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Integrated Approaches Proven Better Weed Control, Productivity and Quality in Blackgram (*Vigna mungo* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted during *kharif* 2023 to study the efficacy of pre and early post-emergence herbicides for the management of weeds in blackgram. The experiment was laid out in a randomized block design with 12 treatments replicated thrice. The weed free treatment recorded significantly higher seed and stover yield (1077 and 2657 kg/ha, respectively). After weed free, significantly higher seed and stover yields (960 and 2258 kg/ha, respectively) were observed in interculturing followed by hand weedings at 20 and 40 DAS and was found at par with post-

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emergence application of imazethapyr + imazamox @ 50 (25 + 25) g/ha *fb*interculturing at 40 DAS (932 and 2224 kg/ha, respectively) and imazethapyr + imazamox @ 60 (30 + 30) g/ha *fb* interculturing at 40 DAS (916 and 2169 kg/ha, respectively) due to better plant height, number of branches per plant due to better weed control in these treatments as evidenced by significantly lower weed dry weight of sedges, grasses, broad leaf weeds and total weeds at 15, 40 DAS and at harvest as compared to unweeded check. Whereas, significantly higher protein yield was observed in weed free (242.11 kg/ha) which was followed by interculturing followed by hand weedings at 20 and 40 DAS (214.46 kg/ha) and other treatments.

Keywords: Blackgram; herbicides; interculturing; weeds; yield.

1. INTRODUCTION

Blackgram (*Vigna mungo* L.) is one of the important pulse crops of India belonging to the family *Fabaceae* or *Leguminosae* and *Papilionacaae* sub family. India is considered as the primary centre of origin of blackgram and central Asia as a secondary centre (De Candolle, 1882; Vavilov, 1926). Black gram is known under different names in different part of India for example Urid or Kalai in Hindi; Mashkalai in Bengali; Manipapappu in Telugu; Ulathamparuppu in Tamil; Uddinabele in Kannda; Uzhunnu in Malayalam; Adad in Gujarati; Udid in Marathi and Mash in Punjabi. Blackgram is highly nutritious grain legume crop mainly grown in South and Southeast Asian countries including Afghanistan, Bangladesh, India, Myanmar, Pakistan, Sri Lanka, Thailand, and Vietnam (Kaewwongwal *et al.,* 2015). In India, during the 2022-23 kharif season, black gram was cultivated in about 19.21 lakh acres (www.agricoop.nic.in). It is well known crop for its hardiness, comparatively more resistance against pests and diseases and withstand against drought conditions. Hence, there is a great scope of increasing the productivity of this crop with adoption of high yielding varieties and suitable agro-technologies. Among various biotic and abiotic factors, weed infestation is the major biotic factor responsible for low productivity of blackgram. Weed emergence in blackgram begins in tune with the crop emergence leading to crop-weed competition from initial stages and reduce yields to the extent of 78% and sometimes lead to the total crop failure (Kumar *et al*., 2015). Weed management with hand weeding was observed to be highly expensive among different weed control methods due to the non-availability and increased cost of labour during the critical stages of the crop weed competition. Hence, the timely control of weeds in blackgram using herbicides would be preferable and the use of post-emergent herbicides could be better option for the control of weeds during the early stages of the crop growth (Thimmegowda*et al*., 2022). Hence, the chemical weed control method is becoming popular among the farmers and the use of post-emergence herbicides alone or in combination may broaden the window of weed management. Considering the above facts and views, the present experiment wasconducted to study the effect of different weed management practices for their influence on weed control, productivity and quality in blackgram.

