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EFFICACY OF SORGAAB FOR WEED CONTROL IN WHEAT GROWN AT DIFFERENT FERTILITY LEVELS

Z. A. Cheema, A. Khaliq and K. Ali[1]

ABSTRACT

Sorgaab (sorghum water extract) was investigated for its effectiveness as a natural herbicide in wheat at different fertilizer levels during 1999-2000, at Agronomic Research Area, University of Agriculture, Faisalabad. Mature and chaffed sorghum was soaked in tap H_2O in the 1:10 ratio, for 24 hours, at room temperature and then filtered to collect sorgaab (sorghum water extract) that was sprayed on the crop at 20, 40 and 60 days after sowing. Each spray with different fertilizer levels as zero, low (84-57-62 N-P-K kg ha^{-1}), medium (114-84-62 N-P-K kg ha^{-1}) and high (143-114-94 N-P-K kg ha^{-1}) dose of fertilizer. While, control plots received no sorgaab spray with no fertilizer. Sorgaab spray reduced total weed density by 45 % and fresh and dry weight up to 48 and 50 %, respectively. It reduced biomass of individual weed species as Rumex dentatus 30 %, Phalaris minor 33 %, Chenopodium album 38 % and Avena fatua by 46 %. Two Sorgaab foliar sprays with medium dose of fertilizer (114-84-62 N-P-K kg ha^{-1}) increased wheat grain yield by 17 %.

Key words: Sorgaab, weed control, fertilizer, and wheat.

INTRODUCTION

Weed infestation is a serious problem in wheat crop. Uncontrolled weeds can reduce wheat yield by 25 to 30 % in Pakistan (Nayyar *et al.*, 1994) or even higher depending upon weed infestation (Anonymous, 1997). Now-a-days weeds are generally controlled by chemical methods that are costly and hazardous for health and cause environmental pollution problem. Due to awareness developed in farming community about the risks involved in herbicide usage, new methods of weed control are being evaluated which are safer and harmless for health and environment.

Use of sorgaab (sorghum water extract) for weed suppression and increase in crop yield has been reported in field studies by Khaliq *et al.*, (1999) and Cheema and Khaliq (2000). However, the frequency of spray and optimum fertility level has to be determined for its effectiveness. The concept of using allelochemical crop extracts for controlling weeds was first given by Putnam and Duke (1974). They found that sorghum residues reduced normal weed population by 95 %. About the frequency of spray different reports have been given as Cheema *et al.*, (2000) and Kaliar (1989) reported that two sprays of Sorgaab were economical, while, Ahmad (1998) earlier stated that three Sorgaab sprays increased maize grain yield by 33 %. Ahmad (1994) evaluated fertilizer application of 114-84-56 NPK kg ha^{-1} with sorghum roots, as most effective for inhibiting weeds and to increase grain yield.

1 Department of Agronomy, University of Agriculture, Faisalabad

The objective of this study was to determine most effective combination of Sorgaab foliar spray and fertilizer dose for effective weed control and optimum yield of wheat.

MATERIALS AND METHODS

Sorghum was harvested at maturity, sun dried, chopped (about 2 cm pieces) and stored in a shed. Chaffed material was soaked in tap H_2O in the 1:10 ratio, for 24 hours, at room temperature and then filtered to collect sorgaab (sorghum water extract). The wheat var. Pb. 96 was planted in second week of December at 25 cm spaced rows with single row hand drill. The net plot size was 5 x 1.75 m^2. Spray calibration was performed before spray. Three sorgaab sprays were applied on standing crop at 20, 40 and 60 days after sowing, by knap sack hand sprayer, fitted with flat fan nozzle. Experiment was laid out in randomized complete block design with factorial arrangement. The treatments were zero to three sorgaab sprays with zero, low (84-57-62 N-P-K kg ha^{-1}), medium (114-84-62 N-P-K kg ha^{-1}) and high fertilizer (143-114-94 N-P-K kg ha^{-1}). The whole fertilizer was applied at sowing. Four irrigations were applied to the crop.

