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USE OF SORGAAB AND SORGHUM MULCH FOR WEED MANAGEMENT IN MUNGBEAN

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Weeds pose a major threat to the yield ofmungbean crop. Allelopathy has emerged as a recent tool for manipulating the growth of different plant species. In this study. selective allelopathic character of sorghum was explored for controlling weeds in mungbean. For this purpose. one. two and three sprays of sorgaab were compared with one and two hand-weedings alone and one sorgaab spray + one hand-weeding. Three foliar sprays of sorgaab at 15. 30 and 45 days after sowing reduced the dry weight of *Cyperus rotundus, Convolvulus arvensis* and *Portulaca oleracea* by 50. 60 and 75%, respectively. while *Trianthema portulacastrum* remained unaffected. Sorghum mulching ((tdO and 15 t ha" reduced weed density by 25 and *27"I".* Maximum reduction in weed dry weight (84%) was achieved by two hand-weedings. Increase in mungbcan grain yield due to three sorgaab sprays. sorghum mulching (li110 and 15 t ha' and two hand-weedings was 19,7. 13 and 22%, respectively over control. Economic and marginal analysis showed the dominance of employing three sorgaab sprays over sorghum mulching and hand-weeding due to higher costs involved in latter cases:
Key words: allelopathy, sorgaab. sorghum mulch, weed control

lNTRODUcnON

Mungbean is one of the important grain legumes of Pakistan. Due to short growth period and having two growing seasons in a year- it fits well in different cropping sequences. The area under mungbean during last ten years has increased by 204% (Anonymous. 1997) and there is enough scope for further increase. However. the yields are still stagnant and there seems no improvement in this regard. Uncontrolled weeds arc mainly responsible for restricting increase in mungbcan yield. Ali (1992) reported that weeds in mungbean reduced its yield by 28%. Similarly. Kondap et al. (i982) reported yield reduction of22.5-57.8% due to weeds. Among various approaches for weed management. conventional weed control methods (chemical and manual) are costlys labour intensive and weather dependent. Moreover. indiscriminate use of chemicals for controlling weeds may pose a threai to the environment.

The allelopathic properties of sorghum have been manipulated for weed control in wheat (Cheema, 1988). Sorgaab (sorghum water extract) has been successfully used as foliar spray on wheat (Cheema et al.. 1997). maize (Ahmad. 199X) and soybean (Khaliq et al., 1999). Similarly, soil incorporation of chaffed sorghum herbage was used for weed control in wheat and it was found that 2-2.5 t ha' of sorghum herbage reduced the weeds by 30% and increased wheat yield by 14-16%. Sorghum allelochemicals arc selective and species specific (Cheema, 1988). Present study was planned to investigate into the response of mungbean to varying frequency of sorgaab spray and two levels of sorghum mulch incorporation in comparison with hand-weeding.

MATERIALS AND METHODS

Sorghum was harvested at maturity. After sun drying it was chaffed with fodder cutter into 2-3clll pieces. It was kept in a shed for subsequent use. The sorghum herbage was soaked in water (I: H) w/v) for 24 hr at room temperature (34°e±2) and filtered to collect sorgaab. Sorgaab was used as a spray material. The experiment was laid out in randomized complete block design with 4 replications. Plot size was 5m X 2.4m. Seed bed was prepared by giving two cultivations and double planking. Mungbean cv. Mung-lJ2 was sown in 30cm spaced rows with single row hand drill in August 1998 on moist seed bed. A basal fertilizer dose (25 kg N, 50 kg Pp, and 50 kg Kp ha:') in the form of urea. single super phosphate and sulphate of potash rcspccuvcly was applied. Crop received three irrigations throughout its growth period. Experimental' treatments were one sorgaab spray 15 days after sowing (DAS). two sorgaab sprays 15 and 30 DAS. three sorgaab sprays 15."\0 and 45 DAS. sorghum mulching at 10 and 15 t ba:'. onc hand-weeding (15 DAS) + one sorgaab spray (30 DAS). one hand-weeding (15 DAS). two hand-wsedings (15 and 30 DAS) and control (weedy check).

