Plant Archives Vol. 26, No. 2, 2026 pp. 1801-1806 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2026.v26.no.2.247

INFLUENCE OF CROP ESTABLISHMENT AND WEED MANAGEMENT PRACTICES ON GROWTH AND YIELD OF RICE FALLOW BLACKGRAM

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(Date of Receiving-17-07-2026; Date of Revision-04-09-2026; Date of Acceptance-17-09-2026)

ABSTRACT

A field experiment was conducted at the Agricultural Research Station, Ghantasala on clay soils to study the "Evaluation of tank mix herbicide under different crop establishment techniques in rice fallow blackgram (*Vigna mungo* L.)" during *rabi*, 2023-24. The experiment was laid out in a split plot design, replicated thrice. The main plot treatments consisted of *viz*., broadcasting of blackgram seed 2 to 3 days prior to manual harvesting of rice, broadcasting of blackgram seed prior to harvest of rice by combine harvester followed by running slasher, line sowing of blackgram seeds with tractor drawn dibbler (after harvest of rice by combine harvester *fb* running slasher). The subplot treatments consisted of, pendimethalin 38.7% CS @ 677 g a.i.ha^{-1} as PE (SMA) *fb* clethodim 25% w/w @ 125 g a.i.ha^{-1} + Imazethapyr 10% SL @ 50 g ha^{-1} (TM) as PoE, pendimethalin 38.7% CS @ 677 g a.i.ha^{-1} as PE (SMA) *fb* haloxyfop-r-methyl 10.5% EC @ 125 g a.i.ha^{-1} + imazethapyr 10% SL @ 50 g ha^{-1} (TM) as PoE, Hand weeding at 20 DAS and control (weedy check). Among the crop establishment techniques broadcasting of blackgram seed 2 to 3 days prior to manual/mechanical harvesting of rice shown higher growth attributes and yield. Among the weed management practices, application of pendimethalin 38.7% CS @ 677 g a.i. ha^{-1} as PE (SMA) *fb* clethodim 25% w/w @ 125 g a.i. ha^{-1} + imazethapyr 10% SL @ 50 g a.i. ha^{-1} (TM) as PoE registered higher crop growth parameters that resulted in higher yield of rice fallow blackgram, however it was on par with (S2) pendimethalin 38.7% CS @ 677 g a.i. ha^{-1} as PE (SMA) *fb* haloxyfop-r-methyl 10.5% EC @ 125 g a.i. ha^{-1}+ imazethapyr 10% SL @ 50 g a.i. ha^{-1} (TM) as PoE.

Key words : Rice fallow blackgram, Crop establishment techniques, Clethodium, Haloxyfop-r-methyl, Imazethapyr, Weed management.

Introduction

Pulses recognized as an integral part of the Indian diet, serving as protein supplements, especially for the vegetarian population, owing to their high protein and essential amino acid content. Pulses, legumes containing 20-25% protein on a dry seed basis, are often referred to as the "poor man's meat" in developing nations like India due to their high-quality protein content at a relatively low cost. Their adaptability to a wide range of agro-climatic conditions and their hardy nature make them suitable for cultivation in areas less conducive to other crops. In South Asia, there's a growing focus on intensifying cropping in rice fallow areas. Rice fallow blackgram stands out as the most extensive and traditional cropping system in the Krishna zone of Andhra Pradesh, serving as the backbone of cereal and pulses production in the region. However, traditional methods of establishing rice fallow blackgram crops, such as broadcasting seeds in standing paddy fields a few days before harvest, come with drawbacks. One significant issue is the uneven distribution of seeds at shallow depths, leading to inconsistencies in germination and plant growth. (Suryakala *et al*., 2021).

In the rice fallow pulse cultivation, crop establishment and weed management and play a vital role in influencing the grain yield. Blackgram is typically sown in rice fallow

fields through broadcasting, usually 2-3 days before harvesting the rice crop. Nowadays, for harvesting of rice, combine harvesters were used, which compact the soil and prevent the seeds from establishment and even damage the emerged seedlings due to trampling effect. With wider adoption of mechanised harvesting, it has emerged as an abiotic stress in rice fallow cultivation. Under such circumstances, strategies, ensuring effective crop establishment in rice fallow areas is critical as it directly impacts plant density, weed control and ultimately, crop yield. Therefore, identifying an appropriate technique for establishing the crop is essential for maximizing productivity in such conditions.

