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# Evaluation of Efficacy of Herbicidal Combinations Through Weed Indices in Black Gram

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## ABSTRACT

*To determine weed, a field investigation was conducted, dynamics factors affected by different weed management herbicides during rabi,2023-24 at Agricultural College, Jagtial's college farm, where the results revealed that the treatment Fomesafen + Fluzifop-p-butyl 220 g ha$^{-1}$ (pre-mix) 11.1% + 11.1% SL PoE at 20 DAS was observed to be performed with the lowest weed index (8.8%), the highest weed management efficiency (61.2%), and the weed control index (78.4%). , favor for better crop yield , among the chemical treatments in the respective field experimental investigation and whereas unweeded check recorded the lowest crop yield , also produced the greatest weed index, the least weed control efficiency, and the weed control index.*

***Keywords:*** *Black gram, Herbicides, Weed index, and Weed control.*

## Introduction

Black gram, or Vigna mungo L., is considered to be among the most well-liked and profitable pulse crops in India. It is composed of minerals, 1.4 g of fat, 9.5 mg of iron, 154 mg of calcium, and 0.37 riboflavin, thiamine (0.42%), 22% protein, and 48% carbs (1). Black gram is grown all over the world for fodder, green manuring, grains, and forage. Rich in lysine and low in methionine, it is essential for crop rotation, which promotes soil fertility and agricultural production systems. One of the primary factors influencing the amount produced of black grams is weed. Weeds vie with other plants for resources such as moisture, light, food, and space.. The period between 15 and 45 DAS is when crop-weed competition is most likely to occur in black gram (6). Weed growth competition is contingent upon the type, density, and length of the occurrence. can reduce grain output by 27 to 90%. (8). Herbicides used before emergence only temporarily suppress weeds; after that, late-emerging weeds start to outcompete crops (3). Broad-spectrum weed control may not be possible with a single herbicide (9). In order to minimize human labor, post-emergence herbicide is required to manage the late-germinating weeds in black gram. Herbicides applied both before and after emergence may effectively control a wide variety of weeds. The current investigation is assessed in light of the aforementioned considerations.

## Materials and Methods

'The study was set up using a randomized block design with eight treatments (T1 through T8). At 1 DAS (T1), Pendimethalin 30% EC 1000 g ha-1 PE was applied pre-emergence. Imazethapyr + Imazamox 35%+35% WG (pre-mix) 80 g ha$^{-1}$ PE at 1 DAS($T_2$), Fomesafen + Fluzifop-p-butyl 11.1%+11.1% SL (pre-mix) 220 g ha$^{-1}$ PoE at 20 DAS($T_3$), Aciflurfen-sodium+Clodinafop-proparyl 16.5%+8% EC (pre-mix) 245 g ha$^{-1}$ PoE at 20 DAS ($T_4$), Propaquizafop + Imazethapyr 2.5%+3.75 ME (pre-mix) 125 g ha$^{-1}$ PoE at 20 DAS($T_5$), Haloxyfop R-methyl 108 g ha$^{-1}$ 10.5 % EC PoE at 20 DAS($T_6$), Three separate replications of a randomized block design (RBD) were used to evaluate weeding by hand twice at 15 and 30 DAS (T7) and unweeded check (T8).'The newly introduced black gram variety MBG-1070 was used in the field experiment, which took place during the 2023–2024 rabi season at the college farm, Agricultural College, Jagtial, India. The study's objective was to assess the impacts of herbicides applied prior to and after emergence and manual weeding methods for controlling weeds and yield in watered black gram cultivation. The trial's mean highest and lowest temperatures were 30.8°C and 17.13°C, respectively. The herbicides were applied pre-emergence (0–1DAS) and post-emergence (20 DAS) using 500 liters of water per hectare and a backpack sprayer with a flat nozzle. Fertilizer dosage recommendations for black gram were 20 kg N and 50 kg P2O5. At the time of black gram sowing, urea as well as one superphosphate were used to apply the entire amount of N and P. The crop was cultivated using all advised agronomic and plant protection techniques, and intercultural activities were conducted as needed. This contains all pertinent data regarding crop yield and production features. Fisher's analysis of variance approach was used to statistically assess the experimental design data. To find critical difference (CD) values, treatment means were compared using an F-test and the test for the smallest difference in significance at a probability threshold of 5%. At 15-day intervals until the crop reached physiological maturity, the quantity of broad-leaved weeds, sedges, and grasses was determined by counting them in randomly chosen locations within eachplotusinga0.5×0.5m quadrant (0.25m$^2$). After gathering and compiling data on weed dried matter and total weed count, the square root conversion was used to normalize the data method ($\sqrt{x} + 0.5$) (5) for statistical analysis. To determine a consistent weight, the weeds extracted from the quadrats were dried for 24 hours at 65°C. This weight was then converted to grams per square meter (g m$^{-2}$).

