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Influence of Sorghum Mulch on Purple Nutsedge (*Cyperus rotundus* L.)

ARIF MAHMOOD AND ZAHID ATA CHEEMA†
Department of Agricultural Extension, Gujrat–Pakistan
†Weed Sci-Allelopathy Research Laboratory, Department of Agronomy, University of Agriculture, Faisalabad–38040, Pakistan

ABSTRACT

Mature sorghum stalk possess a number of water soluble allelochemicals, mainly phenolic compounds which upon release influence the growth of neighbouring plants. Field trials were conducted during 1999 and 2000 to evaluate the allelopathic influence of sorghum mulch on purple nutsedge, a serious weed of summer crops. Chopped sorghum mulch @ 5, 10 and 15 t ha^{-1} was either incorporated into the soil or surface applied. A standard herbicide primextra (atrazine +metolachlor) @ 1.8 kg a.i. ha^{-1} pre-emergence and two hand weedings at 15 and 30 DAS were done as standard treatments and a weedy check was maintained as control. Results revealed maximum reduction in density (73%) and dry mass (77%) with two hand weedings while herbicide primextra (atrazine + metolachlor) @ 1.8 kg a.i. ha^{-1} pre-emergence reduced the purple nutsedge density by 69% and dry mass by 70%, more over, significant suppression of purple nutsedge density and dry mass was also obtained with sorghum mulch that was dependent on quantity of the mulch and method of application (surface or incorporated). Incorporation of mulch was more inhibitory initially (20 days) while surface application showed more inhibition at 40 days after mulching (DAM). Surface application of sorghum mulch @ 15 t ha^{-1} performed better with reduction in purple nutsedge density and dry mass by 45 and 53%, respectively, at 40 DAM and followed by the same rate of mulch as soil incorporated where the reduction was 40 and 50%, respectively.

Key Words: Sorghum; Mulch; Allelopathy; Purple nutsedge; Weed control

INTRODUCTION

Crop residues left on the soil surface suppress germination and growth of weeds by releasing allelochemicals, producing microbial phytotoxins during their decomposition and physically obstructing growth of seedlings (Narwal, 1994). Allelopathic potential of sorghum was determined by Putnam and Defrank (1983). Later on, Cheema (1988) made its possible application in filed conditions and reported that sorghum bicolor contain nine allelochemicals (benzoic acid, p-hydroxy benzoic acid, vanillic acid, m-coumaric acid, p-coumaric acid, gallic acid, caffeic acid, ferulic acid & chlorogenic acid) which could be effectively used for managing some of the important weeds, such as purple nutsedge. In further studies Ahmad *et al.* (1995) reported that sorghum mulch @ 10 t ha^{-1} reduced purple nutsedge population by 38% over control in cotton fields. Cheema *et al*. (2001) stated that sorghum mulch (10-15 Mg ha^{-1}) decreased the dry weight of purple nutsedge by 38-41%, compared to control.

Since purple nutsedge is one of the serious weeds of the world and is among the most common weeds found in our summer (Kharif) season crops. Being a deep rooted perennial with different means of propagation (seed, tubers, rhizomes) it is difficult to control by our commonly used practices such as manual, mechanical and chemical (Crafts & Robbins, 1973) which require intensive labour, depends on weather and also create environmental and health problems. This situation demands an alternative approach for management of this weed. So, keeping in view the allelopathic influence of sorghum mulch as a natural weed control approach, a field study was planned to explore the allelopathic potential of sorghum mulch to control purple nutsedge.

MATERIALS AND METHODS

Field experiments were conducted for two consecutive years during 1999 and 2000. The study is a part of doctoral research work done at Agronomic Research Area, University of Agriculture, Faisalabad, Pakistan, for controlling purple nutsedge in maize. The treatments were sorghum mulch @ 5, 10 and 15 t ha^{-1} as surface applied and soil incorporated, hand weeding twice (15 & 30 DAS), herbicide primextra 500 FW (atrazine + metolachlor) pre-emergence @ 1.8 kg a.i. ha^{-1} and control (weedy check). Sorghum plant herbage was harvested at maturity, dried and chopped with electric fodder cutter into 2-3 cm pieces and kept under cover to avoid possible leaching due to rain water. The sorghum material was either surface applied manually or soil incorporated with last cultivation. The volume of spray (300 L ha^{-1}) for herbicide application was calibrated by using ordinary water. The experiment was laid out in randomized complete block design (RCBD) with

three repeats in plots measuring 7 m x 1.8 m. Herbicide primextra (atrazine + metolachlor) @ 1.8 kg a.i. ha^{-1} was applied in respective plots using Knapsack hand sprayer fitted with T-jet nozzle. Hand weeding was done by a hand hoe. A basal dose of fertilizer @ 150 kg nitrogen and 100 kg phosphorus was used in the form of urea and diammonium phosphate. Half nitrogen and full phosphorus was applied with last cultivation and remaining half nitrogen was applied at 25 DAM. To see the effects of treatments especially on purple nutsedge, other weeds were removed after emergence by hand pulling from the experimental area. Data on purple nutsedge density and dry weight were recorded on 20 and 40 DAM from two randomly selected quadrates (50 x 50cm) from each experimental unit. Dry weight was measured with the help of electric balance after drying (70°C oven dry until constant weight), then average dry weights were determined in grams per meter square. All the data were analysed by using "MSTAT" statistical package on a computer (Anonymous, 1986). A combined analysis of two years data was performed by using Duncan's Multiple Range test.

