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Evaluation of Weed Parameters in Rice Fallow Crops under Zero-till System with Limited Irrigation

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ABSTRACT: A field experiment was conducted in sandy loam soils to study the impact of weeds at 20, 40 and 60 DAS with limited number of irrigations in six different crops under zero till system in rice fallows during *rabi,* 2021-22 at Agricultural College Farm, Naira. Weeds are the major problem in rice fallows that shows direct impact on growth and yields of various fallow crops. Yield can be attained with proper management practices like hand weedings at every 15 days interval and with the irrigations that were provided to different fallow crops. The experiment was laid out in split-plot design, replicated thrice with six treatments. The weed count and weed dry weight was non-significant with number of irrigations in six fallow crops at 20 and 40 DAS. At 20 DAS weed count was highest with three irrigations (41 m^{-2}) and gradually decreased with reduced number of irrigations and lowest with two irrigations (40.07 m^{-2}). At 40 DAS weed count was highest with four irrigations (51.92 m^{-2}) and lowest with two irrigations (49.64 m^{-2}). At 20 DAS weed dry weight was highest with three irrigations (13.23 m^{-2}) and lowest with two irrigations (12.59 m^{-2}). At 40 DAS weed dry weight was highest with four irrigations (26.08 m^{-2}) and lowest with two irrigations (25.46 m^{-2}). Significant difference was recorded in weed count and weed dry weight at 60 DAS. The interaction effect of weed count and weed dry weight at 60 DAS was significant with number of irrigations in six fallow crops.

Keywords: Limited irrigation, Rice fallows, Zero-till system.

INTRODUCTION

Global demand for grain crops is expected to grow rapidly in the coming decades. Upscaling system productivity and to ensure country's food security, sustainable intensification of traditional cropping systems is indispensable (FAO, 2017). Rice (*Oryza sativa* L.) fallow (~14 million ha) is a typical monocrop rice-based system of south Asia (particularly India including Andhra Pradesh), presently gaining larger attention as promising means for sustainable intensification. Rice is grown during *kharif* which is normally followed by a fallow during the *rabi* (November- February). Efficient utilization of these fallow lands may increase the productivity and make the whole system sustainable (Riton Chowdhury *et al*., 2020). Soil condition and climatic situation clearly suggest that short duration crop can easily be fit in that situation. The lowest weed density and biomass, highest weed control efficiency were observed with hand weeding (HW) twice at 15 and 30 days after seeding (DAS) (Sandhya Rani *et al*., 2021). Physical/mechanical methods such as hand weeding at 20 and 30 days after planting (DAP) or passing wheel hoe twice with one manual weeding were found to be equally effective in finger millet (Adusumilli Narayana Rao, 2021). Hasamuddin Hasam *et al.* (2021) conducted an experiment at the research farm, Punjab Agricultural University (PAU) and the results revealed that lowest weed seed bank was observed with green manuring using sunhemp (*Crotalaria juncea* L.). Mishra *et al.* (2019) reported that minimum total weed dry matter (187.6 g m^{-2}) was recorded with RT (reduced

tillage) + 30% anchored crop residue in rice-maize rotation. Venkateswarlu *et al*. (2018) conducted an experiment on weed management in rice fallow maize under zero tillage and their influence on growth and yield of maize. Hand weeding at 15 and 30 DAS recorded the highest grain yield (10309 kg ha^{-1}) and highest gross income (Rs. l54594 ha^{-1}). The resources present in the rice fallows clearly giving an opportunity to introduce different crops into the situation. It will surely be an excellent inclusion, if the location specific constraints are been managed efficiently. Then those unutilized lands can be efficiently converted into productive one. It will not only increase the production of the system but also strengthen the economic condition of the farmers, improve the soil. Therefore, the present investigation was carried out in rice-fallows under zero-tillage conditions in achieving the highest productivity in the country.

