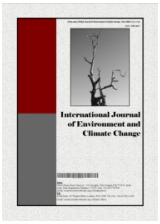

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Efficacy of Weed Management Practices on Weed Dynamics and Productivity of Blackgram

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Authors' contributions

This work was carried out in collaboration among all authors. Authors LM and BP designed the study, performed the statistical analysis and wrote the protocol. Authors SJ and MS managed the analyses of the study. Author BP managed the literature searches and wrote the first draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted during *kharif* 2018 at the Agronomy Main Research Farm, Odisha University of Agriculture and Technology, Bhubaneswar to study the effect of Integrated weed management in blackgram. The experiment was laid out in a randomized block design with a total of eight treatments replicated thrice. Important predominant grass, sedge and broad-leaved weeds found in the experimental field were *Eleusine indica* (12.6%)*, Cyperus rotundus* (8.9%) and *Celosia argentea* (9.7%), respectively. Severe weed competition in *kharif* blackgram recorded a yield loss of 66.7% in this experiment. Post Emergence application of Imazethapyr @ 0.75 kg/ha at 120 Days after sowing followed by one Hand Weeding at 30 DAS recorded lowest weed density (25.33 no./m^2), weed dry weight (38.98 g/m^2); highest weed control efficiency (83.4%) and lowest weed index (7.0%) at harvest.

Keywords: Weed flora; WCE; WI; imazethapyr; pendimethalin; hand weeding; yield.

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1. INTRODUCTION

Blackgram (*Vigna mungo*) is popularly known as urd or marsh bean is one of the most important pulse crop, grown across India. It is mostly cultivated during summer as well as in *kharif* season. Black gram contributes 13% of the total pulse area and 10% of total pulse production in India. The crop is resistant to adverse climatic conditions such as drought resistance and improves the soil physical properties and soil fertility and enrich the soil by fixing atmospheric nitrogen [1]. It is originated from Phaselous sublobatus- its wild progenitor [2]. India is also the largest producer and consumer of blackgram in the world. Blackgram is a protein rich food which is nearly three times as much as cereals. Blackgram supplies a major share of protein requirement of vegetarian population of the country. It is consumed in the form of split pulse as well as whole pulse, which is an essential supplement of cereal based diet. The combination of dal-Bhat (pulse-cooked rice) or dal-roti (pulse wheat bread) is an important ingredient in the average Indian diet. The green foliage of blackgram can also be used as animal feed and the residues as manure. The crop has special importance in intensive cropping system of the country due to its short growing duration.

The national average yield of blackgram has been stagnating around 0.7-0.8 t/ ha over the years and is far behind the research yield [3]. Among the various factors responsible for its poor productivity in the state, heavy weed infestation is the foremost. The degree of reduction in seed yield of blackgram due to weeds depends upon their density and duration of infestation. Weeds compete for water, nutrients and space and cause 43.2 to 90 per cent yield loss in blackgram [4].

Chemical weed management in pulse crops has been found effective and economical [5]. Chemical weed control has become imperative in this crop keeping in view the peak crop -weed competition which varies from 3-6 week after sowing [6] which is coincided with the peak monsoon rains during July-August. The continuous rainfall during the season makes the manual weeding impracticable [7]. Pre-emergence application of pendimethalin has been recommended to control weeds in this crop but this herbicide has limited period of its application and it does not control all types of weeds effectively. It cannot be used as post emergence in case of failure of spray at proper time.

2. MATERIALS AND METHODS

The experiment was conducted at Agronomy Main Research farm, College of Agriculture, Odisha University of Agriculture & Technology, Bhubaneswar during *kharif* 2018. It comes under the East and South Eastern Coastal Plain Agroclimatic Zone of Odisha. The soil of the experimental field was sandy loam in texture, acidic in reaction (pH-5.2), low in organic carbon (0.43%) with low available nitrogen (171.5 kg/ha) and medium in available phosphorus (30.36 kg/ha) and low potassium status (133.4 kg/ha).

During the whole cropping period different categories of weed species commonly present in the experimental field in different treatments were recorded. The number of weeds present in one square meter area and dry weight of weeds in each plot was counted at 15, 30, 45, DAS and at harvest. These weeds were further classified into sedges, grasses and broad-leaved weeds and their population was recorded. The weeds were uprooted from the destructive sampling area of one m^2 and were oven dried to a constant weight at 70℃ and the dry weight of weeds was expressed in g per m^2. Then these results are analysed through RBD design.

