The Andhra Agric. J 73 (1): 013-019, 2026
doi :10.61657/aaj.2026.247

Effect of weed management practices on weed parameters and yield of rice fallow sorghum

J Bharadwaja, K Srinivasulu, S Prathibha Sree and M Latha
Department of Agronomy, Acharya N G Ranga Agricultural University,
Agricultural College, Bapatla - 522101, Andhra Pradesh, India

ABSTRACT

A field experiment was conducted during *rabi* 2023-24 at the Agricultural College Farm, Bapatla. The experiment was laid out in a randomized block design with eleven treatments and replicated thrice. Data on weed dynamics revealed that hand weeding at 20 and 40 DAS and pendimethalin @ 0.75 kg a.i./ha + paraquat @ 0.6 kg a.i./ha applied immediately after dibbling *fb* halosulfuron-methyl @ 67.5 g a.i./ha at 20 DAS recorded significantly lower total weed count and dryweight and higher weed control efficiency at harvest. Hand weeding at 20 and 40 DAS recorded highest grain yield of sorghum. However, atrazine @ 1.0 kg a.i. ha^{-1} + paraquat @ 0.6 kg a.i. kg ha^{-1} immediately after dibbling *fb* 2,4-D @ 0.8 kg a.i. ha^{-1} at 20 DAS as PoE and pendimethalin @ 0.75 kg a.i. ha^{-1} + paraquat @ 0.6 kg a.i. ha^{-1} immediately after dibbling *fb* 2,4- D @ 0.8 kg a.i. ha^{-1} at 20 DAS as PoE resulted in comparable grain yield with hand weeding at 20 and 40 DAS.

Keywords: *Halo-sulfuron methyl, Phytotoxicity, Rice fallow Sorghum and Pre emergence herbicides*

Millets are a group of small seeded, fast growing annual grasses. They are notable for their ability to mature quickly, which makes them especially valuable in regions with short or un predictable growing seasons.India is the leading producer of millets, contributing 41 percent to the global production. Millets are cultivated in an area of 12.45 million hectares, producing 15.53 million tonnes with productivity of 1247 kg ha^{-1}(Advance Estimates-2021-2022, DES, GOI). Sorghum (*Sorghum bicolor*) popularly known as "Jowar" belongs to the family poaceae and is often referred to as the "king of millets". India holds about 79% (11.65 million hectares) of South Asia's total rice fallows, which amounts to 15 million hectares. The available resources in rice fallow lands offer an opportunity to introduce drought resistant and short duration crops. Cultivating drought-tolerant and short-duration millets in rice fallows can help strengthen the nation's nutritional security. In Andhra Pradesh, sorghum is currently cultivated on over 24,000 hectares of rice fallows, with an average yield of 6.5t per hectare (Naik *et al.*, 2018). Weeds are the major problem in rice-fallow sorghum, due to no field preparation, left over weeds from previous rice crop and excess moisture at early stages of crop growth. Chemical weed control presents a more cost- effective and labor-saving option compared to manual weeding. Repeated application of atrazine and 2,4-D in sorghum fields has led to a decline in broadleaf weed populations, while significantly increasing the presence of sedges and grassy weeds. Halosulfuron- methyl, a newly introduced sulfonylurea herbicide, needs to be assessed for its selective effectiveness against sedges and its potential phytotoxic effects on the sorghum crop. Adopting effective weed control methods, such as integrating selective post-emergence herbicides into rice fallow systems, can substantially boost sorghum yields.

