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Effect of Organic Weed Management Techniques on Weeds Infestation, Productivity and Profitability of Summer Blackgram (*Vigna mungo* L. Hepper) under Midhill Conditions of Nagaland

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ABSTRACT

Field experiment was conducted during the *zaid* season of 2022 in black gram crop (Var PU-31) at Agronomy research farm of School of Agricultural Sciences (SAS), Nagaland University, Medziphema Campus, Nagaland. The experiment was laid out in Randomized Block Design comprised of seven weed management treatments, viz. 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 and was replicated thrice. Weed flora observations showed that *Ageratum conyzoides*, *Amaranthus viridis*, *Commelina bengalensis, Phyllanthus niruri* and *Mimosa pudica* were dominant broad leaved weeds, *Cyperus rotundus* and *Cyperus iria* were dominant among sedges and *Cynodon dactylon*, *Eleusine indica* and *Echinochloa colonum* were dominant among grassy weeds in the blackgram field. The experimental results revealed that treatment with hand weeding at 20 and 40 DAS gave maximum decline in weed populations and weed dry weight which was at par with paddy straw mulching @ 5 t ha^{-1}. Hence, hand weeding at 20 and 40 DAS recorded the highest weed control efficiency among all the treatments as well as it produced highest yield and was at par with paddy straw mulching @ 5 t ha^{-1}. Paddy straw mulching @ 5 t ha^{-1} gave the highest B:C ratio (1.42) among all the treatments and thus was found to be most economically sound treatment of summer black gram among all.

Keywords Blackgram, Economics, Growth, Mulching, Weeds, Yield.

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INTRODUCTION

India is currently having the highest area under *kharif* pulses and summer pulses in the world. In India, pulses are considered as an integral part of the cropping system by the farmers as it fits well in the crop rotation. Black gram is grown in many parts of

India since it is a short duration pulse crop. Globally, India accounts for more than 70% of the black gram production. Black gram, also known as urd bean, mungo bean, mash kalai. It contains about 60% carbohydrates, 25.21% protein, 1.64 g fats and other minerals, vitamins and is also rich source of calcium and iron (Tiwari and Shivhare 2016). Black gram is 4th major pulse crop in India and contributes 10-13% of total area and production. In India, it is mainly cultivated in the states of Rajasthan, Maharashtra, Madhya Pradesh, Karnataka, West Bengal, Uttar Pradesh, Gujarat and Tamil Nadu. Madhya Pradesh is the leading producer of black gram with a production of 16.50 lakh tonnes per hectare (Department of Agriculture and Cooperation, Govt of India 2021). In Nagaland, area under black gram 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).

Black gram is a shade tolerant crop thus compatible for intercropping with sugarcane, sorghum, cotton, maize and millet (Praharaj and Blaise 2016). Being a leguminous crop, it demands less nitrogenous fertilizers and it fits well in different crop rotation systems to maintain the fertility level of the soil (Rani *et al.* 2019). Among these several factors responsible for low yields of black gram, weed infestation is considered as one of the major factors. Low yield of black gram is mainly due to heavy weed infestation in the field from early growth stages (Patel *et al.* 2015, Singh 2020). Black gram is mostly grown as a subsidiary crop with the main crop using the residual moisture present in the crop field. The critical period of crop-weed competition for the summer black gram is the initial 30 days after sowing which in certain situations could be 30–45 days after sowing. Being a short duration crop, black gram is heavily infested with grasses, broad leaved weeds and sedges (Patel *et al.* 2015), resulting in yield reduction to the tune of 30-50% (Thongni *et al.* 2023). Proper weed control practices and management are necessary for proper growth and development of black gram, particularly in the early growth stages of the crop. This crop needs more attention during summer as along with the crop, the weeds also grow more luxuriantly and vigorously due to better sunshine and irrigation during this time. Therefore, it is important to control the weeds by suitable methods and practices, especially during the critical period of crop-weed competition of this crop in order to exploit the full yield potential of black gram, especially non-chemical practices as it reduces the pollution caused by higher use of herbicides and weedicides, regular use of weedicides can result in the development of a new variant of weeds which will be resistant to the weedicides. Using organic weed management techniques can reduce the pollution caused by use of harmful chemicals and thus, reducing its harmful impact on environment and human health and at the same time, it promotes the sustainability of the land. It also reduces our dependency on chemical herbicides and weedicides. So, organic weed management techniques can be adopted to protect the environment and to maintain the ecological balance. Keeping in view the above facts, the research was undertaken to study the response of summer black gram to organic weed management practices under Nagaland conditions.

