**Original Research Article**

**Optimizing Growth and Yield of Blackgram (*Vigna mungo* L.) Through Combined Weed and Foliar Nutrient Management**

**ABSTRACT**

This study investigates the assessment of the Combined Influence of Weed Management and Foliar Nutrition Strategies on the Growth and Yield Traits of Blackgram. The treatment was imposed in a factorial randomized block design (FRBD) with 12 treatments and 3 replications. The experiment was carried out at the experimental farm Department of Agronomy, Faculty of Agriculture, Annamalai University, Chidambaram, Tamil Nadu, India, during the period from April to July 2024, using the blackgram variety VBN-8. The results of the experiment revealed that among the different treatments tested. Early post-emergence application sodium acifluorfen @160 g a.i ha-1 + clodinofob propargyl @ 80 g a.i ha-1 on 15 DAS + Hand weeding on 30 DAS + vermiwash @ 10 % on 30 and 45 DAS recorded with highest plant height (30.66,57.53), leaf area index (1.93, 2.86), dry matter production (1752 kg ha-1), effective root nodules(25.4), pod length (5.91) number pods per plant (12.67), Grain yield (730 kg ha-1) and haulm yield(1535 kg ha-1) and it excelled all the others treatments. The research concludes that treatment Early post-emergence application of sodium acifluorfen @160 g a.i ha-1 + clodinofob propargyl @ 80 g a.i ha-1 on 15 DAS + hand weeding on 30 DAS + vermiwash @ 10 % on 30 and 45 DAS(A4B2) was most effective method in control weeds and recorded higher grain yield.

*Keywords*: EPOE, grain yield, Plant height, Pod length, Vermiwash

1. **INTRODUCTION**

“Blackgram is mainly cultivated in tropical to sub-tropical countries like India, Pakistan, Sri Lanka, Burma, and some countries of South East Asia. Black gram is grown in many parts of India since it is a short-duration pulse crop. In our country, pulses are grown in an area of 23.63 million hectares with a total production of 14.76 million tonnes and are considered to be one of the largest pulses-producing countries in the world. In Tamil Nadu, blackgram is cultivated in an area of 4.07 lakh hectares, with a total production of 2.69 lakh tonnes and productivity of 660 kg ha−1” (Marimuthu *et al*., 2024). “This popular pulse goes by various common names like matpe, urd bean, mash bean, black mung bean, mashkalai, urid, etc. India produces about 24.5 lakh tons of urad annually from about 4.6 million hectares of area with an average productivity of 533 kg per hectare in 2020. In India, the average productivity of black gram continues to be low mainly due to various reasons which include poor management practices, non-adoption of improved variety and recommended practices, heat and moisture stress, weed infestation, various physiological and biochemical as well as inherent factors associated with the crop. Among these several factors responsible for low yields of blackgram, weed infestation is considered one of the major factors. Generally, yield loss due to unchecked weed growth in Blackgram ranges from 27 to 100%” (Mansoorie *et al*., 2015). “Being grown as a subsidiary crop, it is given less care and inputs and in addition to that, weeds pose a serious threat and compete for the already limited resources like light, moisture, nutrients, and space in the field which leads to a significant reduction in the yield of blackgram to a great extent. This crop needs more attention during summer as along with the crop, weeds also grow more luxuriantly and vigorously due to better sunshine and irrigation during this time. Therefore, it becomes important to control the weeds by suitable methods and practices, especially during the critical period of crop weed competition (10-40 DAS) in the summer blackgram crop. Foliar nutrition is seen as an important technique of fertilizer delivery because foliar nutrition usually penetrates the leaf cuticle or stomata and enters the cells, allowing for easy and rapid utilization. When compared to soil-applied fertilizers, foliar-sprayed nutrients are more effective. Foliar nutrition can be widely used to diminish nutritional deficiencies in crop plants at critical growth stages” (EI-hady and Hussein 2021). In order to exploit the full yield potential of black gram, it became imperative to undertake such investigations directed towards weed management with the objective to identify the most effective and economical technique for improving the growth and yield potential of blackgram.

