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Weed Management Strategies in Summer Blackgram (*Vigna mungo* L. Hepper) Grown in Sandy Loam Soils of Western Nagaland

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ABSTRACT: Field investigation was carried out during summer season at Medziphema (Nagaland) with a view to find the efficiency of different weed management interventions in managing the weeds of blackgram (*Vigna mungo* L. Hepper) grown during 2022 with seven treatment comprising of T_1: Weedy check (Control), T_2: Hand weeding at 20 and 40 DAS, T_3: Cardboard mulching, T_4: Paddy straw mulching @ 5 t ha^{-1}, T_5: Saw dust mulching @ 5 t ha^{-1}, T_6: Linseed stover mulching @ 5 t ha^{-1} and T_7: Farmer's practice in a randomized complete block design (RCBD) with three replications. The results revealed that hand weeding at 20 and 40 DAS gave maximum decrease in total weed population (5.58, 6.47 no. m^{-2}) and weed dry weight (3.34, 4.41 g m^{-2}). Hence, recorded the highest weed control efficiency (85.94%) which was at par with paddy straw mulching @ 5 t ha^{-1} at 40 DAS (83.84%). Highest growth and yield of summer blackgram was also observed under the same treatment which was at par with paddy straw mulching @ 5 t ha^{-1}. The treatment with paddy straw mulching @ 5 t ha^{-1} gave the highest net return (₹14863.55/ha) and B:C ratio (1.42) thus was found to be economically better and most effective for summer blackgram among all the treatments studied.

Keywords: cardboard mulching, growth, linseed stover mulching, sawdust mulching, weeds, yield.

INTRODUCTION

Blackgram is mainly cultivated in the tropical to sub-tropical countries like India, Pakistan, Sri-Lanka, Burma and some countries of South East Asia. Black gram is grown in many parts of India since it is a short duration pulse crop. In our country, pulses are grown in an area of 23.63 million hectare with a total production of 14.76 million tonnes and are considered to be one of the largest pulses producing country in the world. This popular pulse goes by various common names like black matpe, urd bean, mash bean, black mung bean, mashkalai, urid etc. India produces about 24.5 lakh tons of urad annually from about 4.6 million hectares of area with an average productivity of 533 kg per hectare in 2020-21 (Department of Agriculture and Cooperation, Govt. of India, 2021). In Nagaland, area under blackgram is 680 hectare with a production of about 450 MT. Dimapur leads both in production and area of black gram in Nagaland with a production of about 90 MT from an area of 120 hectare (Directorate of Economics and Statistics, 2021).

In India the average productivity of black gram continues to be low mainly due to various reasons which includes poor management practices, non adoption of improved variety and recommended practices, heat and moisture stress, weed infestation, various physiological and biochemical as well as inherent factors associated with the crop. Among these several factors responsible for low yields of blackgram, weed infestation is considered as one of the major factors. Generally, yield loss due to unchecked weed growth in blackgram ranges from 27 to 100% (Mansoorie *et al.*, 2015). Being grown as a subsidiary crop, it is given less care and inputs and in addition to that, weeds pose a serious threat and it competes for the already limited resources like light, moisture, nutrients and space in the field and which leads to a significant reduction in the yield of blackgram to a great extent. This crop needs more attention during summer as along with the crop, weeds also grow more luxuriantly and vigorously due to better sunshine and irrigation during this time. Therefore, it becomes important to control the weeds by suitable methods and practices, especially during the critical period of crop-weed competition (10-40 DAS) in summer blackgram crop. In order to exploit the full yield potential of black gram, it became imperative to undertake such investigations directed towards weed management with the objective to identify the most effective and economical technique for improving the growth and yield potential of blackgram.

MATERIAL AND METHODS

The study site, Agronomy experimental research farm of SASRD, Nagaland University falls in the Chumukedima district of Nagaland State and the present investigation was carried during the summer season of 2022. Total seven treatment comprised of weedy check (Control), Hand weeding at 20 and 40 DAS, Cardboard mulching, Paddy straw mulching @ 5 t ha^{-1}, Saw dust mulching @ 5 t ha^{-1}, Linseed stover mulching @ 5 t ha^{-1} and Farmer's practice. Blackgram cv. *PU 31* was sown on March 1, 2022 with the seed rate of 15 kg seed ha^{-1} with 30 cm row spacing. The experiment was laid out in randomized block design and replicated thrice. The soil of experimental field was sandy loam in texture having pH 4.3, organic carbon 1.5%, medium in available N (260.42 kg ha^{-1}), available P (20.94 kg ha^{-1}) and available K (183.1 kg ha^{-1}). Recommended doses of fertilizer with 20:40:40 kg ha^{-1} of NPK respectively were incorporated in the field prior to the sowing. Weed control efficiency (WCE) was calculated by the formula suggested by Mani *et al.* (1973) and expressed in per cent.

