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Efficacy of Sorgaab (Sorghum Water Extract) as a Natural Weed Inhibitor in Wheat

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ABSTRACT

Sorgaab (sorghum water extract) was evaluated for its efficacy as natural weed inhibitor in wheat crop in a field study. One to four sprays each at the concentration of 5 and 10% were applied at 30, 40, 50 and 60 days after sowing respectively. Isoproturon (Tolkan) was applied at @ 1 kg a.i/ha at 30 DAS. A weedy check was also maintained. The results of the study showed that the herbicidal treatment reduced weed density and biomass by 69% and 73%, respectively and it increased wheat yield by 40%. While two foliar sprays of Sorgaab (10%) at 30 and 40 days after sowing reduced weed density and biomass by 22 and 46%, respectively and increased wheat yield by 21% over control. Higher concentration (10%) sorgaab was more effective than lower (5%).

Key Words: Sorgaab; Weed inhibitor; Herbicide; Wheat

INTRODUCTION

Use of sorgaab (sorghum water extract) for weed suppression and enhancing crop yields is reported in recent studies (Cheema *et al.,* 1997; Khaliq *et al.,* 1999). However, the effective concentration, frequency of spray and the stage of its spraying is yet to be determined. Cheema and Khaliq (1999) reported that two sprays of sorgaab (10%) were economical than three sprays and increased wheat yield by 20 and 21%, respectively. Contrary to this Ahmad (1998) stated that one to two sprays of sorgaab did not increase maize yield over control while two to three sorgaab sprays increased maize yield by 11 and 33% respectively. Khaliq *et al.* (1999) pointed out that two sprays of sorgaab (10%) at 25 and 45 days after sowing enhanced soybean yield by 8% over control, however, application of sorgaab at flowering stage i.e. 65 days after sowing (DAS) showed some phytotoxicity to soybean crop. The objective of this study was to determine the effective concentration and suitable number of sprays of sorgaab for weed inhibition in wheat at Faisalabad conditions.

MATERIALS AND METHODS

Sorghum was harvested above ground at maturity, sun dried for couple of days and stored under shade. Two concentrations of sorgaab (5 and 10%) were prepared by soaking chaffed sorghum material in water for 24 hours in ratios of 1:20 and 1:10 w/v, respectively.

The experiment comprised the treatments as: one spray at 30 DAS; two sprays at 30 and 40 DAS; two sprays at 30 and 50 DAS; three sprays at 30, 40 and 50 DAS; four sprays at 30, 40 50 and 60 DAS for each concentration respectively. Isoproturon (Tolkan) @ 1 kg ai ha^{-1} at 30 DAS and a weedy check (control) was also included. The experiment was laid out in randomized complete block design with four replications in plots measuring 5m x 2m. Wheat var. Punjab-96 was planted in first week of December 1997 in 25 cm spaced rows with a single row hand drill. A basal fertilizer dose of 125 kg N and 85 kg P_2O_5 ha^{-1} in the form of urea and TSP, respectively, was applied. All phosphorus and half nitrogen was applied at sowing while remaining N was applied at the time of first irrigation. Sorgaab and isoproturon were sprayed in respective plots with the help of knap sack hand sprayer fitted with flat fan nozzle. The volume of spray used was 350 l/ha.

Individual and total weed densities and fresh and dry weight of weeds were recorded from randomly selected two quadrates (50 cm x 50 cm) from each experimental plot. Weeds were cut from ground surface and dried in an oven at 80^{o}C for 72 hours and their dry weight was recorded. To record average plant height and grains per spike, 10 productive tillers were selected at random from each plot. For leaf area measurements 5 plants were cut and their leaves were removed and weighed. Leaf area of a 10 g sub-samples of these leaves was recorded and leaf area/plant was calculated.

From each experimental unit 1000 grains were counted manually and their weight was recorded on an electric balance. Grain yield per plot was recorded and converted in to t ha^{-1}. The data collected were subjected to Fisher`s analysis of variance technique and treatment means were compared using least significance difference (LSD) test at 0.05% (Steel & Torrie, 1984). Economic analysis and marginal rate of return were determined by following the procedure evolved by Byerlee (1988).