### Weed Control Efficiency (WCE)

WCE measures how well a weed control strategy works in comparison to an untreated weedy situation.

WCE was calculated as follows (2), (7) in order to assess the effectiveness of the weed control treatments:

$$WCE = \frac{WPc - WPt}{WPc} \times 100$$

Where, $WP_c$ is the weed population (no.m$^{-2}$) in the control (unweeded check) plot and $WP_t$ is the weed population (no.m$^{-2}$) in treated plot.

**Weed Control Index (WCI)**

WCI was computed as follows in order to compare the various weed control treatments according to dry weight (2), (7).

When compared to weedy plots, it displays the % drop in dry weight of weeds in treated areas.

$$WCI = \frac{Wdc - Wdt}{Wdc} \times 100$$

Where,

WCI = Weed Control Index

Wdc = Dry weight of weeds in control plots or unweeded check

Wdt = Dry weight of weeds in treated plots

**Weed index (WI)**

According to (4), the weed indices is the percentage drop in the yield of seeds under a certain treatment due to weeds as opposed to the seed yield achieved in a weed-free plot.

It was calculated using the following formula and is given as a percentage:

$$WI = \frac{SYh - SYt}{SYh} \times 100$$

Where,

WI = Weed index

$SY_h$ = Seed yield from hand weeding (weed-free plot)

$SY_t$ = The weed index for the treated plot's seed yield needs to be calculated.

Fisher's analysis of variance method was used to statistically assess the experimental design data. The critical difference (CD) values were calculated by comparing treatment means using an F-test and the least significant difference (LSD) test with a significance level of 5%. Every piece of data that was gathered was subjected to analysis of variance.

## Results and Discussions

**Weed dry weight and density**

Weed control herbicidal treatments are found to have a considerable impact on dry weight and the overall weed population or density. Data on dry weight and total weed density from Table No. I. II includes grasses, sedges, broadleaved weeds combined manner.

**At 15 DAS:** The herbicidal therapies T1 and T2, applied prior to emergence, reduced the dry weight and weed density with their efficacy against the weeds in comparable with unweeded check($T_8$), which found the highest number of weeds at the respective interval of observations due to absence of any type of chemical application. Due to the thorough elimination of all weeds, regardless of their type or class, the hand weeding technique produced a smallest density of weeds and dry weight.

**At 30 DAS:** During this interval, only post-emergence herbicidal treatments ($T_3$ to $T_6$) had a profound influence on weed density, dry weight and made appreciable lowering of weed population with their chemical activity against the weed growth.

**Weed indices**

**A. Weed control Efficiency (WCE):**

WCE indicates the how better is the herbicide in restricting weed growth in terms of weed density in comparison with unweeded check, after the treatment application.

**At 15 DAS**, interval of observation, the two-pre-emergence herbicidal treatment $T_1$ and $T_2$ was noticed with WCE of 53.4 and 57.5 % respectively. Here $T_2$ appears to be better among all other herbicidal treatments.

