Original Research Article

EVALUATION OF MULCHING EFFECTS ON WEED CONTROL IN BLACKGRAM PRODUCTION UNDER IRRIGATED CONDITION

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ABSTRACT

A field experiment with the objectives to understand the evaluation of mulching effects on weed control in blackgram production under irrigated condition involving two factors viz., mulching (paddy straw mulching, sugarcane trash mulching, no mulching) and herbicidal treatments (pendimethalin pre-emergence (PE) @ 1.0 Kg/ha, pendimathalin + Imazethapyr (pre-mix) pre-emergence Valor 32% EC 1.0 Kg/ha, Hand weeding on 15 and 30 days after sowing, weedy check) was undertaken in Factorial Randomized Block Design (FRBD) design with three replications at the instructional farm of Karunya Institute of Technology and Sciences, Coimbatore region of western Tamil Nadu during the cropping seasons of Rabi 2022-23. Results revealed that paddy straw mulching sequential application of Pendimathalin + Imazethapyr (pre-mix) pre-emergence Valor 32% EC and sugarcane trash mulching sequential application of pendimathalin + imazethapyr (pre-mix) pre-emergence Valor 32% EC recorded lower weed density, weed dry weight and maximum crop yield as well as net returns over rest of the mulching and herbicidal treatments.

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1.INTRODUCTION

Black gram is a highly priced pulse, very rich in phosphoric acid. India is currently the largest producer of black gram accounting for more than 70% of the global production, followed by Myanmar and Pakistan.

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According to a report by Professor Jayashankar Telangana State Agricultural University (2023), black gram area in India during Rabi 2022-23, as on 03rd February 2023 black gram area was down by 5.0% at 7.77 lakh ha (19.21 lakh acres) as against 8.18 lakh ha (20.23 lakh acres) last year. The major Kharif growing states are Tamil Nadu 2.74 lakh ha (6.78 lakh acres), Andhra Pradesh 2.55 lakh ha (6.30 lakh acres), Odisha 2.00 lakh ha (4.96 lakh acres), Telangana 0.178 lakh ha (0.44 lakh acres), Chhattisgarh 0.14 lakh ha (0.35 lakh acres) and West Bengal 0.18 lakh ha (0.95 lakh acres. According to the first advanceestimates of production of food grainsfor 2022-23by the ministry of agriculture and farmers welfare, all India black gram production estimate was 1.84 million tonnes[1].

Weeds infestation is one of the major factors lowering yield in blackgram and the crop is invaded by a large number of fast-growing weeds during the initial stages of its growth [2].The weeds

generally compete with the crop plants for soil moisture, light, space and nutrientsfor its growth and development. The short life cycle of the crop subjugated bystiff crop weed competition during the critical stages of its growth,results in huge yield losses. The critical period for crop weed competition in blackgram will be usually ranging from 20 to 40 days after sowing, which often results in a yield losses ranging from 40 to 85per cent. Though manual weeding in blackgram is very effective, it is arduous, costly and time consuming. Under such situations, use of herbicides for weed management holds a great promise. Application of herbicides may control diversity of weeds but may not be effective on certain species of weed, and have also resulted in weed shift and weed resistance. Under such situation adopting one single method of weed control may not yield better results and often it warrants a combine use of two or more methods for successful weed management

Comment [A4]: percent

On the other hand, mulching is one of the important agronomic practice beneficial in conserving the soil moisture, supressing the weeds, improving soil fertility and modifying the soil physical environment [3].Adopting organic mulching practices by using paddy straw and sugarcane trashescan decrease the weed density apart from improving the soil health [4].In addition to inhibiting the weed germination and smothering the weed growth, the organic mulches build up the nutrients in the soil and alters thesoil physical properties as well. With decomposition of organic mulchin the soil, the organic acids that gets released would help in enhancing the soil biome, solubilizing the soil nutrients and increasing the nutrient availability to the crop [5].

Keeping in view of the above scenario, the study was conducted to understand the comparative response of integrating mulching practices with the weed management practices on the agronomic traits of blackgram. We hypothesized that this integrated approach will enhance the weed control efficiency, the nutrient use efficiency and, thereby increase the crop growth and yield. The study also aimed to optimize a definite combination of organic mulching with the weed management practice in terms of sustainable blackgram production.

Comment [A5]: in irrigation conditions, what if in other conditions have there been previous studies?

2. MATERIALS AND METHODS

, The field experiment was conducted at the instructional farm, School of Agricultural Sciences, Karunya Institute of Technology and Sciences, Coimbatore (Tamil Nadu), during the Rabi season of 2022. The farm is geographically located at 10^0 56' N latitude and 76^0 44' E longitude at an elevation of 474 m above mean sea level. The blackgram variety VBN 8 was used for the experiment and the crop was grown in the field with a spacing of 30 x10 cmsby following the prescribed packages of practices.

