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Growth and yield of *Kharif* black gram (*Phaseolus mungo* L.) as influenced by pre and post emergence of herbicide

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Abstract

A Field experiment was carried out at the experimental site of Bihar Agricultural College Farm, Bihar Agricultural University, Sabour during *kharif* season, 2018, to study the effect of pre and post emergence herbicide on growth and yield of Blackgram [*Phaseolus mungo* L.] Among herbicide weed treatments, the highest growth and yield parameters were obtained in intercultural operation at 20 & 40 DAS and it was statistically at par with Pendimethalin (PE) *fb* Imazethapyr (POE) and Oxyfluorfen (PE) *fb* Imazethapyr (POE). All chemical treatments increased the growth, seed yield and yield attributes as compared to weedy check. Weedy check registered with lowest seed yield and yield attributing characters.

Keywords: Blackgram, imazethapyr, pendimethalin, growth and yield of black gram

Introduction

In India many pulse crops are grown among which Blackgram (*Phaseolus mungo* L.) is one of the important pulse crop which belongs to the family "Leguminosae". Pulses through their ability to fix the atmospheric nitrogen, and maintain the sustainability of soil productivity. Blackgram, which is also known as urd bean, contains about 26 per cent protein, 1.2 per cent oil, 56 per cent carbohydrates and has significant quantities of vitamin B1, B2 and niacin. Urd bean is cultivated in about 50.31 lakh ha area in India, with production of 32.84 lakh tonne. In Bihar it is cultivated in an area of 50 ha. In India, the highest yield was recorded by the state of Bihar (898 kg/ha) followed by Jharkhand (875 kg/ha). Blackgram [*Phaseolus mungo* (L.)] is grown in both the season. Frequent irrigations during summer season and monsoon rains during *kharif* season results in lot of weeds population and weed growth in this crop. Most important but not recognized factor liable for poor yield is due to inadequate weed control. Blackgram usually correlated with luxuriant weed growth during rainy season. It has been reported by Choudhury *et al.* (2012) [1]. Furthermore, weather conditions may not permit timely hand weeding due to wet field conditions. In agriculture, labour component is becoming scarce, not available at time and prohibitively costly. Chemical control of weeds is an excellent alternative to manual weeding (Singh *et al.*, 2014) [3-4]. Pre-emergence application of herbicide may allow the emergence of weeds, especially grasses after a few days. At present, the farmers are demanding post-emergence herbicides for managing weeds. The present investigation was planned and implemented taking into account the pre- as well as post-emergence herbicides so that weeds can be controlled throughout the crop growth period for this short duration legume and ultimately improving the productivity of the crop.

Materials and Methods

A Field experiment was carried out at the experimental plot (D-block) at Bihar Agricultural College Farm, Bihar Agricultural University, Sabour during *kharif* season, 2018. The soil of the experimental site has 0.46% organic carbon, 206.30, 19.25 and 168.4 kg/ha available N, P and K, respectively. The cumulative rainfall recorded was 248.7 mm during the experimental period, 2018.

The experiment consisted 11 treatments with three replications laid out in randomized block design. Blackgram was sown at 30 x 10 cm row to row and plant to plant spacing using 15 kg seed/ha. Recommended dose of fertilizers (20 kg N + 60 kg P₂O₅ + 40 kg K₂O/ha) was applied to blackgram crop at the time of sowing through Urea, di-ammonium phosphate (DAP) and Murate of Potash. Pre-emergence application of pendimethalin 30 EC and Oxyfluorfen 23.5 EC was done 2 days after sowing and post emergence application of other herbicides was done at 23 DAS.

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Five plants were randomly selected from each plot to record the data about different agronomic parameters like plant height at different crop stages, dry matter accumulation, number of branches plant⁻¹, number of pods plant⁻¹, number of seeds pod⁻¹, 1000-grain weight, total biological yield, total seed yield and harvest index

After drying the crop was threshed & winnowed to get the seed yield from the net plot and was converted to quintal per hectare. Stover obtained from the net plot area was sundried for 2-4 days & then dry weight from each plot was recorded. Finally, the dry weight was converted to quintal per hectare. Harvest index was calculated as ratio of economic yield to biological yield and expressed in percentage.

$$\text{Harvest Index (\%)} = \frac{\text{Grain Yield}}{\text{Biological (Grain+Straw)Yield}} \times 100$$

Results and Discussion

Crop growth constituents like Plant height (cm), No. of branches/plant, and dry matter accumulation were significantly influenced by weed management practices.