**At 30 DAS,** Among the herbicidal remedies used after emergence, T3 treatment had the highest WCE of 61.2% at 30 DAS, but unweeded check (T8) maintained the highest weed density at both observation intervals.

**B. Weed Control Index (WCI):**

WCI indicates also herbicidal efficiency in reducing the weed growth in consideration of weed dry weight or biomass.

**At 15 DAS**, The two pre-emergence herbicidal treatments, T1 and T2, were seen to have WCEs of 30.7% and 29.2%, respectively, over the observation period. In this case, T2 seems to be superior to all other herbicidal treatments.

**At 30 DAS**, Among the herbicidal treatments used after emergence, $T_3$ treatment was observed with maximum WCE 61.2 % while, maximum weed dry weight at both the intervals of observations, noticed with unweeded check ($T_8$).

**C. Weed Index (WI):**

WI shows the effectiveness of herbicides in relation to the crop's seed yield by limiting weed growth, which leads to an effective increase in seed production. WI efficiency is inverse in relation to the seed yield. According to table no. III data, the unweeded check had the highest WI and was the least effective on black gram seed yield. The T7 treatment had the lowest WI because it completely removed the weeds at two intervals, which led to a proportionate increase in seed yield. T3 followed, which can be explained as a better herbicidal treatment because it better controlled weed growth than the other herbicidal treatments (table no. I, II).

## Conclusion

The analysis of the data of the black gram weed features with regard to weed index and seed yield makes it clear that pruning by hand at 15 and 30 DAS appears to be more successful in controlling or lowering the weed growth. Pre-mix: Fomesafen + Fluzifop-p-butyl 11.1%+11.1% SL In the field trial, the highest weed control effectiveness, WCI, and lowest weed index were found at 20 DAS with 220 g ha-1 PoE. This treatment could be regarded as an efficient and effective one, and it can be concluded that it is a better option for managing weeds in black gram cultivation.

*Table No: I. Weed density (No.m$^{-2}$) at 15 and 30 DAS as influenced by different weed management practices of black gram*

| Tr.No. | Treatment details | At 15 DAS | At 30 DAS |
|---|---|---|---|
| T1 | Pendimethalin 30% EC 1000 g ha-1 PE at 1 DAS | 10.76 (115.34) | 14.04 (196.65) |
| T2 | Imazethapyr + Imazamox 35%+35% WG (pre-mix) 80 g ha$^{-1}$ PE at 1 DAS | 10.29 (105.29) | 14.19 (200.91) |
| T3 | Fomesafen + Fluzifop-p-butyl 11.1%+11.1% SL (pre-mix) 220 g ha$^{-1}$ PoE at 20 DAS | 15.49 (239.4) | 10.52 (110.07) |
| T4 | Aciflurfen-sodium + Clodinafop-proparyl 16.5%+8% EC (pre-mix) 245 g ha$^{-1}$ PoE at 20 DAS | 15.43 (237.53) | 11.62 (134.45) |
| T5 | Propaquizafop + Imazethapyr 2.5%+3.75 ME (pre- mix) 125 g ha$^{-1}$ PoE at 20 DAS | 15.31 (233.9) | 14.49 (209.41) |
| T6 | Haloxyfop R-methyl 10.5 % EC 108 g ha$^{-1}$ PoE at 20 DAS | 15.38 (235.93) | 15.17 (229.60) |
| T7 | Hand weeding twice at 15 and 30 DAS | 0.71 (0.00) | 0.71 (0.00) |
| T8 | Un-weeded (Check) | 15.75 | 16.86 |
| | **Sem ±** | **0.2** | **0.2** |
| | **LSD(P=0.05)** | **0.5** | **0.6** |

*Note: Values in parenthesis are the original; above value are square root transformation ($\sqrt{x+0.5}$) used for statistical analysis*

