



An Integrated Effect of Weed Management in Blackgram

**Boya Mamatha Kumari^a, M. Mohamed Yassin^{a*},
S. Anitta Fanish^b, K. Vanitha^c and P. K. Padmanathan^d**

^a Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore - 641 003, Tamil Nadu, India.

^b Department of Pulses, Tamil Nadu Agricultural University, Coimbatore - 641 003, Tamil Nadu, India.

^c Department of Fruit Science, Tamil Nadu Agricultural University, Coimbatore - 641 003, Tamil Nadu, India.

^d Department of Farm Machinery and Power Engineering, Tamil Nadu Agricultural University, Coimbatore - 641 003, Tamil Nadu, India.

Authors' contributions

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

Article Information

DOI: 10.9734/IJPSS/2023/v35i183431

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/103787>

Original Research Article

Received: 01/07/2023

Accepted: 29/07/2023

Published: 04/08/2023

ABSTRACT

A field experiment was conducted at Wetlands farm, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore during *summer season* (March-June) of 2023, to study the effect of different weed management practices on weed flora, weed growth and yield of summer irrigated blackgram (VBN11). The field experiment was laid out in Randomized Block Design with nine treatments and three replications. Treatments comprised of power operated weeder at 15 DAS and 30 DAS with 40 × 7.5 cm and 45 × 7.5 cm plant spacing; pre-emergence application of pendimethalin 30% EC @ 1 kg ha⁻¹ fb (followed by) power operated weeder at 20 DAS with 40 × 7.5 cm and 45 × 7.5 cm plant spacing; pre-emergence application of pendimethalin 30% EC @ 1 kg ha⁻¹ fb early post emergence application of Imazethapyr @ 100 g ha⁻¹ + Quizalofop-ethyl @ 50 g

*Corresponding author: E-mail: mmyassin@tnau.ac.in;

ha⁻¹ (Tank mix) at 20 DAS with 40 × 7.5 cm plant spacing and 45 × 7.5 cm plant spacing; hand weeding at 20 DAS and 40 DAS with 30 × 10 cm plant spacing. The results revealed that among the various weed management practices, the weeds were effectively controlled by the pre-emergence application of pendimethalin 30 % EC @ 1 kg ha⁻¹fb power weeder at 20 DAS with 40 × 7.5 cm plant spacing with significantly lower weed density, higher Weed Control Efficiency and higher grain yield (881 kg ha⁻¹).

Keywords: Altering crop geometry; Blackgram; early post emergence herbicides; mechanical weeding; power weeder; pre-emergence.

1. INTRODUCTION

Pulses are the second most staple food crop following cereals. A special role is assumed by pulses in India's nutritional food security. These are nutritious foods with long shelf-life. They are an excellent source of protein, fiber, minerals, vitamins and phenolic compounds which plays a prominent role in control of chronic diseases. Vieira et al. [1] have reported reduced childhood obesity with regular consumption of pulses and in addition to the control of glycemic response in diabetic children. Blackgram (*Vigna mungo* L., Family: Leguminosae) is the fourth most important pulse crop in India with 8% of the total pulse area. The area under blackgram in India is 4.14 million hectares with an annual production of 2.22 million tonnes and productivity of 538 kg ha⁻¹. Madhya Pradesh is the leading state in India with an area of 1.3 million hectares accounting for a production of 0.44 million tonnes. In Tamil Nadu, the area under blackgram is 0.402 million hectares with an annual production of 0.22 million tonnes (INDIASTAT, 2020-2021) [2]. Pulses are majorly grown by the farmers under poor resource conditions with poor management practices which are restricting its potential yield. Among the various factors affecting the yield of blackgram, weeds play a decisive role. An initial period of 20 to 40 days is very critical which reduces yield to the extent of 87% depending upon the weed density and flora [3]. The critical period of crop weed competition in blackgram is 20 – 40 days after sowing [4]. Most of the farmers fail to manage the weeds which reduces the crop's potential yield by 46 – 53% in the *summer* [3,5] and by 43.2 – 64.1% in the *kharif* [6,5]. This put forth for the emergency of weed management in blackgram. Weeds can be controlled by different methods like physical, chemical, mechanical and biological. Manual weeding is tedious and there is a difficulty in weeding on time due to labour scarcity at peak periods. With the introduction of mechanization, it is now more important than ever to complete tasks promptly in order to acquire the best yields

from various crops [7]. Plant density plays a vital role in yield of most of the legumes. Maintenance of optimum spacing facilitates plants to grow comfortably in both aerial and underground and thus utilizing resources such as water, nutrients and solar radiation effectively, thereby producing more yield [8]. The crop geometry was altered to 40×7.5 cm, 45×7.5 cm instead of 30×10 cm in order to promote the usage of power operated weeder.