The experiment was laid out in a Factorial Randomized Block Design (FRBD) with 2 factors namely,mulching and weed management practices with a combination of 12 treatments, which were replicated thrice. The treatment comprises three mulchingtreatments namely M_1 – Paddy straw mulching@5 t/ha after the emergence of crop, M_2 – Sugarcane trash mulching @ 5 t/ha after the emergence of crop, M_3 – No mulching, along with four best weed weed management treatments for blackgram viz., W_1 – Pendimethalin pre-emergence (PE) @ 1.0 Kg/ha, W_2 - Pendimathalin + Imazethapyr(pre-mix) pre-emergence Valor 32% EC 1.0 Kg/ha, W_3 - Hand weeding on 15 and 30

days after sowing, W_4 – Weedy check. The herbicides spraying as per the treatmentswere done with the help of knapsack backpack pump pressure sprayer by using a spray volume of 500 l/ha. The density and dry weight of weeds were assessed at 20, 40 and 60 days after sowingwith the help of steel square quadrate (1 × 1 m) by placing quadrate randomly in each plot. The weeds existing in the 1 × 1 m areas were counted, categorized as grassy and broad-leaved weeds, and were also uprooted for dry matter determination.

The data collected on various characters studied during the experiment were subjected to statistical analysis in a factorial randomized block design (FRBD). The significance of the difference was tested by the "F" test at a 5 percent level.

Comment [A6]: percent

3. RESULTS AND DISCUSSION

3.1 Effect of mulching and weed management practices on weeds

3.1.1. Weed flora

The major weed flora found in the experimental field were, *Echinochloa colona*, *Cyperusrotudusas*grassy weeds *Amaranthus viridis, Calotropis gigantia, Corchorus trilocularis, Euphorbia thymifolia, Trianthema monogyna, Parthenium hysterophorus, Portulaca oleraceae,* and *Trianthema portulocastrum*as broad leaf.

3.1.2. Weed dry weight (g/m^2)

It was observed that there was progressive increase in total weed dry weight from sowing to harvest (Table 1). All weed control treatments observed lower weed dry weight compared with untreated check. The significantly minimum dry weight of total weeds was noted with two hand weeding at 15 & 30 DAS and paddy straw mulch application plot due to obtained least population of grassy-leaf and broad - leaf weeds, while highest dry weight was recorded under weedy check. Similar findings were reported by Taku *et al*.,[6].

Among herbicidal treatments, lower dry weight was recorded under PE application of pendimethalin @ 1.0 kg/ha along with paddy straw which was statistically at par with PE application of Pendimethalin + Imazethapyr (pre - mix) @ 1.0 kg/ha along with paddy straw and both were observed significantly superior compared to other treatments. Similar findings were also reported by Sukumar *et al*., [7], Singh *et al*., [8] and Mohanty *et al*.,[9].

However, no mulching along with weedy check was adjudged the highest weed dry weight. Similar findings were also reported by Sharma *et al*., [10] and Khairnar *et al*.,[11].

3.1.3. Weed control efficiency (%)

Weed control efficiency (WCE) was higher with Pendimethalin + Imazethapyr (pre - mix) @ 1.0 kg/ha along with paddy straw mulch and sugarcane trash mulch over rest of the mulching and herbicidal treatments. At hand weeding twice at 15 and 30 DAS registered WCE of 91.2% in rabi season, respectively. Similar findings were reported by Jagadesh *et al*., [12]. Minimum Weed control efficiency (WCE) was associated with no mulching along with weedy check 59.9% in rabi season, respectively.

3.2. Effect of mulching and weed management practices on the yield attributes and economics of blackgram

3.2.1. Yield (kg/ha) and Harvest index (%)

The results showed remarkable variation in growth and yield attributes and economics of blackgram due to mulching and herbicides application (Table 2). Among all the mulching and herbicides treatments significantly increased the grain yield, stover yield and test weight over no mulching along with weedy check (619.7kg, 1561.5kg and 4.02 g/100 grains; respectively). The maximum values were obtained with two hand weeding at 15 & 30 DAS along with sugarcane trash. Paddy straw mulch along with Pendimathalin + Imazethapyr (pre-mix) Valor 32% EC and sugarcane trash mulch along with Pendimathalin + Imazethapyr (pre-mix) Valor 32% EC were observed statistically on par and significantly superior over rest of the treatments. The significantly higher value of harvest index was recorded with paddy straw mulch along with PE Pendimathalin + Imazethapyr (pre-mix) 1000 g/ha (29.2%) being statistically at par with sugarcane trash mulch along with PE Pendimathalin + Imazethapyr (pre-mix) 1000 g/ha (28.8%), two hand weeding 15 and 30 days along with paddy straw mulch and as same for sugarcane trash mulch, and significantly economical over rest of the treatments. It may be possible due to lesser weed population under these plots hence increased growth factors availability resulting increase harvest index.

3.2.2. Economics

The choice of any weed control method ultimately depends on economics and weed controlling efficiency. The cost of Mulching and herbicide weed control is actually less than that of manual weeding. This has been a major incentive to many farmers for switching over to herbicides.