Maximum height, number of branches and dry matter was recorded in weed free (43.53 cm, 10.17/plant and 32.50 g/plant, respectively). While minimum was recorded in weedy check (39.25 cm, 6.17/plant and 27.80 g/plant) at maturity followed by Intercultural operation @ 20 and 40 DAS. It might be due to no weed flora in weed free treatment along with good aeration during the cultural operation. Among chemical treatments maximum height, branches and dry matter was recorded in Pendimethalin (PE) *fb* Imazethapyr (POE) i.e.42.38 cm, 9.20/plant and 32.30 g/plant, respectively at maturity. Minimum number of plant height (cm) branches and dry matter was obtained in weedy check (39.25 cm), 6.17 and 27.80 g/plant. Clearly this could be due to highest weed dominance & competition for space, light, moisture, sun light and nutrients with the crop under weedy check. Similar findings were recorded by Raman and Krishnamoorthy (2005)^[8] and Chhodavadia (2014)^[9] in summer green gram.

The successive application of pre-emergence followed by post-emergence herbicide i.e. Imazethapyr 10 SL (T₃ &T₆), Fenoxaprop-p-ethyl 10EC (T₄ &T₇) and Quizalofop-p-ethyl 5 EC (T₅ &T₈) resulted in significantly higher growth parameters than weedy check as application of pre-emergence herbicides followed by post-emergence herbicide maintained the weed free condition throughout the growing period of the crop. Similar results have been reported by Aggarwal *et al.* (2014)^[3]

The yield parameters like, number of pods/plant (35.67) number of grain/pod (9.67) and Test weight (33.5 g) of Blackgram was found maximum in weed free was found statistically at par with intercultural operation at 20 & 40 DAS. Similar findings were reported by Aggarwal *et al.* (2014)^[3]. Minimum number of pods per plant (25), number of seeds per pod (5.25), test weight (30.56 g), was recorded in weedy check (T₁₀). The reduction in yield parameter was due to much more competition between weeds and crop for resources which reduced the growth parameters Similar result of poorer performance of weedy check has been reported by Charan Teja *et al.* (2016)^[11] Among herbicide treatments, application of Pendimethalin (PE) *fb* Imazethapyr (POE) gave higher grain yield (9.25 q/ha), haulm yield (39.29 q/ha) and total biological yield (48.54 q/ha). This might be due to better growth and yield attributes of the crop. These findings were in conformity with Pankaj and Dewangan (2017)^[5].

The Successive application of pre-emergence followed by post-emergence herbicides i.e. Imazethapyr 10 SL (T₃ &T₆), Fenoxaprop-p-ethyl 10EC (T₄ &T₇) and Quizalofop-p-ethyl 5 EC (T₅ &T₈) resulted in increased yield mainly because of better exploitation of resources by the crop in lesser weed environment which lead to better development of crop and ultimately yield. Above discussion indicates that single application of herbicides are better than control but sequential application of pre- and post-emergence herbicides can surpass the weeds throughout the growing period of the crop as compared to single application.

Economics

Maximum gross returns were obtained in weed free (Rs.73283) whereas highest net return was obtained in Pendimethalin (PE) *fb* Imazethapyr (POE) i.e. (Rs 48549) which was followed by Intercultural operation @ 20 and @ 40 DAS (Rs.68444 gross return and Rs.44517 net return ha⁻¹, respectively). This influence might be owing to higher grain yield in these treatments which resulted in higher gross as well as net returns. Similar result was shown by Aggarwal *et al.* (2014)^[3] and Balyan *et al.* (2016)^[10].

Among chemical weed management practices Pendimethalin (PE) *fb* Imazethapyr (POE) recorded the highest B: C ratio followed T₄ and T₆. Higher benefit: cost ratio may be attributed to higher yield attributes and grain yield in these treatments. While, weedy check (T₁₀) recorded lowest benefit: cost ratio which might be due to least yield obtained in this treatment because of severe weed competition. Chuadhary *et al.* (2011) revealed similar findings.

Table 1: Influence of weed management practices on Crop Growth and yield parameters of Black gram at different growth stages

