield under two HW was 10.47 and 9.85% over fluchloralin and isoproturon, respectively (Table 1). Sulphur is a constituent of glutathion—a compound supposed to play vital role in synthesis of oil (oil yield being the function of oil content and seed yield) also increased significantly with the increase in both these parameters (Mondal, 2000).

The sulphur fertilization of 60 kg/ha to mustard recorded significantly higher yield of fodder bajra (370.0 q/ha) as compared to all other levels of sulphur (Table 2).

Table 2. Effect of sulphur and integrated weed management on fodder yield of bajra, system productivity and total sulphur uptake (Pooled over two seasons)

Treatments	Fodder yield (q/ha)	System productivity (q/ha)	Total sulphur uptake (kg/ha)
Sulphur levels (kg/ha)			
Control	322.5	33.8	23.3
20	338.2	37.3	34.7
40	354.8	39.5	42.1
60	370.0	41.1	46.6
LSD (P = 0.05)	13.7	-	3.2
Integrated weed management			
Weedy check	342.4	33.2	27.2
One HW	356.1	38.7	36.0
Two HW	342.8	39.4	41.2
Fluchloralin	341.9	37.8	26.9
Fluchloralin+HW	342.1	38.9	38.0
Isoproturon	351.9	38.4	36.2
Isoproturon+HW	340.1	38.6	39.0
LSD (P=0.05)	NS	-	3.3

NS–Not Significant.

System Productivity

The highest mustard equivalent yield was recorded with application of 60 kg S/ha among the weed management treatments, two HW brought highest system productivity (Table 2).

Total Sulphur Uptake

The data revealed that the total sulphur uptake significantly increased with the increasing levels of sulphur. The highest uptake (46.6 kg/ha) was recorded with application of 60 kg S/ha (Table 2).

Among the weed management treatments, significantly higher total sulphur uptake was with two HW over control and one HW. Fluchloralin and

isoproturon treatments were at par in total sulphur uptake (Table 2). It has been reported that the P x S interaction is synergistic at low-medium levels of P. This positive interaction may be attributed to the promotion of root development. Moreover, sulphur and phosphorus are also linked in the metabolic process of protein and oil formation where if one is available in higher amount, the other will also be needed in higher amount. Rauth and Ali (1985) also reported synergistic effect between P and S in mustard.

Net Return and B : C Ratio

The application of 60 kg S/ha recorded significantly highest pooled mean net return (Rs. 21077/ha) and B : C ratio (2.51) of mustard over lower levels (Table 1). It was obvious because the seed yield of mustard was also significantly higher under 60 kg S/ha. Hence, the net return and B : C ratio also increased markedly under application of 60 kg S/ha.

Among different weed control measures, two HW being at par with both the herbicides coupled with HW gave highest net return (Rs. 20050/ha), whereas B : C ratio was significantly higher (2.41) under isoproturon @ 0.50 kg/ha (Table 1). The reduction in B : C ratio under hand weeding treatments was due to labour cost which increased the treatment cost.

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