Response of Blackgram (*Phaseolus mungo* L.) Varieties to Weed Competition and to Pre and Post Emergence Herbicide Application during *Rabi*

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**ABSTRACT**

**Background:** Blackgram (*Phaseolus mungo* L.), a major pulse crop of Andhra Pradesh grown in an area of 3.52 lakh ha with a production of 2.93 lakh tons during *rabi* season (Anonymous, 2019). One of the major characteristics for selection of blackgram varieties for *rabi* season under conditions of receding soil moisture in black soils is their early vigour and good weed smothering capability. Early varieties due to their early growth habit can cover the land and thus can smother weeds better than late maturing varieties. Further some variations are observed to be more tolerant to post emergence herbicide application, hence, there is need to evaluate the promising blackgram varieties for their weed competitiveness and tolerance to pre and post emergence herbicidal application.

**Methods:** A field experiment was carried out at Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh, with an objective to find out the competitive ability of blackgram varieties to smother weeds during *rabi* season of 2015-16 and 2016-17 under upland conditions. The experiment was laid out in split plot design with three replications. The treatments consisted of five methods of weed control as main plots, viz., pendimethalin 1.0 kg ha⁻¹ PE, imazethapyr 50 g ha⁻¹ PoE, pendimethalin 1.0 kg ha⁻¹ PE fb imazethapyr 50 g ha⁻¹ PoE, manual weeding at 20 and 40 days after sowing (DAS) along with inter cultivation at 30 DAS and unweeded; four blackgram varieties, viz., GBG 1, PU 31, LBG 787, LBG 752, as sub treatments which were replicated thrice.

**Result:** Weed dry matter recorded at 45 days was lower and weed control efficiency (WCE) was higher with pendimethalin 1.0 kg ha⁻¹ PE fb imazethapyr 50 g ha⁻¹ PoE and was on par with manual weeding with inter cultivation. All the varieties were comparable and equally effective in controlling weed dry matter. Yield of variety GBG 1 was higher due to higher yield attributes viz., no. of pods per plant and 100 seed weight. Among the weed control methods manual weeding treatment with inter cultivation recorded significantly higher yield followed by a combination of pendimethalin 1.0 kg ha⁻¹ PE fb imazethapyr 50 g ha⁻¹ PoE. Further, varieties GBG 1 and PU 31 performed better in manual weeding treatment with inter cultivation and without any herbicide use.

**Key words:** Blackgram, Pre emergence, Post emergence, Varietal response.

**INTRODUCTION**

Blackgram is a short duration pulse crop and hence weed control is very important. The critical period of crop-weed competition in blackgram usually falls between 15-45 days after sowing (Vivek et al., 2008). The major area under blackgram in Andhra Pradesh is mainly in *rabi* and grown both in uplands and rice fallows. Repeated weed flushes due to rain or after irrigations make the pre emergence herbicidal application ineffective. However, varieties differ in their ability to compete with weed species depending on their early vigour, growth habit, smothering capacity and thus withstand the weed competition.

Response to post emergence herbicide application in blackgram may vary with the herbicide, application dose, application timing and varietal tolerance. Imazethapyr, a broad-spectrum herbicide, @ 25 g ha⁻¹ had no adverse effect on raingrown blackgram growth characters (Nandan et al., 2011). It is recommended @ 50 g ha⁻¹ for effective weed control. There is need to study the varietal response to herbicidal tolerance. Hence, the present study is taken up to screen varieties for their original weed competitiveness and tolerance to post emergence herbicidal application under upland situation during *rabi* season.

**MATERIALS AND METHODS**

A field experiment was carried out at Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh, located...
at an altitude of 35.1 m above mean sea level, 16°18’ N latitude, 80°29’ E longitude with an objective to find out the competitive ability of blackgram varieties to smother weeds during rabi season of 2015-16 and 2016-17 under upland condition. The soil of the experimental field was black clay in texture slightly alkaline in reaction. The soil has an organic carbon content of 0.38% and low available nitrogen (189 kg ha\(^{-1}\)), medium in available phosphorous (42 kg ha\(^{-1}\)) and high in available potassium (870 kg ha\(^{-1}\)). The experiment was laid out in split plot design with three replications. The treatments consisted of five methods of weed control as main plots, \(W_1\): pendimethalin @ 1.0 kg ha\(^{-1}\) PE, \(W_2\): imazethapyr 50 g ha\(^{-1}\) PoE, \(W_3\): pendimethalin @ 1.0 kg ha\(^{-1}\) PE followed by (fb) imazethapyr 50g ha\(^{-1}\)PoE, \(W_4\): manual weeding at 20 and 40 DAS along with inter cultivation at 30 DAS, \(W_5\): unweeded and four blackgram varieties viz., GBG 1, PU 31, LBG 787, LBG 752, as sub treatments which are replicated thrice. Among the varieties GBG 1 and PU 31 were early with a duration of 65 days where as other two varieties took 75 days to maturity. The crop was sown on 26th October and 14th October, respectively during the years 2015 and 2016. Sowing was done with seed drill using a seed rate of 20 kg ha\(^{-1}\). Before sowing, the seed was treated with carbendazim @2.5 g and imidacloprid @5.0 ml kg\(^{-1}\) seed to protect the crop from sucking pests and diseases upto 15 -20 days after sowing. The crop was fertlized with 20 kg N and 50 kg P\(_2\)O\(_5\) ha\(^{-1}\) and was applied basally. The spray of herbicides was done with the help of knap-sack sprayer fitted with flat- fan nozzle using a spray volume of 500 l ha\(^{-1}\). In \(W_1\) treatment, weeding was done with a hand hoe and inter cultivation with hand drawn gorr. The crop was sprayed with emamectin benzoate at flowering stage @ 0.4 g per liter of water for the control of maruca pod borer. The crop was harvested as and when the varieties matured.