2. MATERIALS AND METHODS

2.1 Experimental Site

A field experiment was conducted at Wetlands farm, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore during *summer* irrigated season (March-June) of 2023. The geographical location of field is, with a latitude of 11°0'9.0648"N, longitude of 76°55'40.7028"E and 462.2 m above the mean sea level in Tamil Nadu western agro-climatic zone. The texture of the soil in the experimental field was clay loam. The pH and EC of the experimental field was recorded as 7.84 and 0.442 ds m⁻¹. The experiment was laid in Randomized Block Design with nine treatments and three replications (Fig. 1). The treatment details are mentioned in Table 1.

Tank mix: It is a process in which two different herbicides are mixed in a spray tank prior to spraying.

2.2 Sowing and Crop Management Practices

Blackgram variety VBN11 was used as a test variety for the experiment. For irrigated blackgram, the recommended fertilizer dose was 25 kg ha⁻¹N, 50 kg ha⁻¹P₂O₅, 25 kg ha⁻¹K₂O and 40 kg ha⁻¹ of sulphur, which were applied in the form of urea, single super phosphate and muriate of potash. The entire dose of fertilizers was applied at the time of sowing as basal. For

irrigated blackgram, the seed rate of 20 kg ha⁻¹ was used. Weed management was done as per the schedule of the treatments. PE and EPoE herbicides were applied with a spray fluid of 500 litres per hectare using knapsack battery operated hand sprayer in certain treatments at 3 DAS and

20 DAS respectively (Fig. 2 and Fig. 3). The power operated weeder (blade width of 30 cm) was used for removing weeds in certain treatments according to the intervals mentioned in the treatments (Fig. 4).

