

Impact of Pre and Post emergence Herbicide Combinations on Yield of Black Gram

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(Received 18 April 2022, Accepted 13 June, 2022)

(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: A field experiment was conducted during summer 2018 at Students' Instructional Farm, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur to find out the most effective herbicide combinations for effective control of weeds to obtain a good harvest of black gram. The experiment was laid in randomized block design with total of ten treatments replicated thrice. In recent years weeds were reported to develop resistance against application of individual herbicides. So as a strategy pre-mix combination of herbicides were employed to test its impact on weed flora. Pre-mix combination of pendimethalin 1000 g/ha PRE + imazethapyr 100 g/ha POE had recorded maximum number of primary as well as secondary branches/plant. However other yield attributes viz. pod/plant, pod weight/ plant, number of grain/ pod and test weight (g) also found to be highest with the same herbicide combination. Seed and stover yield were recorded highest with the application of pendimethalin 1000 g/ha PRE + imazethapyr 100 g/ha POE over other herbicides or herbicide combination applied as pre-or post-emergence.

Keywords: Black gram, Branches, Yield, Herbicide combinations.

INTRODUCTION

In India, black gram is one of the most significant pulse crops. India is the world's top producer and user of black gram. Black gram meets a large portion of the protein needs of the country's vegetarian population. It has a protein content of roughly 26%, almost three times that of grains (Kavitha *et al.*, 2013). It is mostly planted in Uttar Pradesh during the kharif season, when weed infestation causes significant production loss. Distinct types of weeds, such as grasses, wide leaves, and sedges, compete with black gram for different growth factors in a group or individually. The first 20–40 days after planting are essential for weed competition in black gram, and season-long weed competition has been reported to diminish black gram output by 27–64 percent depending on the kind and severity of weed flora (Singh, 2011; Bhowmick *et al.*, 2015). Furthermore, constant rain throughout the season makes hand weeding risky and impractical. As a result, chemical weed management became a viable and cost-effective option for managing weeds in black gram production. Due to the limited flexibility in time of

application, development of resistance in weed against particular herbicide there is poor efficiency for different pre-emergence or post-emergence herbicides during kharif which badly affect the crop productivity. So combination of herbicides may be a good option to avoid these problems. Imazethapyr a post-emergence herbicide that inhibits the enzyme acetohydroxy acid synthase, has been shown to be particularly efficient for broad spectrum weed control in kharif pulses, including black gram. However, efficiency of different herbicide combination in kharif black gram under central plain zone of Uttar Pradesh yet to be determined. As a result, a comprehensive field research was conducted in summer black gram to determine the appropriate herbicide combination for successful crop growth.

METHOD AND MATERIAL

The field experiment was conducted during summer season of the year 2018 at Students' Instructional Farm, Department of Agronomy, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, India. Geographically, Kanpur comes under the sub-tropical semi-arid tract of North India. The

Kanpur-city lies on 26°29'35" North latitude and 80°18'25" East longitude at 125.9 m mean sea level. Kanpur City situated in *Central Plain Zone* of U.P. located on the right bank of holly river Ganga and fall under upper Indo-Gangetic plain zone of India. In all, there were 10 treatments included in the experiment viz. pendimethalin 1000 g/ha, imazethapyr 100 g/ha, quizalofop 50 g/ha at 25-30 DAS, pendimethalin 1000 g/ha + imazethapyr 100 g/ha POE, pendimethalin 1000 g/ha PE + quizalofop 50 g/ha at 20 DAS, pendimethalin 1000 g/ha PE + One hand weeding at 20 DAS, imazethapyr 100 g/ha 20 DAS + quizalofop 50 g/ha at 25 DAS, two hand weeding (20 & 40 DAS), weed free and weedy check. The soil of experimental field was alkaline in reaction (8.2 pH), low in available nitrogen (176.74 kg ha⁻¹) and medium in organic carbon (0.56%), available phosphorus (19.30 kg ha⁻¹) and potassium (217.80 kg ha⁻¹). The average annual rainfall is 65.6 mm out of which 88.70% received during the months of July to October. The black gram (Urd) variety Shekhar-2 was used in the experiment. A uniform seed rate of 25 kg ha⁻¹ was used in all the treatments. The sowing of crop was done on 10th March, 2018 in rows at 30 cm apart with a depth of 5-7 cm by using the "Desi plough". It matures in 90 days but in summer season it mature within 75 DAS. The average seed yield is about 15-20 q ha⁻¹. The herbicides were applied as pre-emergence (0-2 DAS) and post emergence (25 DAS) at 3-4 leaf stage of weeds with the help of manually operated Knapsack sprayer fitted with flat fan nozzle using 500 liters of water ha⁻¹. Crop was irrigated at 15 days interval to get maximum yield. The length of pods (cm) was measured using a scale after randomly choosing plants from three different locations (cm). By counting all the pods on three harvested tagged plants, the number of pods (plant⁻¹) was reported. The total number of seeds extracted and the total number of grains were counted and averaged in three randomly selected pods. For the experimental designs, statistical analysis of the data was performed using Fisher's analysis of variance, and treatment means were compared using the least significant difference test at a 5% probability level using a t-test and RBD values were calculated.