2.1 Weed Control Efficiency (%)

Weed control efficiency was calculated by the help of formula:

$$WCE= (X-Y/X)*100$$

Where, X: Weed dry matter production in weedy plot. Y: Weed dry matter production in treated plot.

2.2 Weed Index (%)

Weed index indicates the extent of reduction in yield due to weed competition. It was worked out for different treatments by adopting the formula:

$$\text{Weed index} = (A-B/A)*100$$

Where A: seed yield of the best treatment, B: seed yield of the particular treatment for which the index is computed.

3. RESULTS AND DISCUSSION

3.1 Weed Flora

An observation of the floristic composition of the *kharif* blackgram revealed that altogether 17 different species of weeds were existed in the experimental field. Broad leaved weeds were more dominant (44.4%) than grasses (40.48%) and sedges (15.12%) in the weedy plot of the experimental field. The problematic grasses were *Eleusine indica* (12.64%), *Digitaria ciliaris* (10.75%), *Echinochloa colonum* (9.6%). Among sedges, *Cyperus rotundus* (8.95%) was the most predominant weed. The broad-leaved weeds like *Celosia argentinea* (9.76%), *Eclipta alba* (7.38%), *Commelina benghalensis* (5.60%) and *Ludwigia parviflora* (4.18%) were found to be more conspicuous during different days after sowing. These weeds were observed because of the micro climatic condition available for them under blackgram. Similar weed species were also reported by Chaudhari et al. [8] and Sai [9].

3.2 Weed Population

Weed count taken at different stages of crop growth are presented in Fig. 1(a, b, c, d). The lowest weed population recorded in weed free treatment supplemented with two HW at 15 DAS and 30 DAS (T7) at harvest (19). Imazethapyr as PoE supplemented with one HW at 30 DAS (T6), Pendimethalin as PE + 1 HW at 30 DAS (T4) significantly reduced the total weed population at harvest. The unweeded control (T8) recorded the maximum total weed population at all stages (102.22, 192.29, 261.68 and 236.67).

At 15 DAS minimum number of grasses, sedges, broadleaf weeds were found in Pendimethalin 1.0 kg/ha as PE and Pendimethalin 1.0 kg/ha as PE + 1 HW at 30 DAS. Hence pre-emergence herbicides showed their efficiency at earlier stage of crop growth but later as the age of the crop progressed the effect declines and thus resulted more weeds at later stages. This is in conformity with the findings of Kaur et al. [10]. At 30 DAS the minimum weed density was recorded in weed free treatment fb two hand weeding at 15 DAS and 30 DAS followed by Imazethapyr 0.75 kg/ha as PoE supplemented with one hand weeding at 30 DAS. It indicates that post-emergence application of herbicides followed by one hand weeding at 30 DAS results in lower weed growth. This might be due to combined effect of herbicide and hand weeding to reduce the weed density. The results are in agreement with the findings of Singh et al. [11] and Tiwari et al. [12].

Table 1. Floristic composition of weed flora in the experimental field

Sl. No	Botanical name	Common name	Family	Percentage at 30 DAS
Grass				
1	*Cynodon dactylon*	Bermunda grass Devil grass	Poaceae	3.2
2.	*Digitaria ciliaris*	Large crab grass	Poaceae	10.7
3.	*Echinochloa colonum*	Jungle grass	Poaceae	9.6
4.	*Dactyloctenium aegyptium*	Crowfoot grass	Poaceae	4.2
5.	*Eleusine indica*	Goose grass, wild grass	Poaceae	12.6
Sedges				
1.	*Cyperus rotundus*	Purple nut sedge	Cyperaceae	8.9
2.	*Cyperus iria*	Umbrella sedge	Cyperaceae	6.1
Broad leaved				
1.	*Phyllanthus niruri*	Stone breaker	Euphorbiaceae	2.1
2.	*Commelina benghalensis*	Dayflower	Commelinaceae	5.6
3.	*Ludwigia parviflora*	Water primrose	Onagraceae	4.1
4.	*Celosia argentea*	Plumb cock"s comb	Amaranthaceae	9.7
5.	*Cleome rutidosperma*	Fringed spider flower	Cleomaceae, Caparidaceae	3.0
6.	*Ageratum conyzoides*	Goat weed	Asteraceae	1.9
7.	*Mimosa pudica*	Sensitive plant	Fabaceae	3.5
8.	*Amaranthus spinosus*	Spiny amaranth, spiny pig weed	Amaranthaceae	4.8
9.	*Eclipta alba*	False daisy	Asteraceae	7.3
10	*Sida acuta*	Common wire weed	Malvaceae	1.9