RESULTS AND DISCUSSION

Purple nutsedge population (20 & 40 DAM) was significantly reduced by all the treatments compared to control (Table I). During early days (20 DAM) incorporation of sorghum mulch resulted in relatively higher mortality (19-37%) of purple nutsedge than surface application (13-35%), however, at later stage (40 DAM) surface applied sorghum mulch gave more reduction (19-45%) than soil incorporation (19-40%). This was possibly due to more release of allelochemicals at early stage in case of incorporation of sorghum mulch. Among sorghum mulch treatments surface application of sorghum mulch @ 15 t ha^{-1} resulted in higher weed mortality (45%) as compared to control and was followed by the same rate of mulch as soil incorporated with 40% mortality of purple nutsedge. As far as the common weed control practices as hand weeding twice and herbicide are concerned both treatments were effective than sorghum mulch with 73 and 69% mortality, respectively. In case of sorghum mulch it was noted tat more the sorghum mass added into the soil, more was the mortality of the purple nutsedge suggesting relatively higher release of allelochemicals into the soil and better physical cover. These finding are in line with those of Cheema *et al.* (2001) who reported 14-23% mortality of purple nutsedge in maize under sorghum herbage @ 10-15 Mg ha^{-1}.

Purple nutsedge dry weight recorded at 20 and 40 DAM (Table II) was significantly reduced by all the treatments as compared to control except sorghum mulch @ 5 t ha^{-1} surface applied during 1999 at 40 DAM. More the quantity of sorghum mulch, more was the suppression in dry weight of purple nutsedge. Sorghum mulch @ 15 tha^{-1} surface applied and soil incorporated reduced purple nutsedge dry weight by 53 and 50%, respectively, at 40

Table I. Effect of Sorghum mulch on purple Nutsedge density (m^{-2})

Treatments		1999		2000	
		20 DAM	40 DAM	20 DAM	40 DAM
T_1	Control (weedy check)	163.33 a	178.67 a	171.33 a	186.67 a
T_2	Sorghum mulch @ 5 t ha^{-1} surface applied	150.00 b	153.33 b	142.67 b	142.67 b
T_3	Sorghum mulch @ 10 t ha^{-1} surface applied	133.33 c	134.00 c	119.33 d	120.00 d
T_4	Sorghum mulch @ 15 t ha^{-1} surface applied	120.67 de	110.67 e	96.00 e	91.33 f
T_5	Sorghum mulch @ 5 t ha^{-1} soil incorporated	139.33 c	149.33 b	132.00 c	146.67 b
T_6	Sorghum mulch @ 10 t ha^{-1} soil incorporated	126.67 d	140.00 c	114.67 d	129.33 c
T_7	Sorghum mulch @ 15 t ha^{-1} soil incorporated	116.00 e	120.00 d	93.33 e	100.67 e
T_8	Hand weeding (15 + 30 DAS)	65.33 f	46.67 g	64.00 f	52.00 h
T_9	Primextra 500 FW (atrazine + metolachlor) pre-emergence @ 1.8 kg a.i. ha^{-1}	44.00 g	54.67 f	41.33 g	58.67 g
	S $\bar{x}$	2.233	2.266	2.233	2.266

Means not sharing a letter in common differ significantly at 0.05 p; Figures in parenthesis show percent decrease over control; DAM = Days after mulching

Table II. Effect of Sorghum mulch on purple Nutsedge dry weight (g m^{-2})

Treatments		1999		2000	
		20 DAM	40 DAM	20 DAM	40 DAM
T_1	Control (weedy check)	15.38 a	21.06 a	16.48 a	22.37 a
T_2	Sorghum mulch @ 5 t ha^{-1} surface applied	13.28 b	19.97 a	13.19 b	17.57 b
T_3	Sorghum mulch @ 10 t ha^{-1} surface applied	11.78 cd	14.78 c	9.51 c	11.45 c
T_4	Sorghum mulch @ 15 t ha^{-1} surface applied	9.34 e	12.13 d	7.30 de	8.41 de
T_5	Sorghum mulch @ 5 t ha^{-1} soil incorporated	12.56 bc	17.85 b	12.44 b	17.12 b
T_6	Sorghum mulch @ 10 t ha^{-1} soil incorporated	11.13 d	13.97 c	8.28 d	11.82 c
T_7	Sorghum mulch @ 15 t ha^{-1} soil incorporated	8.53 e	12.02 d	5.96 f	9.51 d
T_8	Hand weeding (15 + 30 DAS)	5.72 f	4.51 e	6.67 ef	5.63 f
T_9	Primextra 500 FW (atrazine + metolachlor) pre-emergence @ 1.8 kg a.i. ha^{-1}	2.98 g	5.73 e	3.52 g	7.11 e
	S $\bar{x}$	0.370	0.468	0.370	0.468

Means not sharing a letter in common differ significantly at 0.05 p; Figures in parenthesis show percent decrease over control; DAM = Days after mulching.

DAM. Herbicide treatment primextra (atrazine + metolachlor) @ 1.8 kg a.i.ha^{-1} and hand weeding twice (15 and 30 DAM) reduced purple nutsedge dry weight by 70-80 and 61-77%, respectively. Although the reduction of purple nutsedge was more in there treatments than sorghum mulch yet 42-62% decrease in purple nutsedge dry mass with 15 t ha^{-1} surface applied sorghum mulch is quite reasonable, however, further investigations with higher rates of mulch applied on the surface of soil may be conducted.

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