Occurrence of weeds including re-growth of rice stubbles, during early stages, is one of the most important factors, as the weeds compete with the crop for residual soil moisture and nutrients. Furthermore, the application of pre-emergence herbicides is constrained by the absence of field preparation and the narrow window available for herbicide application. Proper weed management eliminates the two major issues namely the competition for moisture and nutrients which are the most limiting factors under rice fallow pulse cultivation since the crop is raised only with residual moisture and nutrients. (Umamageswari *et al.*, 2019). Manual removal of weed is labour intensive, tedious, back breaking and does not ensure weed removal at critical stages of crop weed. (Choudhary *et al.*, 2012). Pre-emergence herbicides initially control germinating weeds and late-emerging weeds are managed by selective post-emergence herbicides. (Sharma *et al.*, 2025). Under these circumstances, the present investigation was undertaken to develop efficient management strategies for achieving optimum crop establishment and effective weed control by suppressing both pre-existing weeds and those emerging after sowing in rice fallow ecosystems, thereby ensuring a weed-free environment during the critical period of crop-weed competition.

Materials and Methods

The present experiment "Evaluation of tank mix herbicides under different crop establishment techniques in rice fallow blackgram (*Vigna mungo* L.) was conducted at the Agricultural Research Station, Ghantasala, Andhra Pradesh during *rabi*, 2023-24. Based on the soil analysis, the soil of the experimental site was clay in texture, neutral in reaction with medium organic carbon content, low in available nitrogen, medium in available phosphorus and potassium. The experiment was laid out in a split plot design, replicated thrice. The main plot treatments consisted of (i) broadcasting of blackgram seed 2 to 3 days prior to manual harvesting of rice (ii) boadcasting of blackgram seed prior to harvest of rice by combine harvester followed by runner slasher (iii) line sowing of blackgram seeds with tractor drawn dibbler (after harvest of rice by combine harvester followed by runner slasher). The subplot treatments consisted of (i) pendimethalin 38.7% CS @ 677 g a.i. ha^{-1} as PE (SMA) *fb* clethodim 25% w/w @ 125 g a.i. ha^{-1} + imazethapyr 10% SL @ 50 g ha^{-1} (TM) as PoE, (ii) pendimethalin 38.7% CS @ 677 g a.i. ha^{-1} as PE (SMA) *fb* haloxyfop-r-methyl 10.5% EC @ 125 g a.i. ha^{-1} + imazethapyr 10% SL @ 50 g ha^{-1} (TM) as PoE (iii) Hand weeding at 20 DAS, (iv) Control (weedy check). All the post emergence herbicides were applied at 20 DAS (Blackgram cultivar LBG 752 was used in the present study). The data on growth and yield attributes at regular intervals upto harvest were recorded as per the standard procedure. The seed and haulm yield were measured as total yield per plot and transformed to kg ha^{-1}. The data was analysed statistically as per the method suggested by Gomez and Gomez (1984).

Results and Discussion

Growth attributes

All the growth attributes like plant height (cm), dry matter accumulation (kg ha^{-1}) and no. of branches per plant shown a significant effect among the crop establishment techniques and weed management practices depicted in Tables 1, 2 and in Fig. 1.

The results show that different methods of planting blackgram resulted in varying in plant height (cm), at all the stages except at 20 DAS, other growth parameters like dry matter accumulation (kg ha^{-1}) and no. of branches $plant^{-1}$ also shown significant effect among the treatments up to harvest. The tallest plants, higher dry matter and more no. of branches $plant^{-1}$ were recorded in M_1 treatment where, broadcasting of blackgram seed 2 to 3 days prior to harvest of rice (manual) which was at par with mechanical harvesting of rice (M_2). It is likely due to the favorable microclimate provided by the standing rice crop, which promoted healthy growth. Taller plants with higher number of branches might have resulted in higher dry matter accumulation, this might be due to the fact that, optimum soil moisture and nutrient availability which resulted in higher rate of photosynthesis and thus more growth parameters in in rice fallow blackgram. In contrast, planting blackgram in rows using a tractor-drawn dibbler after rice harvest and using a runner slasher resulted in shorter plants, lower dry matter and no. of branches $plant^{-1}$, probably due to rapid loss of residual moisture due to deep furrows, resulting in poor

Table 1 : Plant height (cm) at different growth stages of rice fallow blackgram as influenced by crop establishment techniques and weed management practices.

