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Influence of organic nutrient and weed management strategies on weed dynamics in sorghum

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ABSTRACT

An experiment was conducted on “Nutrient and Weed Management Strategies in Organic *Sorghum*” at the Regional Agricultural Research Station, Lam, Guntur, during the rabi 2025-26. The experiment was laid out in a split plot design with four main plots (M_1 : 50% N through FYM+ 50% N through Vermicompost, M_2 : 75% N through FYM, M_3 : 50% N through Ghanajeevamrutham + 50% N through Vermicompost, M_4 : 75% N through Ghanajeevamrutham), four sub plots (S_1 : Weedy check, S_2 : one hand weeding + one intercultural operation, S_3 : Two hand weedings + two intercultural operations, S_4 : Mulching @ 5 t ha⁻¹ with maize stover residue) and were replicated thrice. The experimental results revealed that two hand weedings and two intercultural operations recorded the lowest weed density and weed dry weight which was fb one hand weeding and one intercultural operation, mulching @ 5 t ha⁻¹ with maize stover residue. The highest density and dry weight of weeds were found in weedy check.

Keywords: Hand weeding, Intercultivation, Weed management, Mulching

1. Introduction

Sorghum is a versatile crop cultivated widely across the world and is considered as one of the major millet crops (Dimple *et al.*, 2024) [1]. It serves as an important staple food for millions of people, particularly in semi-arid and arid regions, owing to its ability to withstand drought, high temperatures and low soil fertility. In addition to its importance as a food grain, sorghum is extensively utilized as animal feed and for biofuel production.

Weed infestation is a major constraint to crop productivity, particularly in organic farming systems, where weeds compete with crops for essential resources such as water, nutrients, light and space, which adversely affecting the crop growth and yield. The susceptibility of sorghum to weed competition is greater during the early growth stages due to its slow initial growth and low vigour (Mohammad *et al.*, 2024) [2]. Uncontrolled weed competition during this period can cause yield losses of 15–40 per cent (Priya *et al.*, 2013) [3]. Although, chemical herbicides provide effective weed control with reduced labour requirements, their excessive and indiscriminate use may contribute to herbicide resistance, environmental pollution and deterioration of soil health. Therefore, greater emphasis is being placed on sustainable weed management approaches, including timely hand weeding, inter-row cultivation, crop rotation, mulching and intercropping, which can provide effective and environmentally safer alternatives.

2. Materials and Methods

The experiment was conducted during *rabi* season 2025–26 at the Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh. The experimental site is situated at an altitude of 31.5 m above mean sea level, at 16°36' N latitude and 80°43' E longitude, and falls under the Krishna Agro-climatic Zone of Andhra Pradesh. The experiment was laid out in a split-plot design with four organic nutrient management treatments in the main plots and four weed management treatments in the sub-plots, each replicated three times. The main plot treatments comprised M_1 : 50 per cent N through FYM + 50 per cent N through vermicompost, M_2 : 75 per cent N through FYM, M_3 : 50 per cent N through ghanajeevamrutham + 50 per cent N through vermicompost and M_4 : 75 per cent N through ghanajeevamrutham. The sub-plot treatments consisted of S_1 : weedy check, S_2 : one hand weeding + one intercultural operation, S_3 : two hand weedings + two intercultural operations and S_4 : mulching with available crop residue @ 5 t ha⁻¹.

Sorghum variety NTJ-5 (Nandyal Tella Jonna) was sown on 21-10-2025 with a spacing of 45 cm × 15 cm. Organic nutrient sources *viz.*, FYM, ghanajeevamrutham and vermicompost were applied as basal on nitrogen equivalent basis. The recommended dose of fertilizers for sorghum was 74 kg N, 39 kg P₂O₅, 30 kg K₂O ha⁻¹. The experimental soil was clayey in texture, slightly alkaline and non-saline, with medium organic carbon content (0.5%), low available nitrogen, medium phosphorus and high potassium (175 kg ha⁻¹, 32 kg ha⁻¹, 289 kg ha⁻¹ respectively).

Weed density and weed dry weight were assessed at 20, 40 and 60 days after sowing (DAS) and the data were subjected to square-root transformation prior to statistical analysis. Weed control efficiency and weed

index were subsequently determined using the respective standard formulae.

$$\text{Weed control efficiency} = \frac{X - Y}{X}$$

Where,

X = Dry weight of weeds in unweeded check plot

Y = Dry weight of weeds in the treatment plot

Weed Index =

Where,

X = Yield of weed free plot Y = Yield of treated plot

3. Results and Discussion

3.1 Weed flora

The dominant weed flora observed in the experimental field consisted of grasses viz. *Cynodon dactylon*, *Echinochloa colonum*, sedges *Cyperus rotundus* and broad-leaved weeds *Phyllanthus niruri*, *Trianthema portulacastrum*, *Digera arvensis*, *Cleome viscosa*, *Chrozophora rottleri*. The interaction effect of organic nutrient and weed management practices on weed flora of sorghum was found to be non-significant.