2. MATERIALS AND METHODS

A field experiment was conducted during *Kharif* season of 2023 at the Agronomy Instructional Farm, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Banaskantha (Gujarat) to study the effect of different weed management practices for their influence on weed control, productivity and quality in blackgram. Geographically, Sardar krushinagar Dantiwada Agricultural University is situated at 24˚19' North latitude and 72˚19' East longitude with an elevation of 154.52 metre above the mean sea level. The experiment was laid out in randomised block design with three replications having twelve treatments *viz*., T_1:Pendimethalin @ 750 g/ha (PE) *fb* interculturing at 40 DAS T_2: Quizalofop-p-ethyl @ 38 g/ha (PoE) *fb*interculturing at 40 DAS T_3: Quizalofop-p-ethyl @ 50 g/ha (PoE) *fb*interculturing at 40 DAS T_4: Imazethapyr @ 50 g/ha (PoE) *fb*interculturing at 40 DAS T_5: Imazethapyr @ 75 g/ha (PoE) *fb* interculturing at 40 DAS T_6: Fenoxaprop-p-ethyl @ 56.25 g/ha (PoE) *fb*interculturing at 40 DAS T_7: Fenoxaprop-p-ethyl @ 67.5 g/ha (PoE) *fb*interculturing at 40 DAS T_8: Imazethapyr + imazamox @ 50 (25 + 25) g/ha (PoE) *fb*interculturing at 40 DAS T_9: Imazethapyr + imazamox @ 60 (30 + 30) g/ha (PoE) *fb*interculturing at 40 DAS T_{10}: Interculturing followed by hand weedings at 20 and 40 DAS T_{11}: Weed free T_{12}: Unweeded check. The soil of the experimental plot was loamy sand in texture and slightly alkaline in reaction (pH=7.40), low in organic carbon (0.24%) and available nitrogen (149.0 kg/ha) and medium in available phosphorus (39.3 kg/ha) and potassium (267.45 kg/ha).Blackgram cultivar (GU 1) was sown on 15th July, 2023 with a spacing of 45 cm and harvested on 10thOctober, 2023. The herbicides were sprayed using knapsack sprayer with flat fan nozzle having 15 litre capacity. Pendimethalin was applied as pre-emergence at two DAS, while, quizalofop-p-ethyl, imazethapyr fenoxaprop-p-ethyl, and imazethapyr + imazamox were applied as post-emergence at 20 DAS. The herbicides were applied as per the treatments in respective plots by using the spray volume of 500 litres/ha. The sedges, grasses, broad leaf weeds were uprooted from 0.25 m^2 (50 cm × 50 cm quadrate) in ring area of plots at 15, 40 DAS and at harvest and were kept in separate brown paper packets for sun drying and later they were kept in hot air oven at 60 ^{0}C for 72 hours till the dry weight becomes constant. Later, category wise weed dry weight of sedges, grasses and broad leaf weeds were noted down separately by weighing in weighing balance and later total weed dry weight of each stage were calculated. Further, the data was multiplied with four to convert the data into g/m^2. Since the weed dry weight data does not follow normal distribution, the weed dry weight data were analyzed after subjecting to$\sqrt{x+0.5}$ transformation. The weed control efficiency was calculated by using the following formula (Kondap and Upadhyay, 1985). Total five plants were selected randomly from net plot and tagged in each plot for recording plant height, no. of branches per plant at harvest. The data on pod, seed and stover yield were recorded from net plot and converted on hectare basis. Weed index was worked out on the basis of formula suggested by Gill and Kumar (1969).The protein content (%) in seed was determined by Near Infrared Spectroscopy and recorded separately for each treatment. Protein yield was calculated by using the following formula (Gassi*et al*., 1973). The statistical analysis of the data collected for different parameters were carried out following the procedures of as described by Panse and Sukhatme (1967) using computer system at the Computer Centre, Department of Agricultural Statistics, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar.

$$Protein\ yield\ \left(\frac{kg}{ha}\right) = \frac{Protein\ content\ (\%)\ ^{x}\ Seed\ yield\ (kg/ha)}{100}$$