Treatments		Plant height (cm)			
Crop establishment techniques		**20 DAS**	**40 DAS**	**60 DAS**	**Harvest**
M_1	Broadcasting 2 to 3 days prior to manual harvesting of rice crop	12.35	22.72	38.85	40.47
M_2	Broadcasting 2 to 3 days prior to harvest of rice by combine harvester (*fb* runner slasher)	12.03	21.03	37.13	38.97
M_3	Line sowing with tractor drawn dibbler after harvest of rice by combine harvester (*fb* runner slasher)	11.24	14.55	25.37	27.78
S. Em (±)		0.42	0.58	0.54	0.41
CD (P = 0.05 %)		NS	2.27	2.10	1.60
C.V (%)		12.18	10.15	7.70	9.03
Weed management practices					
S_1	Pendimethalin 38.7% CS @ 677 g a.i. ha^{-1} as PE (SMA) *fb* clethodim 25% w/w @ 125 g a.i. ha^{-1} + imazethapyr 10% SL @ 50 g a.i. ha^{-1} (TM) as PoE at 15-20 DAS	11.84	22.60	35.43	37.69
S_2	Pendimethalin 38.7% CS @ 677 g a.i. ha^{-1} as PE (SMA) *fb* haloxyfop-r-methyl 10.5%EC @ 125 g a.i. ha^{-1}+ imazethapyr 10% SL @ 50 g a.i. ha^{-1} (TM) as PoE at 15-20 DAS	11.74	21.56	34.58	36.24
S_3	Hand weeding at 20 DAS	12.28	18.33	31.59	33.87
S_4	Control (weedy check)	11.64	16.58	28.76	31.60
S. Em (±)		0.40	0.75	0.84	0.92
CD (P = 0.05 %)		NS	2.22	2.49	2.74
C.V (%)		10.04	11.32	7.73	7.87
INTERACTION					
C × W		NS			
W × C		NS			

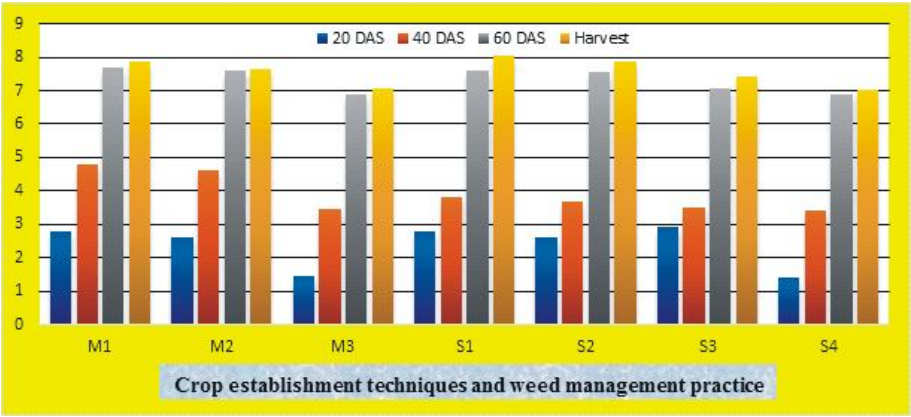


Fig. 1 : No. of branches $plant^{-1}$ as influenced by crop establishment and weed management practices in rice fallow blackgram.

germination and establishment.