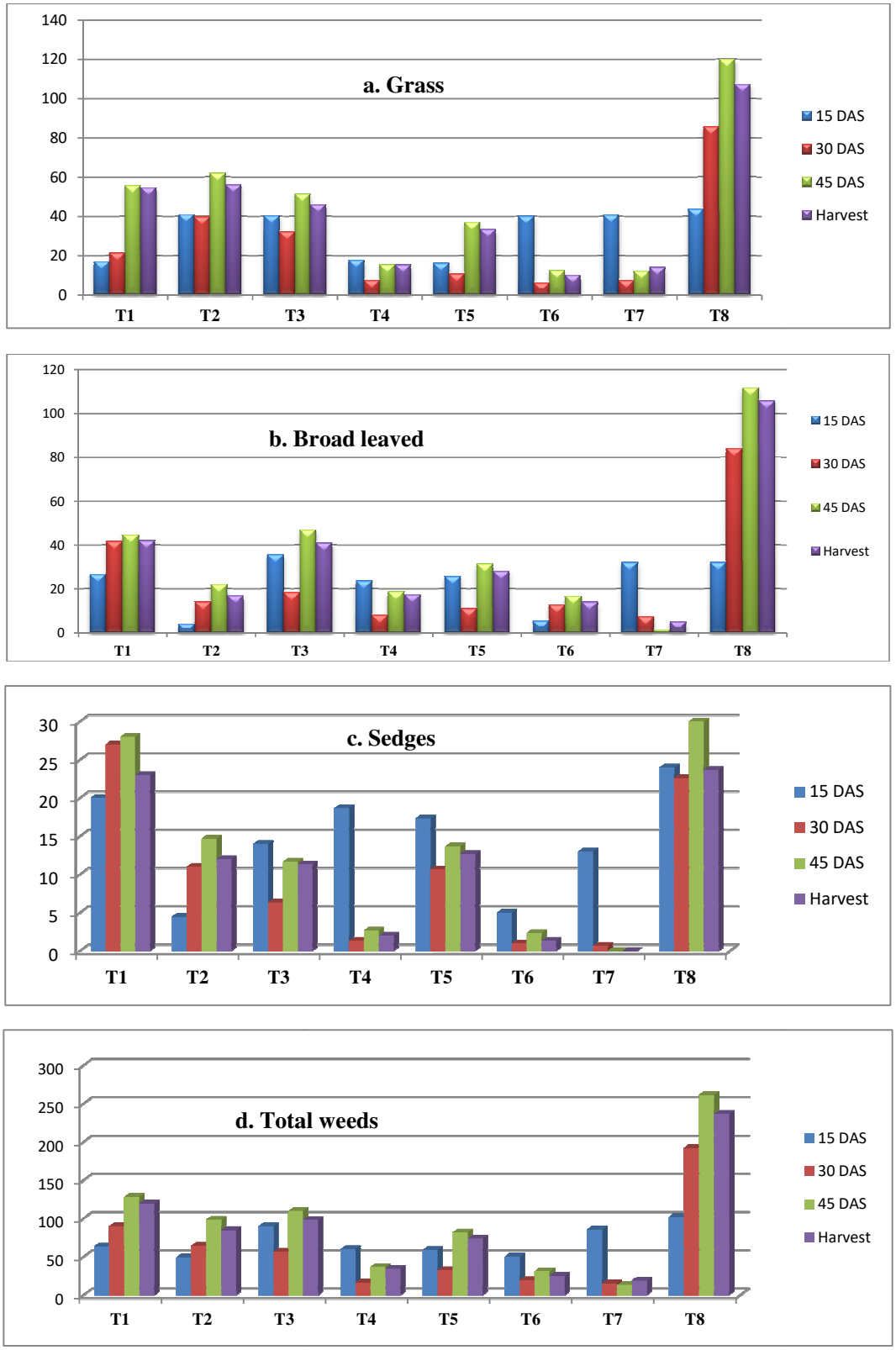

Fig. 1. Effect of different integrated weed control treatments on weed population/ m^2

Clodinafop Propargyl + Acifluorfen sodium (RM) 0.245 kg/ha as PoE and Pendimethalin 1 kg/ha as PE fb HW at 25-30 DAS were also effective for weed control and recorded less weed population. This might be due to the broad spectrum control of weeds by post-emergence herbicides. Sai [9] also recorded similar findings. At 45 DAS and harvest by two hand weeding at 15 DAS and 30 DAS (Weed free) recorded lowest weed count and was the most effective treatment at this stage which was followed by Imazethapyr 0.75 kg/ha as PoE supplemented with one hand weeding at 30 DAS. Hand weeding instantly removes all types of weeds and thus gives a clear assurance of weed control. This corroborated the earlier findings of Rathi et al. [13].

