INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/2001/03–4–360–362
http://www.ijab.org

Effect of Row Spacing and Sorgaab on Sunflower and its Weeds

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ABSTRACT

A field study was conducted to evaluate the effect of row spacing and Sorgaab (water extract of sorghum) on two kharif weeds, growth and yield of sunflower during 1999. The results revealed that combination of row spacing and Sorgaab at 20 DAS increased yield by 25% while dry weight plant^{-1}, number of achenes head^{-1} and 1000-achene weight was maximum at wider (60 cm) rows with Sorgaab spray at 20 DAS. Plant height increased with decreasing row spacing and was not affected by Sorgaab. Sorgaab at 20 DAS decreased density and dry weight of *Cyperus rotundus* and *Trianthema portulacastrum* by 10, 19, 21 and 17.5%, respectively, while row spacing inhibited density and dry weight by 35, 35, 54 and 52%, respectively.

Key Words: Sunflower; Row spacing; Sorgaab; Weeds

INTRODUCTION

Sunflower (*Helianthus annuus* L.) holds promising position among non-conventional oil seed crops due to its premium oil quality and fitness in our existing cropping systems as short duration crop. However, its yield is very low as compared to potential of existing varieties. The most important yield limiting factors are heavy weed infestation and improper production technology particularly row spacing producing proper nutritional area to exploit available resources judiciously. Row spacing plays an important role in determining yield and yield components (Rizzardi & Kuffel, 1993). Weeds account for 29-75% reduction in sunflower seed yield (Singh *et al*., 1992). Chemical weed control increases cost of production and is hazardous to environment. Allelopathy is natural, environment friendly and unique technology to control weeds effectively and thereby increase crop yield (Cheema, 1988). The use of sorghum water extract (Sorgaab) as foliar weed inhibitor in wheat has recently been reported (Cheema *et al*., 1997). It is quite possible that species and varieties of crop plants may respond differently to sorghum allelochamicals. The present study aimed at determining the effect of row spacing and Sorgaab (water extract of sorghum) on sunflower and its weeds.

MATERIALS AND METHODS

A field experiment was carried out at Agronomic Research Area, University of Agriculture, Faisalabad. The experiment was quadruplicated in RCBD having split-plot arrangement randomizing Sorgaab in main plots and row spacing in sub-plots. Net plot size was 3.6 x 7.0 m.

Three row spacings (30, 45 and 60 cm) and two levels of Sorgaab (one spray at 20 DAS and one spray at 40 DAS) were tested. Plots with 60 cm apart rows without Sorgaab were considered as control treatment. Sunflower variety SF-187 was sown on August 21, 1999 at seed rate of 15 kg ha^{-1}. Thinning was done at 3-4 leaves stage maintaining plant to plant distance of 30 cm. A basal dose of fertilizer @ 100 kg N and 100 kg P_2O_5 ha^{-1} in the form of urea and DAP was applied. Four irrigations were applied: first after 15 days of emergence, second after 30 days, third at head formation and the last one at the time of seed filling. All other cultural practices were kept normal and uniform for all the treatments.

Sorgaab was prepared by the method described by Cheema and Khaliq (2000). Prior to spraying, volume of the spray (330 L ha^{-1}) was calibrated by using ordinary water. Sorgaab was sprayed in respective plots by using Knapp sack sprayer fitted with T jet nozzle.

The data on weed density and biomass (fresh and dry weight) were recorded thrice, i.e., 25, 45 and 65 DAS from randomly selected two sites each measuring 50 x 50 cm from each experimental plot. Weeds were counted individually and their fresh weight was recorded. For recording weed dry weight, weeds were dried in an oven at 80ºC till constant weight. Major weeds in the experimental area were *Trianthema portulacastrum* L. and *Cyperus rotundus* L., while a few plants of *Echinochloa colona* L., *Convolvulus arvensis* and *Tribulus terrestris* L. were also present. Observations on sunflower plant height at maturity, dry weight plant^{-1}, number of achenes head^{-1} and 1000-achene weight were recorded from randomly selected samples. Achene yield per plot was recorded in kg and then converted into kg ha^{-1}.

The data were analyzed statistically and treatment means were compared by using LSD test at 5% probability level (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

Weed density. Population of *Trianthema portulacastrum* recorded at 45 and 65 DAS was significantly suppressed by decreasing row spacing and Sorgaab (Table I). The decrease in the density of *T. portulacastrum* on 45 and 65 DAS (19.33 and 21.42%, respectively) was recorded in plots sprayed with Sorgaab at 20 DAS. However, spray at 40 DAS was not effective. Probably allelochamicals are effective against young weed seedlings. These results support the work of Velu and Ali (1995) who reported that allelochamicals were much effective

against young weed seedlings. Narrow rows (30 cm) also suppressed (46% at 45 DAS and 54% at 65 DAS) weeds effectively as against 60 cm spaced rows. These results are supported by the findings of Johri and Govindra (1991) who suggested that at closer row spacing reduction of weeds was greater over wider row spacing.