**2. MATERIAL AND METHODS**

The Field experiment was conducted using VBN 8 variety of blackgram at GL 2 Block of the Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar. The experimental site is geographically situated at 11.24°N latitude and 79.44°E longitude and at +5.79 m elevation from mean sea level. The soil at the site is clay loamy with a pH of 7.9. The soil nutrient status analysis revealed that the soil was low in available nitrogen (N- 234.0 kg ha⁻¹), medium in available phosphorus (P₂O₅ – 20.50 kg ha⁻¹), and high in available potassium (K₂O – 305.7 kg ha⁻¹). The experiment was designed in a Factorial Randomized Block Design (FRBD) with the two factors weed management and foliar nutrition making a total of 12 treatment combinations which were replicated three times. The treatment structure consisted of four levels of weed management practices and three levels of foliar nutrition practices. They are

**Factor -A (Weed management)**

**A1**- unweeded control,

**A2**- EPOE application of imazethapyr @ 50 g a.i ha-1 on 15 DAS + hand weeding on 30 DAS

**A3** - EPOE application of Quizalofob-ethyl@50g a.i ha-1 on15DAS+ hand weeding on 30 DAS,

**A4**- EPOE application of sodium acifluorfen @160 g a.i ha-1+ clodinofob propargyl @80 g a.i ha-1 on 15 DAS + hand weeding on 30 DAS.

**Factor- B (foliar nutrition)**

**B1**- Control (water spray),

**B2**- vermiwash spray @ 10 % on 30 and 45 DAS,

**B3**-Nano DAP spray @ 3 ml/l on 30 and 45 DAS.

The spacing adopted is 30x10cm. Recommended fertilizer schedules of 25:50:25 kg   
ha-1 were adopted. The required quantities of herbicide were calculated treatment-wise and applied to the respective plot as per the treatment schedule. All the herbicides were applied in the morning hours by using hand operated knapsack sprayer fitted with a flood Jet nozzle using 500 liters of water per hectare. The vermiwash and Nano DAP were purchased from the market and the required quantities of 10 % vermiwash and Nano DAP 3 ml/l were prepared and sprayed to the respective plots as per the treatment schedule on 30 and 45 DAS. The spray fluid used was water @ 500 l ha-1.

3. results and discussion

**3.1 PLANT HEIGHT**

According to the weed management practices (Table 1), EPOE application of sodium acifluorfen @160 g a.i.ha-1 + clodinofob propargyl @ 80 g a.i.ha-1 on 15 DAS + Hand weeding on 30 DAS (A4) registered higher plant height of 28.97 and 53.03 cm respectively at 30 DAS and 60 DAS (Table-1) This could be due to weed-free condition obtained with two hand weeding which might have given a competitive advantage to crops over weeds in utilizing the moisture, nutrient, light and space and thus the crops in this treatment gave better results. Similar findings were observed by Kundu *et al*. (2011), and Rao *et al*. (2015) This was followed by of EPOE application of imazethapyr @ 50 g ai   
ha-1 on 15 DAS + hand weeding on 30 DAS (A2) and EPOE application quizalofob ethyl @ 50 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS (A3). The least plant height of 22.13 and 40.06 cm was recorded at 30 DAS and 60 DAS in un-weeded control (A1) respectively.

Regarding the application of foliar nutrition among the treatments tested, the application of vermiwash @ 10 % on 30 and 45 DAS (B2) recorded maximum plant height of 27.80 and 50.55 cm respectively, and was significantly superior over other treatments at 30 DAS and 60 DAS this is due to the foliar spray of vermiwash provided balanced nutrition to blackgram and helped in improving the quality parameters as it has readily available nutrients and growth hormones. This result is in agreement with the findings of Sutar *et al*., (2019). This was followed by Nano DAP @ 3ml/l on 30 and 45 DAS (B3). The least plant height of 24.42 and 43.28 cm was recorded in control (B1).