MATERIALS AND METHODS

A field experiment was conducted at Agriculture College Farm, Naira of Acharya N. G. Ranga Agricultural University located at North Coastal Zone of Andhra Pradesh during *Rabi*, 2021-2022. The soil of the experimental site was sandy loam in texture, with pH 7.2, organic carbon 0.38 %, available nitrogen 225 kg ha^{-1}, available P_2O_5 31 kg ha^{-1} and available K_2O 275 kg ha^{-1}. The weather conditions during the crop growth period were normal.

The experiment was laid out in a split plot design, replicated thrice with three irrigation levels *viz.*, two irrigations (I_1), three irrigations (I_2) and four irrigations (I_3) assigned to main plots and six different crops *viz.*, Maize (C_1), Sorghum (C_2), Fingermillet (C_3), Mustard (C_4), Sunhemp (C_5) and Blackgram (C_6) assigned to sub plots.

The cultivars used for the experiment in six crops were Maize (*Zea mays*) hybrid is DKC 9150, Sorghum (*Sorghum bicolor*) hybrid is CSH 16, Finger millet (*Eleusine coracana*) variety is Sri Chaitanya, Mustard (*Brassica nigra*) variety is Pusa Mustard 28, Sunhemp (*Crotalaria juncea* L.) variety is Shailesh (SH-4), and Blackgram (*Vigna mungo*) variety is LBG 787 (Tulasi), were procured for sowing. Seeds of maize and sorghum were dibbled at recommended spacing 60 × 20 cm and 45 × 15 cm. Finger millet, mustard, sun hemp and blackgram were broadcasted uniformly. Sowings were done at 14th December, 2021 in residual soil moisture after the harvest of paddy crop.

To maintain optimum plant population, gap filling was done at 15 DAS and thinning was done at 20 DAS. Two hand weedings were carried out at 20 and 40 DAS to keep the plots free from weeds. Fertilizer was applied as per the recommended doses to respective crops. The crops were grown on residual soil moisture up to first irrigation and there after irrigations were given as per the treatments.

The data was recorded with respect to weed count and evaluated over time by counting the number of emerged weeds in four randomly placed 0.25 m^{-2} quadrants at 20, 40 and 60 DAS in each sub-sub plot of the experiment. Within each quadrant, weeds were counted and recorded. After above-ground weed biomass was collected in four randomly placed 0.25 m^{-2} quadrants at 20, 40 and 60 DAS to record dry weight. Data values regarding weed count and weed dry weight were transformed by used square root transformation method. Within each quadrant, plants were cut at the soil surface, placed into brown paper bags and dried in a forced-air oven at 60°C for three days. Dried biomass of weeds was then weighed, averaged and expressed in kg m^{-2}.

RESULTS AND DISCUSSION

Weed count at 20, 40 and 60 DAS. The weed count was non-significant with number of irrigations in six fallow crops at 20 and 40 days after sowing DAS. At 60 DAS weed count was significantly influenced by number of irrigations in six fallow crops. Data regarding weed count at 20, 40 and 60 DAS are presented in Table 1. The interaction effect at 60 DAS on weed count was significant and presented in Table 2. The weed count at 60 DAS was significant with number of irrigations in six fallow crops. The highest weed count was progressively increased with four irrigations and weed count was decreased significantly and gradually with reduction in number of irrigations and recorded minimum values with two irrigations. Among six fallow crops significantly highest weed count was recorded in Maize crop and lowest in Blackgram.

The interaction effect of weed count at 60 DAS was significant with number of irrigations and six fallow crops. The highest weed count was recorded significantly highest with three irrigations which was however on par with four irrigations in Maize crop and lowest weed count was recorded with two irrigations in Mustard.

At 60 DAS the weed count is more compared to 20 and 40 DAS as weeds were more aggressive than crop plants having competitive advantage with the progression of growth. At 60 DAS the weed count was progressively increased with four irrigations and decreased significantly and gradually with reduction in number of irrigations and recorded lowest with two irrigations due to liberal and adequate availability of resources with four irrigations. These findings are in corroborations with those reported by Adusumilli Narayana Rao (2021), Sandhya Rani *et al*. (2021), Venkateswarlu *et al*. (2018), Bamboriya *et al.* (2017), Parameswari *et al.* (2017) and Malla Reddy *et al*. (2013).