Data recorded at 45 and 65 DAS indicated that population of *C. rotundus* was reduced effectively by row spacing and Sorgaab (Table I). Maximum reduction (28 and 35%, respectively) of population of *C. rotundus* was observed in narrow rows (30 cm) as compared to wider (60 cm) rows.

Sorgaab spray at 20 DAS effectively reduced *C. rotundus* density at 45 DAS while at 65 DAS both the treatments of Sorgaab produced statistically similar results. The effect of Sorgaab at 20 DAS was not maintained to later growth stages. This work is backed up by the work of Velu (1996) who indicated that the effect of allelochemicals was not maintained to 60 days.

Weed dry weight. Dry weight of *T. portulacastrum* recorded at45 and 65 DAS was significantly reduced by narrow rows (Table I). Row spacing of 30 cm was more effective in reducing dry weight (57 and 52%, respectively) as against 60 cm (wider rows). Row of 45 cm apart reduced dry weight by 44 and 40% at 45 and 65 DAS, respectively. These results are in conformity with those of Andersson (1986) who reported that with increase in seed rate and reduced row widths, weight of weeds decreased. The data at 45 and 65 DAS indicated that maximum suppression (21.7 and 17.7%, respectively) of dry weight was observed in plots applied with Sorgaab at 20 DAS. While spray at 40 DAS was not so effective. It is concluded that allelochemicals are less effective against older seedlings of weeds. These results are in harmony with the work of Velu and Ali (1995) who stated that allelochemicals were much effective against young weed seedlings.

Dry weight of *C. rotundus* was significantly affected by row spacing and Sorgaab (Table I). The data at 45 and 65 DAS revealed that narrow rows effectively suppressed dry weight (27.5 and 35%, respectively) over 60 cm spaced rows. At later growth stages (65 DAS), 30 cm rows were much effective in suppressing *C. rotundus* dry mass (35%) by contrast to 60 cm spaced rows. These results are in harmony with those reported by Anderson (1986) who reported that with increase in seed rate and reduced row widths, weight of weeds decreased.

The data at 45 and 65 DAS revealed that both treatment of Sorgaab effectively suppressed dry mass of *C. rotundus*. Sorgaab application at both stages of growth gave statistically the same results.

Growth and yield of sunflower. Maximum plant height (164.8 cm) was achieved in narrow rows (30 cm) and was followed by 45 cm wide rows (159.0 cm) while minimum plant height (152.1 cm) was recorded in wider rows (Table II). Taller plants in narrow rows may be due to inter plant competition for light and aerial resources as reported by Gubbels and Dedia (1988).

Table I. Effect of row spacing and Sorgaab on weed density and dry weight of weeds (values in parentheses represent per cent decrease over control)

Treatments	45 DAS		65 DAS	
	Trianthema portulacastrum	*Cyperus rotundus*	*Trianthema portulacastrum*	*Cyperus rotundus*
Weed density				
A. Sorgaab Spray (S)				
S0 : Control	3.00 a	4.17 a	3.50 a	4.25 a
S1 : one spray at 20 DAS	2.42 b (19.33%)	3.50 b (16.07%)	2.75 b (21.42%)	3.83 b (9.88%)
S2 : one spray at 40 DAS	2.83 a (6.0%)	4.08 a (2.15%)	3.25 a (7.14%)	3.58 b (15.76%)
LSD	0.340	0.3046	0.2878	0.2878
B. Row Spacing (P)				
P1 : 30 cm	1.88 c (46.0 %)	3.33 c (28.07%)	2.00 c (54.0%)	3.13 c (34.6%)
P2 : 45 cm	2.88 b (17.7%)	3.79 b (18.14%)	3.17 b (27.0%)	3.75 b (22.0%)
P3 : 60 cm	3.50 a	4.63 a	4.33 a	4.79
LSD	0.3431	0.3912	0.4211	0.4068
Dry weight of weeds				
A. Sorgaab Spray (S)				
S0 : Control	12.677 a	0.6867 a	14.560 a	2.327 a
S1 : one spray at 20 DAS	9.917 c (21.77%)	0.5000 b (27.18%)	11.990 c (17.65%)	1.798 b (22.73%)
S2 : one spray at 40 DAS	11.659 b (8.0%)	0.4633 (32.53%)	13.570 b (7.0%)	1.882 b (19.12%)
LSD	0.9429	0.0632	0.5103	0.2364
B. Row Spacing (P)				
P1 : 30 cm	7.412 c (57.0 %)	0.4292 c (27.5%)	9.270 c (52.0%)	1.617 c (35.0%)
P2 : 45 cm	9.663 b (44.0%)	0.5167 b (26.6%)	11.590 b (40.0%)	1.893 b (24.0%)
P3 : 60 cm	17.180 a	0.7042	19.27 a	2.496 a
LSD	0.8843	0.07176	0.8664	0.2203