Among the single herbicide application lowest weed density at 30 DAS was found in clodinafop propargyl + acifluorfen sodium (RM) 0.245 kg/ha at 25 DAS as PoE. Harithavardhini [14] and Sai [9] also reported similar findings. After the imposition of all treatments, it was revealed that either two hand weeding or post emergence herbicide application supplemented with hand weeding at 30 DAS was the best weed management practice for reducing all types of weed population. The results are in agreement with the findings of Venkata rao et al. [15] and Chhodavadia et al. [1].

3.3 Weed Dry Weight

It was observed that there was progressive increase in total weed dry weight from sowing to harvest (Table 2). After weed free treatment Imazethapyr as PoE fb one HW at 30 DAS (T6) was recorded the minimum dry weight of weeds at all the stages of crop growth (3.81,2.42,9.44 and 12.89). This is closely followed by PE application of pendimethalin @ 1.0 kg/ha fb one HW at 30 DAS. Pendimethalin fb one mechanical weeding and Clodinafop Propargyl fb one Acifluorfen sodium (RM) also reduced dry weight of total weeds at all stages. Imazethapyr 0.75 kg/ha as PoE supplemented with one hand weeding at 30 DAS and Pendimethalin 1.0 kg/ha as PE supplemented with one hand weeding at 30 DAS significantly reduced the weed dry weight at all the stages of crop growth. The lowest dry matter accumulation (83.4% lower than weedy check) in Imazethapyr supplemented with one hand weeding could be ascribed to preferential absorption of Imazethapyr by susceptible weeds and effective control of weeds throughout the crop growing season reported by Harithavardhini et al. [14] also reported less weed dry weight due to Imazethapyr in blackgram. This is due to effective control of both pre and post emerged weeds at critical period of crop weed competition. Hand weeding results in better control because of uprooting of weeds from roots and thus reducing the dry weight. The results are in conformity with the findings of Venkata Rao et al. [15].

3.4 Weed Control Efficiency (WCE)

The weed control efficiency and weed index worked out for different weed control treatments is presented in Table 2. WCE varied in different treatments with time. At harvest after weed free treatment (T7), the maximum WCE of 83.41% was observed with Imazethapyr as PoE + one HW at 30 DAS (T6). Application of Pendimethalin @ 1.0 kg/ha as a PE recorded the lowest WCE of 42.48% (T1) after weedy check treatment (T8). The highest WCE (94.47%) was recorded with weed free treatment fb two hand weeding at 15 DAS and 30 DAS and the next best treatment was Imazethapyr 0.75 kg/ha as PoE supplemented with one hand weeding at 30 DAS. Nagender [16] and Venkata Rao et al. [15] also reported similar results.

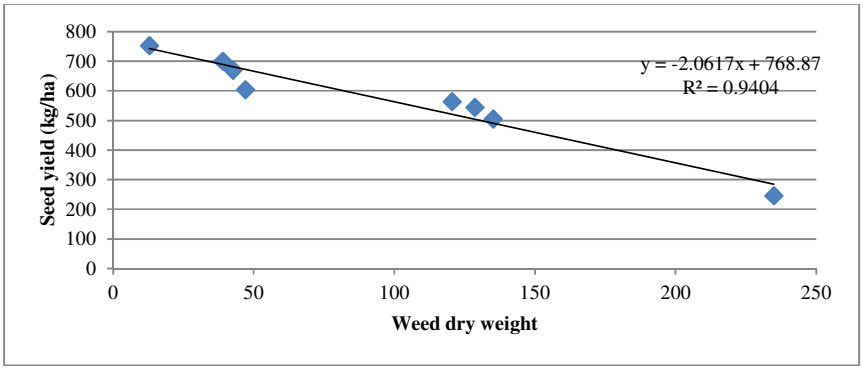

Fig. 2. Relationship between Weed dry weight and seed yield of Blackgram

Table 2. Effect of different integrated weed control treatments on weed control efficiency (%) at different stages and weed index (%) at harvest