MATERIALS AND METHODS

A field experiment was conducted in the Agronomy experimental research farm of School of Agricultural Sciences, Nagaland University, Medziphema Campus, during summer season of 2022. The experimental farm is located in the foot hill of Nagaland at an altitude of 310 meters above mean sea level with the geographical location at 25°45′ 43″ North Latitude and 95°53′ 04 ″ East Longitude. The experimental area lies in the humid sub- tropical zone with high relative humidity, moderate temperature and medium to high rainfall which varies between 2000-2500 mm per annum. The mean temperature ranges from 21-32°C during summer and goes down to about 8°C during the winter season. The soil of the experimental field was well drained and sandy loam in texture, acidic in soil reaction, high in organic carbon, medium in available nitrogen, phosphorus and potassium. The characteristic of experimental soil is given in the Table 1. The experiment was laid out in Randomized Block Design (RBD) with three replication. There were seven treatment combinations viz., T_1: Weedy check, 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

Table 1. Initial soil fertility status of the experimental field.

Parameters	Value	Status	Methods employed
pH	4.3	Acidic	Digital pH meter (Single pH method)
Organic carbon (%)	1.5	High	Walkley and black rapid titration method (Piper 1966)
Available N (kg ha^{-1})	260.42	Medium	Alkaline potassium permanganate method (Subbiah and Asija 1956)
Available P_2O_5 (kg ha^{-1})	20.94	Medium	Bray's method (Bray and Kurtz 1945)
Available K_2O (kg ha^{-1})	183.1	Medium	Flame photometer (Hanway and Heidal 1952)

ha^{-1}, T_6: Locally available mulching like linseed stover mulching @ 5 t ha^{-1} and T_7: Farmer's practice. The recommended dose of nutrients was applied in the ratio of (20:40:40 kg NPK ha^{-1}) and supplied in the form of Urea, single super phosphate (SSP) and muriate of potash (MOP) respectively prior to sowing in the single dose. Healthy and fungicide treated seeds of black gram cultivar 'PU-31' were sown in March in 30 cm rows at 10 cm apart. The observations on weed population and weed dry weight were recorded treatment wise at 20 DAS and 40 DAS with the help of least count method using quadrates of 50 cm × 50 cm. Weeds within the quadrates were uprooted, sundried and finally dried in hot air oven (60±1°C for 24 hrs), dry weight was recorded. The data on weeds were subjected to square root transformation ($\sqrt{x+0.5}$) before subjecting to statistical analysis by Analysis of Variance (F-test) as per the method suggested by Gomez and Gomez (1976).

RESULTS AND DISCUSSION

Effect on weeds

The predominant weed flora in the experimental

Table 2. Effect of organic weed management techniques on weed population of summer black gram crop. Note: Values in parenthesis are original values that were subjected to square root transformation ($\sqrt{x + 0.5}$).

Treatment	Weed population (no. m^{-2})					
	Broad leaved		Sedges		Grasses	
	20 DAS	40 DAS	20 DAS	40 DAS	20 DAS	40 DAS
T_1 (Weedy check)	7.13 (50.33)	8.47 (71.33)	5.64 (31.33)	8.96 (80.00)	5.58 (30.67)	10.02 (100.00)
T_2 (Hand weeding)	4.22 (17.33)	4.38 (18.67)	2.61 (6.33)	2.91 (8.00)	2.68 (7.00)	3.89 (14.67)
T_3 (Cardboard mulching)	4.88 (23.33)	5.18 (26.33)	2.86 (7.67)	3.92 (15.00)	3.13 (9.33)	4.97 (24.33)
T_4 (Paddy straw mulching)	4.30 (18.00)	4.49 (19.67)	2.68 (6.67)	3.13 (9.33)	2.73 (6.67)	4.06 (16.00)
T_5 (Sawdust mulching)	6.47 (41.33)	6.94 (47.67)	3.67 (13.00)	6.36 (40.33)	4.64 (21.00)	6.94 (47.67)
T_6 (Linseed stover mulching)	5.21 (26.67)	5.52 (30.00)	2.91 (8.00)	4.63 (21.00)	3.67 (13.00)	5.61 (31.00)
T_7 (Farmer's practice)	5.70 (32.00)	5.99 (35.33)	3.49 (11.67)	5.34 (28.00)	4.02 (15.67)	6.18 (37.67)
SEm±	0.03	0.05	0.04	0.12	0.06	0.08
CD (p=0.05)	0.09	0.17	0.12	0.37	0.18	0.25

Table 3. Effect of organic weed management techniques on the dry weight of weeds. Note: Values in parenthesis are original values that were subjected to squareroot transformation ($\sqrt{x + 0.5}$).