MATERIAL AND METHODS

A field experiment entitled "Performance of rice fallow sorghum as influenced by weed management practices" was conducted during *rabi* 2023-24 at the Agricultural College Farm, Bapatla. The results of the soil analysis showed that the experimental field had a sandy clay loam on texture, neutral in pH 6.8, with electrical conductivity of 0.43 ds m^{-1}, low in organic carbon (0.44 %), low in available nitrogen (196.8 kg ha^{-1}), medium levels of available phosphorus (26.4 kg ha^{-1}) and potassium (285.5 kg ha^{-1}). Average mean maximum and minimum temperature were 32 ^{0}C and 20.9 ^{0}C and weekly mean relative humidity ranged from 62.7% to 86.7% with an average of 75.8 % during crop growth, 2023-24. The total amount of rainfall received was 3.1 mm with in one rainy day**.** Experiment comprising of twelve treatments laid out in a randomized block design with three replications. The treatments consisted of T1 : Weedy check, T2: Hand weeding at 20 and 40 DAS, T3: Atrazine @ 1.0 kg a.i. ha^{-1} immediately after dibbling, T4: Atrazine @ 1.0 kg a.i. ha^{-1} as PE *fb* clethodim @ 125 g a.i. ha^{-1} as PoE , T5: Atrazine @1.0 kg a.i. kg ha^{-1} + paraquat @0.6 kg a.i. kg ha^{-1} immediately after dibbling, T6: Pendimethalin @ 0.75 kg a.i. ha^{-1} + paraquat @ 0.6 kg a.i. ha^{-1} immediately after dibbling T7: Pendimethalin @ 0.75 kg a.i. ha^{-1} as PE *fb* clethodim @ 125 g a.i. ha^{-1} as PoE, T8: Halosulfuron methyl @ 67.5 g a.i. ha^{-1} at 20 DAS as PoE, T9: Atrazine @1.0 kg a.i. kg ha^{-1} + paraquat @0.6 kg a.i. kg ha^{-1} immediately after dibbling *fb* 2,4-D @ 0.8 kg a.i. ha^{-1} at 20 DAS as PoE , T10 : Atrazine @1.0 kg a.i. kg ha^{-1} + paraquat @0.6 kg a.i. kg ha^{-1} immediately after dibbling *fb* Halo-sulfuron methyl @ 67.5 g a.i. ha^{-1} at 20 DAS as PoE, T11 : Pendimethalin @ 0.75 kg a.i. ha^{-1} + paraquat @ 0.6 kg a.i. ha^{-1}immediately after dibbling *fb* 2,4-D @ 0.8 kg a.i. ha^{-1} at 20 DAS as PoE, T12 : Pendimethalin @ 0.75 kg a.i. ha^{-1} + paraquat @ 0.6 kg a.i. ha^{-1} immediately after dibbling *fb* Halo-sulfuron methyl @ 67.5 g a.i. ha^{-1} at 20 DAS as PoE. Sorghum variety Mahalaskhmi - 296 was sown after the harvest of rice crop with a spacing of 45 cm X 15 cm. Urea, single super phosphate, and muriate of potash were used as sources of nitrogen, phosphorus, and potassium, respectively.120 kgha^{-1}of nitrogen was applied in three equal splits of 40 kgha^{-1}each at 15, 45, and 60 days after sowing, timed with the first and second irrigations. The full recommended doses of phosphorus (60 kg P_2O_5 kg ha^{-1}) and potassium (40 kg K_g ha^{-1}) were incorporated into the soil as a basal application at sowing. Prescribed plant protection practices were implemented as per need. Pre emergence herbicide applications were carried out using a hand-operated knapsack sprayer with a flat-fan nozzle, @ 500 liters spray fluid per hectare. Post emergence herbicides applied at 20 DAS with knapsack sprayer. To minimize large variations, the weed density data was transformed using the square root transformation.

RESULTS AND DISCUSSION

Effect of different weed management practices on weed density, weed drymatter and weed control efficiency

Weed density

All weed control treatments resulted in a significant reduction in weed density at all stages of crop growth compared to the weedy check as presented in Table 1. Hand weeding at 20 and 40 DAS recorded significantly lower weed density at 20, 40, 60, 80 DAS and harvest. The herbicide combinations involving halosulfuron-methyl i.e T10 - T5 + Halo-sulfuron methyl @ 67.5g a.i. ha^{-1} at 20 DAS as PoE & T12 - pendimethalin @ 0.75 kg a.i./ ha + paraquat @ 0.6 kg a.i./ha applied immediately after dibbling *fb* halosulfuron-methyl @ 67.5 g a.i./ha at 20 DAS recorded lowest weed density at 20, 40, 60, 80 DAS and harvest and demonstrated weed suppression compared to the pre-emergence applications only (Atrazine @ 1.0 kg a.i. ha^{-1} immediately after dibbling). The decreased weed growth in these treatments was mainly due to the efficient suppression of weeds during the early stages by pre-emergence herbicides and continued control at later stages through post-emergence applications. Similar findings were reported by Prasanna *et al*. (2020) and Mundphane (2023).