RESULTS AND DISCUSSION

Weed flora consisted of mainly the weed species as wild oat (*Avena fatua*), Sweet clover (*Melilotus parviflora*), Broad leaved dock (*Rumex dentatus*), while few plants of creeping thistle (*Conicus arvensis*) and field bind weed (*Convolvulus arvensis*) were also recorded. The density of all the weeds except *M. parviflora* was significantly suppressed by sorgaab treatments in the range of 16-55% (Table I). However sorgaab increased *Melilotus* density indicating the species specific effects of sorgaab and confirming the findings of Rice (1984), and Cheema and Ahmad (1992). The herbicidal treatment was most effective in inhibiting the total weed density 65-72% over control and it was followed by two foliar sprays of sorgaab (10%) at 30 and 40 DAS reducing weed density by 22-34%.

Table I. Effect of sorgaab on weed density (50 cm x 50 cm)

Treatments	Total weed	% decrease over control	Sweet clover	% increase over control	Other weeds	% decrease over control
T_1 = (1:10) SWE one spray 30 DAS	112.125 b	20.38	34.50 abcd	32.02	77.62 b	33.72
T_2 = (1:20) SWE one spray 30 DAS	105.500 b	25.0	30.63 bcd	17.22	74.87 c	36.07
T_3 = (1:10) SWE two spray 30 + 40 DAS	93.375 b	33.66	27.75 cd	6.19	65.62 gh	43.97
T_4 = (1:20) SWE two spray 30 + 40 DAS	108.875 b	22.64	35.38 abc	33.39	73.50 cde	37.24
T_5 = (1:10) SWE two spray 30 + 50 DAS	110.375 b	21.58	37.63 ab	44.01	72.75 def	37.88
T_6 = (1:20) SWE two spray 30 + 50 DAS	104.250 b	25.93	30.75 bcd	17.68	71.00 f	39.37
T_7 = (1:10) SWE three spray 30 + 40 + 50 DAS	97.625 b	30.63	30.50 bcd	16.72	67.12 g	42.69
T_8 = (1:20) SWE three spray 30 + 40 + 50 DAS	105.750 b	24.86	41.50 a	58.82	64.25 h	45.18
T_9 = (1:10) SWE four spray 30 + 40 + 50 + 60 DAS	105.875 b	24.77	33.88 abcd	29,.65	72.00 cf	38.52
T_{10} = (1:20) SWE four spray 30 + 40 + 50 + 60 DAS	113.250 b	19.53	38.50 ab	47.34	74.75 cd	36.17
T_{11} = Isoproturon (Tolkan kg a.i/ha)	42.750 c	69.62	10.00 e	61.72	32.75 i	72.03
T_{12} = Control	140.750 a	-	26.13 d	-	117.12 a	-
LSD =	22.27		8.970		2.02	

Any two means not sharing a letter in common differ significantly at 5%

The reduction in fresh weight and dry weight of all the weeds with herbicide was maximum (73% and 75%) while most of the sorgaab treatments significantly reduced total weed dry weight except sorgaab 5% two sprays (Table II). These findings confirm the previous work of Iqbal (1997) who reported reduction in weed dry weigh with sorgaab.

Table II. Effect of sorgaab weed fresh and dry weight (50 cm x 50 cm)