Treatments	Dry wt. of weeds / m²				Weed control efficiency (%)				Weed Index	Yield (kg/ha)
	15 DAS	30 DAS	45 DAS	Harvest	15 DAS	30 DAS	45 DAS	Harvest		
Pendimethalin (1 kg/ha as PE)	3.7 (13.3)	6.1 (36.1)	9.1 (82.3)	11.6 (135.1)	6.2	55.5	43.0	42.5	32.2	504.7
Imazethapyr 0.75 kg/ha at 12 DAS as PoE	3.5 (11.7)	5.3 (27.7)	8.9 (80.2)	11.3 (128.5)	17.4	65.8	44.5	45.3	27.5	543.9
Clodinafop propargyl + Acifluorfen sodium (RM) 0.245 kg/ha at 25DAS as PoE	2.3 (5.0)	4.5 (19.3)	8.8 (77.7)	11.0 (120.5)	64.5	76.2	46.1	48.7	23.8	563.4
Pendimethalin (1 kg/ha) as PE fb one hand weeding at 30 DAS	2.1 (4.0)	3.6 (12.4)	5.6 (31.3)	6.5 (42.6)	71.3	84.6	78.3	81.9	10.7	669.7
Pendimethlin 1 kg/ha as PE fb Mechanical weeding by star weeder at 30 DAS	2.1 (4.3)	4.1 (16.5)	6.6 (43.0)	6.9 (47.0)	69.6	79.6	70.2	79.9	19.7	603.6
Imazethapyr 0.75 kg/ha as PoE fb one hand weeding at 30 DAS	1.9 (3.3)	3.1 (9.3)	5.2 (27.3)	6.3 (38.9)	76.6	88.4	81.1	83.4	7.0	699.7
Two hand weeding at 15 DAS and 30 DAS (Weed free)	2.0 (3.8)	1.7 (2.4)	3.1 (9.4)	3.6 (12.8)	73.2	97.0	93.5	94.5	0	752.1
No weeding (Weedy check)	3.8 (14.2)	9.0 (81.1)	12.0 (144.4)	15.3 (234.9)	0	0	0	0	66.7	245.5
SE m(±)	0.1	0.2	0.2	0.3	-	-				0.7
CD (P=0.05)	0.2	0.4	0.5	0.7						1.8

3.5 Weed Index (WI)

Weed index is the percentage reduction in crop yield due to presence of weeds in comparison with weed free plot. Weed index is decided by the yield of the crop. The lowest weed index (7.04%) was recorded in Imazethapyr as PoE + one HW at 30 DAS (T6) after weedy check treatment (T8). Weed index was lowest in weed free treatment (15 DAS and 30 DAS) closely followed by Imazethapyr as PoE supplemented with one hand weeding at 30 DAS which might be due to the fact that combined effect of both chemical and manual method resulted in effective weed control. The results are in accordance with the findings of Nagender [16] and Venkat rao et al. [15]. Weedy check recorded the maximum weed index (66.74%) followed by Pendimethalin @1.0 kg/ha as a PE (33.23%).

3.6 Seed Yield

The maximum yield attributes and grain yield was recorded in Imazethapyr 0.75 kg/ha as PoE supplemented with one hand weeding at 30 DAS among the herbicidal treatment. This might be due to better weed control action of herbicides when combined with manual weeding which has been finally reflected on growth parameters, yield attributes, yield and harvest index. Similar results were found by Tiwari et al. [12].

Weedy check recorded significantly the maximum weed density, weed dry weight, shortest plant height, minimum dry matter accumulation in crop and other growth parameters, lowest yield attributes and grain yield. The main reason behind this is that in weedy check uncontrolled voluminous weed growth resulted in severe crop weed competition and thus more depletion of resources like nutrients, water, solar radiation, CO2 etc. by weed. Weeds take away all the necessary requirements needed for the crop growth, development and photosynthesis. Severe weed competition in this treatment reduced yield to the extent of 68.5%. This is in conformity with the findings of Nagender [16] and Tiwari et al. [12] also reported similar yield reduction due to uncontrolled weed growth.