Treatment	Plant height (cm)			Number of Branches per plant			Dry matter accumulation (g /plant)			Pods/ plant (at maturity)	No. of seeds per pod	Test weight (g)
	30 DAS	60 DAS	At Maturity	30 DAS	60 DAS	At Maturity	30 DAS	60 DAS	At Maturity			
T ₁	9.78	38.33	40.50	30 DAS	60 DAS	At Maturity	6.80	20.00	29.80	28.35	9.30	31.25
T ₂	10.00	38.00	39.50	3.80	6.25	7.75	6.70	19.84	29.64	28.25	9.25	31.5
T ₃	10.52	41.37	42.38	3.78	6.12	7.62	9.20	22.50	32.30	34.00	9.55	32.89
T ₄	10.46	40.50	41.75	4.50	7.70	9.20	8.70	22.19	31.99	32.50	9.51	32.19
T ₅	10.45	39.80	41.10	4.35	7.33	8.83	7.50	21.94	31.74	30.45	9.41	31.69
T ₆	10.33	40.85	42.25	4.00	7.00	8.50	7.30	22.36	32.16	33.50	9.52	32.44
T ₇	9.92	40.00	41.36	4.32	7.32	8.82	7.40	22.16	31.96	31.28	9.45	31.94
T ₈	9.85	39.00	40.88	4.33	7.20	8.70	6.90	20.48	30.28	29.45	9.35	31.54
T ₉	10.00	41.60	42.60	4.00	7.23	8.73	9.30	22.60	32.40	34.17	9.63	33.34
T ₁₀	9.72	37.00	39.25	4.80	7.80	9.30	6.50	18.00	27.80	25.00	5.25	30.56
T ₁₁	10.60	41.73	43.53	3.67	4.67	6.17	9.40	22.70	32.50	35.67	9.67	33.5
SE m ±	0.39	1.62	1.58	5.02	8.67	10.17	0.28	0.75	0.68	1.35	0.35	0.74
CD (P=0.05)	NS	NS	NS	0.31	0.28	0.32	0.81	2.20	2.01	3.99	1.04	NS

T₁ Pendimethalin (PE)

T₇ Oxyfluorfen (PE) *fb* Fenoxaprop-p-ethyl (POE)

- T2 Oxyfluorfen (PE) T8 Oxyfluorfen (PE) *fb* Quizalofop-p-ethyl (POE)
 T3 Pendimethalin (PE) *fb* Imazethapyr (POE) T9 Intercultural operation @ 20 and 40 DAS
 T4 Pendimethalin (PE) *fb* Fenoxaprop-p-ethyl (POE) T10 Weedy check
 T5 Pendimethalin (PE) *fb* Quizalofop-p-ethyl (POE) T11 Weed free
 T6 Oxyfluorfen (PE) *fb* Imazethapyr (POE)

Table 2: Influence of weed management practices on yield and economics of Black gram

Treatment	Yield				Economics			
	Seed yield (q/ha)	Haulm yield (q/ha)	Total Biological yield (q/ha)	Harvest Index (%)	Cost of cultivation (Rs. ha-1)	Gross return (Rs. ha-1)	Net return (Rs. ha-1)	B:C ratio
T1	5.60	29.03	34.63	16.17	17,031	42723	25692	1.51
T2	5.58	28.05	33.63	16.59	18,031	42194	24162	1.34
T3	9.25	39.29	48.54	19.06	18,295	66845	48549	2.65
T4	8.85	37.94	46.79	18.91	19,305	64104	44799	2.32
T5	8.60	37.80	46.40	18.53	19,145	62694	43549	2.27
T6	8.92	39.10	48.02	18.58	19,295	64981	45686	2.37
T7	8.65	37.93	46.58	18.57	20,305	63020	42715	2.10
T8	8.14	37.78	45.92	17.73	20,145	60201	40056	1.99
T9	9.50	39.87	49.37	19.24	23,927	68444	44517	1.86
T10	3.99	21.35	25.34	15.75	16,217	30727	14509	0.89
T11	10.24	41.83	52.07	19.67	26,497	73283	46786	1.77
SE m ±	0.31	1.39	1.70	0.70	-----	2294	2294	0.11
CD (P=0.05)	0.93	4.09	5.02	2.07	-----	6768	6768	0.34

- T1 Pendimethalin (PE) T7 Oxyfluorfen (PE) *fb* Fenoxaprop-p-ethyl (POE)
 T2 Oxyfluorfen (PE) T8 Oxyfluorfen (PE) *fb* Quizalofop-p-ethyl (POE)
 T3 Pendimethalin (PE) *fb* Imazethapyr (POE) T9 Intercultural operation @ 20 and 40 DAS
 T4 Pendimethalin (PE) *fb* Fenoxaprop-p-ethyl (POE) T10 Weedy check
 T5 Pendimethalin (PE) *fb* Quizalofop-p-ethyl (POE) T11 Weed free
 T6 Oxyfluorfen (PE) *fb* Imazethapyr (POE)

Conclusion

Based on the experiment conducted for one year it might be concluded that among chemical weed management application of Pendimethalin (PE) *fb* Imazethapyr (POE) resulted in high number of pod/plant, seed/pod, grain yield, as well as better weed management. Also it was found economically viable as compare to weed free & Intercultural operation @ 20 and 40 DAS.

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