Sorghum mulch was surface applied. Calibration was performed before spraying sorgaab to detcnuinc its volume (400 I ha'). Spraying was done with Kuap sack hand-sprayer fitted with t-jet nozzle. Hand-weeding was done with the help of Kasola (hand hoe). Data on weed density. fresh and dry weight were recorded at 25. 40 and 55 DAS from two randomly selected quadrats (50 cm x 50 cm) from each e~~erimental plot. Weeds were cut from ground surface and were weighed fresh and after drying ill an (wen at 80°e for 48 hours. Data on mungbean pia lit height. leaf area, number of pods per plant and number of grains per pod were recorded from randomly selected samples

Mungbean was threshed manually to determine grain yield per plot which was converted into kg ha:'. Data collected were subjected to Fisher's analysis of variance. Least significance difference (LSD) test was applied at 0.05 probability level to compare treatment means (Steel and Torrie.. 1\)84) The procedure devised by Byerlee (1988) was followed to perform economic and marginal analysis to determine the best economical treatment.

RESULTS AND DISCUSSION

Weed species present in the experimental area were *Trianthema portulacastrum. Convolvulus arvensis. Cyperus rotundus* and *Portulaca oleracea.* Among these *Trianthema portulacastrum* was the major weed. The density and dry weight .of other weeds *(Cyperus rotundus, Convolvulus arvensis* and *Portulaca oleracea)* were suppressed by 60.3 and 70.0% respectively, with three foliar sprays of sorgaab (Tables I and 2). while the effect on *Trianthema partulacastrum* was non-significant. It indicated the inherent selective behaviour of sorghum allelochemicals present in sorgaab as also reported by Cheema (1988). Sorghum mulch at both levels suppressed weeds Significantly against control. These findings conform to those of Cheema et al. (1997). One and two hand-weedings reduced by 84.0% and 77.8% weed dcnsitv at 55 DAS (Table I) and resulted' in weed dry weigh) reduction b~ 85.0% and 80.0'X. (Table 2). Sorgaab and sorghulll mulch had no phytotoxic effects on mungbean Three sorgaab sprays reduced mungbean plant height significantly over control (Table 3). This reduction was also recorded in other sorgaab and sorghum mulch treatments Three sorgaab sprays led to the highest number (142) of pods per plant. Two hand-weedings and two sorgaab sprays produced statistically similar number of pods per plant. Among all experimental treatments. two hand-wcedings produced the highest number of grains per pod. The next to follow in this regard were three sprays 01 sorgaab However. sorghum mulching (a 15 t ha:' and one hand-weeding also resulted in statistically the same number of grains per pod. The highest leaf area per plant was recorded in plots receiving two hand-weedings and was followed by three sorgaab sprays. Three sorgaab sprays. one hand-weeding + onc sorgaab spray and hand-weeding alone produced statistically similarleaf.. area per plant This reflects better performance of mungbean under reduced weed-crop competition resulting from the application of these treatments over control.

Table I, Effect of various weed control practices on weed density (50 x 50cm^2)

Treatments	40 DAS		55 DAS	
	Trianthema partulacastrum	Other weeds	*Trianthema partulacastrum*	Other weeds
Control	19.9 abc"	6.3 a	19.8 abc	6.3 a
One sorgaab spray (15 DAS)	25.8 a (29.6)	2.0 b (68.2)	25.5 a (28.8)	2.0 b (68.2)
Two sorgaab sprays (15 & 30 DAS)	26.6 a (33.7)	2.8 b (55.2)	25.8 a (30.3)	1.8 cde (71.4)
Three sorgaab sprays (15, 30 & 45 DAS)	23.8 ab (19.6)	2.0 b (68.2)	23.0 ab (16.0)	2.5 be (60.3)
Sorghum mulching (10 t/ha)	17.0 bed (14.5)	2.9 b (54.0)	17.0 bed (14.0)	2.5 be (60.3)
Sorghum mulching (15 tlha)	15.8 bed (20.5)	2.0 b (68.2)	15.9 cd (19.7)	3.0 b (52.4)
One hand-weeding (15 DAS) + One sorgaab spray (30 DAS)	12.3 cd (38.2)	0.75 b (88.0)	10.8 d (45.4)	0.25 f (96.0)
One hand-weeding (15 DAS)	11.0 de (44.7)	2.4 b (62.0)	11.8 d (40.4)	1.0 ef (84.0)
Two hand-weedings (15 & 30 DAS)	2.9 e (85.4)	2.0 b (68.2)	2.8 e (85.8)	1.4 de (77.8)
LSD (a. 0.05)	8.31	2.24	7.11	0.93

• Any two means in a column not sharing the same letter differ significantly at 0.05 probability level; DAS = Days after sowing; figures in parentheses indicate % increase/decrease over control.