Weed dryweight

The dryweight of weeds in rice fallow sorghum is presented in Table 2. Hand weeding at 20 and 40 DAS recorded significantly lower weed dry weight across the growth stages. The herbicide combinations involving halosulfuron-methyl i.e T10 - T5 + Halo-sulfuron methyl @ 67.5g a.i. ha^{-1} at 20 DAS as PoE & T12 - pendimethalin @ 0.75 kg a.i./ ha + Paraquat @ 0.6 kg a.i./ha applied immediately after dibbling *fb* halosulfuron-methyl @ 67.5 g a.i./ha at 20 DAS recorded lowest weed dry weight over other herbicidal treatments. The decreased weed growth in these treatments was mainly due to the efficient suppression of weeds during the early stages by pre-emergence herbicides and continued control at later stages through post-emergence applications. Similar findings were reported by Surya *et al*. (2017), Girase *et al*. (2017),

Weed control efficiency:

Data on weed control efficiency was

Table1.Total weed density m^{-2} in rice fallow sorghum as influenced by different weed management practices

Treatment	20DAS	40DAS	60DAS	80DAS	At Harvest
T_1 : Weedycheck	7.5-55.67	13.18-173.33	15.6-243.33	15.31-234.33	14.98-224
T_2 : Hand weeding at 20 DAS and 40 DAS	7.13-50.33	6.68-44.67	6.87-46.67	6.02-35.79	5.18-26.33
T_3 : Atrazine @ 1.0 kg a.i. ha^{-1} immediately after dibbling	6.01-35.67	11.28-127	13.45-180.67	13.14-172.33	13.21-165.67
T_4 : Atrazine @ 1.0 kg a.i. ha^{-1} as PE *fb* Clethodim @ 125 g a.i ha^{-1} as PoE	6.25-38.67	8.97-80	11.29-127	10.86-117.67	10.61-112
T_5 : Atrazine @ 1.0 kg a.i. ha^{-1} + Paraquat @ 0.6 kg a.i. kg ha^{-1} immediately after dibbling	3.17-9.67	9.23-84.67	11.24-126.33	10.85-117.33	10.63-112.67
T_6 : Pendimethalin @ 0.75 kg a.i. ha^{-1} + Paraquat @ 0.6 kg a.i. ha^{-1} immediately after dibbling	3.03-8.67	9.04-81.67	11.17-124.33	10.78-116	10.53-111
T_7 : Pendimethalin @ 0.75 kg a.i. ha^{-1} as PE *fb* Clethodim @ 125 g a.i ha^{-1} as PoE	5.2-26.67	8.67-74.67	11.2-125.33	10.6-113.33	10.29-105.67
T_8 : Halo-sulfuron methyl @ 67.5g a.i. ha^{-1} at 20 DAS as PoE	6.94-47.67	10.21-104	12.11-147.33	11.98-143.33	11.68-136
T_9 : T + 2,4-D @ 0.8 kg a.i. ha^{-1} at 20 DAS as PoE	4.06-16	8.12-65.67	10.61-112.33	10.28-105.33	9.95-99
T_{10} : T + Halo-sulfuron methyl @ 67.5g a.i. ha^{-1} at 20 DAS as PoE	4.21-17.33	7.56-56.67	9.94-98.33	9.53-90.33	9.23-85.16
T_{11} : T + 2,4-D @ 0.8 kg a.i. ha^{-1} at 20 DAS as PoE	7.5-55.67	7.98-62.85	10.56-111.33	10.02-100.33	9.65-92.66
T_{12} : T + Halo-sulfuron methyl @ 67.5 g a.i. ha^{-1} at 20 DAS as PoE	3.63-12.67	7.29-53	9.85-96.67	9.13-83	8.5-72.33

The data subjected to square root transformation(“5ØKÜ+0.5). The figures in parenthesis are original values.