3.2 Weed density (No. m⁻²) and weed dry weight (g m⁻²)

Among organic weed management practices, two hand weeding + two intercultural operations (S₃) recorded significantly the lowest weed density and weed dry weight (Table. 1 & 2) of grasses, sedges and broad-leaved weeds at 20, 40 and 60 DAS followed by one hand weeding + one intercultural operation (S₂) and mulching with maize stover residue @ 5 t ha⁻¹ (S₄). At all the stages of crop growth, two hand weeding and two intercultural operations significantly reduced the weed growth due to effective and season-long weed control by maintaining a weed-free environment throughout the critical crop-weed competition period. Similar findings were reported by Ram *et al.* (2005) [4] in pearl millet, Sharma *et al.* (2010) [5] in maize.

3.3 Weed control efficiency (WCE %) and weed index (WI %)

The highest weed control efficiency and lower weed index (Table. 3) were recorded in two hand weeding + two intercultural operations (S₃) followed by one hand weeding + one intercultural operation (S₂) and mulching with available maize stalk residue @ 5 t ha⁻¹ (S₄). The minimum weed index and maximum weed control efficiency recorded with two hand weeding + two intercultural operations may be attributed to effective and timely suppression of weeds throughout the critical crop-weed competition period, which reduced weed population and dry weight of weeds and minimized crop-weed competition, these results were in line with Bhandari *et al.* (2004) [6], Arvadiya *et al.* (2012) [7], and Sangwan *et al.* (2016) [8].

Table 1. Weed density (No.m⁻²) of grasses, sedges and broad-leaved weeds at 20, 40 and 60 DAS as influenced by organic nutrient and weed management strategies in sorghum

Treatments	Weed density (No.m ⁻²)								
	20 DAS			40 DAS			60 DAS		
Nutrient management strategies (M)	Grasses	Sedges	BLW	Grasses	Sedges	BLW	Grasses	Sedges	BLW
M ₁	2.1 (4.4)	2.1 (4.2)	2.8 (5.8)	2.4 (9.9)	2.5 (11.6)	3.4 (25.9)	3.9 (17.5)	2.9 (12.7)	4.5 (47.6)
M ₂	2.2 (4.7)	2.3 (6.0)	2.2 (5.4)	2.4 (9.6)	2.8 (13.5)	3.5 (29.2)	3.7 (14.3)	3.3 (12.9)	4.7 (57.3)
M ₃	2.3 (5.8)	2.2 (6.0)	2.5 (6.5)	2.2 (6.2)	2.6 (14.3)	3.8 (26.7)	3.6 (13.2)	3.2 (13.9)	4.1 (40.4)
M ₄	2.2 (6.3)	2.2 (4.6)	2.3 (7.4)	2.3 (8.2)	2.6 (12.6)	3.6 (30.3)	3.5 (12.2)	3.4 (14.5)	4.4 (49.1)
SEm (±)	0.07	0.06	0.06	0.07	0.07	0.09	0.1	0.1	0.1
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	10.3	9.7	8.7	9.6	8.9	9.0	9.6	10.5	9.3
Weed management strategies (S)									
S ₁	3.0 (7.6)	3.1 (7.1)	3.2 (9.0)	3.6 (11.3)	4.2 (16.8)	6.2 (39.5)	4.3 (18.6)	5.2 (17.2)	8.2 (68.2)
S ₂	1.9 (5.0)	1.9 (4.7)	2.0 (5.8)	1.9 (7.8)	2.0 (11.4)	2.4 (25.1)	3.5 (13.3)	2.5 (13.8)	3.3 (44.2)
S ₃	1.7 (3.2)	1.6 (4.0)	1.8 (4.8)	1.6 (6.0)	1.8 (9.5)	2.0 (19.8)	3.1 (11.5)	1.9 (10.5)	2.8 (29.7)
S ₄	2.2 (5.1)	2.1 (5.2)	2.3 (6.1)	2.2 (8.4)	2.4 (13.7)	3.6 (29.5)	3.8 (14.2)	3.4 (12.7)	3.8 (52.3)
SEm (±)	0.06	0.07	0.06	0.07	0.07	0.1	0.1	0.1	0.1
CD (P = 0.05)	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4
CV (%)	9.5	10.5	9.1	10.3	9.2	10.1	9.3	10.2	10.6
Interaction (M×S)	NS	NS	NS	NS	NS	NS	NS	NS	NS
Interaction (S×M)	NS	NS	NS	NS	NS	NS	NS	NS	NS

The data was subjected to square root transformation ($\sqrt{x + 0.5}$). The figures in parenthesis are original values.

*DAS- Days after sowing BLW- Broad-leaved weeds

M₁ – (50% N through FYM+ 50% N through Vermicompost), M₂ – (75% N through FYM), M₃ – (50% N through Ghanajeevamrutham + 50% N through Vermicompost), M₄ – (75% N through Ghanajeevamrutham), S₁ – (Weedy check), S₂ – (One hand weeding + one intercultural operation), S₃ – (Two hand weeding + two intercultural operation), S₄ – (Mulching @ 5 t ha⁻¹ with maize stalk residue).