Treatment	Dry weight of weeds (g m^{-2})					
	Broad leaved		Sedges		Grasses	
	20 DAS	40 DAS	20 DAS	40 DAS	20 DAS	40 DAS
T_1 (Weedy check)	4.51 (19.87)	6.19 (37.89)	3.28 (10.26)	6.90 (47.17)	2.84 (7.57)	7.12 (50.57)
T_2 (Hand weeding)	2.76 (7.14)	2.86 (7.66)	1.49 (1.71)	2.37 (5.13)	1.52 (1.80)	2.58 (6.17)
T_3 (Cardboard mulching)	3.20 (9.72)	3.28 (10.25)	1.85 (2.93)	2.81 (7.37)	1.88 (3.05)	3.18 (9.66)
T_4 (Paddy straw mulching)	2.81 (7.37)	3.00 (8.5)	1.56 (1.92)	2.53 (5.89)	1.59 (2.03)	2.78 (7.27)
T_5 (Sawdust mulching)	4.15 (16.69)	4.94 (24.00)	2.49 (5.71)	4.91 (23.64)	2.47 (5.60)	5.34 (28.21)
T_6 (Linseed stover mulching)	3.35 (10.73)	3.62 (12.66)	2.07 (3.80)	3.17 (9.54)	2.13 (4.06)	3.87 (14.49)
T_7 (Farmer's practice)	3.71 (13.24)	4.28 (17.85)	2.30 (4.81)	4.18 (16.99)	2.32 (4.90)	4.37 (18.58)
SEm±	0.02	0.05	0.03	0.06	0.02	0.12
CD (p=0.05)	0.06	0.16	0.11	0.19	0.08	0.38

Table 4. Effect of organic weed management techniques on the weed control efficiency. Note: Values in parenthesis are original values that were subjected to square root transformation ($\sqrt{x+0.5}$).

Treatment	Weed control efficiency	
	20 DAS	40 DAS
T_1 (Weedy check)	0.00	0.00
T_2 (Hand weeding)	71.72	85.94
T_3 (Cardboard mulching)	58.37	79.84
T_4 (Paddy straw mulching)	69.94	83.84
T_5 (Sawdust mulching)	25.72	43.99
T_6 (Linseed stover mulching)	50.71	72.80
T_7 (Farmer's practice)	39.17	60.40
SEm±	0.86	0.69
CD (p=0.05)	2.66	2.14

field was consisted of *Cynodon dactylon*, *Digitaria sanguinalis* and *Eleusine indica* among the grasses, *Cyperus rotundus* and *Cyperus iria* among the sedges and *Ageratum conyzoides*, *Amaranthus viridis*, *Commelina benghalensis*, *Euphorbia hirta* and *Mimosa spinosa* were among the dominant broad leaved weeds, which constituted the major proportion of the weed density. Almost similar weed species were reported by Tamang *et al.* (2015), Patel *et al.* (2017) and Reddy *et al.* (2022).

The data presented in Table 2 revealed that the organic weed management treatments caused marked variation on the weed population (no. m^{-2}). Different weed management techniques had significant effect on population of broad leaved weeds, sedges and grassy weeds at 20 and 40 DAS. The lowest broad leaved weed population (4.22 and 4.38), sedge weed population (2.61 and 2.91) and grassy weeds population (2.68 and 3.89) was recorded under hand weeding at 20 and 40 DAS and it was found to be statistically at par with paddy straw mulching. The highest population of broad leaved weeds, sedges and grassy weeds were noticed under weedy check at all the stages of observations. These findings are in conformity with the results of Patel *et al.* (2015) and Reddy *et al.* (2022) who reported maximum reduction in weed population in treatments with two hand weedings.