Application of weed management measures has shown, a significant effect on all the growth attributes like plant height, dry matter and no. of branches $plant^{-1}$. At 20 DAS, the highest growth attributes were found in hand weeding treatment (S_3) might be due to good growth and development of crop right from its germination owing to weed free environment at initial stages, however it was on par with (S_1) pendimethalin 38.7% CS @ 677 g *a.i.* ha^{-1} as PE (SMA) *fb* clethodim 25% w/w @ 125 g *a.i.* ha^{-1} + imazethapyr 10% SL @ 50 g *a.i.* ha^{-1} (TM) as PoE. The conventional method of one manual weeding at 20 DAS was inferior to the application of post emergence herbicides to obtain increased crop growth parameters. This might be due to the growth of weeds up to one manual weeding at 20 DAS and subsequent rejuvenation of weeds registered in traditional manual weeding practice (Sasikala *et al.*, 2014). But at later stages highest growth

Table 2 : Dry matter accumulation (kg ha^{-1}) at different growth stages of rice fallow blackgram as influenced by crop establishment techniques and weed management practices.

Treatments		Dry matter accumulation (kg ha^{-1})			
Crop establishment techniques		**20 DAS**	**40 DAS**	**60 DAS**	**Harvest**
M_1	Broadcasting 2 to 3 days prior to manual harvesting of rice crop	287.03	1492.49	2086.75	2691.51
M_2	Broadcasting 2 to 3 days prior to harvest of rice by combine harvester (*fb* runner slasher)	255.80	1346.89	1992.58	2354.06
M_3	Line sowing with tractor drawn dibbler after harvest of rice by combine harvester (*fb* runner slasher)	191.38	1028.36	1623.42	1855.82
S. Em (±)		9.98	80.37	52.26	94.46
CD (P = 0.05 %)		39.19	315.56	205.20	370.89
C.V (%)		14.13	13.59	9.52	14.22
Weed management practices					
S_1	Pendimethalin 38.7% CS @ 677 g a.i. ha^{-1} as PE (SMA) *fb* clethodim 25% w/w @ 125 g a.i. ha^{-1} + imazethapyr 10% SL @ 50 g a.i. ha^{-1} (TM) as PoE at 15-20 DAS	297.72	1586.58	2193.78	2733.65
S_2	Pendimethalin 38.7% CS @ 677 g a.i. ha^{-1} as PE (SMA) *fb* haloxyfop-r-methyl 10.5% EC @ 125 g a.i. ha^{-1} + imazethapyr 10% SL @ 50 g a.i. ha^{-1} (TM) as PoE at 15-20 DAS	219.84	1367.84	2157.67	2525.42
S_3	Hand weeding at 20 DAS	311.71	1211.96	1788.34	2198.24
S_4	Control (weedy check)	149.69	990.60	1463.89	1747.55
S. Em (±)		21.51	102.98	100.24	147.94
CD (P = 0.05 %)		63.91	305.97	297.84	439.57
C.V (%)		13.37	13.64	15.82	19.29
INTERACTION					
C × W		NS			
W × C		NS			

parameters was found with S_1, which was at par with S_2 treatment and the lowest was obtained in control (weedy check).

This might be observed, due to, reduced weed pressure at critical stages which might have contributed to higher growth parameters of rice fallow blackgram. Effective control of broad spectrum of weeds in S_1, which was at par with S_2, with similar mode of action *i.e.*, control of grasses by aryloxy phenoxy propionate group herbicides and broad-leaved weeds by imidazolins, thus, creating a weed free environment, owing to reduced crop weed competition during critical stages resulted in rapid cell multiplication and elongation lead to taller plants and higher dry mmater accumulation and more no. of branches plant^{-1} in those treatments.

In weedy check (S_4), where huge weed competition resulted in poor growth of plant. Thus, short stature accumulation of lower dry weight and low no. of branches plant^{-1}, might be due to the fact that, lack of internal nutrients in plant which caused reduction in both cell division, cell elongation and thus reduced synthesis of carbohydrate. Similar findings were reported by Kundu *et al*. (2011) and Mirjha *et al*. (2013).

Yield parameters

The seed and haulm yield (kg ha^{-1}) of rice fallow blackgram shown a significant effect among the crop establishment methods and weed management practices, however harvest index (%) shows non-significant effect among the treatments studied, which was presented in the Table 3. Broadcasting of blackgram seed in standing paddy crop, 2 to 3 days before manual harvesting, produced higher seed and haulm yield, which was on a par with blackgram sown prior to harvest of rice by combine harvester *fb* running tractor drawn rotary slasher. These results are in line with the Vijaykumar *et al*. (2022). The timely sowing without field preparation, optimum maintenance of plant population and long term availability of resources such as nutrients & residual

Table 3 : Seed yield (kg ha^{-1}), haulm yield (kg ha^{-1}) and harvest index (%) of rice fallow blackgram as influenced by crop establishment techniques and weed management practices.