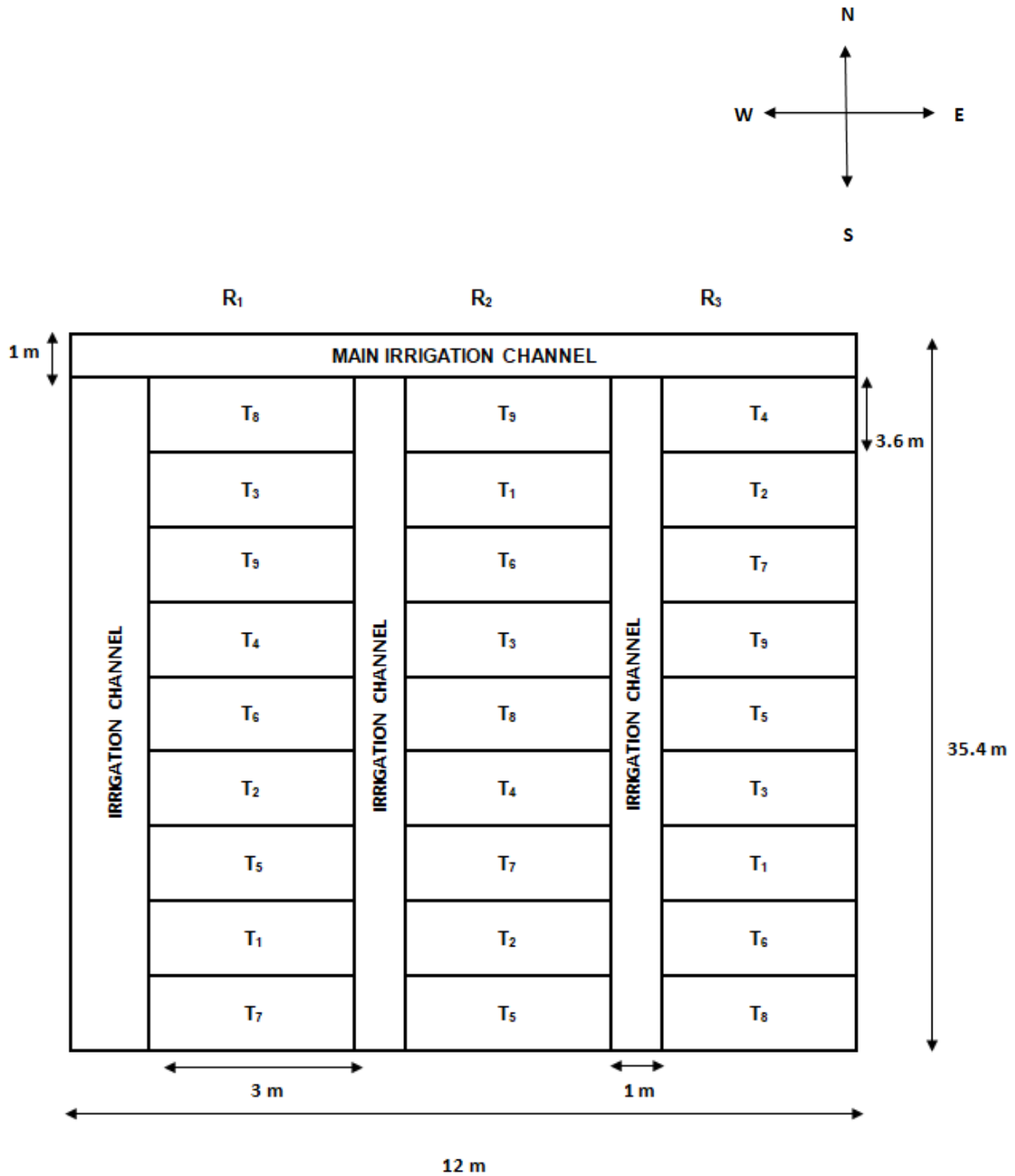


Fig. 1. Layout of experimental field

Table 1. Treatment details of field experiment

| |
|---|
| T ₁ -Power Operated Weeder at 15 DAS and 30 DAS with 40 × 7.5 cm plant spacing |
| T ₂ - Power Operated Weeder at 15 DAS and 30 DAS with 45 × 7.5 cm plant spacing |
| T ₃ - PE Pendimethalin 30% EC @ 1 kgha ⁻¹ fb Power operated weeder at 20 DAS with 40 × 7.5 cm plant spacing |
| T ₄ - PE Pendimethalin 30% EC @ 1 kgha ⁻¹ fb Power operated weeder at 20 DAS with 45 × 7.5 cm plant spacing |
| T ₅ - PE Pendimethalin 30% EC @ 1 kgha ⁻¹ fb EPoE Imazethapyr @ 100 g ha ⁻¹ + Quizalofop-ethyl @ 50 g ha ⁻¹ (Tank mix) at 20 DAS with 40 × 7.5 cm plant spacing |
| T ₆ - PE Pendimethalin 30% EC @ 1 kgha ⁻¹ fb EPoE Imazethapyr @ 100 g ha ⁻¹ + Quizalofop-ethyl @ 50 g ha ⁻¹ (Tank mix) at 20 DAS with 45 × 7.5 cm plant spacing |
| T ₇ - Hand weeding at 20 DAS and 40 DAS with 30 × 10 cm plant spacing |
| T ₈ - Weedy check with 30 × 10 cm plant spacing |
| T ₉ - Weed free with 30 × 10 cm plant spacing |

DAS – Days After Sowing; PE - Pre emergence; EPoE - Early post emergence; fb- Followed by



Fig. 2. PE application of Pendimethalin 30% EC @ 1 kg ha⁻¹



Fig. 3. EPoE application of Imazethapyr @ 100 g ha⁻¹ + Quizalofop-ethyl @ 50 g ha⁻¹ (Tank mix) at 20 DAS



Fig. 4. Power operated weeding

2.3 Observations on Weed

2.3.1 Weed flora

Weeds were identified and classified into three categories such as grasses, sedges and broad-leaved weeds.

2.3.2 Weed density (No. m⁻²)

The weeds were counted by placing a quadrat with dimensions of 0.5 m × 0.5 m (0.25 m²) at four random places in each plot at 15, 30, and 45 DAS. The total sum of all weeds was expressed in No. m⁻² [9].

