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Research Article

Allelopathic Effect of Sorghum Plants Parts Water Extract to Control Weeds in Wheat Field

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Abstract: An observation trial was conducted at the research field of Bangladesh Agricultural Research Institute, Joydebpur, Gazipur during November 2012 to March 2013. This experiment was under taken to find out the efficiency of weed control in wheat field by the application of sorghum plant parts water extract. The treatments were: i) T_1= 2 kg dry sorghum plant parts/10 lit water extract/ha ii) T_2= 1 kg dry sorghum plant parts/10 lit water extract/ha and iii) T_3= only water spray. Treatment, T_1 showed the minimum number of weeds (28) compared to treatment T_2 (43). But minimum dry wt of weeds were found in treatment T_2.Weed control efficiency, (WCE) was also highest in treatment, T_2 (17.08) compared to treatment T_1 (13.76). The grain yield was highest in treatment, T_2; though the length of spike and no. of grains/spike was highest in treatment, T_3 (Only water spray).
Keywords: Allelopathic, sorghum, water extract, weed, wheat.

INTRODUCTION

In Bangladesh wheat is the 2nd cereal crops after rice [1]. Wheat is an important crop which is successfully grown under different environments due to its flexibility to unfavorable conditions [2, 3]. But every year the yield loss occurs due to different weed infestations. If could be able to control the weeds of wheat field then the yield will be increased [4]. In Bangladesh different chemicals were used to control the weeds. These chemicals are very much costly and have residual effects. This is also harmful for the environment and health of human beings. Yield ranged 0.5-1.3 t ha-1 depending on the amount of rainfall in rainfed areas and 2.5-3 t ha-1 depending on the amount of water available and other factors in irrigated areas [5]. The major reasons for low productivity and variation includes; delayed harvesting of kharif crops such as cotton, sugarcane and rice, and consequently late planting of wheat, unavailability of improved inputs such as seed, inefficient fertilizer use, weed infestation, shortage of irrigation water, drought, terminal heat stress, soil degradation, inefficient extension services, etc. [6].

In present study we focused on the use of natural chemicals produced by the plants that might have negative or positive effect on weed or wheat growth which is also known as allelopathy. It is an interference mechanism, in which plant materials (living or dead) release chemical substances, which inhibit or stimulate the associated plant growth [7-9]. It is also assumed that allelopathy, plays an important role in the intraspecific and interspecific plant competition and may determine the type of interspecific association between them. The plant may exhibit inhibitory or rarely stimulatory effects on germination and growth of other plants in the immediate vicinity [10-12]. Using similar allelopathic technique [13] suggested that three weed species (*Fumaria indica*, *Asphodelus tenuifolius* and *Euphorbia hirta*) produced allelopathic chemicals which reduced germination as well as the subsequent growth of wheat plant.

Cheema *et al*. [14] reported that yield of wheat increased and weed was suppressed when cultivated after sorghum cultivation [15]. Also reported that sorgaab used alone or in combination with herbicide has great promise in increasing weed control and grain yield of wheat. If the allelochemicals of sorghum extract

could be used to control weeds of wheat field, it might be economic as no hazardous and no residual effect exists. The experiment was undertaken to find out the effects of allelochemicals of sorghum plant parts water extract to control weeds in wheat field.

MATERIALS OF METHODS

The experiment was conducted at the Agronomy research field at Bangladesh Agricultural Research Institute, Joydebpur, Gazipur during November 2012 to March 2013. The treatments were: i) T_1= 2 kg dry sorghum plant parts/10 lit water extract/ha ii) T_2= 1 kg dry sorghum plant parts/10 lit water extract/ha and iii) T_3= only water spray. Three plots 10 x 7 m^2 area were taken to conduct the experiment with same area and same place. The land was fertilized with 100-26-50-20-1 kg/ha of NPK&B in the form of urea, TSP, MOP, Gypsum & Boric acid respectively and cow dung @ 10 t/ha was applied. Two third of urea and total amount of other fertilizers were applied as basal dose & rest 1/3rd of urea was top dressed at CRI stage (17-21 DAS). The seeds were sown in line on 29 November 2012.The sorghum plant parts water extract were sprayed at 2 DAS & 29 DAS. The experimented fields were irrigated three times at 18 DAS, 37 DAS & 59 DAS. The data of weeds were taken one time at 31 DAS. The crop was harvested at 121 DAS. Data were recorded as plant height, no of tiller plant^{-1}, length of spike, no of grains spike^{-1}, 1000 grains wt, grain yield/m^2 which was later converted into kg/ha. Data were presented with mean value.

The Relative Density (RD) and Weed Control Efficiency (WEC) were calculated by the following formula-

Relative Density (RD) = (No of specific weed species/Total no of weeds) x 100.

Weed Control Efficiency (WEC) = [(Dry wt. of control plot-Dry wt. of specific plot)/ Dry wt. of control plot] x100.