3. RESULTS AND DISCUSSION

3.1 Weed Flora, Weed Dry Weight and Weed Control Efficiency

The different weed species observed at 15, 40 DAS and harvest were *Cyperus rotundus* L. and *Bulbostylis barbata* Rottb. among sedges, *Cynodondactylon* L., *Setariaviridis* L. and *Digitariasanguinalis* L. among grasses and *Digera arvensis* L., *Amaranthus viridis* L., *Amaranthus spinosus* L., *Amaranthus polygonoides* L., *Portulaca oleracea* L., *Boerhaviaerecta* L., *Tribulus terrestris* L., *Commelinabenghalensis* L. and *Leucas aspera* L. among broad leaf weeds. The assessment and scrutiny of data on weed dry weight at 15 DAS (Table 1) indicated that, among different weed management practices, weed free treatment recorded significantly lower dry weight of sedges, grasses, broad leaf and total weeds as compared to other treatments. Following weed free, the pre-emergence application of pendimethalin @ 750 g/ha *fb*interculturing at 40 DAS depicted significantly lower dry weight of sedges, grasses, broad leaf and total weeds. Whereas, all the post-emergence herbicides, interculturing followed by hand weedings at 20 and 40 DAS and unweeded check treatment showed significantly higher dry weight of sedges, grasses, broad leaf and total weeds because of no any weed control measures initiated by/before 15 DAS. The dry weight of weeds at 40 DAS and at harvest (Tables 2 and 3) revealed that weed free treatment recorded significantly lower dry weight of sedges, grasses, broad leaf and total weeds. The similar results of lower weed dry weight and higher weed control efficiencies under weed free in blackgram were noticed by Marimuthu *et al.* (2024). Subsequent to weed free, significantly lower dry weight of sedges, grasses, broad leaf and total weeds were noticed under interculturing followed by hand weedings at 20 and 40 DAS and found at par with post-emergence application of imazethapyr + imazamox @ 60 (30+30) g/ha *fb*interculturing at 40 DAS and imazethapyr + imazamox @ 50 (25+25) g/ha *fb*interculturing at 40 DAS. Yet, under the unweeded check, significantly greater dry weights of sedges, grasses, broad leaf and total weeds were noted. The lower weed dry weight in post-emergence application of imazethapyr + imazamox @ 60 (30+30) g/ha *fb*interculturing at 40 DAS and imazethapyr + imazamox @ 50 (25+25) g/ha *fb*interculturing at 40 DAS was attributed to effective suppression of weeds due to inhibition of ALS enzyme in the target weeds after imazethapyr + imazamox applied and subsequent killing of emerged weeds through interculturing. Mansoori *et al*. (2015) reported lower weed dry weight in imazethapyr + imazamox (premix) as compared to pendimethalin and imazethapyr applied plot. Weed free treatment resulted 100% weed control efficiency across all the crop growth stages. Furthermore, the data on weed control efficiency at 40 DAS and harvest was found superior under weed free (100% and 100%, respectively), which was followed by interculturing followed by hand weedings at 20 and 40 DAS (82.74% and 89.87%, respectively), post-emergence application of imazethapyr + imazamox @ 60 (30 + 30) g/ha (PoE) *fb* interculturing at 40 DAS (80.99% and 88.39%, respectively) and imazethapyr + imazamox @ 50 (25 + 25) g/ha (PoE) *fb* interculturing at 40 DAS (78.49% and 86.16%, respectively). These results are in conformity with Kumar *et al*. (2015) and Barla and Upasani (2022).

3.2 Growth and Yield Parameters

An exploration of data in Table 4 stipulated that weed free treatment recorded significantly higher plant height and number of branches per plant at harvest (51.60 cm and 6.93, respectively) which was followed by interculturing followed by hand weedings at 20 and 40 DAS (50.13 cm and 6.07, respectively), post-emergence application of imazethapyr + imazamox @ 50 (25 + 25) g/ha (PoE) *fb*interculturing at 40 DAS (49.64 cmand 6.02, respectively) and imazethapyr + imazamox @ 60 (30 + 30) g/ha (PoE) *fb* interculturing at 40 DAS (49.40 cmand 5.94, respectively). Further, the reasons for significantly higher plant height and number of branches per plant noted under weed free plot was mainly due to significantly lower weed density and weed dry weight recorded under this treatment due to effective suppression of different categories of weeds. Higher plant height and number of branches per plant observed in interculturing and hand weeding was due to lower weed density and dry weight recorded which is primarily on account of better removal and control of all the weeds in blackgram crop. Similar results were obtained by Jakhar *et al*. (2015) and Manohar and Sushmita (2019) who noticed better growth parameters in weed free treatment.