Table2.Total weed dry matter gm^{-2} in rice fallow sorghum as influenced by different weed management practices

Treatment	20DAS	40DAS	60DAS	80DAS	At Harvest
T_1 : Weedycheck	7.43-51.66	14.05-197.03	20.73-432.61	19.38-376.22	17.82-317.44
T_2 : Hand weeding at 20 DAS and 40 DAS	6.79-46.94	5.94-34.74	6.62-43.27	5.51-30.02	5.26-27.16
T_3 : Atrazine @ 1.0 kg a.i. ha^{-1} immediately after dibbling	5.43-29.14	11.59-134.19	17.08-291.36	16.03-257.57	14.72-217.46
T_4 : Atrazine @ 1.0 kg a.i. ha^{-1} as PE *fb* Clethodim @ 125 g a.i ha^{-1} as PoE	5.66-31.63	9.16-83.77	14.25-202.71	12.9-166.74	11.9-141.84
T_5 : Atrazine @ 1.0 kg a.i. ha^{-1} + Paraquat @ 0.6 kg a.i. kg ha^{-1} immediately after dibbling	2.67-6.61	8.9-78.67	13.05-170.63	12.22-149.48	11.1-123.62
T_6 : Pendimethalin @ 0.75 kg a.i. ha^{-1} + Paraquat @ 0.6 kg a.i. ha^{-1} immediately after dibbling	2.55-6	8.74-75.96	12.84-164.41	11.78-138.45	10.95-120.27
T_7 : Pendimethalin @ 0.75 kg a.i. ha^{-1} as PE *fb* Clethodim @ 125 g a.i ha^{-1} as PoE	4.88-24.69	9.02-81.22	13.95-195.1	12.58-158.6	11.53-132.76
T_8 : Halo-sulfuron methyl @ 67.5g a.i. ha^{-1} at 20 DAS as PoE	6.67-44.06	10.89-118.22	15.97-254.74	15.06-227.55	13.95-194.3
T_9 : T_5 + 2,4-D @ 0.8 kg a.i. ha^{-1} at 20 DAS as PoE	3.1-9.49	7.85-61.21	11.69-136.9	10.73-114.95	10.24-104.09
T_{10} : T_5 + Halo-sulfuron methyl @ 67.5g a.i. ha^{-1} at 20 DAS as PoE	3.13-9.51	7.42-54.77	11.33-128.42	10.01-100	9.72-94.41
T_{11} : T_6 + 2,4-D @ 0.8 kg a.i. ha^{-1} at 20 DAS as PoE	2.99-8.51	7.62-57.74	11.65-136.13	10.54-111.49	9.94-99.04
T_{12} : T_6 + Halo-sulfuron methyl @ 67.5 g a.i. ha^{-1} at 20 DAS as PoE	3.06-9.02	7.27-52.57	11.12-123.61	9.82-96.9	9.66-92.9
SEm(±)	0.26	0.56	1.1	1.06	0.83
CD(P=0.05)	0.77	1.65	3.23	3.12	2.44
C.V(%)	9.97	10.77	14.28	15.09	12.64

Thedatasubjectedtosquareroottransformation(“5ØKÜ+0.5).Thefiguresinparenthesisareoriginalvalues.