Treatments	Fresh Wt.	% decrease over control	Dry Wt.	% decrease over control
T_1 = (1:10) SWE one spray 30 DAS	135.525 abcd	14.29	15.94 cd	14.30
T_2 = (1:20) SWE one spray 30 DAS	126.900 bcd	19.74	14.81 e	20.37
T_3 = (1:10) SWE two spray 30 + 40 DAS	126.625 bcd	19.92	14.89 de	19.94
T_4 = (1:20) SWE two spray 30 + 40 DAS	153.955 ab	2.63	17.61 ab	5.32
T_5 = (1:10) SWE two spray 30 + 50 DAS	142.350 abc	9.97	16.74 bc	10.0
T_6 = (1:20) SWE two spray 30 + 50 DAS	92.125 e	41.73	10.83 h	41.75
T_7 = (1:10) SWE three spray 30 + 40 + 50 DAS	110.107 dc	30.36	12.95 g	30.37
T_8 = (1:20) SWE three spray 30 + 40 + 50 DAS	137.80 abcd	12.85	16.21 c	12.84
T_9 = (1:10) SWE four spray 30 + 40 + 50 + 60 DAS	123.175 bcde	22.10	14.49 ce	22.09
T_{10} = (1:20) SWE four spray 30 + 40 + 50 + 60 DAS	115.025 cde	27.25	13.53 fg	27.25
T_{11} = Isoproturon (Tolkan kg a.i/ha)	41.875 f	73.53	4.920 i	73.50
T_{12} = Control	158.125 a		18.60 a	
LSD =	31.20		1.086	

Any two means not sharing a letter in common differ significantly at 5%

Wheat gain yield was significantly increased by most of the treatments (Table III). The herbicidal treatment was most effective in improving the wheat yield by 40% while two foliar sprays of sorgaab (10%) at 30 and 40 DAS was also effective treatment among sorgaab sprays by improving the wheat grain yield by 21% and was followed by sorgaab (10%) three sprays at 30, 40 and 50 DAS enhancing the yield by 16.4% over control. These results conformed the findings of Iqbal (1997) who reported 17% increase in wheat yield by sorgaab. All the sorgaab treatments have promotive effective on wheat leaf area. Three sorgaab (10%) sprays and herbicidal treatment resulted in maximum leaf area and these two treatments significantly differed from all other treatments. The effect of sorgaab on leaf area was reported by Iqbal (1997).

Sorgaab and herbicide application significantly increased the number of grains per spike of wheat over control (Table III). Grain weight was significantly higher in case of herbicidal treatment while in other treatments grain weight did not differ from control. These results are contrary to the findings of Cheema *et al.* (1997) who reported significant increase in grain weight due to sorgaab spray. The improvement in grain yield was possibly due to weed inhibition which resulted in better leaf area facilitating photosynthesis and hence more grain formation. Wheat plant height was not affected by any of the treatments which is contrary to the work reported by Cheema and Khaliq (1999). Economic analysis and marginal rate of return (MRR) (Table IV & V) showed that the herbicidal treatment gave the maximum net benefits (Rs. 21770) while sorgaab (10%)

Table III. Eeffect of sorgaab on growth and yield of wheat

Treatments	Plant height (cm)	Leaf area (cm^2)	No. of grains per spike	Wheat grains weight (g)	Wheat grain yield (kg ha^{-1})	% increase over control
T_1 = (1:10) SWE one spray 30 DAS	99.00NS	254.50f	45.35b	35.36b	3.40bc	11.40
T_2 = (1:20) SWE one spray 30 DAS	95.55	287.50b	46.22ab	35.94b	3.40bc	11.40
T_3 = (1:10) SWE two spray 30 + 40 DAS	99.47	261.60e	47.55ab	37.68ab	3.70b	21.30
T_4 = (1:20) SWE two spray 30 + 40 DAS	95.52	239.50h	47.22ab	36.29b	3.47bc	13.90
T_5 = (1:10) SWE two spray 30 + 50 DAS	100.42	240.50h	46.22ab	35.40b	3.42bc	12.29
T_6 = (1:20) SWE two spray 30 + 50 DAS	99.66	248.50g	47.03ab	35.19b	3.37bc	10.60
T_7 = (1:10) SWE three spray 30 + 40 + 50 DAS	98.47	306.60a	46.65ab	36.87b	3.55b	16.39
T_8 = (1:20) SWE three spray 30 + 40 + 50 DAS	100.10	273.70d	47.33ab	36.65b	3.40bc	11.40
T_9 = (1:10) SWE four spray 30 + 40 + 50 + 60 DAS	98.75	260.50e	45.78b	37.48ab	3.37bc	10.60
T_{10} = (1:20) SWE four spray 30 + 40 + 50 + 60 DAS	99.25	279.50c	45.75b	36.49b	3.25bc	6.50
T_{11} = Isoproturon (Tolkan kg a.i/ha)	101.25	305.70a	49.15a	40.28a	4.25a	40.00
T_{12} = Control	96.22	232.70i	42.30e	34.92b	3.05c	
LSD =	*	2.92	2.56	2.99	0.41	