Among different weed management practices, weed free recorded significantly higher pod yield, seed yield and stover yield (1460, 1077 and 2657 kg/ha, respectively) showing 149.57% higher pod yield over unweeded check. After weed free, interculturing followed by hand weedings at 20 and 40 DAS realized significantly higher pod yield, seed yield and stover yield (1302, 960 and 2258 kg/ha, respectively with 122.56% higher pod yield over unweeded check) which became statistically at par with post-emergence application of imazethapyr + imazamox @ 50 (25 + 25) g/ha *fb*interculturing at 40 DAS (1263, 932 and 2224 kg/ha, respectively with 115.90% higher pod yield over unweeded check) and imazethapyr + imazamox @ 60 (30 + 30) g/ha *fb*interculturing at 40 DAS (1242, 916 and 2169 kg/ha, respectively with 112.31% higher pod yield over unweeded check). Whereas, significantly lower pod yield, seed yield and stover yield were observed under unweeded check (585, 432 and 999 kg/ha, respectively). This might be due to better growth parameters recorded under these treatments which in turn due to better weed control in these treatments as expressed in terms of significant lower weed dry weight higher weed control efficiencies in these treatments. This is indicated by significantly negative correlation between weed dry weight at 40 DAS, weed dry weight at harvest and seed yield of blackgram (-0.9880** and -0.9830**, respectively). In addition, regression equations explored that every one g/m^2 increase in weed dry weight at 40 DAS and at harvest reduced the seed yield of blackgram by 6.043 and 7.074 kg/ha, respectively. This is further indicated by significantly negative correlation between weed dry weight at 40 DAS, weed dry weight at harvest and stover yield of blackgram (-0.9823** and -0.9764**, respectively). In addition, regression equations explored that every one g/m^2 increase in weed dry weight at 40 DAS and at harvest reduced the stover yield of blackgram by 15.100 and 17.600 kg/ha, respectively. Hence, as the weed dry weight were lowered in weed free and other better treatments, the seed and stover yields were increased. These findings were in close vicinity with those reported by Choudhary *et al*. (2012), Gupta *et al*. (2013), Dhakad*et al*. (2023) and Marimuthu *et al.* (2024). The semblance of data asserted that weed free recorded lower weed index (00%) which was followed by interculturing followed by hand weedings at 20 and 40 DAS (10.9%), post-emergence application of imazethapyr + imazamox @ 50 (25 + 25) g/ha *fb*interculturing at 40 DAS (13.5%) and imazethapyr + imazamox @ 60 (30 + 30) g/ha *fb*interculturing at 40 DAS (15.0%). Whereas, the higher weed index was observed under unweeded check (59.9%).Similar findings were correspondingly reported by Komal *et al*. (2015) and Sahoo *et al*. (2017).

Table 1. Effect of weed management practices on category wise weed dry weight at 15 DAS in blackgram

