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Short communication

Weed management in zero-till sorghum

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Sorghum [*Sorghum bicolor* (L.) Moench] cultivation under zero tillage is practiced under rice-fallow conditions after *Kharif* rice in coastal districts of Andhra Pradesh. Usually, farmers grow pulses (greengram and blackgram) in rice-fallows in the Krishna-Godavari zone of Andhra Pradesh as "utera" crop (broadcasting of seeds in standing crop of rice). However, in recent times, the area under pulses has declined due to late planting of rice and severe attack of viral diseases (YMV) and parasitic weed (dodder). Farmers of this region are now growing maize (in assured irrigated areas) and sorghum (in limited irrigated areas) in rice-fallows as an alternate crop to pulses (Mishra *et al.* 2011). Weed problem in zero-till sown sorghum is severe due to lack of field preparation, left over weeds from previous rice crop and excess moisture during early stages of crop growth. Though information pertaining to weed control in normal sown crop is available but in zero till sown sorghum it is scanty. Keeping this in view, the present investigation was undertaken to study the effect of weed management practices on weed control and yield of zero till sown sorghum.

Field experiment was conducted at Agricultural College Farm, Bapatla during *Rabi* 2011-12 on sandy clay loam soil with pH 7.8, low in organic carbon (0.49 per cent) and available N (227 kg/ha), P (80 kg/ha) and K (440 kg/ha). Experiment comprising of ten treatments (Table 1) was laid out in a randomized block design with three replications. Sorghum variety '*Mahalakshmi*' was sown after the harvest of rice crop with a spacing of 45 x 10 cm. Fertilizers were applied to the plots as N-P_2O_5-K_2O 100-60-60 kg/ha through urea, SSP, MOP respectively. The entire amount of P and half of K was applied as basal dose prior to sowing as band placement. N was top-dressed as 20 kg/ha as basal, 40 kg/ha at 30 DAS and 40 kg/ha at 60 DAS along with 30 kg/ha of K fertilizer.

All the herbicidal treatments were applied with a manually operated knapsack sprayer fitted with flat fan nozzle using a spray volume of 500 l/ha. The data on weed density was subjected to square root transformation using $\sqrt{x + 0.5}$ to reduce large variations.

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Weed flora

The major weed flora of the experimental field were *Cynodon dactylon*, *Digitaria marginata*, *Cyperus rotundus*, *Cleome viscosa*, *Physalis minima* and *Convolvulus arvensis*. Other weeds were *Echinochloa colona*, *Panicum repens*, *Fimbristylis miliaceae*, *Euphorbia hirta*, *Phyllanthus maderaspatensis* and *Xanthium strumarium*.

All the weed control treatments significantly reduced the density and dry weight of weeds compared to weedy check at 60 DAS (Table 1). Among the treatments, the lowest weed density, dry weight and highest weed control efficiency (WCE) of 65% was observed in the sequential treatment with pre-emergence application of pendimethalin 0.75 kg + paraquat 0.5 kg/ha *fb* post-emergence application of 2,4-D amine 0.58 kg/ha and was at par with other sequential treatments and hand weeding at 20 and 40 DAS, but significantly superior to pre-emergence application of herbicides. The lower weed growth in these treatments was mainly due to effective control of weeds in the early stage by pre emergence herbicides and at later stage by post emergence herbicides. Maximum weed growth was observed in unweeded check. In general, sequential treatments were found to be superior to one time application of herbicides. Similar observations reported in normal sown sorghum by Sharma *et al.* (2000).

All the herbicides under study were found to be selective to sorghum crop without any injury. All the weed management treatments exhibited profound influence on grains per panicle, grain and straw yield (Table 2). Among the treatments, highest grain yield (7.13 t/ha) was observed in sequential treatment with the pre-emergence application of pendimethalin 0.75 kg + paraquat 0.5 kg/ha *fb* post-emergence application of 2,4-D amine salt 0.58 kg/ha at 30 DAS and was at par with other sequential treatments and hand weeding at 20 and 40 DAS but significantly