Data on weed density, weed biomass (fresh and dry weight) were recorded twice i.e. 45 DAS and 65 DAS, from randomly selected two quadrates (50 x 25 cm^2) from each plot. Weeds were also counted individually and their fresh weights were recorded by electronic balance. For recording weed dry weight, weeds were dried in an oven at 70^0 C for 72 hours. Data on wheat fertile tillers, spike length (cm), spikelets per spike, number of grains per spike and 1000-grain weight (g) were recorded. Fertile tillers were counted from an area of one m^2 and ten spikes were selected at random from each plot for recording spike length, spikelets per spike and number of grains per spike. Grains were counted manually from each plot for recording their 1000-grain weight. Straw and grain yield per plot were recorded in kilogram, and then converted to tons ha^{-1}

Major weed flora of the experimental site comprised of *Phalaris minor*, *Chenopodium album*, *Rumex dentatus*, *Avena fatua*, *Coronopus didymus*, *Anagallis arvensis*, *Medicago denticulata* and *Fumaria indica*. All weeds were collected for total weed density, total fresh and dry weight. However individual weed dry weight was taken for the predominant weeds as *Phalaris minor*, *Chenopodium album*, *Rumex dentatus* and *Avena fatua*.

The data so collected were analyzed statistically by using Fisher's analysis of variance technique and least significance difference test was employed to compare the differences among treatment means (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

Weed density and Dry weight

Sorgaab foliar spray at 60 days after sowing significantly suppressed the total weed density (44.4 %). Individual weed density was also significantly reduced as *Chenopodium album* (40.8 %), *Rumex dentatus* (34 %), *Phalaris minor* (54 %) and *Avena fatua* (50 %) with respect to control (Table-1). Two sorgaab sprays with medium dose of fertilizer (114-84-62 N-P-K kg ha^{-1}) showed more allelopathic effect and better suppressed weed density. These results are in line with Ahmad *et al.*, (1994) who reported better weed control with sorghum residues and fertilizer application @ 114-84-56 N-P-K kg ha^{-1}.

Table-1 Effect of foliar sorgaab on weed density (50 x 25 m^2)

Treatments		Weeds' dry weight (g) 65DAS				Total
N-P-K (Kg ha^{-1})	Spray of sorgaab (DAS)	*Chenopodium album*	*Rumex dentatus*	*Phalaris minor*	*Avena fatua*	
0-0-0	No sorgaab spray (control)	6.75 a*	5.87 a	6.00 a	2.25 a	30.4 a (-)**
0-0-0	One sorgaab spray at (20)	5.50 b	4.62 defg	4.62 bcd	1.50 bcd	26.1 c (13.2)
0-0-0	Two sorgaab sprays at (20+40)	4.50 c	3.87 g	3.87 cde	1.25 cd	20.8 d (31.7)
0-0-0	Three sorgaab sprays at (20+40+60)	4.50 c	4.00 fg	4.00 cde	1.37 bcd	20.0 de (34.2)
84-57-62	No sorgaab spray	7.12 a	5.50 abc	5.50 ab	2.00 ab	29.1 (4.50)
84-57-62	One sorgaab spray at (20)	4.75 bc	4.25 efg	3.25 ef	1.62 abcd	18.9 ef (37.9)
84-57-62	Two sorgaab sprays at (20+40)	4.25 c	4.00 fg	3.12 ef	1.25 cd	17.8 fgh (41.6)
84-57-62	Three sorgaab sprays at (20+40+60)	4.50 c	4.75 cdef	3.50 ef	1.37 bcd	18.3 fg (39.9)
114-84-62	No sorgaab spray	6.50 a	5.75 ab	5.50 ab	1.62 abcd	13.3 ab (0.80)
114-84-62	One sorgaab spray at (20)	4.75 bc	5.00 bcde	4.75 bc	1.50 bcd	19.9 de (34.6)
114-84-62	Two sorgaab sprays at (20+40)	4.00 c	5.12 fg	2.75 f	1.12 d	16.9 gh (44.4)
114-84-62	Three sorgaab sprays at (20+40+60)	4.50 c	4.37 efg	3.62 ef	1.25 cd	20.6 d (32.09)
143-114-84	No sorgaab spray	7.37 a	5.37 abcd	5.75 a	1.87 abc	31.1 a (2.46)
143-114-84	One sorgaab spray at (20)	4.12 c	4.50 efg	3.75 de	1.25 cd	18.1 fg (40.32)
143-114-84	Two sorgaab sprays at (20+40)	4.00 c	4.12 fg	3.62 ef	1.25 cd	16.75 h (44.9)
143-114-84	Three sorgaab sprays at (20+40+60)	4.37 c	4.25 fg	3.75 de	1.37 bcd	17.8 gh (41.6)
	LSD	0.93	0.86	0.90	0.64	1.13

* Means bearing different letters in a column differ significantly at 0.05 probability levels; **Figures in parenthesis show the percent decrease with respect to control.