$$WCE\ (\%) = (DMC - DMT)/DMC \times 100$$

Where,

WCE = Weed control efficiency

DMC = Dry matter production by weeds in control plot (g)

DMT = Dry matter production by weeds in treated plot (g)

Observations on weed count and weed dry matter were collected by placing a quadrate of 50 x 50 cm at 20 DAS and 40 DAS. Biometric observations were take at an interval of 25 days from 25 DAS to 75 DAS of blackgram while yield attributes and yield were also evaluated after harvest. Data were analyzed statistically using ANOVA suggested by Gomez and Gomez (1976) and the significance was tested by Fisher's least significant difference (P= 0.05)

RESULTS AND DISCUSSION

Total weed population, weed dry weight and weed control efficiency. Major weed flora in the experimental field was broad leaved weeds like *Ageratum conyzoides* (L.), *Amaranthus viridis* (L.), *Commelina benghalensis* (L.), *Euphorbia hirta* (L.) and *Mimosa spinosa* (L.) among sedge weeds, *Cyperus rotundus* (L.) and *Cyperus iria* (L.) were dominant and *Cynodon dactylon* (L.), *Digitaria sanguinalis* (L.) and *Eleusine indica* (L.) were dominant among grassy weeds where blackgram was grown. The results of weed control efficiency, total weed population, and total weed dry weight is presented in the Table 1.

Lowest total weed population (no. m^{-2}) (5.58 at 20 DAS and 6.47 at 40 DAS) was recorded with hand weeding at 20 and 40 DAS *fb* paddy straw mulching. The low weed population under hand weeding could be because hand weeding uproots the weeds and caused desiccation resulting in death of weeds and hence their low population was noticed. The highest weed population was observed under weedy check (10.62 at 20 DAS and 15.87 at 40 DAS).

The lowest dry weight of weeds (g m^{-2}) (3.34 at 20 DAS and 4.41 at 40 DAS) was recorded with two hand weeding at 20 and 40 DAS *fb* paddy straw mulching (3.44 at 20 DAS and 4.70 at 40 DAS). Low weed dry weight could be due to effective killing of weeds by hand weeding. The highest dry matter was recorded in unweeded control (6.18 at 20 DAS and 11.66 at 40 DAS). Due to higher weed density under weedy check, it has competitive advantage over crops and hence more weed dry weight.

The weed control efficiency of hand weeding at 20 and 40 DAS was highest (71.72% at 20 DAS and 85.94% at 40 DAS) compared to unweeded control plot at 20 and 40 DAS. Similar findings were reported by Vaishya *et al*. (2003); Singh *et al.* (2011); Reddy *et al.* (2022) who stated that weed control efficiency in blackgram was highest with hand weeding twice at 20 and 40 DAS.

Table 1: Effect of treatments on total weed population, weed dry weight and weed control efficiency.

Treatment	Total weed population (no. m^{-2})		Total weed dry weight (g m^{-2})		Weed control efficiency	
	20 DAS	40 DAS	20 DAS	40 DAS	20 DAS	40 DAS
T_1 (Weedy check)	10.62 (112.33)	15.87 (251.33)	6.18 (37.69)	11.66 (135.62)	0	0
T_2 (Hand weeding)	5.58 (30.67)	6.47 (41.33)	3.34 (10.66)	4.41 (18.96)	71.72	85.94
T_3 (Cardboard mulching)	6.39 (40.33)	8.12 (65.67)	4.02 (15.7)	5.27 (27.27)	58.37	79.84
T_4 (Paddy straw mulching)	5.64 (31.33)	6.74 (45.00)	3.44 (11.32)	4.70 (21.66)	69.94	83.84
T_5 (Sawdust mulching)	8.71 (75.33)	11.66 (135.67)	5.34 (28.01)	8.73 (75.85)	25.72	43.99
T_6 (Linseed stover mulching)	6.94 (47.67)	9.08 (82.00)	4.37 (18.59)	6.09 (36.69)	50.71	72.8
T_7 (Farmer's practice)	7.73 (59.33)	10.07 (101.00)	4.84 (22.95)	7.34 (53.41)	39.17	60.4
S.Em±	0.02	0.09	0.03	0.1	0.86	0.69
CD (p=0.05)	0.08	0.3	0.11	0.31	2.66	2.14

Note: Values in parenthesis are original values that were subjected to square root transformation ($\sqrt{X + 0.5}$

Growth attributes. The results of data recorded on growth attributes of blackgram during the course of investigation is presented in the Table 2. Observations on growth parameters were found to be non significant at 25 DAS.