2.3.3 Weed dry weight (g m⁻²)

The weeds were taken from each plot by placing quadrat (0.25 m²) at four random places and the samples were shade dried and then it was placed in hot air oven at 70 C for 48 hours and then dry weight was taken and expressed in g m⁻². All the weed data were statistically analysed by subjecting with Analysis of Variance as reported by Gomez and Gomez [10]. The pooled data of weeds were transformed to square root method ($\sqrt{X + 0.5}$) and probability of significant difference made at P ≤ 0.05.

2.3.4 Weed Control Efficiency (WCE)

Weed control efficiency was calculated by the formula proposed by Mani et al. [11].

$$\text{WCE (\%)} = \frac{\text{Weed density in weedy check plot} - \text{Weed density in treated plot}}{\text{Weed density in weedy check plot}} \times 100$$

2.3.5 Weed Control Index (WCI)

WCI was calculated as per the formula suggested by Mishra and Tosh [12].

$$\text{WCI (\%)} = \frac{\text{Weed dry weight in weedy check plot} - \text{Weed dry weight in treated plot}}{\text{Weed dry weight in weedy check plot}} \times 100$$

2.4 Yield

The pods after got matured, were separated from each plot and dried in the sun. Later, the pods were threshed manually, winnowed and the seeds were dried till the moisture content in it was reduced to 12 %. The seeds were weighed and thus obtained value was expressed in kg ha⁻¹. The data was statistically analysed at 5 percent level of significance [10].

3. RESULTS AND DISCUSSION

3.1 Weed Flora

The experimental field was observed more with grass species followed by broad leaved weeds. The major grass species found in the experimental plots were *Echinochloa colona*, *Echinochloa crusgalli* and broad leaf weed species viz., *Abutilon indicum*, *Trianthema portulacastrum*, *Portulaca oleracea*, *Cleome viscosa* and *Corchorus olitorius*; sedges were not found in the experimental field.

3.2 Weed Density

The data related to weed density is presented in Table 2. At 15 DAS, among the different treatments, T₃, T₄, T₅, T₆ which were statistically on par have shown less in weed density (30.33, 34, 31.33 and 37.67 No. m⁻² respectively) over the weedy check (319.67 No. m⁻²) due to the suppression of weed growth by the usage of pendimethalin 30% EC @1 kg ha⁻¹. Similarly, Reddy et al. [13] also reported lower weed density by the usage of Pendimethalin 30% EC @ 1kg ha⁻¹. The remaining treatments have shown more weed density due to uninterrupted weed growth. At 30 DAS, T₃ and T₄ treatments which were statistically on par have shown lower weed growth (8 and 11.33 No. m⁻²) due to the management of weeds using power weeder which was followed by T₅, T₆ treatments with weed growth of 17 and 21.67 No. m⁻²) due to the EPoE application of Imazethapyr 10 % SL + Quizalofop-ethyl 5 % EC (Tank mix) over the weedy check (389.33 No. m⁻²). At 45 DAS, T₃ and T₄ recorded least weed growth (18 and 20.67 No. m⁻²) compared to other treatments, however there was a slight increase in number of weeds when compared to 30 DAS but was on par with T₅ and T₇ treatments. More weed density (41.67 and 48.33 No. m⁻²) observed in T₁ and T₂ due to regrowth of weeds.

3.3 Weed Dry Weight

Weed management practices followed at different growth stages has shown a significant impact on weed dry weight (Table 2). At 15 DAS, T₃, T₄, T₅, T₆ treatments have shown lesser weed dry weight (1.88, 2.17, 1.93 and 2.33 g m⁻², respectively) due to the restriction of weed germination by the action of pendimethalin 30 % EC @1 kg ha⁻¹ over the weedy check and other treatments with more dry weight (10.72 g m⁻²) due to undisturbed weed growth. (Pendimethalin 30 % EC @1 kg ha⁻¹ has recorded lowest weeds in blackgram [14]. At 30 DAS, T₃ and T₄ treatments which were statistically on par have shown lower weed dry weight (5.22 and 6.43 g m⁻²) due to the management of weeds using power weeder at 20 DAS. Similar results of weed management using power weeder at 20 DAS were reported by Lavanya et al. [15]. Next best treatment T₅ with lower weed dry weight (11.19 g m⁻²) was statistically on par with T₆ treatment (13.41 g m⁻²) due to the control of weeds by the EPoE application of Imazethapyr 10 % SL + Quizalofop-ethyl 5 % EC (Tank mix). At 45 DAS, T₃ and T₄ recorded lower weed dry weight (8.27

and 9.2 g m⁻²) compared to other treatments however, there was a slight increase in number of weeds when compared to 30 DAS and was on par with T₅ and T₇ treatments. Weed dry weight was more in T₁ and T₂ (18.77 and 20.07 g m⁻²) due to regrowth of weeds.