The dominant weed species observed in the experimental plot include, \(D\)igera \(a\)rven\(s\)is, \(T\)rian\(t\)hema \(d\)ec\(a\)ndra, \(P\)h\(y\)llanth\(u\)s \(m\)ad\(a\)raspan\(a\)\(t\)e\(n\)e\(s\), \(P\)arth\(e\)nium \(h\)yster\(o\)ph\(o\)\(r\)us among the broadleafed weeds; \(E\)chino\(c\)hloa \(c\)ola, \(D\)ine\(n\)ebra \(r\)et\(o\)t\(r\)e\(f\)\(l\)e\(x\)a among grasses and \(C\)yperus \(r\)ot\(u\)\(n\)d\(u\)\(n\)us among the sedges. No rain was received after the crop sowing and the crop was grown only on residual moisture during both the years of study.

### Table 1: Weed dry matter (g m\(^{-2}\)) at 45 DAS as influenced by blackgram varieties and weed control methods during rabi season.

| Weed Control Treatment | Variety | Mean |
|------------------------|---------|------|
|                        | GBG 1   | PU 31 | LBG 787 | LBG 752 |
| \(W_1\): Pendimethalin 1.0 kg ha\(^{-1}\) PE | 4.96    | 8.23  | 8.61    | 5.35     | 6.79 |
| \(W_2\): Imazethapyr 50 g ha\(^{-1}\) PoE | 7.33    | 7.00  | 5.49    | 7.24     | 6.76 |
| \(W_3\): Pendimethalin 1.0 kg ha\(^{-1}\) PE fb Imazethapyr 50 g ha\(^{-1}\) PoE | 4.71    | 4.60  | 5.134   | 3.85     | 4.58 |
| \(W_4\): Hand weeding at 20 and 40 DAS with inter cultivation at 30 DAS | 4.29    | 4.61  | 3.47    | 4.16     | 4.13 |
| \(W_5\): Weedy | 13.33 | 10.05 | 11.32 | 8.88 | 10.90 |
| Mean | 6.92 | 6.90 | 6.81 | 5.90 |
| Weed control methods | 0.66 | 0.57 | 1.33 |
| Varieties | CD (P=0.05) | NS | NS |

\(\text{S.Em.}\) * at 45 DAS as influenced by blackgram varieties and weed control methods during rabi season.

#### RESULTS AND DISCUSSION

No visual adverse effect in terms of crop germination, or yellowing, leaf injury or necrosis or change in morphology was observed on any of the blackgram varieties due to pre emergence pendimethalin and post emergence application of imazethapyr. The visual observations on growth showed that all the varieties have good degree of tolerance to imazethapyr.

**Effect on weed dry matter**

Weed dry matter recorded at 45 DAS was significantly influenced by different methods of weed control. All the weed control treatments significantly reduced the weed dry matter as compared with unweeded control (Table 1). Weed drymatter recorded with pendimethalin @ 1.0 kg ha\(^{-1}\) PE followed by imazethapyr @ 50 g ha\(^{-1}\) PoE (\(W_1\)) was (4.577 g m\(^{-2}\)) and was on par with hand weeding + inter cultivation treatment (\(W_1\)) (4.437 g m\(^{-2}\)) followed by pendimethalin @ 1.0 kg ha\(^{-1}\) PE alone application (\(W_1\)) and imazethapyr @ 50 g ha\(^{-1}\) PoE (\(W_1\)) which were on par with each other. All the varieties were comparable and equally effective in controlling the weed dry matter.

**Effect on growth and yield attributes**

Plant height was not influenced by weed management treatments (Table 2). However, weedy treatment recorded higher plant height (30.1 cm). Among the varieties, LBG 787 and LBG 752 recorded significantly higher plant height over the other two varieties because of their duration advantage. The no. of pods per plant \(W_1\) (19.2) and \(W_1\) (16.7) was significantly higher because of elimination of competition from weeds in these treatments. The WCE recorded at 45 DAS, was higher with \(W_1\) (77.5%) indicated hand weeding with intercultivation to be the best management for control of weed populations. Among the varieties GBG 1 was found to smother weeds because of its early vigour and growth as indicated by higher WCE (78.5%) than other varieties.