Regarding The interaction effect between different weed management practices and foliar nutrition, the application was found to be significant at the 30 and 60 DAS. The EPOE application of sodium acifluorfen @160 g a.i.ha-1 + clodinofob propargyl @ 80 g a.i.ha-1 on 15 DAS + hand weeding on 30 DAS + vermiwash spray @ 10 % on 30 and 45 DAS (A4B2) recorded maximum plant height of 30.66 and 57.53 cm at 30 DAS and 60 DAS respectively and it was the most effective treatment concerning the plant height of the blackgram crop. The results of this study are validated by Chovatia *et al.* (2010). Higher weed populations remove more nutrients from the soil and the nutrients faster than crops. Therefore, assuring greater nutrient availability to the crop during its initial period of growth due to suppression of weeds by suitable herbicide resulted in increasing the growth of blackgram. This was followed by the EPOE application of sodium acifluorfen @160 g a.i. ha-1 + clodinofob propargyl @ 80 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS + Nano DAP @ 3 ml/l at 30 and 45 DAS (A4B3). Maximum plant height with the noted treatment might be due to less weed population, which reduced crop weed competition for soil moisture, solar radiation, plant nutrients, and space during the active growth period resulting in better nutrient availability which helped in rapid cell development and facilitated luxurious crop growth. Similar results were also reported by Susmitha *et al*. (2019). The least plant heights of 20.80 and 38.10 cm were recorded in the unweeded control(A1B1) at 30 DAS and 60 das respectively.

**3.2 LEAF AREA INDEX**

Regarding weed management practices, EPOE application of sodium acifluorfen @160 g a.i.ha-1 + clodinofob propargyl @ 80 g a.i.ha-1 on 15 DAS + hand weeding on 30 DAS(A4) registered the highest leaf area index of 1.72 and 2.59 at 30 and 45 DAS respectively and were significantly superior over the other treatments (Table-2) This is due to better weed management at the critical crop growth stage of the crop which minimizes the competition between crops and weeds and leads to higher uptake of nutrients resulting in better crop growth and development. This finding was similar to the finding of Kumar *et al.* (2018) and Jat *et al*. (2021). This was followed by the EPOE application of imazethapyr @ 50 g a.i.ha-1 on 15 DAS + hand weeding on 30 DAS (A2). The least leaf area index of 1.11 and 1.43 was recorded at 30 and 45 DAS respectively in unweeded control(A1). The lowest leaf area index under the weedy check could be due to the higher density of weed population leading to poor crop growth parameters. These results were by the findings of Das *et al*. (2014). The leaf area index was greater with herbicide-applied plots over the unweeded check and two-hand weeding at 30 DAS irrespective of stages and seasons

Among the various foliar nutrition, application of vermiwash @ 10 % on 30 and 45 DAS (B2) registered higher leaf area index of 1.60 and 2.35 on 30 and 45 DAS, and it excellent other treatments Vermiwash is also strong in plant growth hormones such auxins, cytokinins, gibberellins, amino acids, and vitamins, which boost plant growth and productivity as well as acting as nematicides and vermiwash, responsible for plants’ rapid growth and development. Similar results were also obtained by Maya and Sathish (2015). This was followed by the application of Nano DAP @ 3 ml/l on 30 and 45 DAS (B3). The lowest leaf area index was registered in control (B1) with a value of 1.25 and 1.93 at 30 and 45 DAS, respectively.

Regarding various interaction effects, the treatment combination of EPOE application of sodium acifluorfen @160 g a.i. ha-1 + clodinofob propargyl @ 80 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS + vermiwash spray @ 10 % on 30 and 45 DAS (A4B2) recorded a higher leaf area index as 1.93 and 2.86 on 30 and 45 DAS. This was followed by the application of sodium acifluorfen @ 160 g a.i. ha-1 + clodinofob propargyl @ 80 g a.i.ha-1 on 15 DAS + hand weeding on 30 DAS + Nano DAP @ 3 ml/l on 30 and 45 DAS (A4B3). Control (A1B1) registered a least leaf area index with a value of 1.09 and 1.35 at 30 and 45 DAS, respectively. A higher leaf area index obtained could be due to better control of all types of weeds like grasses, broad-leaved, and sedges during the early crop growth period. Similar results were also reported by Yadav *et al*. (2015).