3.4 Weed Control Efficiency

The data related to WCE were represented in Table 3. Among the treatments, weed control efficiency was highest in T₃ and T₄ treatments due to the control of weeds initially by pendimethalin and later by the usage of power weeder followed by T₅, T₆ treatments as the weeds were controlled initially by pendimethalin 30 % EC @1 kg ha⁻¹, later by EPoE application of Imazethapyr 10 % SL + Quizalofop-ethyl 5 % EC (Tank mix). Similar results were reported by Sukumar and Kunjammal [16] with higher weed control efficiency of 91.27%.

3.5 Weed Control Index

The different weed management methods had a significant impact on weed control (Table 3). The lowest weed control was recorded in T₁ and T₂ treatments due to regrowth of weeds after weeding and higher weed control index of 82.4% at 15 DAS, 97% at 30 DAS and 94.9% at 45 DAS was observed in T₃ treatment due to the continual interruption to the weeds at 3 DAS and 20 DAS which was statistically on par with T₄ treatment with weed control index of 79.80% at 15 DAS, 96.40% at 30 DAS and 94.35% at 45 DAS as similar weed management practices were followed. The results were also confirmed by Mahilang et al. [17] with less weed population as the more weeding efficiency of power weeder (91%).

3.6 Grain Yield

Grain yield has shown significant difference among the various weed management practices (Fig. 5). Pre-emergence application of pendimethalin 30 % EC @1 kg ha⁻¹ followed by power operated weeding at 20 DAS with 40 × 7.5 cm spacing (T₃) produced higher grain yield of (881 kg ha⁻¹) which was statistically on par with (T₄) pre-emergence application of pendimethalin 30 % EC @1 kg ha⁻¹ followed by power operated weeding at 20 DAS with 45 × 7.5 cm spacing obtained grain yield of 871 kg ha⁻¹ followed by remaining treatments. The lesser grain yield of 553 kg ha⁻¹ was observed in T₈ (Weedy check). Thus, there was 41.5% reduction in yield in

weedy check over weed free condition. Similar results were reported by Kumar et al. [18] with 48.1% reduction in grain yield of blackgram under uncontrolled weed condition.

Table 2. Effect of weed management methods on weed density (No. m⁻²) and weed dry weight (g m⁻²)

| Treatments | Weed density (No. m ⁻²) | | | Weed dry weight (g m ⁻²) | | |
|----------------|-------------------------------------|-------------------|-------------------|--------------------------------------|-------------------|-------------------|
| | 15 DAS | 30 DAS | 45 DAS | 15 DAS | 30 DAS | 45 DAS |
| T ₁ | 16.83 (284.33) | 9.72 (94) | 6.49 (41.67) | 3.21 (9.79) | 5.00 (24.56) | 4.37 (18.77) |
| T ₂ | 17.25 (297) | 10.00 (99.67) | 6.98 (48.33) | 3.21 (9.84) | 5.18 (26.34) | 4.53 (20.07) |
| T ₃ | 5.57 (30.33) | 2.91 (8) | 4.29 (18) | 1.50 (1.88) | 2.39 (5.22) | 2.94 (8.27) |
| T ₄ | 5.87 (34) | 3.44 (11.33) | 4.59 (20.67) | 1.63 (2.17) | 2.63 (6.43) | 3.11 (9.2) |
| T ₅ | 5.59 (31.33) | 4.13 (17) | 5.05 (25) | 1.56 (1.93) | 3.42 (11.19) | 3.76 (13.73) |
| T ₆ | 6.17 (37.67) | 4.70 (21.67) | 5.53 (30.67) | 1.68 (2.33) | 3.73 (13.41) | 4.08 (16.31) |
| T ₇ | 17.41 (302.67) | 7.03 (49) | 4.94 (24) | 3.24 (9.98) | 4.51 (19.89) | 2.74 (7.13) |
| T ₈ | 17.89 (319.67) | 19.74 (389.33) | 15.13 (228.33) | 3.35 (10.72) | 13.48 (182.16) | 12.79 (163.27) |
| T ₉ | 0.71 (0) | 0.71 (0) | 0.71 (0) | 0.71 (0) | 0.71 (0) | 0.71 (0) |
| SEd | 0.501 | 0.336 | 0.341 | 0.14 | 0.319 | 0.323 |
| CD(P=0.05) | 1.061 | 0.712 | 0.723 | 0.297 | 0.677 | 0.685 |