Treatments	**Weed dry weight (g/m^2)**			
	Sedges	**Grasses**	**Broad leaf weeds**	**Total**
T_1: Pendimethalin @ 750 g/ha *fb* interculturing at 40 DAS	1.20b* (1.07**)	1.94b (3.26)	2.37b(5.10)	3.15b(9.43)
T_2: Quizalofop-p-ethyl @ 38 g/ha *fb* interculturing at 40 DAS	1.69a (2.36)	2.58a (6.14)	3.45a (11.43)	4.52a (19.94)
T_3: Quizalofop-p-ethyl @ 50 g/ha *fb*interculturing at 40 DAS	1.97a (3.40)	2.74a (7.03)	3.35a (10.98)	4.67a (21.41)
T_4: Imazethapyr @ 50 g/ha *fb*interculturing at 40 DAS	1.84a (2.91)	2.99a (8.60)	3.47a (11.58)	4.85a (23.08)
T_5: Imazethapyr @ 75 g/ha *fb*interculturing at 40 DAS	1.85a (2.99)	2.61a (6.97)	3.58a (12.35)	4.76a (22.31)
T_6: Fenoxaprop-p-ethyl @ 56.25 g/ha *fb*interculturing at 40 DAS	1.95a (3.32)	3.04a (8.76)	3.53a (12.00)	4.96a (24.08)
T_7: Fenoxaprop-p-ethyl @ 67.5 g/ha *fb*interculturing at 40 DAS	1.74a (2.52)	2.64a (6.47)	3.62a (12.67)	4.70a (21.66)
T_8: Imazethapyr + imazamox @ 50 (25 + 25) g/ha *fb*interculturing at 40 DAS	2.01a (3.54)	2.84a (7.54)	3.41a (11.43)	4.78a (22.51)
T_9: Imazethapyr + imazamox @ 60 (30 + 30) g/ha *fb*interculturing at 40 DAS	1.79a (2.83)	3.01a (8.59)	3.66a (12.89)	4.98a (24.31)
T_{10}: Interculturing followed by hand weedings at 20 and 40 DAS	1.93a (3.25)	3.06a (8.88)	3.10a (9.21)	4.67a (21.35)
T_{11}: Weed free	0.71c (0.00)	0.71c (0.00)	0.71c (0.00)	0.71c (0.00)
T_{12}: Unweeded check	1.89a (3.07)	2.94a (8.15)	3.31a (10.45)	4.71a (21.67)
S.Em.±	**0.13**	**0.19**	**0.20**	**0.17**
C.V.%	**12.69**	**12.51**	**11.19**	**6.91**

**Data analyzed after square root transformation √ (x + 0.5); **Figures in parentheses are original values*

Table 2. Effect of weed management practices on category wise weed dry weight and WCE at 40 DAS in blackgram

Treatments	**Weed dry weight (g/m²)**				**WCE (%)**
	Sedges	**Grasses**	**Broad leaf weeds**	**Total**	
T_1: Pendimethalin @ 750 g/ha *fb* interculturing at 40 DAS	3.19c* (9.85**)	4.05c(16.10)	4.43c(19.20)	6.76c (45.16)	60.32
T_2: Quizalofop-p-ethyl @ 38 g/ha *fb* interculturing at 40 DAS	3.86b (14.49)	4.91b (23.68)	5.40b (28.72)	8.21b (66.88)	41.22
T_3: Quizalofop-p-ethyl @ 50 g/ha *fb* interculturing at 40 DAS	3.84b (14.33)	4.85b (23.11)	5.36b (28.39)	8.14b (65.82)	42.15
T_4: Imazethapyr @ 50 g/ha *fb* interculturing at 40 DAS	3.03c (8.70)	3.94c (15.44)	4.39c (18.89)	6.60c (43.03)	62.19
T_5: Imazethapyr @ 75 g/ha *fb* interculturing at 40 DAS	2.92c (8.10)	3.86c (14.44)	4.34c (18.40)	6.44c (40.94)	64.02
T_6: Fenoxaprop-p-ethyl @ 56.25 g/ha *fb* interculturing at 40 DAS	4.00b (15.64)	4.97b (24.26)	6.01b (35.67)	8.72b (75.57)	35.59
T_7: Fenoxaprop-p-ethyl @ 67.5 g/ha *fb* interculturing at 40 DAS	3.90b (14.81)	4.92b (23.76)	5.88b (34.11)	8.55b (72.69)	36.12
T_8: Imazethapyr + imazamox @ 50 (25 + 25) g/ha *fb* interculturing at 40 DAS	2.26d (4.77)	2.94d (8.24)	3.39d (11.47)	4.99d (24.48)	78.49
T_9: Imazethapyr + imazamox @ 60 (30 + 30) g/ha *fb* interculturing at 40 DAS	2.16d (4.18)	2.56d (6.17)	3.43d (11.29)	4.70d (21.63)	80.99
T_{10}: Interculturing followed by hand weedings at 20 and 40 DAS	2.12d (4.02)	2.42d (5.55)	3.16d (10.07)	4.45d (19.64)	82.74
T_{11}: Weed free	0.71e (0.00)	0.71e (0.00)	0.71e (0.00)	0.71e (0.00)	100.00
T_{12}: Unweeded check	4.63a (20.99)	6.33a (39.93)	7.29a (52.88)	10.67a (113.79)	0.00
S.Em.±	**0.20**	**0.25**	**0.28**	**0.22**	**NA**
C.V.%	**11.60**	**11.15**	**11.00**	**5.87**	