Table 2. Effect of various weed control practices on dry weight of weeds

Treatments	40 DAS		55 DAS	
	Trianthema partulacastrum	Other weeds	*Trianthema partulacastrum*	Other weeds
Control	15.7 abc*	3.1 a	15.6 a	2.0 a
One sorgaab spray (15 DAS)	18.6 a (18.5)	0.7 bc (77.4)	15.5 a (0.6)	0.5 bed (75.0)
Two sorgaab sprays (15 & 30 DAS)	18.4 ab (17.8)	0.9 b (71.0)	13.6 ab (12.8)	0.S bed (75.0)
Three sorgaab sprays (15, 30 & 45 DAS)	18.3 ab (16.5)	0.6 be (80.6)	12.3 abc (21.1)	OG>be (70.0)
Sorghum mulching (10 t/ha)	I2.8abcd (18.5)	0.9 b (71.0)	10. I bed (35.2)	07 bc «(,5.0)
So~ghum mulching (I5 tIha)	12,4 bed (21.,0)	0.7 be (77.4)	,8.6 cd (44.8)	OX b «(,011
One hand-weeding (15 DAS) + One sorgaab spray (30 DAS)	8.9 d (43.3)	0.2 c (93.5)	7.6 d (51.3)	02 d (l)O.O)
One hand-weeding (15 DAS)	9.8 cd (37.5)	0.9 b (71.0)	7.6 d (51.3)	0 ..\ ed (X5.0)
Two hand-weedings (15 & 30 DAS)	2,4 e (84.7)	0.6 be (80.6)	2.2 e (85.8)	O.,J bed (XOO)
LSD (« 0.05)	6.07	0.51	4.14	O.,J2

*Any two means in a column not sharing the same letter differ significantly at 0.05 probability level: DAS =. Days after sowing; figures in parentheses indicate % increase/decrease over control.

Table J. Effect of various weed control practices on yield and yield components of mungbean

Treatments	Plant height (cm)	No. of pods/plant	No. of grains/pod	Leaf area (cm-)	Grain yield (kg/ha)
Control	58.0 a*	II.5 h	8.0 f	615.5 d	12,Jo.O h
One sorgaab sprays (15 DAS)	57.0 abc	11,8 g	8.8 e	616.5 d	12,JX.Olt (0.2)
Two sorgaab sprays (15 & 30 DAS)	55.9 bc	12.8 b	9.3 d	625.3 cd	12'J,J.O g (1.8)
Three sorgaab spray (15. 30 & 45 DAS)	55.5 c	14.2 a	10.0 b	645.3 ab	I,JXO.Ob (l8.8)
Sorghum mulching (10 t/ha) .	56.8 abc	12.0 f	9.5 cd	630. I c	133o.0f (7.2)
Sorghum mulching (15 tIha)	56.8 abc	12.3 e	9.8 be	631.3 c	I,JOo.Oc 12.X)
One hand-weeding (15 "AS) + One sorgaab spray (30 DAS)	57.5 ab	12.9 cd	9.8 be	635.2 be	1,J31.0 c (15.0)
One hand-weeding (15 DAS)	57.5 ab	13.0 c	9.5 cd	634.2 bc	I,J~(,.O d (14.5)
Two hand-weedings (15 ~ 30 DAS)	57.8 a	13,5 b	10.5 a	647.8 a	1510.0 a (21,7)
LSD (« 0.0S:	1,58	0.20	0.26	12.10	5. 10

*Any two means in a column not sharing the same letter differ significantly at' 0.05 probability level: DAS = Days after sowing: figures in parentheses indicate % increase/decrease over control.

Table 4. Economic analysis

	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	---	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

T_1 = control; T_2 = sorgaab spray (15 days after sowing: DAS); T_3 = sorgaab spray (15 & 30 DAS); T_4 = sorgaab spray (15, 30 & 45 DAS); T_5 = sorghum mulch (10 t ha^{-1}); T_6 = sorghum mulch (15 t ha^{-1}); T_7 = hand-weeding (15 DAS) + sorgaab spray (30 DAS); T_8 = hand-weeding (15 DAS); T_9 = hand-weeding (15 & 30 DAS).