Plant height in blackgram showed pronounced superiority in the plots receiving hand weeding twice at 20 and 40 DAS (18.10, 34.54 cm) *fb* paddy straw mulching (17.00, 33.57 cm) at 50 and 75 DAS. This could be due to weed free condition obtained with two hand weedings which might have given competitive advantage to crops over weeds in utilizing the moisture, nutrient, light and space and thus the crops in this treatment gave better results. Similar findings were observed by Kundu *et al.* (2011); Rao *et al.* (2015). Contrary to the above values of plant height was observed lower in weedy check at all the stages of observation. Plant dry weight was significantly highest (1.23, 5.63 g plant^{-1}) under two hand weeding at 20 and 40 DAS and was found to be statistically at par with paddy straw mulching (1.20, 5.53 g plant^{-1}) at 50 and 75 DAS. These findings are similar to those of Kundu *et al.* (2011); Komal *et al.* (2015).

Leaf area index was found to be significantly affected at 50 and 75 DAS. Significantly highest leaf area index (1.23, 1.71) was observed under two hand weedings and was found to be statistically at par with paddy straw mulching (1.20, 1.67) at 50 and 75 DAS. Improved leaf area index in blackgram with two hand weedings could be because of competitive advantage of crops over weeds and absence of competition from weeds for limited resources at the early stages of crop growth which proved to be very effective in controlling weeds and it resulted in improving the overall growth of crop and thus, it also improved the leaf area index of the crop. The findings are in close agreement with those reported by Srivastava *et al.* (2003); Amini *et al.* (2013); Tamang *et al.* (2015).

Table 2: Effect of treatments on the growth attributes of blackgram.

Treatment	Plant height (cm)			Plant dry weight (g plant^{-1})			Leaf area index		
	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS	25 DAS	50 DAS	75 DAS
T_1 (Weedy check)	5.43	12.37	23.33	0.35	0.75	3.13	0.87	0.77	1.2
T_2 (Hand weeding)	6	18.1	34.54	0.4	1.23	5.63	1.03	1.23	1.71
T_3 (Cardboard mulching)	5.77	16.13	32.2	0.38	1.03	5.07	0.96	1.1	1.59
T_4 (Paddy straw mulching)	5.87	17	33.57	0.39	1.2	5.53	0.98	1.2	1.67
T_5 (Sawdust mulching)	5.57	13.13	26	0.33	0.83	3.67	0.89	0.83	1.3
T_6 (Linseed stover mulching)	5.9	15.33	29.42	0.37	1	4.6	0.93	1.03	1.48
T_7 (Farmer's practice)	5.67	14	25.67	0.35	0.87	4.07	0.88	0.93	1.4
S.Em±	0.13	0.41	0.64	0.009	0.01	0.11	0.02	0.01	0.01
CD (p=0.05)	0.4	1.29	1.99	0.02	0.05	0.36	0.07	0.05	0.04

Physiological attributes. It is important to analyze the physiological parameters of plants in order to study the plant's internal functions, including the physical and chemical processes that are associated with the life cycle of a plant. Data observed on physiological analysis of blackgram during the course of study is presented in the Table 3.

Crop growth rate (CGR) recorded at 25-50 and 50-75 DAS were found to be significantly affected due to treatments. It was found that at 25-50 DAS and 50-75 DAS, two hand weedings at 20 and 40 DAS recorded the highest crop growth rate (1.11 and 5.87 gm^{-2}day^{-1}) and was found to be statistically at par with paddy straw mulching (1.08 and 5.78 gm^{-2}day^{-1}). The lowest crop growth rate was recorded under weedy check at both the time intervals. The findings are in close conformity with the findings of Akter *et al.* (2013); Shweta and Malik (2015).

Relative growth rate (RGR) were recorded at 25-50 and 50-75 DAS and the data pertaining to it revealed that highest relative growth rate was recorded under treatment two hand weedings (0.045 and 0.060 gg^{-1} day^{-1}) at 25-50 and 50-75 DAS and it was found to be statistically at par with paddy straw mulching (0.045 and 0.061 gg^{-1}day^{-1}) while lowest relative growth rate (0.031 and 0.056 gg^{-1}day^{-1}) was observed under weedy check at all the stages of observation.

Table 3: Effect of treatments on the physiological attributes of blackgram.