(The values in the table are square root transformed values, original values are represented in parentheses)

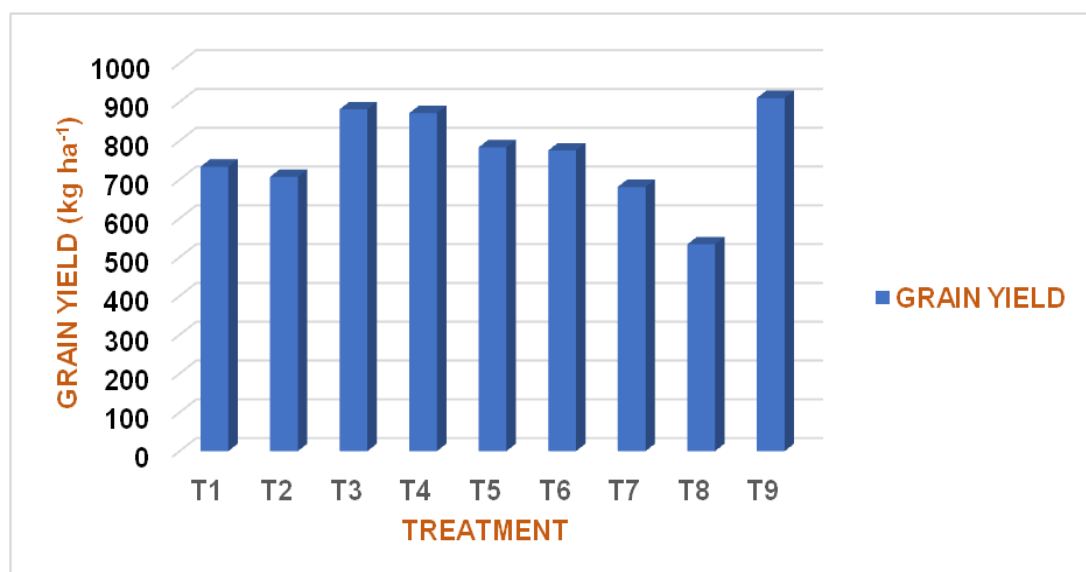


Fig. 5. Effect of different weed management methods on grain yield (kg ha⁻¹) of blackgram

Table 3. Effect of weed management methods on Weed Control Efficiency (WCE) and Weed Control Index (WCI)

| Treatments | WCE (%) | | | WCI (%) | | |
|----------------|---------|--------|--------|---------|--------|-------|
| | 15 DAS | 30 DAS | 45 DAS | 15 DAS | 30 DAS | 45DAS |
| T ₁ | 10.96 | 75.79 | 81.73 | 8.74 | 86.17 | 88.34 |
| T ₂ | 7.07 | 74.34 | 78.84 | 8.22 | 95.70 | 87.64 |
| T ₃ | 90.52 | 97.95 | 92.10 | 82.47 | 97.07 | 94.93 |
| T ₄ | 89.36 | 97.08 | 90.93 | 79.80 | 96.40 | 94.35 |
| T ₅ | 90.21 | 95.58 | 89.03 | 82.02 | 93.78 | 91.63 |
| T ₆ | 88.21 | 94.45 | 86.57 | 78.25 | 92.50 | 89.85 |
| T ₇ | 5.34 | 87.42 | 89.50 | 6.94 | 88.86 | 95.55 |
| T ₈ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| T ₉ | 100 | 100 | 100 | 100 | 100 | 100 |



Fig. 6. PE Pendimethalin 30% EC @ 1 kg ha⁻¹ fb Power operated weeder at 20 DAS with 40 × 7.5 cm plant spacing (T₃)



Fig. 7. PE Pendimethalin 30% EC @ 1 kg ha⁻¹ fb Power operated weeder at 20 DAS with 45 × 7.5 cm plant spacing (T₄)