Means having different letters in a coloumn differ significantly at 5% probability level according to LSD; Figures presented in parentheses show per cent decrease over 60 cm wide rows and no Sorgaab

Table III. Effect of row spacing and Sorgaab on sunflower

Treatments	Number of plants m^{-2}	Plant height (cm)	Dry weight $plant^{-1}$ (g)	Number of achenes $head^{-1}$	1000-achene weight (g)	Achene yield (kg ha-1)	Increase* (%)
A. Sorgaab Spray (S)							
S0 : Control	6.89	159.92	126.95	1058.80 c	34.83 c	2131 c	-
S1 : one spray at 20 DAS	6.89	157.93	128.93	1116.83 a	36.81 a	2296 a	7.7
S2 : one spray at 40 DAS	6.90	157.95	127.95	1084.92 b	35.39 b	2207 b	3.6
LSD	NS	NS	NS	13.90	0.4545	17.46	
B. Row Spacing (P)							
P1 : 30 cm	9.52 a	164.8 a	114.6 c	927.8 c	32.78 c	2341 a	13.3
P2 : 45 cm	6.38 b	159.0 b	125.4 b	1103.6 b	36.45 b	2226 b	7.7
P3 : 60 cm	4.78 e	152.1 c	143.8 a	1229.1 a	37.81 a	2066 c	-
LSD	0.047	2.8360	2.113	11.09	0.3619	22.02	
C. Interaction (S x P)							
S0P1	9.53	166.15	114.0 e	893.3 h	32.10 e	2301 bc	20.5
S0P2	6.35	160.50	124.7 cd	1090.0 e	35.90 c	2182 d	14.3
S0P3	4.79	153.10	142.2 b	1193.0 c	36.50 bc	1909 f	-
S1P1	3.51	163.85	116.5 e	968.5 f	33.67 d	2383 a	24.8
S1P2	6.40	158.80	123.5 d	1122.0 d	36.94 b	2296 c	20.3
S1P3	4.76	151.15	146.8 a	1260.0 a	39.82 a	2208 d	15.7
S2P1	9.52	164.25	113.4 e	921.8 g	32.58 e	2339 b	22.5
S2P2	6.40	157.65	128.0 c	1099.0 e	36.50 bc	2200 d	15.2
S2P3	4.78	151.95	142.5 b	1234.0 b	37.10 b	2082 e	9.0
LSD	NS	NS	3.659	19.20	0.6268	38.14	

Means having different letters in a column differ significantly at 5% probability level according to LSD; NS = non-significant; * over 60 cm rows and no Sorgaab spray

Maximum dry weight (146.8 g) was recorded in 60 cm apart rows with Sorgaab spray at 20 DAS (Table II) followed by 142.5 g in 60 cm rows sprayed at 40 DAS, which was statistically similar without Sorgaab foliar spray. Wider rows and Sorgaab spray at 20 DAS promoted dry weight of plant which was attributed to more nutritional area and aerial resources. Number of achenes $head^{-1}$ was significantly influenced by the interaction between row spacing and Sorgaab (Table II). Maximum number (1260) of achenes was observed in 60 cm spaced rows with Sorgaab application at 20 DAS followed by 40 DAS (1234) at the same row spacing. More number of achenes $head^{-1}$ got advantage of larger head size and less weed infestation. Similar results were also reported by Rizzardi and Kuffel (1993). The interaction of row spacing and Sorgaab effectively increased 1000-achene weight (Table II). 1000-achene weight was found maximum (39.82 g) in 60 cm spaced rows with Sorgaab spray at 20 DAS followed by 37.10 g in the same row spacing with Sorgaab at 40 DAS. However, later was on a par with 45 cm wider rows + 20 DAS spray, 60 cm wider rows without spray and 45 cm wider rows + 40 DAS Sorgaab application. Narrow rows (30 cm) without Sorgaab foliar spray produced minimum (32.10 g) 1000-achene weight. Increase in 1000-achene weight was attributed to bold achenes as a result of more nutrition and better weed management. These results are in accordance with the work of Rizzardi and Kuffel (1993). Highest achene yield (2383 kg ha^{-1}) was noticed in narrow rows (30 cm) with Sorgaab spray at 20 DAS (Table II) followed by 2339 kg ha^{-1} in the same row spacing with Sorgaab spray at 40 DAS. Narrow rows and Sorgaab increased sunflower yield by 25% over wider rows (60 cm) without Sorgaab attributed to more number of plants m^{-2} and better weed management. These findings are in line with that of Rizzardi and Kuffel (1993).

CONCLUSION

Sunflower may be planted in narrow rows (30 cm) and sprayed 20 DAS for better weed suppression.

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(Received 10 March 2001;Accepted 12 July 2001)