Table 3. Weed control efficiency (%), grain yield, straw yield, harvest index (%) and weed index (%) in rice fallow sorghum as influenced by different weed management practices

Treatment	Weed Control Efficiency (%)		Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)	Weed index (%)
	60DAS	At Harvest				
T_1 : Weedycheck	0	0	1564	3383	31.5	66.95
T_2 : Hand weeding at 20 DAS and 40 DAS	89.69	91.43	4792	9300	34	0
T_3 : Atrazine @ 1.0 kg a.i. ha^{-1} immediately after dibbling	30.99	30.7	3177	6367	33.3	33.74
T_4 : Atrazine @ 1.0 kg a.i. ha^{-1} as PE *fb* Clethodim @ 125 g a.i ha^{-1} as PoE	52.34	55.08	1360	3033	31	71.56
T_5 : Atrazine @ 1.0 kg a.i. ha^{-1} + Paraquat @ 0.6 kg a.i. kg ha^{-1} immediately after dibbling	59.49	60.68	3747	7133	34.4	21.82
T_6 : Pendimethalin @ 0.75 kg a.i. ha^{-1} + Paraquat @ 0.6 kg a.i. ha^{-1} immediately after dibbling	60.96	61.75	3851	7458	34.2	19.68
T_7 : Pendimethalin @ 0.75 kg a.i. ha^{-1} as PE *fb* Clethodim @ 125 g a.i ha^{-1} as PoE	54.58	57.89	1493	3200	30.4	70.25
T_8 : Halo-sulfuron methyl @ 67.5g a.i. ha^{-1} at 20 DAS as PoE	39.88	38.16	2987	6025	33.1	37.49
T_9 : T_5 + 2,4-D @ 0.8 kg a.i. ha^{-1} at 20 DAS as PoE	67.89	67.14	4458	8683	33.8	5.79
T_{10} : T_5 + Halo-sulfuron methyl @ 67.5g a.i. ha^{-1} at 20 DAS as PoE	69.21	70.11	4185	8267	34.1	12.48
T_{11} : T_6 + 2,4-D @ 0.8 kg a.i. ha^{-1} at 20 DAS as PoE	67.89	68.46	4492	9100	33.1	5.68
T_{12} : T_6 + Halo-sulfuron methyl @ 67.5 g a.i. ha^{-1} at 20 DAS as PoE	70.46	70.5	4163	8425	33.1	13.25
SEm(±)	2.74	3.01	197.47	432.16	1.97	3.9
CD(P=0.05)	8.05	8.84	579.17	1267.48	5.78	11.43
C.V(%)	8.59	9.32	10.21	11.18	10.34	22.58

summarized and presented in Table 3. The highest weed control efficiency was recorded with hand weeding at 20 and 40 DAS (89.69 % and 91.43% at 60 DAS and at harvest, respectively) Similar report of highest weed control efficiency was reported with hand weeding by Vijaykumar *et al*. (2017) and Saravanane *et al*. (2023). which was followed by application of pendimethalin @ 0.75 kg a.i. ha^{-1} + paraquat @ 0.6 kg a.i. ha^{-1} immediately after dibbling *fb* halo-sulfuron methyl @ 67.5 g a.i. ha^{-1} at 20 DAS as PoE (70.46% and 70.5%) at harvest.

Effect of weed management practices on grain yield, straw yield, harvest index and weed index of rice fallow sorghum

The effect of weed management practices on yield and weed index of rice fallow sorghum is presented in Table 3.Among different weed management practices tested, the highest grain yield (4792 kg ha^{-1}) and stover yield (9300 kg ha^{-1}) was noticed with hand weeding at 20 and 40 DAS, which was on par with sequential treatments, atrazine @ 1.0 kg a.i. ha^{-1} + paraquat @ 0.6 kg a.i. kg ha^{-1} immediately after dibbling fb + 2,4-D @ 0.8 kg a.i. ha^{-1} at 20 DAS as PoE or pendimethalin @ 0.75 kg a.i. ha^{-1} + paraquat @ 0.6 kg a.i. ha^{-1} immediately after dibbling fb + 2,4-D @ 0.8 kg a.i. ha^{-1} at 20 DAS as PoE and these are significantly superior to pre-emergence application of herbicides alone. The enhanced grain yield and stover yield observed in these treatments could be attributed to the combined effects of reduced weed density and dryweight and higher weed control efficiency (WCE). These results are in agreement with Rajesh *et al*. (2023) and Krishnamurthy *et al*. (2021).