Weed dry weight at 20, 40 and 60 DAS. The weed dry weight was non-significant with limited number of irrigations in six fallow crops at 20 and 40 days after

sowing. At 60 DAS weed dry weight was significantly influenced by number of irrigations in six fallow crops. The weed dry weight at 20, 40 and 60 DAS was presented in Table 3. The interaction effect at 60 DAS on weed dry weight was significant and presented in Table 4.

Weed dry weight at 60 DAS was significant with number of irrigations and six fallow crops. The weed dry weight was progressively increased with four irrigations (56.19 gm m^{-2}) and weed dry weight was decreased significantly and gradually with reduction in number of irrigations and recorded minimum values with two irrigations (45.73 gm m^{-2}). Among six fallow crops significantly highest weed dry weight was observed in Maize crop (58.43 gm m^{-2}) and lowest with Sunhemp crop (47.44 gm m^{-2}).

The interaction effect of weed dry weight at 60 DAS was recorded as significant with number of irrigations and six fallow crops. Significantly highest weed dry weight was recorded in Maize with four irrigations (64.77 gm m^{-2}) and lowest weed dry weight was recorded with two irrigations (42.47 gm m^{-2}) in Sunhemp which was however, observed on par with three irrigations (46.97 gm m^{-2}).

At 60 DAS the weed dry weight is more compared to 20 and 40 DAS as weeds were more established and vigourous than crop plants having competitive advantage with the progression of growth. At 60 DAS the weed dry weight was progressively increased with four irrigations due to better growth and accumulation of sufficient drymatter and decreased significantly and gradually with reduction in number of irrigations and recorded lowest with two irrigations due to liberal and adequate availability of resources with four irrigations. These findings are in corroborations with those reported by Venkateswarlu *et al*., (2018), Malla Reddy *et al*., (2013), Dhanapal *et al.,* (2015) and Srinivasulu *et al*., (2016).

Table 1: Weed count (no m^{-2}) at 20, 40 and 60 DAS in six fallow crops with limited number of irrigations.

Treatments	Weed count at 20 DAS	Weed count at 40 DAS	Weed count at 60 DAS
Main plots : No of Irrigations			
M_1: Two Irrigations	40.07 (6.83)	49.64 (7.54)	72.30 (9.00)
M_2: Three Irrigations	41.00 (6.90)	51.59 (7.68)	79.47 (9.41)
M_3: Four Irrigations	40.02 (6.82)	51.92 (7.70)	84.05 (9.66)
SEm±	1.3	0.9	1.6
CD (P=0.05)	NS	NS	6.255
CV (%)	13.26	7.761	8.598
Sub plots : Different crops			
C_1: Maize	44.80 (7.19)	57.77 (8.10)	92.03 (10.09)
C_2: Sorghum	44.22 (7.14)	55.52 (7.95)	88.66 (9.91)
C_3: Fingermillet	39.00 (6.74)	48.81 (7.48)	74.56 (9.13)
C_4: Mustard	39.41 (6.77)	46.63 (7.32)	73.85 (9.09)
C_5: Sunhemp	37.58 (6.63)	46.69 (7.33)	72.03 (8.98)
C_6: Blackgram	37.17 (6.59)	50.88 (7.63)	70.50 (8.89)
SEm±	1.1	1.0	1.5
CD (P=0.05)	NS	NS	4.2
CV (%)	8.437	5.626	5.583
Interaction			
SEm±	1.2	1.7	2.5
CD (P=0.05)	NS	NS	S

Table 2: Interaction effect of weed count (no m^{-2}) at 60 DAS in six fallow crops with limited number of irrigations.