The highest grain yield (1516.0 kg ha:') was recorded in plots receiving two hand-weedings. It was 21.7% higher than control. Three sorgaab sprays gave 18.8(Yd higher grain yield (1480.0 kg ha') over control (1246.0 kg ha'). The increase in grain yield may be attributed to regulation of plant height and weed control in improving leaf area per plant. number of pods per plant and number of grains per pod (Table 3). The effectiveness of any production practice is ultimately evaluated on the basis of its economics. EC9nomic and marginal analyses (Tables 4 and S) showed that three sorgaab sprays was termed as the most effective treatment in this regard with highest net returns of Rs. 2616.0 ha" and 664.7% marginal rate of return. Although two hand-weedings gave the highest grain yield among all the treatments but due to higher costs involved. it was overshadowed by three soruaab sprays which turned out to be rather cheap.

It was concluded that sorgaab (three spray s) ma~ be used as a natural weed inhibitor in mungbean The long term effects of sorghum mulch incorporation on soil physical conditions. pH. organic matter contents. etc. mav be investigated in future studies.

Table 5. Marginal analysis

Treatments	Costs that vary (Rs./ha)	Net benefit (Rs./ha)	Marginal rate of return (%)*
1'1 = Control	0	22428	---
1'2 = sorgaab spray (15 DAS)	160	22304 D	---
T3 = sorgaab spray (15 & 30 DAS)	320	22972	170,3
1'4 = sorgaab spray (15,30 & 45 DAS)	480	26160	664.7
1'5 = sorghum muleh (10 ton/ha)	2820	21228 D	---
1'6 = sorghum mulch (15 ton/ha)	4070	21238 D	---
1'7 = hand-weeding (15 DAS) + sorgaab spray (30 DAS)	960	24816 D	---
1'8 = hand-weeding (15 DAS)	800	24868 D	---
1"1 = hand-weeding (15 & 30 DAS)	1600	25688 D	---

D = dominant; DAS = days after sowing; costs that vary (the cost that is incurred on the variable inputs for the production of a particular commodity).

$$\text{*Marginal rate of return (\%)} = \frac{\text{Change in income}}{\text{Change in cost}} \times 100$$

REFERENCE."

Ali. M. 1')<)2 Weeds are a great threat to Kharif pulses. Indian Farming 42(5): 27-30 (Field Crop. Abst. 4(,(1): ,(de,. Il)')3) .

Anonymous 1')')7 Agricultural Statistics of Pakistan. Ministry of Food. Agriculture and Livestock (Economic Wing). Islamabad: 4(,.

Ahmad. R l,)lJ8. Response of maize *(Zea mays* !~.)and some Kharif weeds to foliar application of sorgaab (sorghum water extract] M.Sc. (Hons.) Thesis. Univ. Agri .. Faisalabad

Bycrlcc. D. IlJ88. From agronomic data to farmers reconulIcndatlOns. AI' Economics Training Manual. CIMMYT. Mcxico..', 1-3\.

Chccma. Z. A. 1')88. Weed control in wheat through sorghum allclochelllicals. Ph. D. Thesis. Univ. Agri .. Faisalabad

Chccma. Z. A.. M. Luqman and A. Khaliq I,)lJ7. Use of allclopathic extracts of sorghum and sunflower herbage for weed control in wheat. JAPS. 7:lJl-92

Khaliq. A.. Z A. Chccma, M. A. Mukhtar and S M. A Basra. IlJlJlJ. Evaluation of sorgum *(\"".1'(1111/ bicolor)* water extract for weed control in soybeall lilt J Agri BioI. I:23-2(,.

Kondap. S M. K Ramakrishna. G. B Rcddy and A. N. Rao. IlJ82. Investigations on the competitive abilir; of certain crops against purple nut sedges. Ind. J. Weed Sei 14(2) 124-126 (Field Crop Abst. 37(1): SOOlJ. IlJX4)

Steel. R G. D. and J. H. Torrie. 1984. Principles and Procedures of Statistics. 2nded. McGrawHill Book *Co* Ine. Singapore