RESULTS AND DISCUSSION

Spraying of sorghum water extract showed some influenced on weed biomass and grain yield of wheat. The highest plant height was obtained (80.8) from 2kg sorghum plant parts/10 lit water/ha while the lowest was found in control. The number of effective tillers and total number of tillers were highest in 2kg sorghum plant parts/10litwater/ha while the total number of tiller was lowest in control, but effective tiller was lowest (4.2) in both 1kg sorghum plant parts/10 lit water/ha and control. Number of non-effective tillers was highest in 1kg sorghum plant parts/10lit water/ha, but lowest in 2kg sorghum plant parts/10lit water/ha. Length of spike and number of grains spike^{-1} were highest in control treatment and lowest in 1kg sorghum plant parts/10lit water/ha.1000 grains wt. and yield were highest in 1kg sorghum plant parts/10lit water/ha and lowest in control. Similar result was found by [14] in maize. These results are in line with [16] who reported that application of Sorghum roots, stem and leaf water extracts, root water extracts extracts were most effective to reduce weeds fresh weight. However, varied response of wheat plant height by the application of different leaf water extracts could be due to their allelopathic effect on wheat vegetative growth, which consequently suppressed plant height (115.00 to 137.50 cm). Similar results were observed when concentrated

Extracts (50 and 75%) of *Chenopodium album* L. [17] and Sorghum plant parts extracts such as stem, leaf and roots [16] were applied which had detrimental effects on plant height.

Table 2 shows weed species relative density weed dry weight and WCE. Eleven types of different weeds were found in the experimental field. Total number of weed was highest in control treatment, and lowest in 2kg sorghum plant parts/10lit water/ha.

Table-1: Yield and yield contributing characters of wheat

Treatment	Plant height (cm)	No. of tiller per plant			Length of Spike (cm)	No. of Grains/spike	1000 grain wt. (g)	Grain yield (t/ha)
		Effective	None Effective	Total				
2kg sorghum water extract/10 liter /ha	80.8	5.1	0.9	6.0	9.3	48.7	46	3.24
1kg sorghum water extrect/10 liter/ha	78.7	4.2	1.6	5.8	9.2	42.5	47	3.31
Only water spray	73.9	4.2	1.5	5.7	9.8	50.8	44	3.12

Table-2: Weed species, relative density, weed dry weight and weed control efficiency in wheat field (31 DAS)

Treatment	Weed species		No. (m^2)	Relative Density (%)	Weed dry weight/m^2 (gm)	WCE (%)
	Local Name	Scientific name				
2kg sorghum water extract/10 liter/ha	Bathua	*Chenopdium album*	1	3.6	5.2	13.76
	Anguli	*Digitaria Sanguinalis*	1	3.6		
	Helencha	*Jussiea repens*	18	64.3		
	Hatishur	*Heliotropium indicam*	2	7.1		
	Shama	*Echinochloa crusgalli*	4	14.3		
	Bangchora					
	Swetlomy	*Gnaphalium japonicum*	2	7.1		
	Mutha	*cyperus rotundus*				
	Shaknote	*Amaranthus viridis*				
	Gaicha	*Paspalum commersonil*				
	Chapra	*Elusine indica*				
		Total	28	100		
1kg sorghum water extract/10 liter/ha	Bathua	*Chenopdium album*	3	7	5	17.08
	Anguli	*Digitaria Sanguinalis*	2	4.7		
	Helencha	*Jussiea repens*	14	32.6		
	Hatishur	*Heliotropium indicam*				
	Shama	*Echinochloa crusgalli*	12	28		
	Bangchora		1	2.3		
	Swetlomy	*Gnaphalium japonicum*	5	11.6		
	Mutha	*cyperus rotundus*	4	9.2		
	Shaknote	*Amaranthus viridis*	1	2.3		
	Gaicha	*Paspalum commersonil*	1	2.3		
	Chapra	*Elusine indica*				
		Total	43	100		
Only water spray	Bathua	*Chenopdium album*	5	13.2	6.03	-
	Anguli	*Digitaria Sanguinalis*	3	7.9		
	Helencha	*Jussiea repens*	10	26.3		
	Hatishur	*Heliotropium indicam*	3	7.9		
	Shama	*Echinochloa crusgalli*	2	5.3		
	Bangchora					
	Swetlomy	*Gnaphalium japonicum*	12	31.5		
	Mutha	*cyperus rotundus*	1	2.6		
	Shaknote	*Amaranthus viridis*				
	Gaicha	*Paspalum commersonil*				
	Chapra	*Elusine indica*	2	2.5		
		Total	38	100		

The relative density, RD of Helencha (*Jussicarepens*) was highest in 2kg sorghum plant parts/10lit water/ha and 1kg sorghum plant parts/10lit water/ha. But RD of Swettlomy (*Gnaphalium japonicum*) was highest in control. Dry wt. of weeds/m^2 was highest in control treatment and lowest in 1kg sorghum plant parts/10lit water/ha. It might be happened due to allelopathic effect of sorghum plants water extract. Weed Control Efficiency WCE was 13.76 and 17.08 respectively in 2kg sorghum plant parts/10lit water/ha and 1 kg sorghum plant parts/10lit water/ha. Our results are closely related with the findings of [17] who reported that lower concentration of *Chenopodium album* L. extract (25%) promoted number of tillers and grains.

CONCLUSION

From the experiment it was observed that the Weed Control Efficiency (WCE) was very low in treated treatment although weed in the field was minimum. It needs further investigation to observe the efficiency of sorghum plant extracts.

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