Treatment	Crop growth rate (gm^{-2}day^{-1})		Relative growth rate (gg^{-1}day^{-1})	
	25-50 DAS	50-75 DAS	25-50 DAS	50-75 DAS
T_1 (Weedy check)	0.54	3.17	0.031	0.056
T_2 (Hand weeding)	1.11	5.87	0.045	0.06
T_3 (Cardboard mulching)	0.87	5.38	0.04	0.063
T_4 (Paddy straw mulching)	1.08	5.78	0.045	0.061
T_5 (Sawdust mulching)	0.67	3.78	0.037	0.058
T_6 (Linseed stover mulching)	0.83	4.8	0.039	0.06
T_7 (Farmer's practice)	0.69	4.27	0.036	0.061
S.Em±	0.02	0.15	0.002	0.004
CD (p=0.05)	0.08	0.47	0.005	0.013

The results are in consonance with those observed by Akter *et al*. (2013).

Yield attributes and yield. Data pertaining to yield attributing characters like number of pods per plant, length of pod, number of seeds per pod, test weight and seed and stover yield were recorded at harvest and the corresponding data is presented in the Table 4. Observations revealed that there was no significant effect of treatments on the length of pod, number of seeds per pod and test weight of blackgram. Weed management strategies did not show significant effect on these parameters.

Significantly highest value of number of pods per plant(28.00) was obtained under the treatment two hand weedings at 20 and 40 DAS and it was found to be statistically at par with paddy straw mulching (27.33). The lowest number of pods per plant(20.33) was recorded under weedy check. Similar findings were documented by Asaduzzam *et al*. (2010); Kumar *et al*. (2015).

Highest seed yield (742.33 kg ha^{-1}) and stover yield (2112.33 kg ha^{-1}) was noticed under the treatment two hand weedings at 20 and 40 DAS and was found to be statistically at par with the treatment paddy straw mulching with the seed yield of (732.67 kg ha^{-1}) and stover yield (2107.33 kg ha^{-1}). This could be due to higher yield attributes which were favoured due to better crop growth which is evident by the observations recorded on growth attributes like plant height, leaf area index and crop dry matter production. Similar results has been reported by Singh *et al*. (2011) who observed that due to lesser competition from weeds for limited resources in this treatment, they control the weed populations more effectively than all the other treatments.

Economics. The economic analysis of crop cultivation includes the cost of input usage and crop profitability analysis of output. The economics of blackgram was evaluated after the harvest of the crop and sell of the produce. The findings evinced that there was variation among the treatments in terms of net return and the B:C ratio which is demonstrated in the Table 5. Paddy straw mulching gave the highest net return and B:C ratio among all the treatments practiced while the lowest net return and B:C ratio was obtained under unweeded plots. The findings are in harmony with Kalhapure and Shete (2013).

Table 4: Effect of treatments on the yield attributes and yield of blackgram

Treatment	Number of pods $plant^{-1}$	Length of pods	Number of seeds pod^{-1}	Test weight	Seed yield (kg ha^{-1})	Stover yield(kg ha^{-1})
T_1 (Weedy check)	20.33	4.55	7.13	40.21	450	1714.67
T_2 (Hand weeding)	28	4.98	7.93	43.18	742.33	2112.33
T_3 (Cardboard mulching)	26	4.76	7.53	42.6	651.67	2052.33
T_4 (Paddy straw mulching)	27.33	4.86	7.6	41.65	732.67	2107.33
T_5 (Sawdust mulching)	21.67	4.62	7.4	42.28	565.67	1810.33
T_6 (Linseed stover mulching)	24.33	4.75	7.2	42.57	618.67	1953.67
T_7 (Farmer's practice)	23	4.67	7.33	42.45	603.67	1863
S.Em±	0.35	0.11	0.1	0.68	3.93	11.19
CD (p=0.05)	1.08	0.33	0.33	2.11	12.13	34.5

Table 5: Effect of treatments on the economic analysis of blackgram

Treatment	Cost of cultivation (₹)	Gross return (₹)	Net return (₹)	B:C Ratio
T_1(Weedy check)	29000	31414.67	2414.67	1.08
T_2(Hand weeding)	41000	51106.11	10106.11	1.25
T_3(Cardboard mulching)	45600	45062.55	-537.45	0.99
T_4(Paddy straw mulching)	35600	50463.55	14863.55	1.42
T_5 (Sawdust mulching)	35600	39144.55	3544.55	1.1
T_6 (Linseed stover mulching)	35600	42785.89	7185.89	1.2
T_7 (Farmer's practice)	35000	41661	6661	1.19

CONCLUSIONS

The research findings of the study revealed that different Weed management strategies has potential impact on the growth and yield attributes of summer blackgram. Hand weeding at 20 and 40 DAS gave the highest seed yield, stover yield and harvest index and it was found to be statistically at par with paddy straw mulching while the economic analysis revealed that paddy straw mulching recorded the highest B:C ratio and this was found to be more economically viable than the rest of the treatments. Hence, this practice can be adopted by farmers of this region in blackgram for maximizing the benefits.

Conflict of Interest. None.

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