Any two means not sharing a letter in common differ significantly at 5%

Table IV. Economic analysis

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	Remarks
Total yield	3400	3400	3700	3475	3425	3375	3550	3400	3375	3250	4250	3050	Kg ha^{-1}
Adjusted yield	3060	3060	3330	3127.50	3082.50	3037.50	3195	3060	3037.50	2925	3825	2745	10 z discount
Value of yield	18360	18360	19980	18765	18495	18225	19170	18360	18225	17550	22950	16470	Rs. 240/40 kg
Cost of herbicide											1050		Rs = 375/kg Isoproturon (Tolkan)
Cost of sorgaab	35.75	27.87	71.50	55.74	71.50	55.74	107.25	83.61	143.00	151.48			Vol. of sorgaab=350 L ha^{-1} Rate=18/40 kg preparation=2 h/man Rs.20
Spray application cost	80	80	160	160	160	160	240	240	320	320	80		Rs. 80/spray one man for one spray
Sprayer rent	50	50	100	100	100	100	150	150	200	200	50		Rs. 50/spray
Cost that vary	165.75	157.87	331.50	375.74	331.50	315.74	497.25	473.61	663.00	671.48	1180.00		
Net benefit	18194.25	18202.13	19648.50	18449.26	18163.50	17909.26	18672.75	17886.39	17562.00	16878.52	21770.00	16470.00	

T_1 = (1:10) SWE one spray 30 DAS; T_2 = (1:20) SWE one spray 30 DAS; T_3 = (1:10) SWE two spray 30 + 40 DAS; T_4 = (1:20) SWE two spray 30 + 40 DAS; T_5 = (1:10) SWE two spray 30 + 50 DAS; T_6 = (1:20) SWE two spray 30 + 50 DAS; T_7 = (1:10) SWE three spray 30 + 40 + 50 DAS; T_8 = (1:20) SWE three spray 30 + 40 + 50 DAS; T_9 = (1:10) SWE four spray 30 + 40 + 50 + 60 DAS; T_{10} = (1:20) SWE four spray 30 + 40 + 50 + 60 DAS; T_{11} = Isoproturon (Tolkan kg a.i/ha); T_{12} = Control

Table V. Marginal analysis

Treatments	Cost that vary	Net benefit Rs/ha	Marginal rate of return %
T_1 = (1:10) SWE one spray 30 DAS	0	16470	
T_2 = (1:20) SWE one spray 30 DAS	157.87	18202.13	1097.18
T_3 = (1:10) SWE two spray 30 + 40 DAS	165.75	18194.25	D
T_4 = (1:20) SWE two spray 30 + 40 DAS	315.74	18449.26	156.540
T_5 = (1:10) SWE two spray 30 + 50 DAS	315.74	17909.26	D
T_6 = (1:20) SWE two spray 30 + 50 DAS	331.50	18163.50	D
T_7 = (1:10) SWE three spray 30 + 40 + 50 DAS	331.50	19648.50	7609.39
T_8 = (1:20) SWE three spray 30 + 40 + 50 DAS	473.61	17886.39	D
T_9 = (1:10) SWE four spray 30 + 40 + 50 + 60 DAS	497.25	18672.25	D
T_{10} = (1:20) SWE four spray 30 + 40 + 50 + 60 DAS	663	17562	D
T_{11} = Isoproturon (Tolkan kg a.i/ha)	671.48	16878.52	D
T_{12} = Control	1180	21770	250.00

two sprays (30 and 40 DAS) was the most economical treatment with maximum MRR (7609.39%).

CONCLUSIONS

It can be concluded from these results that sorgaab (10%) is effective than sorgaab 5%. Moreover two sprays of sorgaab (10%) at 30 and 40 DAS is useful practice with relatively less cost as compared to herbicides. However, the studies of this nature may be continued.

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