Table-2 Effect of foliar sorgaab spray on weed dry weight (g per 50 x 25 m^2)

Treatments		Weeds' dry weight (g) 65DAS				Total
N-P-K (Kg ha^{-1})	Spray of sorgaab (DAS)	*Chenopodium album*	*Rumex dentatus*	*Phalaris minor*	*Avena fatua*	
0-0-0	No sorgaab spray (control)	2.30 a*	0.40 abc	0.45 ab	0.12 b	4.61a (-)**
0-0-0	One sorgaab spray at (20)	1.80 b	0.34 cde	0.38 bcd	0.08 c	3.67 b (20.4)
0-0-0	Two sorgaab sprays at (20+40)	1.50 cd	0.30 e	0.35 cde	0.06 e	2.78 cd (39.7)
0-0-0	Three sorgaab sprays at (20+40+60)	1.50 cd	0.30 de	0.38 bcde	0.07 de	2.88 c (37.5)
84-57-62	No sorgaab spray	2.28 a	0.41 ab	0.42 abc	0.10 b	4.52 a (1.95)
84-57-62	One sorgaab spray at (20)	1.50 cd	0.32 de	0.39 bcd	0.08 cd	2.73 cd (40.8)
84-57-62	Two sorgaab sprays at (20+40)	1.47 d	0.28 e	0.34 de	0.06 e	2.31 f (49.9)
84-57-62	Three sorgaab sprays at (20+40+60)	1.48 d	0.34 cde	0.33 de	0.08 cd	2.34 ef (49.2)
114-84-62	No sorgaab spray	2.38 a	0.43 a	0.48 a	0.10 b	3.90 a (15.4)
114-84-62	One sorgaab spray at (20)	1.01 e	0.34 bcd	0.37 cde	0.08 cd	2.73 cd (40.8)
114-84-62	Two sorgaab sprays at (20+40)	1.50 d	0.31 de	0.30 e	0.06 e	2.30 f (50.1)
114-84-62	Three sorgaab sprays at (20+40+60)	1.50 cd	0.33 de	0.37 cde	0.07 de	2.64 cde (42.7)
143-1144-84	No sorgaab spray	2.39 a	0.44 a	0.47 a	0.15 a	4.55 a (1.30)
143-114-84	One sorgaab spray at (20)	1.50 cd	0.34 cde	0.33 de	0.07 cde	2.61 cdef (43.4)
143-114-84	Two sorgaab sprays at (20+40)	1.43 d	0.33cde	0.33 d	0.07 de	2.56 def (44.4)
143-114-84	Three sorgaab sprays at (20+40+60)	1.46 d	0.34 cde	0.37 cde	0.07 cde	2.48 def (46.2)
	LSD	0.18	0.03	0.07	0.01	0.31

* Means bearing different letters in a column differ significantly at 0.05 probability levels; **Figures in parenthesis show the percent decrease with respect to control.