**Data analyzed after square root transformation √ (x + 0.5); **Figures in parentheses are original values*

Table 3. Effect of weed management practices on category wise weed dry weight and WCE at harvest in blackgram

Treatments	Weed dry weight (g/m^2)				WCE (%)
	Sedges	**Grasses**	**Broad leaf weeds**	**Total**	
T_1: Pendimethalin @ 750 g/ha *fb* interculturing at 40 DAS	3.47c* (11.57**)	2.88c (7.84)	3.35c (10.78)	5.54c (30.19)	66.25
T_2: Quizalofop-p-ethyl at @ g/ha *fb* interculturing at 40 DAS	4.53b (20.18)	3.60b (12.48)	4.77b (22.31)	7.44b (54.97)	38.54
T_3: Quizalofop-p-ethyl @ 50 g/ha *fb* interculturing at 40 DAS	4.28b (17.82)	3.58b (12.33)	4.69b (21.55)	7.24b (51.70)	42.20
T_4: Imazethapyr @ 50 g/ha *fb* interculturing at 40 DAS	3.46c (11.44)	2.85c (7.62)	3.29c (10.75)	5.49c (29.82)	66.66
T_5: Imazethapyr @ 75 g/ha *fb* interculturing at 40 DAS	3.33c (10.58)	2.60c (6.29)	2.97c (8.32)	5.07c (25.19)	71.83
T_6: Fenoxaprop-p-ethyl @ 56.25 g/ha *fb* interculturing at 40 DAS	4.63b (21.03)	3.80b (13.93)	4.89b (23.43)	7.67b (58.39)	34.71
T_7: Fenoxaprop-p-ethyl @ 67.5 g/ha *fb* interculturing at 40 DAS	4.57b (20.44)	3.68b (13.02)	4.82b (22.87)	7.54b (56.32)	37.03
T_8: Imazethapyr + imazamox @ 50 (25 + 25) g/ha *fb* interculturing at 40 DAS	2.48d (6.02)	1.81d (2.80)	1.99d (3.55)	3.58d (12.37)	86.16
T_9: Imazethapyr + imazamox @ 60 (30 + 30) g/ha *fb* interculturing at 40 DAS	2.24d (4.54)	1.65d (2.63)	1.93d (3.22)	3.27d (10.39)	88.39
T_{10}: Interculturing followed by hand weedings at 20 and 40 DAS	2.08d (4.20)	1.56d (1.99)	1.82d (2.86)	3.08d (9.06)	89.87
T_{11}: Weed free	0.71e (0.00)	0.71e (0.00)	0.71e (0.00)	0.71e (0.00)	100.00
T_{12}: Unweeded check	5.93a (34.74)	5.00a (24.55)	5.51a (30.15)	9.48a (89.43)	0.00
S.Em.±	**0.22**	**0.17**	**0.21**	**0.18**	**NA**
C.V.%	**10.73**	**10.56**	**10.56**	**5.64**	

**Data analyzed after square root transformation √ (x + 0.5); **Figures in parentheses are original values*

Table 4. Effect of weed management practices on various growth parameters, yield, quality and weed index in blackgram