**3.3 DRY MATTER PRODUCTION**

Among the weed management practices EPOE application of sodium acifluorfen @160 g a.i. ha-1 + clodinofob propargyl @ 80 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS (A4) registered with the highest dry matter production of 1573.33 kg ha-1 (Table-3) Application of post-emergence herbicide has advantages like minimizing human labor consumption and controlling the second flush of weeds in pulse crops. This finding was similar to Marimuthu *et al*. (2024). This was followed by EPOE application of imazethapyr @ 50 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS (A2) and it was found to be on par with EPOE application of quizalofob ethyl @ 50 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS. The lowest dry matter production of 849 kg ha-1 was noticed in the unweeded control (A1).

Among the foliar nutrition applications of vermiwash @ 10 % at 30 and 45 DAS resulted with the highest dry matter production of 1437.25 kg ha-1 vermiwash could be attributed to the fact that vermiwash 10 % spray was responsible for the rapid growth and development of plants. This result was a similar finding with Joshi *et al*. (2023). This was followed by the application of Nano DAP @ 3 ml/l on 30 and 45 DAS. The lowest dry matter production 1207 kg ha-1 was recorded in water spray(B1).

“The interaction effect was also significant in terms of dry matter production. The EPOE application sodium acifluorfen @160 g a.i. ha-1 + clodinofob propargyl @ 80 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS + vermiwash @ 10 % on 30 and 45 DAS(A4B2) outstripped all other treatments and resulted in the highest dry matter production of 1752 kg ha-1. This is due to the weed-free treatment reduced the crop weeds competition by providing no weed situation in black gram field. Thus, the crop being vigorous by efficiently utilizing nutrients, moisture, and sunlight with space gave better yield leading to the highest dry weight of the plant” (Naidu *et al.,* 2012). This was followed by the application of sodium acifluorfen @160 g a.i. ha-1 + clodinofob propargyl @ 80 g a.i. ha-1 on 15 DAS+ hand weeding on 30 DAS + Nano DAP @ 3 ml/l on 30 and 45 DAS (A4B3). The least dry matter of 815 kg ha-1 was noticed in control (A1B1).

**3.4 POD LENGTH**

Among the different weed management practices, EPOE application of sodium acifluorfen @160 g a.i. ha-1 + clodinofob propargyl @ 80 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS(A4) resulted in a lengthiest pod with a value of 5.41 cm and was found significantly superior over other weed management practices (Table 4). This may also be attributed to the better growth of crops in terms of higher leaf area index and dry matter accumulation in these treatments, which may have resulted in better translocation of photosynthetic for the development of all the yield attributes. These results are in close conformity with Poonia and Pithia (2013) and Vikas *et al*. (2013). This was followed by the EPOE application of imazethapyr @ 50 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS (A2). The lowest pod length was registered in unweed control (A1) with a value of 3.47 cm.

It was clear from the data regarding various foliar nutrition, the lengthiest pod of 4.98 cm was observed in the application of vermiwash @ 10 % on 30 and 45 DAS (B2) and was significantly superior over the rest of the treatments. This was followed by Nano DAP @ 3ml/l on 30 and 45 DAS (B3). The shortest pod length with a value of 3.99 cm was recorded in the control treatment(B1). A timely supply of nutrients through foliar spray during peak nutrient demand might have reduced the shedding of flowers resulting in a higher number of pods. A similar result was earlier reported by Ashraf *et al*. (2024).