Relationship between dry weight and seed yield presented in Fig. 2. Showed that dry weight have high determination factor (R^2=0.9404) indicating a strong relationship between them. But from the equation we found that they are negatively correlated i.e. if drymatter is high then yield is found to be less. So in order to enhance productivity of Blackgram more focus should be laid to reduce weed population as well as dry weight.

4. CONCLUSION

Severe infestation of weeds reduced seed yield of kharif black gram to the extent of 66.74%. Among different weed management treatments, application of Imazethapyr 0.75 kg/ha as PoE at 120 DAS supplemented with one hand weeding at 30 DAS was recorded maximum weed control efficiency (83.4%) and lowest weed index (7.0%) consequently improves yield (699.7 kg/ha).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Chhodavadia SK, Mathukiya RK, Dobariya VK. Pre and post-emergence herbicides for integrated weed management in summer greengram. Indian Journal of Weed Science. 2013;45(2):137-139.
2. Zokovskij PM. Cultivated plants and their relatives, Commonwealth Agriculture Bureau London; 1962.
3. Patel KR, Patel BD, Patel VJ, Darji VB. Bio-efficacy of herbicides against weeds in blackgram. Indian Journal of Weed Science. 2015;47:78-81.L. Sharma, Bhusan B. Returns from pulses in different region for Rajsthan at alternative rice scenario. Agricultural science Digest. 2019; 39(1):1-7.
4. Rao AS, Rao GS, Ratnam M. Bio-efficacy of sand mix application of preemergence herbicides alone and in sequence with imazethapyr on weed control in relay crop of blackgram, Pak. J. Weed Sci. Res. 2010;16(3):279-285.
5. Dungarwal HS, Chaplot PC, Nagda BL. Chemical weed control in mungbean (*Phaseolus radiates* L.). Indian Journal of Weed Science. 2003;35:283-284.
6. Meylemans SB, Damme UR, Van P. Critical period of weed competition for blackgram (*Vigna mungo* L.) in Sri Lanka, Mededelingen - Faculteit Landbouwkundige en Toegepaste Biologische Wetenschappen Universiteit Gent. 1994;59:1351-1360.

7. Shweta, Singh VK. Integrated weed management in urd bean during kharif season. Indian Journal of Weed Science. 2005;37:121-122.
8. Chaudhari VD, Desai LJ, Chaudhari SN, Chaudhari PR. Effects of weed management on weeds, growth and yields of summer greengram [*Vigna radiata* L.], The Bioscan. 2016;11(1):531-534.
9. Sai NK. Effect of date of sowing and weed management techniques on yield of blackgram (*Vigna mungo* L.), M.Sc. (Ag.) (thesis), Indira Gandhi Krishi Vishwavidyalaya, Raipur; 2018.
10. Kaur G, Brar HS, Singh G. Effect of weed management on weeds, nutrient uptake, nodulation, growth and yield of summer mungbean (Vigna radiata), Indian Journal of Weed Science. 2010;42(1&2):114-119.
11. Singh RK, Verma A, Singh DK. Effect of weed management practices on yield of greengram (*Vigna radiata* L.) and weed population under guava based agrihorticultural system in Vindhyan region. Environment and Ecology. 2015;33(4B): 1932- 1935.
12. Tiwari VK, Yadav RS, Mahajan R, Namdev B, Kumar S. Effect of weed management practices on yield attribution of urd bean under late sown. Journal of Pharmacognosy and Phytochemistry. 2018;7(1):742-746.
13. Rathi PK, Rathi JPS, Singh OP, Rajiv B. Production and economics of greengram under various row spacing in relation to weed control methods. Plant Archives. 2008;8(1):47.
14. Harithavardhini J, Jayalalitha K, Ashoka Rani Y, Krishnaveni B. Efficacy of post emergence herbicides on weed control efficiency partitioning of drymatter and yield of blackgram (*Vigna mungo* (L.) Hepper). International Journal of Food, Agriculture and Veterinary Sciences. 2016; 6(2):39-44.
15. Venkata Rao P, Subbarami Reddy A, Sateesh Babu J, Ramana MV. Integrated weed management practices for improved productivity and economics in mungbean (*Vigna radiata* (L.). Journal of Research ANGRAU. 2017;45(1):32-38.
16. Nagender T. Studies on integrated weed management in greengram (*Vigna radiata* L.), M.Sc. (Ag.) (thesis), Acharya N. G. Ranga. Agricultural University, Rajendranagar, Hyderabad; 2014.

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