Treatments	Plant height (cm)	Number of branches per plant	Yield (kg/ha)			Protein content (%)	Protein yield (kg/ha)	Weed index (%)
			Pod	Seed	Stover			
T_1: Pendimethalin @ 750 g/ha *fb* interculturing at 40 DAS	40.65	4.90	1054	777	1808	22.22	172.65	27.8
T_2: Quizalofop-p-ethyl at @ g/ha *fb* interculturing at 40 DAS	33.15	4.25	867	640	1402	21.99	140.74	40.6
T_3: Quizalofop-p-ethyl at @ g/ha *fb* interculturing at 40 DAS	33.51	4.29	895	660	1443	22.06	145.60	38.7
T_4: Imazethapyr @ 50 g/ha *fb* interculturing at 40 DAS	42.35	5.10	1070	789	1824	22.10	174.37	26.8
T_5: Imazethapyr @ 75 g/ha *fb* interculturing at 40 DAS	42.82	5.14	1074	792	1857	22.03	174.48	26.4
T_6: Fenoxaprop-p-ethyl @ 56.25 g/ha *fb* interculturing at 40 DAS	31.11	4.17	757	559	1356	22.45	125.50	48.1
T_7: Fenoxaprop-p-ethyl @ 67.5 g/ha *fb* interculturing at 40 DAS	32.22	4.21	778	574	1391	22.27	127.83	46.7
T_8: Imazethapyr + imazamox @ 50 (25 + 25) g/ha *fb* interculturing at 40 DAS	49.64	6.02	1263	932	2224	22.48	209.51	13.5
T_9: Imazethapyr + imazamox @ 60 (30 + 30) g/ha *fb* interculturing at 40 DAS	49.40	5.94	1242	916	2169	22.47	205.83	15.0
T_{10}: Interculturing followed by hand weedings at 20 and 40 DAS	50.13	6.07	1302	960	2258	22.34	214.46	10.9
T_{11}: Weed free	51.60	6.93	1460	1077	2657	22.48	242.11	0.0
T_{12}: Unweeded check	30.73	3.29	585	432	999	21.93	94.74	59.9
S.Em.±	**2.13**	**0.26**	**49.12**	**36.23**	**104.26**	**0.37**	**9.13**	**NA**
CD at 5%	**6.25**	**0.75**	**144.07**	**106.25**	**305.77**	**NS**	**26.77**	
C.V.%	**9.10**	**8.81**	**8.27**	**8.27**	**10.13**	**2.87**	**9.35**	

Table 5. Correlation and regression equations for various dependent and independent parameters of blackgram

Sr. No.	Independent variable (x)	Dependent variable (y)	Correlation coefficient (r)	Regression equation y	R^2
1	Total weed dry weight at 40 DAS (g/m^2)	Seed yield (kg/ha)	-0.9880**	y = 1055.867 – 6.043x	0.9762
2	Total weed dry weight at harvest (g/m^2)		-0.9830**	y = 1011.133 – 7.074x	0.9662
17	Total weed dry weight at 40 DAS (g/m^2)	Stover yield (kg/ha)	-0.9823**	y = 2524.150 – 15.100x	0.9648
18	Total weed dry weight at harvest (g/m^2)		-0.9764**	y = 2411.851 – 17.660x	0.9534

*** = Significant at 1% * = Significant at 5%*

3.3 Quality Parameters

The analysis of data indicated that various weed management practices have not created significant difference on protein content of blackgram seeds. However, among different weed management practices weed free treatment recorded significantly higher protein yield (242.11 kg/ha). After weed free, significantly higher protein yield was found under interculturing followed by hand weedings at 20 and 40 DAS (214.46 kg/ha) and was noted as at par with post- emergence application of imazethapyr + imazamox @ 50 (25 + 25) g/ha (PoE) *fb*interculturing at 40 DAS (209.51 kg/ha) and imazethapyr + imazamox @ 60 (30 + 30) g/ha (PoE) *fb* interculturing at 40 DAS (205.83 kg/ha). Whereas, significantly lower protein yield was observed under unweeded check (94.74 kg/ha). This might be due to effective control of weeds resulting in the significant reduction in crop-weed competition which benefited the crop with more nutrients and water, which reflects in higher seed yield, accordingly higher protein yield. The similar consequences were also witnessed by Khot *et al*. (2016).

4. CONCLUSION

Based on the results of the oneyear experiment, it is concluded that interculturing followed by hand weedings at 20 and 40 DAS or application of imazethapyr + imazamox @ 50 (25 + 25) g/ha at 15-20 DAS *fb* interculturing at 40 DAS give effective control of weeds and provide higher seed and protein yield in blackgram.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Barla, A., Upasani, R. R. Efficacy of pre- and post-emergence application of imazethapyr and its ready-mix herbicides on growth, weed dynamics, and productivity of chickpea (*Cicer arietinum* L.). Legume Research: An International Journal. 2022; 45(2):253-259.