The data was subjected to square root transformation ($\sqrt{x + 0.5}$). The figures in parenthesis are original values.

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sorghum

Table 2. Weed dry weight (g m^{-2}) of grasses, sedges and broad-leaved weeds at 20, 40 and 60 DAS as influenced by organic nutrient and weed management strategies in sorghum

Treatments	Weed dry weight (g m^{-2})								
	20 DAS			40 DAS			60 DAS		
Nutrient management strategies (M)	Grasses	Sedges	BLW	Grasses	Sedges	BLW	Grasses	Sedges	BLW
M ₁	1.7 (2.7)	1.8 (2.7)	1.9 (3.3)	2.4 (5.9)	2.1 (4.7)	2.7 (7.8)	2.5 (7.2)	2.5 (6.2)	4.7 (32.7)
M ₂	1.6 (2.4)	2.0 (3.8)	2.0 (3.8)	2.3 (5.8)	2.3 (4.9)	2.4 (6.1)	2.4 (7.0)	2.5 (7.0)	5.2 (39.6)
M ₃	1.9 (3.4)	2.0 (3.6)	1.9 (3.4)	2.2 (4.6)	2.2 (4.4)	2.3 (5.5)	2.6 (7.2)	2.6 (8.4)	4.7 (28.1)
M ₄	1.8 (3.2)	1.9 (2.9)	2.1 (4.1)	2.1 (4.8)	2.4 (5.8)	2.4 (6.3)	2.7 (8.1)	2.8 (8.6)	5.3 (32.6)
SEm ($\pm$)	0.08	0.06	0.06	0.07	0.06	0.07	0.07	0.08	0.1
CD ($P = 0.05$)	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	10.1	9.8	10.1	10.2	9.6	10.4	9.5	10.1	10.6
Weed management strategies (S)									
S ₁	2.3 (4.7)	2.5 (4.8)	2.5 (5.1)	3.0 (7.8)	2.7 (6.8)	3.4 (11.8)	3.4 (11.1)	3.3 (10.8)	6.5 (42.5)
S ₂	1.6 (2.3)	1.7 (2.7)	1.8 (3.2)	2.0 (4.4)	2.1 (4.5)	2.2 (4.7)	2.2 (5.7)	2.3 (5.6)	4.6 (27.3)
S ₃	1.4 (1.6)	1.5 (1.9)	1.5 (2.1)	1.7 (3.2)	1.8 (2.8)	1.6 (2.4)	1.9 (4.6)	2.0 (5.1)	3.8 (27.9)
S ₄	1.8 (3.0)	2.1 (3.7)	2.1 (4.1)	2.3 (5.8)	2.4 (5.5)	2.5 (6.6)	2.8 (7.9)	2.8 (8.6)	5.1 (35.4)
SEm ($\pm$)	0.05	0.05	0.05	0.07	0.06	0.07	0.08	0.07	0.1
CD ($P = 0.05$)	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.4
CV (%)	8.9	9.6	8.1	10.4	8.8	9.7	10.6	9.8	10.0
Interaction (M×S)	NS	NS	NS	NS	NS	NS	NS	NS	NS
Interaction (S×M)	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 3. Weed control efficiency (%) and weed index (%) as influenced by organic nutrient and weed management strategies in

TREATMENTS	Weed control efficiency (%)			Weed index (%)
	20 DAS	40 DAS	60 DAS	
M ₁ S ₁	0	0	0	23.4
M ₁ S ₂	29.0	30.3	22.3	2.5
M ₁ S ₃	44.7	43.1	32.4	0
M ₁ S ₄	18.4	36.4	15.6	14.9
M ₂ S ₁	0	0	0	19.9
M ₂ S ₂	26.5	35.3	34.7	2.4
M ₂ S ₃	44.5	50.1	46.6	0
M ₂ S ₄	25.3	33.0	18.0	11.6
M ₃ S ₁	0	0	0	25.1
M ₃ S ₂	27.1	46.6	36.8	9.8
M ₃ S ₃	48.1	55.0	50.1	0
M ₃ S ₄	22.2	37.4	30.1	20.7
M ₄ S ₁	0	0	0	23.9
M ₄ S ₂	37.3	30.5	30.2	5.8
M ₄ S ₃	51.8	53.0	41.8	0
M ₄ S ₄	34.2	27.8	12.6	14.1

4. Conclusion

Two hand weeding combined with two intercultural operations resulted in a substantial reduction in the weed density and dry weight of grasses, sedges and broad-leaved weeds in sorghum throughout the crop growth period. This could be attributed to the effective maintenance of a relatively weed-free environment in the experimental plots. This treatment was followed by one hand weeding combined with one intercultural operation and mulching with maize stalk residue @ 5 t ha⁻¹. Among the different organic nutrient and weed management strategies, the differences in weed density and weed dry weight were found to be non-significant. The interaction effect of organic nutrient and weed management practices in sorghum on weed density, weed dry weight was found to be non-significant.

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