**Effect on grain yield**

Yield data recorded with different weed control treatments (Table 3) indicates that all the weed control treatments significantly increased the grain yield of blackgram as compared to unweeded control (355 kg ha\(^{-1}\)) and significantly
higher grain yield (709 kg ha\(^{-1}\)) was recorded with two hand weeding + intercultivation (\(W_4\)), followed by the treatment pendimethalin 1.0 kg a.i ha\(^{-1}\) PE / imazethapyr 50 g a.i ha\(^{-1}\) (\(W_5\)) and imazethapyr 50 g ha\(^{-1}\) PoE (\(W_3\)) with 564 and 546 kg ha\(^{-1}\) of grain yield, respectively. This was due to higher weed control efficiency of this treatment and due to more no. of pods per plant. The lower yield recorded with pendimethalin 1.0 kg ha\(^{-1}\) PE (\(W_1\)) may be as a result of the crop sowing on a well prepared soil during \textit{rabi} season. Late emergence of weeds favoured the treatments receiving post emergence applications (\(W_3\) & \(W_4\)) leading to higher grain yield. Increased grain yield of blackgram due to imazethapyr application as compared to unweeded control was reported by several workers (Nirala \textit{et al.}, 2012 and Aggarwal \textit{et al.} 2014).

Among the varieties, GBG 1 recorded higher yield than the other varieties which may be due to higher test weight (4.56 g) and the early duration as compared to the other varieties. Short duration varieties performed better than the other normal duration varieties under conditions of receding soil moisture.

In the unweeded control, the grain yield of GBG 1 and LBG 752 was significantly higher than the other two varieties. This can be attributed to the early vigour and fast growth which enabled them to avoid weed competition.

Table 2: Growth and yield attributes of blackgram as influenced by varieties and weed control methods (Mean data of two years).

| Weed control methods | Plant height (cm) | No. of pods per plant | No. of seeds per pod | 100 seed weight (g) | Weed control efficiency (%) at 45 DAS |
|----------------------|-------------------|-----------------------|---------------------|---------------------|--------------------------------------|
| \(W_1\): Pendimethalin 1.0 kg ha\(^{-1}\) PE | 29.9 | 14.1 | 5.51 | 4.18 | 55.6 |
| \(W_2\): Imazethapyr 50 g ha\(^{-1}\) PoE | 28.0 | 14.4 | 5.37 | 4.28 | 54.7 |
| \(W_3\): Pendimethalin 1.0 kg ha\(^{-1}\) PE / imazethapyr 50 g ha\(^{-1}\) PoE | 25.7 | 16.7 | 6.17 | 4.39 | 77.5 |
| \(W_4\): Hand weeding at 20 and 40 DAS with inter cultivation at 30 DAS | 28.5 | 19.2 | 6.31 | 4.2 | 81.4 |
| \(W_5\): Weedy | 30.1 | 12.3 | 5.13 | 4.15 | - |

Varieties

GBG 1: 25.7, PU 31: 22.4, LBG 787: 31.9, LBG 752: 33.8, S.Em.: 1.42

CD (P=0.05) NS, CV (%) 11.6, 15.2

Interaction

CD (P=0.05) NS

Table 3: Grain yield (kg ha\(^{-2}\)) of blackgram varieties as influenced by weed control methods during \textit{rabi} season (Mean of 2015-16 and 2016-17).

| Weed Control Treatment | Variety | GBG 1 | PU 31 | LBG 787 | LBG 752 |
|------------------------|---------|-------|-------|---------|---------|
| \(W_1\): Pendimethalin 1.0 kg ha\(^{-1}\) PE | 492 | 405 | 407 | 437 | 435 |
| \(W_2\): Imazethapyr 50 g ha\(^{-1}\) PoE | 551 | 573 | 590 | 470 | 546 |
| \(W_3\): Pendimethalin 1.0 kg ha\(^{-1}\) PE / imazethapyr 50 g ha\(^{-1}\) PoE | 581 | 562 | 551 | 561 | 564 |
| \(W_4\): Hand weeding at 20 and 40 DAS with inter cultivation at 30 DAS | 748 | 780 | 648 | 661 | 709 |
| \(W_5\): Weedy | 415 | 331 | 292 | 383 | 355 |
| Mean | 558 | 530 | 498 | 502 |

Weed control methods

Varieties

S.Em.: 18.78, CD (P=0.05): 62.20, CV (%): 12.5

Int. between varieties

10.42, 37.56, 27.57

Between weed control methods

37.56, 27.57, 85.25

CV (%)

12.5, 7.7

further research would provide insights into the specific mechanisms underlying these effects and could help in developing more effective strategies for managing weed competition and improving yield in blackgram crops.
Pre-emergence application of pendimethalin was found to be more benefitted by GBG 1 as the variety has early vigour and canopy coverage. Higher correlation between the crops competitive effect and its ability to generate a large leaf area index early in its growth stage was reported by Coleman et al. (2001).

**CONCLUSION**

Blackgram variety GBG 1 out yielded with its shorter duration, early vigour and thus was able to smother weeds under conditions of receding soil moisture in rabi. Application of imazethapyr 50 g ha$^{-1}$ PoE or a combination of pendimethalin 1.0 kg ha$^{-1}$ PE fb imazethapyr 50 g ha$^{-1}$ PoE were the best alternatives to hand weeding with interculture in blackgram for rabi season.

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