Choudhary, VK, Kumar, PS, Bhagawati, R. Integrated weed management in blackgram (*Vigna mungo*) under the mid hills of Arunachal Pradesh. Indian Journal of Weed Science. 2012;57(4):382-385.

De Candolle, A. *Origin of cultivated plants*. (English translation). London: Hafner Publishing Co. (Original work published 1882). pp. 411-415.

Dhakad, P, Kumar, S, Kanaujiya, PK, Kashyap, C. Effect of integrated weed management on yield and economics of black gram. The Pharma Innovation Journal. 2023;12(8):917-919.

Gassi, S, Tikoo, JL, Banerjee, SK. Changes in protein and methionine content in the maturing seeds of legumes. Seed Research. 1973;1:104-106.

Gill, GS, Kumar, V. Weed index: A new method for reporting weed control traits. Indian Journal of Agronomy. 1969; *6*(2), 96-98.

Gupta, V, Singh, M, Kumar, A, Sharma, BC, Kher, D. Influence of weed management practices on weed dynamics and yield of urdbean (*Vigna mungo*) under rainfed conditions of Jammu. Indian Journal of Agronomy. 2013;58(2):220-225.

Jakhar, P, Yadav, SS, Choudhary, R. Response of weed management practices on the productivity of urdbean (*Vigna mungo* L. Hepper). Journal of Applied and Natural Science. 2015;*7*(1):348-352.

Kaewwongwal, A, Kongjaimun, A, Somta, P, Chankaew, S, Yimram, T, Srinives, P. Genetic diversity of blackgram (*Vigna mungo* [L.] Hepper) gene pool as revealed by SSR markers. Breeding Science. 2015;65:127–137.

Khot, AB, Sagvekar, VV, Muthal, YC, Panchal, VV, Dhonde, MB. Effect of different sowing times and weed management practices on summer black gram (*Phaseolus mungo* L.) with respect to yield, quality, and nutrient uptake. International Journal of Tropical Agriculture. 2016;34(7):2155-2161.

Komal, Singh, SP, Yadav, RS. Effect of weed management on growth, yield, and nutrient uptake of greengram. Indian Journal of Weed Science. 2015;47(2):206-210.

Kondap, SM, Upadhyay, UC. A practical manual on weed control. Oxford and IBH Publishing Co. 1985.

Kumar, S, Bhatto, MS, Punia, SS, Punia, R. Bioefficacy of herbicides in blackgram and their residual effect on succeeding mustard. Indian Journal of Weed Science. 2015;47(2):211-213.

Manohar, B, Sushmita. Efficacy of pre- and post-emergence herbicide on weed growth and yield of kharif black gram (*Phaseolus mungo* L.). Indian Journal of Crop Science. 2019;7(6):2387-2390.

Mansoori, N, Bhadauria, N, Rajput, RL. Effect of weed control practices on weeds and yield of black gram (*Vigna mungo*). Legume Research. 2015;38(6):855-857.

Marimuthu, S, Gunasekaran, M, Parimaladevi, R, Subrahmaniyan, K, Byrareddy, VM, Mushtaq, S, Dhanalakshmi, A. Effective weed control through post-emergence herbicides to enhance blackgram (*Vigna mungo* L.) productivity in South India. Scientific Reports. 2024;14:26468.

Panse, VG, Sukhatme, PV. *Statistical methods for agricultural research workers*. ICAR Publishing, New Delhi, 1967.

Sahoo, S, Dhanapal, GN, Goudar, P, Sanjay, MT, Lal, MK. Yield and weed density of blackgram (*Vigna mungo* [L.] Hepper) as influenced by weed control methods. Journal of Applied and Natural Science. 2017;9(2):693-697.

Thimmegowda, MN, Hanumanthappa, DC, Ningoji, SN, Sannappanavar, S. Evaluation of weed management efficacy of post-emergence herbicides in blackgram under semi-arid Alfisols. Indian Journal of Weed Science. 2022;54(2):174-181.

Vavilov, NI. Centres of origin of cultivated plants. Bulletin of Applied Botany of Genetics and Plant-breeding. 1926;139-148.

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