Dry weight of weeds (g m^{-2}) varied appreciably under organic weed management techniques and the data pertaining to it is exhibited in the Table 3. It was invariably lesser in all the plots wherever weeds were controlled by hand weeding at 20 and 40 DAS. Lowest dry weight of broad leaved weeds (2.76 and 2.86), sedges (1.49 and 2.37) and grassy weeds (1.52 and 2.58) at 20 and 40 DAS was noted under under two hand weedings at 20 and 40 DAS followed by paddy straw mulching. Among all the treatments, weedy check recorded highest dry weight of weeds. The results are in consonance with Shweta and Malik (2015), Chandrakar *et al.* (2015) and Reddy *et al.* (2022).

Weed control efficiency varied significantly due to different organic weed management techniques during the crop growing season and the pursuance of data is revealed in the Table 4. Two hand weedings at 20 and 40 DAS recorded the highest weed control efficiency (71.72% and 85.94%) at different crop growth interval of 20 and 40 DAS and it was found to be statistically at par with paddy straw mulching. The findings are in accordance with that of Singh (2011). They observed that amongst the weed management treatments, two hand weeding (20 and 40 DAS) was found to be the most effective in controlling weeds at different stages.

Effect on seed and stover yields

Seed and stover yield of black gram varied significantly due to different organic weed management practices during the crop growing season and the

Table 5. Effect of organic weed management techniques on the seed and stover yield (kg ha^{-1}) and harvest index of black gram.

Treatment	Seed yield (kg/ha^{-1})	Stover yield (kg/ha^{-1})	Harvest index
T_1 (Weedy check)	450	1714.67	26.24
T_2 (Hand weeding)	742.33	2112.33	35.14
T_3 (Cardboard mulching)	651.67	2052.33	31.76
T_4 (Paddy straw mulching)	732.67	2107.33	34.76
T_5 (Sawdust mulching)	565.67	1810.33	31.25
T_6 (Linseed stover mulching)	618.67	1953.67	31.67
T_7 (Farmer's practice)	603.67	1863	32.39
SEm±	3.93	11.19	0.26
CD (p=0.05)	12.13	34.5	0.81

Table 6. Effect of organic weed management techniques on the economics of black gram.

Treatment	Cost of cultivation (₹)	Gross return (₹)	Net return (₹)	B:C ratio
T_1 (Weedy check)	29000	31414.7	2414.67	1.08
T_2 (Hand weeding)	41000	51106.1	10106.1	1.25
T_3 (Cardboard mulching)	45600	45062.6	-537.45	0.99
T_4 (Paddy straw mulching)	35600	50463.6	14863.6	1.42
T_5 (Sawdust mulching)	35600	39144.6	3544.55	1.1
T_6 (Linseed stover mulching)	35600	42785.9	7185.89	1.2
T_7 (Farmer's practice)	35000	41661	6661	1.19

corresponding data is presented in the Table 5. Highest seed yield (742.33 kg ha^{-1}), stover yield (2112.33 kg ha^{-1}) and harvest index (35.14) was observed 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}), stover yield (2107.33 kg ha^{-1}) and harvest index (34.76). This could be due to higher yield attributes which were favored due to better crop growth. The results are in close conformity with findings of Das *et al*. (2014), Kumar *et al.* (2015), Patel *et al.* (2015) and Reddy *et al.* (2022) who reported higher seed yield in treatment with two hand weedings. Singh (2011) and Mansoori *et al.* (2015) also 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. The lowest seed yield (450.00 kg ha^{-1}), stover yield (1714.67 kg ha^{-1}) and the lowest harvest index (26.24) was obtained under weedy check (control).

Economics

Economics is the major consideration for the farmers while taking decision regarding the adoption of any cultivation practices because it reveals the losses, cost of cultivation incurred and benefits derived from adopting a particular cultivation practice. Net return and B : C ratio of summer black gram varied significantly due to different weed control treatments during the growing season and the results recorded is presented in the Table 6. Net return and B:C ratio were higher in the plots receiving paddy straw mulching while the lowest gross return, net return and benefit cost ratio was recorded under weedy check. Kalhapure and Shete (2013) also reported significant higher net return with paddy straw mulching.

REFERENCES

Bray RH, Kurtz LT (1945) Determination of total, organic and available forms of phosphorus in soils. *Soil Science* 59:39-45.