All the weed control treatments gave more net returns over no mulch along with weedy check (Rs.44295/ha). The maximum net return was found with sugarcane trash mulch along PE application of Pendimethalin+Imazethapyr (pre-mix) @ 1000 g/ha (Rs. 68217/ha) over rest of the treatments. Similar results were also obtained by Chicham *et al.*, [13]. The next order best treatments were, Hand weeding on 15 and 30 days (Rs. 58612/ha), PE Pendimethalin @ 1000 g/ha (Rs. 55379/ha) over the rest of the treatments.

The highly economical benefit: cost ratio was recorded under sugarcane trash mulch along with PE application of Pendimethalin+Imazethapyr (pre-mix) @ 1000 g/ha (1.99) followed by PE application of Pendimethalin @ 1000 g/ha (1.88) and hand weeding on 15 and 30 days (1.73); while lowest was noticed under no mulch with weedy check (1.55).

4. CONCLUSION

In conclusion, this study demonstrates that mulching and effective weed management practices have a significant impact on the growth, yield, weed infestation, and economic performance of black gram cultivation. Mulching treatment M_2 and weed management treatment W_2 were economically and W_3 consistently showed the most favorable outcomes across various attributes,

indicating their potential for improving black gram cultivation practices. These findings can guide farmers and researchers in making informed decisions to optimize black gram production and maximize economic returns.

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Table 1. Weed dry weight and weed control efficiency of black gram as influenced by mulching and herbicides.

Treatments	Symbol	Dry wt. of weeds (g/ m²)			Weed control efficiency (%)		
		20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS
Mulching							
Paddy straw mulching @ 5 t/ha	M_1	3.13	21.85	28.91	69.8	90.2	89.7
Sugarcane trash mulching @ 5 t/ha	M_2	0.77	9.70	14.11	92.6	95.7	95.0
No mulching	M_3	7.82	88.19	110.68	24.8	60.6	60.7
SEm (±)		0.09	0.29	0.30	0.8	0.1	0.1
C. D. (P=5%)		0.26	0.85	0.88	2.3	0.4	0.3
Weed management practices							
PE Pendimethalin @ 1000 g/ha	W_1	4.52	29.23	38.20	56.5	87.0	86.4
PE Pendimathalin + Imazethapyr (pre-mix) 1000 g/ha	W_2	3.07	25.54	29.44	70.4	88.6	89.5
Hand weeding on 15 and 30 DAS	W_3	2.49	16.54	24.52	76.0	92.6	91.3
weedy check	W_4	5.54	88.34	112.77	46.7	60.6	59.9
SEm (±)		0.10	0.33	0.35	0.9	0.1	0.1
C. D. (P=5%)		0.30	0.98	1.02	2.7	0.4	0.3
Interaction							
SEm (±)		0.17	0.58	0.60	1.6	0.3	0.2
C. D. (P=5%)		0.51	1.69	1.76	4.7	0.7	0.6

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Table 2. Yield attributes and economics of black gram as influenced by mulching and herbicides.

Treatments	Symbol	No. of pod/ plant	Test weight	Grain yield	Halum yield	Harvest index	Total cost of cultivation (Rs /ha)	Gross return (Rs/ha)	Net income (Rs/ha)	B:C Ratio
Mulching										
paddy straw mulching @ 5 t/ha	M_1	7.14	4.07	719.00	1745.2	29.2	32635	84430	51795	1.59
Sugarcane trash mulching @ 5 t/ha	M_2	7.92	4.11	872.11	2159.2	28.8	34235	102452	68217	1.99
No mulching	M_3	6.20	4.02	619.73	1561.5	28.4	28535	72830	44295	1.55
SEm (±)		0.01	0.003	0.69	0.30	0.02	-	-	-	-
C. D. (P=0.05)		0.03	0.01	2.02	0.9	0.1	-	-	-	-
Weed management practices										
PE Pendimethalin @ 1000 g/ha	W_1	6.98	4.06	722.92	1777.5	28.8	29535	84914	55379	1.88
PE Pendimathalin + Imazethapyr (pre-mix) 1000 g/ha	W_2	7.18	4.07	748.36	1846.6	28.8	29435	87908	58473	1.99
Hand weeding on 15 and 30 DAS	W_3	7.37	4.08	786.32	1969.8	28.6	33785	92397	58612	1.73
weedy check	W_4	6.82	4.05	690.16	1694.1	29.0	28535	81063	52528	1.84
SEm (±)		0.01	0.004	0.79	0.35	0.02	-	-	-	-
C. D. (P=0.05)		0.04	0.01	2.33	1.0	0.1	-	-	-	-
Interaction										
SEm (±)		0.02	0.01	1.37	0.61	0.04	-	-	-	-
C. D. (P=0.05)		0.068	NS	4.03	1.79	0.11	-	-	-	-