Among the various interaction effects, the EPOE application of sodium acifluorfen @160 g a.i. ha-1 + clodinofob propargyl @ 80 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS + vermiwash @ 10 % on 30 and 45 DAS(A4B2) registered with the lengthiest pod with a value of 5.91 cm. The treatments resulted in increased yield and enhanced yield attributes by ensuring effective weed control during the critical crop-weed competition period. This minimized competition for essential resources such as space, nutrients, and water, thereby promoting better crop development and productivity. This similar result was observed by Kaur *et al*. (2025). This was followed by the application of sodium acifluorfen @ 160 g a.i. ha-1 + clodinofob propargyl @ 80 g a.i. ha-1 on 15 DAS+ hand weeding on 30 DAS + Nano DAP @ 3 ml/l on 30 and 45 DAS (A4B3). The lowest pod length was noticed in unweed control (A1B1) with a value of 3.3 cm.

**3.6 NUMBER OF PODS PLANT-1**

Among the different weed management practices, EPOE application of sodium acifluorfen @160 g a.i. ha-1 +clodinofob propargyl @ 80 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS(A4) resulted in the highest number of pods plant-1 with a value of 11.84 and was found significantly superior over the other weed management practices (table-4) the lower weed population had provided a favorable environment to the crop and the least crop weed competition, which resulted in a higher photosynthetic accumulation rate and better translocation to the sink as compared. A similar finding was reported by Reddy *et al*. (2022). This was followed by the EPOE application of imazethapyr @ 50 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS (A2). The unwedded control (A1) registered with the least number of pods plant-1 with a value of 8.92.

Regarding various foliar nutrition, the highest number of pods per plant-1 with a value of 11.22 was observed in the application of vermiwash @ 10 % on 30 and 45 DAS (B2) and excelled over the rest of the treatments. This was followed by Nano DAP @ 3ml/l on 30 and 45 DAS (B3). The least number of pods plant-1 (9.77) was recorded in the control treatment(B1). The foliar nutrients might have supplemented the nutrient demand of the crop at the critical stage, resulting in better growth and development of the crop and ultimately enhancing the yield attributing characters and promoting a positive source-sink gradient of photosynthates translocation guaranteeing seed formation and better grain filling (Manivannan *et al*., 2002)

Among the various interaction effects, EPOE application sodium acifluorfen @ 160 g a.i. ha-1 + clodinofob propargyl @ 80 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS + vermiwash @ 10 % on 30 and 45 DAS (A4B2) registered with the highest number of pods plant-1 with a value of 12.67 and outstripped all other treatment combinations. This was due to the least competition from weeds for light, as weed is all all-ground resource, due to effective weed control practices which reduced weed growth and gave higher yield attributes. This is in agreement with the finding of Mansoori *et al*. (2015). This was followed by the application of sodium acifluorfen @160 g a.i ha-1 + clodinofob propargyl @ 80 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS + Nano DAP @ 3 ml/l on 30 and 45 DAS (A4B3). The lowest number of pods plant-1 (8.01) was registered in unweed control(A1B1).

**3.7 GRAIN AND HAULM YIELD (kg ha-1)**

Among the different weed management practices, EOPE application of sodium acifluorfen @160 g a.i. ha-1 + clodinofob propargyl @ 80 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS(A4) recorded with the highest grain yield with a value of 675 kg ha-1 and also a higher haulm yield of 1437.33 kg ha-1 and it excelled rest of the treatments (Table 5). Effective weed management could be mainly because of an excellent suppression of all weeds right from crop emergence to harvest. This created a congenial environment similar to a weed-free situation for irrigated blackgram and improved the crop growth in terms of biomass and thus recorded superior yield attributes and yield. This was similar to finding Jagadesh and Raju (2021). This was followed by the EPOE application of imazethapyr @ 50 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS (A2). The least grain yield of 398 kg ha-1 and haulm yield of 876.66 kg ha-1 was recorded in unweed control(A1).

The different foliar nutrients applied significantly influenced the seed yield and haulm yield. Regarding various foliar nutrition applied, the highest grain yield of 606.25 kg ha-1 and haulm yield of 1301.25 kg ha-1 was recorded under the application of vermiwash @ 10 % on 30 and 45 DAS (B2). This was followed by Nano dap @ 3ml/l application on 30 and 45 DAS (B3). The least grain yield and haulm yield were recorded in control (B1) with a value of 524.25 kg ha-1 and 1149.00 kg ha-1.