Treatments	Weed count at 60 DAS			
	M_1: Two Irrigations	M_2: Three Irrigations	M_3: Four Irrigations	Mean
C_1: Maize	82.83 (9.60)	97.58 (10.37)	95.67 (10.28)	92.03
C_2: Sorghum	79.17 (9.39)	97.88 (10.39)	88.94 (9.93)	88.66
C_3: Finger millet	68.15 (8.75)	73.92 (9.09)	81.60 (9.53)	74.56
C_4: Mustard	66.17 (8.63)	75.41 (9.18)	79.98 (9.44)	73.85
C_5: Sunhemp	71.00 (8.92)	65.33 (8.58)	79.75 (9.43)	72.03
C_6: Blackgram	66.46 (8.65)	66.67 (8.66)	78.38 (9.35)	70.50
Mean	73.30	79.47	84.05	

	SEm±	CD (p = 0.05)
Six different crops (S)	1.5	4.2
Number of Irrigations (M)	1.6	6.3
S at M	2.5	7.3
M at S	2.8	8.5

Table 3: Weed dry weight (g m^{-2}) at 20, 40 and 60 DAS in six fallow crops with limited number of irrigations.

Treatments	Weed dry weight at 20 DAS	Weed dry weight at 40 DAS	Weed dry weight at 60 DAS
Main plots : No of Irrigations			
M_1: Two Irrigations	12.59 (4.04)	25.46 (5.54)	45.73 (7.26)
M_2: Three Irrigations	13.23 (4.13)	25.66 (5.56)	51.22 (7.65)
M_3: Four Irrigations	13.22 (4.13)	26.08 (5.60)	56.19 (7.99)
SEm±	0.2	0.6	1.1
CD (P=0.05)	NS	NS	4.4
CV (%)	6.6	9.5	9.4
Sub plots : Different crops			
C_1: Maize	13.46 (4.16)	29.50 (5.93)	58.43 (8.14)
C_2: Sorghum	13.12 (4.12)	26.47 (5.64)	54.80 (7.90)
C_3: Fingermillet	12.37 (4.01)	24.64 (5.46)	49.64 (7.54)
C_4: Mustard	13.72 (4.20)	25.62 (5.56)	48.40 (7.45)
C_5: Sunhemp	12.31 (4.00)	22.44 (5.23)	47.44 (7.38)
C_6: Blackgram	13.09 (4.11)	25.67 (5.56)	47.56 (7.39)
SEm±	0.4	0.6	0.9
CD (P=0.05)	NS	NS	2.7
CV (%)	8.9	7.0	5.5
Interaction			
SEm±	0.7	1.1	1.6
CD (P=0.05)	NS	NS	S

Table 4: Interaction effect of Weed dry weight (g m^{-2}) at 60 DAS in six fallow crops with limited number of irrigations.

Treatments	Weed dry weight at 60 DAS			
	M_1: Two Irrigations	M_2: Three Irrigations	M_3: Four Irrigations	Mean
C_1: Maize	51.53 (7.67)	59.00 (8.18)	64.77 (8.54)	58.43
C_2: Sorghum	45.67 (7.25)	57.53 (8.08)	61.20 (8.32)	54.80
C_3: Fingermillet	43.43 (7.09)	49.70 (7.54)	55.80 (7.96)	49.64
C_4: Mustard	45.90 (7.27)	46.57 (7.32)	52.73 (7.76)	48.40
C_5: Sunhemp	42.47 (7.01)	46.97 (7.35)	52.90 (7.77)	47.44
C_6: Blackgram	45.40 (7.23)	47.53 (7.39)	49.73 (7.55)	47.56
Mean	45.73	51.22	56.19	

	SEm±	CD (p = 0.05)
Six different crops (S)	0.9	2.7
Number of Irrigations (M)	1.1	4.4
S at M	1.6	4.7
M at S	4.0	5.7

CONCLUSION

Among six fallow crops significantly higher weed counts and dry weight was observed in Maize followed by Sorghum.

Conspicuously weed count and dry weight was low with Sunhemp and Blackgram due to more weed suppression and smothering ability of Sunhemp and Blackgram compared to erect growing crops Maize and Sorghum.

Better management of weeds in fallow crops by hand weedings at 15 days interval and with suitable recommended chemical sprayings will enhance and improve the overall production and productivity of the system.

Conflict of Interest. None.

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