Treatments		Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Harvest Index (%)
Crop establishment techniques				
M_1	Broadcasting 2 to 3 days prior to manual harvesting of rice crop	1205	2069	39.81
M_2	Broadcasting 2 to 3 days prior to harvest of rice by combine harvester (*fb* runner slasher)	1092	1905	37.04
M_3	Line sowing with tractor drawn dibbler after harvest of rice by combine harvester (*fb* runner slasher)	935	1302	36.25
S. Em (±)		31	62	0.76
CD (P = 0.05 %)		123	242	NS
C.V (%)		10.03	12.14	6.99
Weed management practices				
S_1	Pendimethalin 38.7% CS @ 677 g a.i. ha^{-1} as PE (SMA) *fb* clethodim 25% w/w @ 125 g a.i.ha^{-1} + imazethapyr 10% SL @ 50 g a.i. ha^{-1} (TM) as PoE at 15-20 DAS	1259	2049	39.48
S_2	Pendimethalin 38.7% CS @ 677 g a.i. ha^{-1} as PE (SMA) *fb* haloxyfop -r-methyl 10.5% EC @ 125 g a.i. ha^{-1} + imazethapyr 10%SL @ 50 g a.i. ha^{-1} (TM) as PoE at 15-20 DAS	1129	1998	37.42
S_3	Hand weeding at 20 DAS	1032	1730	37.18
S_4	Control (weedy check)	856	1257	36.73
S. Em (±)		46	81	1.23
CD (P = 0.05 %)		137	241	NS
C.V (%)		12.81	13.83	9.82
INTERACTION				
C × W		NS		
W × C		NS		

moisture leftover after paddy crop resulted in a greater number of growth as well as yield attributes such as, pods per plant and test weight will certainly aid in increment of seed yield. High seed yield due to more of pods per plant also reported earlier by Ramesh *et al*. (2016) in rice fallow blackgram.

Among the weed management practices, the highest seed and haulm yield was obtained in (S_1) treatment, however it was on par with pendimethalin 38.7% CS @ 677 g a.i. ha^{-1} as PE (SMA) *fb* haloxyfop-r-methyl 10.5%EC @ 125 g a.i. ha^{-1} + imazethapyr 10% SL @ 50 g a.i. ha^{-1} (TM) as PoE (S_2) and the control (weedy check) treatment recorded the lower yields. Better environmental and eco-physiological conditions prevailed by less crop-weed competition for moisture, light and better availability of nutrients for proper development of plant drymatter and yield attributing characters *viz.*, pods per plant and seeds per pod resulted in increased seed and haulm yield of blackgram. Similar findings were reported by Amuthaselvi *et al*. (2011).

The lowest yield in control (weedy check) might be due to the fact that, higher weed density and dry matter production in the treatment, depleted the nutrients and moisture from soil right from the crop germination to harvest and in turn reduced the growth and yield components leads to decreased seed yield. Harvest index was not significantly influenced by both crop establishment and weed management techniques in rice fallow blackgram.

Conclusion

From this experiment, it was concluded that among the different methods of sowing, broadcasting of blackgram seed 2 to 3 days prior to manual/mechanical

harvesting of rice registered higher crop growth parameters that resulted in higher yield in rice fallow blackgram. In the weed management practices application of pendimethalin 38.7% CS @ 677 g a.i. ha^{-1} as PE (SMA) *fb* clethodim 25% w/w @ 125 g a.i.ha^{-1} + imazethapyr 10% SL @ 50 g a.i. ha^{-1} (TM) as PoE at 15-20 DAS recorded higher crop growth and yield parameters and however it was on par with (S2) pendimethalin 38.7% CS @ 677 g a.i. ha^{-1} as PE (SMA) *fb* haloxyfop-r-methyl 10.5% EC @ 125 g a.i. ha^{-1} + imazethapyr 10%SL @ 50 g a.i. ha^{-1} (TM) as PoE at 15-20 DAS.

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