Table1. Effect of different treatments on weed and crop growth parameters

Treatment	Weed density (no./m^2) at 60 DAS	Weed dry weight (g/m^2) at 60 DAS	WCE at 60 DAS (%)	Plant height at 60 DAS (cm)	Crop dry weight at 60 DAS (t/ha)
Hand weeding 20 and 40 DAS	5.8 (33.8)	45.7	68	183	11.9
Atrazine alone (1.0 g/ha) 2 DAS	8.2 (69.0)	84.6	42	159	8.8
Pendimethalin alone (0.75 g/ha) 2 DAS	8.5 (71.8)	86.8	43	160	8.4
Atrazine + paraquat (1.0+0.5 g/ha) 2 DAS	8.2 (68.2)	84.1	42	163	9.8
Pendimethalin + paraquat (0.75+0.5 g/ha) 2 DAS	8.2 (67.2)	83.6	43	160	10.2
Atrazine alone (1.0 g/ha) 2 DAS *fb* 2,4-D amine salt (0.58 g/ha) 30 DAS	7.0 (49.5)	62.9	57	169	11.0
Pendimethalin alone (0.75 g/ha) 2 DAS *fb* 2,4-D amine salt (0.58 g/ha) 30 DAS	6.9 (48.2)	56.7	62	168	11.4
Atrazine + paraquat (1.0+0.5 g/ha) 2 DAS *fb* 2,4-D amine salt (0.58 g/ha) 30 DAS	7.0 (48.5)	53.9	63	181	11.7
Pendimethalin + paraquat (0.75+0.5 g/ha) 2 DAS *fb* 2,4-D amine salt (0.58 g/ha) 30 DAS	6.9 (47.5)	53.0	65	186	12.5
Weedy check	11.0 (122.0)	150.1	-	152	8.1
LSD (P=0.05)	1.8	25.8	13	19	2.8

Figures in parentheses are original values

Table 2. Effect of different treatments on yield attributes, yield and economics in zero till sown sorghum

Treatment	Panicle length (cm)	Grains per panicle (no.)	100-seed weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Net monetary returns (x10^3 `/ha)	Returns per rupee of investment
Hand weeding 20 and 40 DAS	34.9	1896	2.03	6.98	9.94	61.42	4.17
Atrazine alone (1.0 g/ha) 2 DAS	31.4	1739	1.99	5.03	8.64	46.32	4.71
Pendimethalin alone (0.75 g/ha) 2 DAS	31.9	1730	1.93	5.13	8.51	46.79	4.59
Atrazine + paraquat (1.0+0.5 g/ha) 2 DAS	31.5	1765	1.98	5.49	9.18	50.64	4.77
Pendimethalin + paraquat (0.75+0.5 g/ha) 2 DAS	31.0	1797	2.01	5.66	9.51	52.05	4.72
Atrazine alone (1.0 g/ha) 2 DAS *fb* 2,4-D amine salt (0.58 g/ha) 30 DAS	32.3	1865	2.10	6.64	9.74	63.84	5.87
Pendimethalin alone (0.75 g/ha) 2 DAS *fb* 2,4-D amine salt (0.58 g/ha) 30 DAS	32.5	1884	1.96	6.77	9.85	64.77	5.74
Atrazine + paraquat (1.0+0.5 g/ha) 2 DAS *fb* 2,4-D amine salt (0.58 g/ha) 30 DAS	33.9	1876	2.01	6.83	9.86	65.07	5.63
Pendimethalin + paraquat (0.75+0.5 g/ha) 2 DAS *fb* 2,4-D amine salt (0.58 g/ha) 30 DAS	34.6	1930	2.09	7.13	9.93	67.84	5.64
Weedy check	29.2	1507	1.82	4.67	8.80	43.00	4.62
LSD (P=0.05)	NS	233.5	NS	0.93	0.56		

Note: Sorghum grain: ₹ 11.00/- kg. Sorghum straw: ₹ 0.40/-kg.

superior to pre-emergence application of herbicides. The increased grain yield in these treatments might be due to cumulative effect of lower weed density, dry weight, higher WCE and increased number of grains per panicle. The lowest grain yield (4.67 t/ha) was observed in weedy check with an yield loss of 52.8% as compared to the best treatment because of severe weed competition during the crop growth period. Regarding economics, the treatment pendimethalin 0.75 kg + paraquat 0.5 kg/ha *fb* post-emergence application of 2,4-D amine 0.58 kg/ha recorded higher net returns (₹ 67,840/ha) but the highest benefit cost ratio (₹ 5.87) obtained with pre-emergence application of atrazine 1.0 kg/ha *fb* 2,4-D amine 0.58 kg/ha at 30 DAS, which was due to differences in cost of inputs. Thus, it can be summarized that pre-emergence application of atrazine 1.0 kg/ha *fb* 2,4-D amine 0.58 kg/ha at 30 DAS was found to be effective and economical for weed management in zero till sown sorghum as an alternative to hand weeding.

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