In respect of various interaction effects EPOE applications of sodium acifluorfen @160 g a.i. ha-1 + clodinofob propargyl @ 80 g a.i. ha-1 on 15 DAS + hand weeding on 30 DAS + vermiwash @ 10 % on 30 and 45 DAS (A4B2) recorded with the highest grain yield of 730 kg ha-1 and haulm yield of 1535 kg ha-1 was significantly superior over rest of the interactions The higher yield in weed control treatments could be credited to the efficient management of weeds in early growth stages providing a congenial environment for better crop growth. Moreover, the nutrient uptake of the crop plants is also increased with weed control treatments. This result was similar with Malhi *et al*. (2021). This was followed by the application of sodium acifluorfen @160 g a.i. ha-1 +clodinofob propargyl @ 80 g a.i. ha-1 on 15 DAS+ hand weeding on 30 DAS + Nano DAP @ 3 ml/l on 30 and 45 DAS (A4B3). The unweed control (A1B1) recorded a lower grain yield and haulm yield of 379 kg ha-1 and 845 kg ha-1. A significantly higher seed yield attained in these treatments was due to efficient control of all categories of weeds, reduced weed index, higher weed control index, and higher herbicide efficiency in controlling the weeds to a great extent confirming the findings of Tigga and singh (2019) in blackgram.

**4. CONCLUSION**

**The study concludes that the early post-emergence application of sodium acifluorfen 160 g a.i. ha⁻¹ + clodinafop-propargyl 80 g a.i. ha⁻¹ at 15 DAS, followed by hand weeding at 30 DAS (A4), along with foliar application of 10 % vermiwash at 30 and 45 DAS (B2), proved to be the most effective treatment. This integrated approach significantly improved growth rate, yield attributes, and overall productivity of summer irrigated blackgram.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Plant Height (cm)** | | | | | | | | |
| Foliar  Nutrition  Weed  Management | **30 DAS** | | | | **60 DAS** | | | |
| B1 | B2 | B3 | MEAN | B1 | B2 | B3 | MEAN |
| A1 | 20.80 | 22.89 | 22.69 | 22.13 | 38.10 | 41.95 | 40.13 | 40.06 |
| A2 | 25.32 | 28.98 | 29.12 | 27.81 | 44.63 | 53.27 | 51.16 | 49.69 |
| A3 | 25.01 | 28.65 | 28.04 | 27.24 | 44.31 | 49.47 | 49.21 | 47.66 |
| A4 | 26.56 | 30.66 | 29.69 | 28.97 | 46.10 | 57.53 | 55.47 | 53.03 |
| MEAN | 24.42 | 27.80 | 27.39 |  | 43.28 | 50.55 | 48.99 |  |
|  | **S.Ed** | | **CD(*p*=0.05)** | | **S.Ed** | | **CD(*p*=0.05)** | |
| A | 0.23 | | 0.49 | | 0.45 | | 0.95 | |
| B | 0.20 | | 0.42 | | 0.39 | | 0.82 | |
| AxB | 0.40 | | 0.85 | | 0.78 | | 1.64 | |

**Table 1 Impact of weed management and foliar nutrtion on plant height of blackgram on 30 DAS and 60 DAS (cm)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **(LAI)** | | | | | | | | |
| Foliar  Nutrition  Weed  Management | **30 DAS** | | | | **45 DAS** | | | |
| B1 | B2 | B3 | MEAN | B1 | B2 | B3 | MEAN |
| A1 | 1.09 | 1.14 | 1.11 | 1.11 | 1.35 | 1.51 | 1.44 | 1.43 |
| A2 | 1.30 | 1.76 | 1.71 | 1.59 | 2.14 | 2.62 | 2.48 | 2.41 |
| A3 | 1.30 | 1.59 | 1.47 | 1.45 | 2.03 | 2.42 | 2.30 | 2.25 |
| A4 | 1.33 | 1.93 | 1.90 | 1.72 | 2.20 | 2.86 | 2.71 | 2.59 |
| MEAN | 1.25 | 1.60 | 1.54 |  | 1.93 | 2.35 | 2.23 |  |
|  | **S.Ed** | | **CD(*p*=0.05)** | | **S.Ed** | | **CD(*p*=0.05)** | |
| A | 0.03 | | 0.08 | | 0.04 | | 0.10 | |
| B | 0.02 | | 0.05 | | 0.03 | | 0.07 | |
| AxB | 0.05 | | 0.11 | | 0.07 | | 0.15 | |