Fig. 8. Weedy Check plot

4. CONCLUSION

The results revealed that the integrated approach of pre-emergence application of Pendimethalin 30 % EC @ 1 kg ha⁻¹ followed by power operated weeder at 20 DAS with crop geometry of 40 × 7.5 cm was the best option to manage the weeds in summer irrigated blackgram to get higher grain yield (881 kg ha⁻¹) with higher weed control efficiency due to the decreased competition to the plants by weeds at critical growth stages of the crop.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Vieira ED, Gomes AM, Gil AM, Vasconcelos MW. Pulses benefits in children's diets: A narrative review. *Journal of Obesity and Chronic Diseases*. 2021; 5(1):13-22.
2. Indiastat; 2020-2021. Available: <https://www.indiastat.com/table/agriculture/state-season-wise-area-production-productivity-ura/1423714>
3. Bhandari V, Singh J, Randhawa JS, Randhawa RS. Studies on weed control in summer blackgram (*Phaseolus mungo*). *Indian Journal of Weed Science*. 2004;36(1and2):129-30.
4. Sarswat VN, Mishra JS. Weed management in pulse crops. In *Proceedings of International Seminar on Weed Management for Sustainable Agriculture*. Indian Society of Weed Science. 1993;(3):137-140.
5. Rathi JP, Tewari AN, Kumar M. Integrated weed management in blackgram (*Vigna mungo* L.). *Indian Journal of Weed Science*. 2004;36(3and4):218-20.
6. Chand R, Singh NP, Singh VK. Effect of weed control treatments on weeds and grain yield of late sown urdbean (*Vigna mungo* L.) during kharif season. *Indian Journal of Weed Science*. 2004; 36(1and2):127-8.
7. Singh J. Scope, progress and constraints of farm mechanization in India. *Status of farm mechanization in India*. 2005;48-56.
8. Kumar S, Rajput AS. Effect of variety and spacing on growth and yield of Blackgram (*Vigna mungo* L.) under vertisol of Chhattisgarh. *International Journal of Chemical Studies*. 2020;8(6):594-601.
9. Burnside OC, Wicks GA. Effect of Herbicides and Cultivation Treatments on Yield Components of Dryland Sorghum in Nebraska 1. *Agronomy Journal*. 1965;(1):21-4.
10. Gomez KA, Gomez AA. *Statistical procedures for agricultural research*. John Wiley & Sons; 1984.
11. Mani VS, Malla ML, Gautam KC. Weed-killing chemicals in potato cultivation. *Indian Farming*; 1973.
12. Mishra A, Tosh GC. Chemical weed control studies on dwarf wheat. *Journal of Research (Orissa University of Agricultural Science and Technology)*. 1979;10:1-6.
13. Reddy PR, Tzudir L, Kumari S, Nongmaithem D, Singh AP, Yadav R. Response of blackgram (*Vigna mungo* L.) to integrated weed management and its effect on weed dynamics. *Plant Archives*. 2022;22(2):397-402.

14. Richardsan AS, Bharathi C, Janaki P, Kalaiselvi T, Arthanari PM. Effect of Weed Management Practices and Bio-fertilizers with and without FYM on Weed Flora, Growth and Yield of Blackgram (*Vigna mungo* L.). International Journal of Plant & Soil Science. 2022; 34(22):37-48.
15. Lavanya Y, Srinivasan K, Chinnamuthu CR, Murali PA, Shanmugasundaram S, Chandrasekhar CN. Study on effect of weed management practices on weed dynamics and productivity of kharif maize. The Pharma Innovation Journal. 2021; 10(1):662-5.
16. Sukumar J, Kunjammal P. Effect of Pre and Early Post Emergence Herbicides on Weed Control in Irrigated Blackgram (*Vigna mungo* L.). Madras Agricultural Journal. 2020;107:1.
17. Mahilang K, Choudhary S, Victor V, Sonboier K. Design and development of power operated rotary weeder for rice. Current Journal of Applied Science and Technology. 2017;24(5):1-7.
18. Kumar S, Angiras NN, Singh R. Effect of planting and weed control methods on weed growth and seed yield of blackgram. Indian Journal of Weed Science. 2006; 38(1and2):73-6.

© 2023 Kumari et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/103787>