*Table No: II. Weed dry weight (No./m$^2$) at 15 and 30 DAS as influenced by different weed management practices of black gram*

| Tr. No. | Treatment details | At 15 DAS | At 30 DAS |
|---|---|---|---|
| T1 | Pendimethalin 30% EC 1000 g ha$^{-1}$ PE at 1 DAS | 5.30 (27.80) | 9.40 (88.40) |
| T2 | Imazethapyr + Imazamox 35%+35% WG (pre-mix) 80 g ha$^{-1}$ PE at 1 DAS | 5.50 (29.40) | 9.10 (82.80) |
| T3 | Fomesafen + Fluzifop-p-butyl 11.1%+11.1% SL (pre-mix) 220 g ha$^{-1}$ PoE at 20 DAS | 8.50 (71.80) | 6.30 (39.00) |
| T4 | Aciflurfen-sodium + Clodinafop-proparyl 16.5%+8% EC (pre-mix) 245 g ha$^{-1}$ PoE at 20 DAS | 8.30 (67.80) | 7.40 (54.00) |
| T5 | Propaquizafop + Imazethapyr 2.5%+3.75 ME (pre- mix) 125 g ha$^{-1}$ PoE at 20 DAS | 8.10 (65.70) | 10.60 (111.80) |
| T6 | Haloxyfop R-methyl 10.5 % EC 108 g ha$^{-1}$ PoE at 20 DAS | 8.40 (69.30) | 11.70 (137.00) |
| T7 | Hand weeding twice at 15 and 30 DAS | 0.71 (0.00) | 0.71 (0.00) |
| T8 | Un-weeded (Check) | 9.10 (82.90) | 13.50 (181.10) |
| | **Sem ±** | **0.1** | **0.1** |
| | **LSD (P=0.05)** | **0.3** | **0.3** |

*Note: Values in parenthesis are the original; above value are square root transformation ($\sqrt{x+0.5}$) used for statistical analysis*

*Table No: III. Weed control efficiency (WCE), weed control index (WCI) and weed index (WI) at 15 and 30 DAS as influenced by different weed management practices of black gram.*

| Tr. No. | Treatment details | At 15 DAS | | At 30 DAS | | At harvest | |
|---|---|---|---|---|---|---|---|
| | | WCE (%) | WCI (%) | WCE (%) | WCI (%) | SEED YIELD (kg/ha) | WI (%) |
| T1 | Pendimethalin 30% EC 1000 g ha-1 PE at 1 DAS | 53.45 | 66.47 | 30.71 | 51.19 | 530 | 33.33 |
| T2 | Imazethapyr + Imazamox 35%+35% WG (pre-mix) 80 g ha$^{-1}$ PE at 1 DAS | 57.50 | 64.54 | 29.21 | 54.50 | 512 | 35.60 |
| T3 | Fomesafen + Fluzifop-p-butyl 11.1%+11.1% SL (pre-mix) 220 g ha$^{-1}$ PoE at 20 DAS | 3.37 | 13.39 | 61.22 | 78.46 | 725 | 8.81 |
| T4 | Aciflurfen-sodium + Clodinafop-proparyl 16.5%+8% EC (pre-mix) 245 g ha$^{-1}$ PoE at 20 DAS | 4.14 | 18.21 | 52.63 | 70.18 | 680 | 14.47 |
| T5 | Propaquizafop + Imazethapyr 2.5%+3.75 ME (pre- mix) 125 g ha$^{-1}$ PoE at 20 DAS | 5.59 | 20.75 | 26.21 | 38.27 | 584 | 26.54 |
| T6 | Haloxyfop R-methyl 10.5 % EC 108 g ha$^{-1}$ PoE at 20 DAS | 4.77 | 16.41 | 19.10 | 24.35 | 576 | 27.55 |
| T7 | Hand weeding at 15 and 30 DAS | 100 | 100 | 100.00 | 100.00 | 795 | 0.00 |
| T8 | Un-weeded (Check) | - | - | 30.71 | 0.00 | 350 | 55.97 |

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