The lowest yield among the herbicide treatments was observed in T7 treatment (pendimethalin @ 0.75 kg a.i. ha^{-1} as PE *fb* Clethodim @ 125 g a.i ha^{-1} as PoE) followed by T4 treatment (Atrazine @1.0 kg a.i. ha^{-1} as PE *fb* Clethodim @ 125 g a.i ha^{-1} as PoE) might be due to the phytotoxic effects of Clethodim on the crop, that inhibited the growth.The effect of weed management practices on harvest index was found to be non significant in rice fallow sorghum. Among various weed management practices, the lowest weed index was recorded with the application of pendimethalin @ 0.75 kg a.i. ha^{-1} + paraquat @ 0.6 kg a.i. ha^{-1} immediately after dibbling *fb*2,4-D @ 0.8 kg a.i. há$^{-1}$ at 20 DAS as PoE (5.68 %) and atrazine @ 1.0 kg a.i. ha^{-1} + paraquat @ 0.6 kg a.i. ha^{-1} immediately after dibbling *fb*2,4-D @ 0.8 kg a.i. ha^{-1} at 20 DAS as PoE (5.79 %) which was comparable with that of hand weeding at 20 and 40 DAS.

CONCLUSION

Based on findings, it is concluded that lower values of weed density, and higher weed control efficiency, grain and stover yield was recorded with hand weeding at 20 and 40 DAS and among herbicide treatments, the combination of Pendimethalin @ 0.75 kg a.i. ha^{-1} or Atrazine @ 1.0 kg a.i. ha^{-1} along with Paraquat @ 0.6 kg a.i. ha^{-1} as PE followed by 2,4-D @ 0.8 kg a.i. ha^{-1} as PoE resulted higher grain yield of sorghum in rice fallows.

LITERATURE CITED

AdvanceEstimates.Source:*www.desap.gov.in.*

Girase P P, Suryawanshi R T, Pawar P P and Wadile S C 2017. Integrated weed managem ent in pearl millet. *Indian Journal of Weed Science*. 49 (1): 41-43.

Krishnamurthy D, Gangaiah D and Tonapi V A 2021. Non suitability of tembotrione and topramezone for weed management in sorghum (*Sorghum bicolorL.*). *Indian Journal of Weed S cience.*53(4):381–386.

Mundphane T, Kiran T, Jadhav and Pranali S 2023. Weed management in summer pearl millet. *The pharma Innovation Journal.* 12 (10): 1297- 1300.

Naik B S, Murthy K V, Ramana A V and Gurumurthy P 2018. Performance of Sorghum Hybrids under Different Nitrogen Levels in Rice-Fallow Conditions of North Coastal Areas. *International Journal of Current Microbiology and Applied Sciences*. 7 (3): 3655- 3662.

PrasannaK, Joseph M, Hemalatha M and Jothimani S 2020. Suitableweed Management practices for dual purpose sorghum K12 under irrigated condition. *International Journal of chemical Studies*. 8 (6): 944-948.

Rajeshpatil V A, Krishnamurthy D, Ramesha Y M and Ajay Kumar M Y 2023. Weed Management practices on growth, yield and economics of *kharif* grain sorghum.

International Journal of Environment and Climate Change.(13):1060-1071.

Saravanane P, Karthickraja A, Nadaradjan S and Mohan R 2023. Sustainable and eco-friendly weed management options for transplanted finger millet. Sensitizing the Millet Farming, Consumption and Nutritional Security - Challenges and Opportunities.197-201

Surya P M, Reddi R Y and Subramanyam 2017. Effect of integrated weed management on weeds control, yield attributes and yield of pearl millet (*Pennisetum glaucum* L.). *Trends in Bio sciences*. 10 (2): 693-695.

Vijaykumar M, Jayanthi C, Kalpana R and Ravi D 2017. Integrated weed managem ent in sorghum (*Sorghum bicolor* (L.) Monech) – A review. *Agricultural Review*. 35 (2): 79-91.

Received on 25.01.2026 and Accepted on 28.02.2026