Table-3: Effect of foliar sorgaab spray on yield components and yield of wheat

Treatments		Fertile tillers m^{-2}	Spike length (cm)	Spikelets/ spike	Grains/ spike	TGW (g)	Straw yield t ha^{-1}	Grain yield t ha^{-1}
N-P-K (Kg ha^{-1})	Spray/s of sorgaab (DAS)							
0-0-0	No (control)	272 cdef*	9.0 g	15.7 efg	42.0 fg	39.1 g	8.51 def (-)**	4.06 f (-)
0-0-0	One (20)	279 bcdef	10.8 ab	17.0 a	49.5 c	40.9 ef	8.58 def (0.8)	4.08 ef (0.4)
0-0-0	Two (20+40)	298 ab	11.0 a	17.8 a	50.2 bc	41.1 def	9.62 a (13.0)	4.42 c (8.8)
0-0-0	Three 20-40-60)	292 abc	10.3 dc	16.4 d	46.3 d	41.1 def	8.57 def (0.70)	4.20 de (3.20)
84-57-62	No (control)	255 fgh	10.4 cde	15.9 def	42.5 fg	40.4 f	8.32 f (-2.2)	4.09 ef (0.70)
84-57-62	One (20)	262 efgh	9.15 g	15.5 fg	43.4 e	42.9 bc	8.72 def (2.4)	4.24 d (4.20)
84-57-62	Two (20+40)	285 abcde	10.6 bc	17.3 bc	50.5 b	44.0 ab	9.73 a (14.3)	4.49 bc (10.3)
84-57-62	Three (20+40+60)	266 defg	10.3 de	17.7 ab	52.6 a	44.0 ab	8.56 def (0.57)	4.40 c (8.35)
114-84-62	No (control)	269 cdefg	10.1 c	17.7 ab	41.5 g	41.4 def	9.3 abc (9.2)	4.16 def (2.20)
114-84-62	One (20)	248 gh	10.6 bcd	15.3 g	43.7 e	43.1 abc	8.56 def (-1.8)	4.20 d (3.20)
114-84-62	Two (20+40)	309 a	10.8 ab	17.7 ab	52.2 a	44.4 a	9.6 a (12.8)	4.73 a (16.5)
114-84-62	Three (20+40+60)	297 ab	10.7 ab	16.2 de	47.1 d	43.8 ab	8.93 cde (4.9)	4.48 bc (10.0)
143-114-84	No (control)	205 h	10.3 de	17.4 abc	46.7 d	40.9 ef	8.95 cde (5.1)	4.48 def (2.7)
143-114-84	One (20)	289 abcd	10.2 e	16.1 de		41.7 de	8.44 ef (-0.8)	4.21 d (3.69)
143-114-84	Two (20+40)	291 abc	9.59 f	17.0 c	49.5 c	42.3 cd	9.3 bcd (6.1)	4.55 b (12.0)
143-114-84	Three (20-40-60)	288 abcd	10.1 a	17.3 bc	50.4 bc	41.3 def	9.57 ab (12.45)	4.5 ab (11.8)
LSD α 0.05		25.1	0.33	0.47	0.95	1.23	0.56	0.12

TGW: thousand grain weight; * Means bearing different letters in a column differ significantly at 0.05 probability levels; **Figures in parenthesis show the percent decrease with respect to control.

Total dry weight of weeds was significantly reduced by Sorgaab application at 60 days after sowing (Table-2). The suppression in weed dry weight was possibly due to allelochemical action of sorgaab (sorghum water extract). Total weed dry weight reduction was found 31 to 50 %. The treatment combination F2S2 resulted in maximum weed suppression (50 %). Individual weed dry weight was also significantly reduced by Sorgaab foliar application as *Chenopodium album* showed (37.5 %), *Rumex dentatus* (31 %), *Phalaris minor* (33 %) and *Avena fatua* (50 %) reduction in dry weight at 65 days after sowing. Results are in line with Cheema (1998) who suggested the strong inhibitory effects with allelopathic material.

Wheat yield and yield components

Two sorgaab foliar applications with medium dose of fertilizer (114-84-62 N-P-K kg ha^{-1}) increased wheat grain yield by 16.5 percent over control (Table-3). Two sorgaab sprays also gave higher yield than one or three sprays at other fertilizer levels. More grain yield in treatment combination F2S2 may be due to reduced weed growth, which facilitated better provision of nutrients to crop and more assimilate allocation towards productive parts. The sorgaab (sorghum water extract) also enhanced number of fertile tillers, spike lets per spike, Number of grains per spike and 1000 grain weight (Table 3). It was due to better translocation of photosynthates towards productive parts (Salisbury and Ross, 1978). Cheema *et al.*, (2000) and Cheema *et al.*, (1999) also found similar results, and reported 14 % higher grain yield by the spray of sorgaab (sorghum water extract.)

The results of this study indicated that two sorgaab foliar applications with optimum fertilizer level is effective for weed control. As it controlled weeds such as *Chenopodium album, Phalaris minor, Rumex dentatus, Avena fatua,* etc and increased wheat grain yield up to 17 %, so it can be recommended for natural weed inhibition in wheat crop. Further research on this aspect may be continued to test the feasibility on other crops successfully.

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