Chandrakar S, Sharma A, Thakur DK (2015) Effect of weed management on weeds and yield of chickpea varieties (*Cicer arietinum* L.). *Advance Research Journal of Crop Improve ment* 6(1): 1-4.

Das R, Patra BC, Mandal MK, Pathak A (2014) Integrated weed management in black gram (*Vigna mungo* L.) and its effect on soil microflora under sandy loam soil of West Bengal. *The Bioscan* 9(4): 1593-1596.

Department of Agriculture and Cooperation, Govt. of India, pp 2020-21.

Directorate of Economics and Statistics, Govt. of Nagaland, Kohima (2021) In: *Statistical Handbook of Nagaland*, pp 38.

Gomez KA, Gomez AA (1976) Statistical procedure for Agricultural Research. Wiley International Science Publication, New York, pp. 660.

Hanway JJ, Heidal H (1952) Soil analysis method as used in Iowa state college soil testing Laboratory. *Iowa Agriculture* 57: 1-31.

Kalhapure AH, Shete S (2013) Cultural methods of weed management in pulses. *Indian Journal of Weed Science* 45: 116-19.

Kumar D, Qureshi A, Nath P (2015) Refining the weed management practices to increase the yield of urd bean (*Vigna mungo* L.) in north-western India. *International Journal of Applied Pure Science and Agriculture* 1(7): 123-9.

Mansoori N, Bhadauria R, Rajput L (2015) Effect of weed control practices on weeds and yield of black gram (*Vigna mungo*). *Legume Research* 38(6): 855-857. DOI: 10.18805/lr.v38i6.6736.

Patel CV, Poonia TC, Pithia MS (2017) Integrated weed management in *kharif* blackgram. *Indian Journal of Weed Science* 49(1): 44-46. DOI: 10.5958/0974-8164.2017.00011.9

Patel KR, Patel BD, Patel RB, Patel VJ, Darji VB (2015) Bio-efficacy of herbicides against weeds in blackgram. *Indian Journal of Weed Science* 47(1): 78-81.

Piper CS (1966) Soil chemical analysis. Asia Publishing House, Bombay, pp. 408.

Praharaj CS, Blaise D (2016) Intercropping: An approach for area expansion of pulses. Indian Journal of Agronomy 61(4th IAC Special issue): S113-21.

Rani K, Sharma P, Kumar S, Wati L, Kumar R, Gurjar DS, Kumar D, Kumar R (2019) Legumes for sustainable soil and

crop management. Sustainable management of soil and environment, pp 193-215. DOI: 10.1007/978-981-13-8832-3_6

Reddy PRK, Tzudir L, Kumari S, Nongmaithem D, Singh AP, Yadav R (2022) Response of black gram (*Vigna mungo* L.) to integrated weed management and its effect on weed dynamics. *Plant Archives* 22(2): 397-402. DOI: https://doi.org/10.51470/PLANTARCHIVES.2022.v22.no2.069

Shweta, Malik M (2015) Influence of integrated weed management on growth and yield of blackgram (*Vigna mungo* L.). *Agriculture and Sustainable Development* 3(1): 27-31.

Singh G (2011) Weed management in summer and *kharif* season black gram (*Vigna mungo* L.). *Indian Journal of Weed Science* 43(1-2): 77-80.

Singh K (2020) Evaluation of weed management practices in summer mungbean (*Vigna radiata*) under zero tillage condition. MSc thesis (Agronomy). ICAR-National Dairy Research Institute, Karnal (Deemed University), pp. 1-3

Subbiah BV, Asija GL (1956) A rapid procedure for the determination of available N in soils. Current science. 25: 259-260.

Tamang D, Nath R, Sengupta K (2015) Weed management in green gram (*Vigna radiata* L.). *Advances in Crop Science and Technology* 3(2): 163. DOI: http://dx.doi.org/10.4172/2329-8863.1000163

Thongni A, Tzudir L, Kumari S (2023) Response of summer blackgram (*Vigna mungo* L. Hepper) to planting geometry and weed management under Nagaland conditions. *Indian Journal of Hill Farming* 36: 203-209. DOI: 10.56678/iahf-spl36.2023.25

Tiwari AK, Shivhare AK (2016) Pulses in India: Retrospect and prospects. Directorate of Pulses Development Bhopal 1(2): In press.