**Table 2 Impact of weed management and foliar nutrtion on LAI on 30 and 45 DAS**

**Table 3 Impact of weed management and foliar nutrtion crop dry matter production (DMP) (kg ha-1)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Foliar  Nutrition  Weed  Management | **DMP (kg ha-1)** | | | |
| B1 | B2 | B3 | MEAN |
| A1 | 815 | 889 | 843 | 849 |
| A2 | 1353 | 1589 | 1507 | 1483 |
| A3 | 1285 | 1519 | 1443 | 1415.66 |
| A4 | 1357 | 1752 | 1593 | 1573.33 |
| MEAN | 1207 | 1437.25 | 1346.50 |  |
|  | **S.Ed** | | **CD(*p*=0.05)** | |
| A | 38.84 | | 80.56 | |
| B | 31.47 | | 65.28 | |
| AxB | 67.81 | | 140.65 | |

**Table 4 Impact of weed management and foliar nutrtion on pod length and number of pods plant-1**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Foliar**  **Nutrition**  **Weed**  **Management** | **Pod length(cm)** | | | | **Number of pods plant-1** | | | |
| B1 | B2 | B3 | MEAN | B1 | B2 | B3 | MEAN |
| A1 | 3.3 | 3.63 | 3.5 | 3.47 | 8.01 | 9.48 | 9.26 | 8.92 |
| A2 | 4.12 | 5.44 | 5.36 | 4.97 | 10.53 | 11.91 | 10.79 | 11.07 |
| A3 | 4.03 | 4.95 | 4.55 | 4.51 | 9.93 | 10.83 | 10.63 | 10.46 |
| A4 | 4.51 | 5.91 | 5.82 | 5.41 | 10.63 | 12.67 | 12.22 | 11.84 |
| MEAN | 3.99 | 4.98 | 4.80 |  | 9.77 | 11.22 | 10.72 |  |
|  | **S.Ed** | | **CD(*p*=0.05)** | | **S.Ed** | | **CD(*p*=0.05)** | |
| A | 0.03 | | 0.08 | | 0.15 | | 0.33 | |
| B | 0.03 | | 0.07 | | 0.10 | | 0.21 | |
| AxB | 0.07 | | 0.15 | | 0.19 | | 0.40 | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Foliar**  **Nutrition**  **Weed**  **Management** | **Grain yield** | | | | **Haulm Yield** | | | |
| B1 | B2 | B3 | MEAN | B1 | B2 | B3 | MEAN |
| A1 | 379 | 405 | 410 | 398 | 845 | 895 | 890 | 876.66 |
| A2 | 570 | 655 | 645 | 623 | 1272 | 1405 | 1390 | 1355.66 |
| A3 | 553 | 635 | 612 | 600 | 1194 | 1370 | 1320 | 1294.67 |
| A4 | 595 | 730 | 700 | 675 | 1285 | 1535 | 1492 | 1437.33 |
| MEAN | 524.25 | 606.25 | 591.75 |  | 1149.00 | 1301.25 | 1273.00 |  |
|  | **S.Ed** | | **CD(*p*=0.05)** | | **S.Ed** | | **CD(*p*=0.05)** | |
| A | 9.40 | | 20.57 | | 12.02 | | 24.94 | |
| B | 8.21 | | 17.82 | | 10.41 | | 21.60 | |
| AxB | 12.16 | | 26.39 | | 20.82 | | 43.20 | |

**Table 5 Impact of weed management and foliar nutrtion on Grain and haulm yield of blackgram (kg ha-1)**

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

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