RESULT AND DISCUSSION

Application of various herbicides significantly influenced the number of branches per plant at all the stages of crop growth. Highest number of primary as well as secondary branches was recorded with weed free treatment. However, among herbicidal treatment highest number of primary branches plant⁻¹ was recorded with the application of pendimethalin 1000 g/ha PE + imazethapyr 100 g/ha POE of at all stages of crop growth which is at par with allother treatments except quizalofop 50 g/ha at 25-30 DAS. However, in case of secondary branches pendimethalin 1000 g/ha+ imazethapyr 100 g/ha POE recorded the highest

number which is statistically at par with pendimethalin 1000 g/ha PE + One hand weeding at 20 DAS and imazethapyr 100 g/ha 20 DAS + quizalofop 50 g/ha at 25 DAS. Number of pod plant⁻¹, pod weight plant⁻¹, Number of grain pod⁻¹ and Test weight (g) was recorded highest with weed free treatment and lowest with weedy check. However, among herbicidal treatment combination of pendimethalin 1000 g/ha PE + imazethapyr 100 g/ha POE recorded the highest weight of pod plant⁻¹ and number of grain pod⁻¹ which is at par with pendimethalin 1000 g/ha PE + One hand weeding at 20 DAS and imazethapyr 100 g/ha 20 DAS + quizalofop 50 g/ha at 25 DAS. Number of pod plant⁻¹ also follow the same trend but was at par with pendimethalin 1000 g/ha PE + One hand weeding at 20 DAS. Test weight (g) was recorded highest with weed free treatment but in case of herbicidal treatment pendimethalin 1000 g/ha PE + imazethapyr 100 g/ha POE recorded the highest value. Due to the implementation of successful weed management technologies, weeds competed less with the crop for various resources such as space, light, nutrients, and moisture. As a result of reduced crop-weed competition, crop growth improved overall, and reproductive structures and photosynthate transfer to the sink improved. These results were in close conformity with Yadav *et al.* (2014).

Seed and stover yield of black gram recorded significant variations with respect to different weed management treatments. It was observed that among the different weed management treatments, weed free recorded significantly highest seed yield (10.95 q/ha) and stover yield (36.45 q/ha). Reduced crop weed competition and greater weed management efficacy by providing below threshold weed conditions were clearly responsible for the increase in seed and stover production of black gram under weed-free circumstances. As a result, the agricultural plants used nutrients, hydration, sunshine, space, and other input elements more efficiently, resulting in higher yield. Due to severe competition for nutrients, moisture, and light between the crop and weeds at crucial phenophases of the crop, the weedy check plots produced considerably lower yields. Similar findings were reported by Mirjha *et al.* (2013); Yadav *et al.* (2015). Among the herbicidal treatments, application of pendimethalin 1000 g/ha PE + imazethapyr 100 g/ha as POE significantly recorded highest seed yield (10.52 q/ha) and stover yield (34.68 q/ha), which was statistically at par with pendimethalin 1000 g/ha PE + One hand weeding at 20 DAS, imazethapyr 100 g/ha 20 DAS + quizalofop 50 g/ha at 25 DAS and pendimethalin 1000 g/ha PE + quizalofop 50 g/ha at 20 DAS. This is likely owing to enhanced weed control of both grassy and broad-leaved weeds during early crop growth phases, increased weed control effectiveness, increased nutrient absorption by the crop, and improved yield characteristics (Shashidhar *et al.*, 2020).

Table 1: Effect of weed control treatment on number primary branches (plant⁻¹) of crop.

Treatments	30 DAS	45 DAS	At maturity
T ₁ : Pendimethalin 1000 g/ha	2.70	3.82	4.78
T ₂ : Imazethapyr 100 g/ha	2.77	3.92	4.91
T ₃ : Quizalofop 50 g/ha	2.61	3.70	4.65
T ₄ : Pendimethalin 1000 g/ha + Imazethapyr 100 g/ha	3.13	4.45	5.77
T ₅ : Pendimethalin 1000 g/ha + Quizalofop 50 g/ha	2.79	3.95	4.95
T ₆ : Pendimethalin 1000 g/ha + One hand weeding at 20 DAS	3.09	4.38	5.49
T ₇ : Imazethapyr 100 g/ha + Quizalofop 50 g/ha	2.88	4.08	5.12
T ₈ : Two hand weeding (20 & 40 DAS)	3.19	4.52	5.66
T ₉ : Weed free	3.60	5.10	6.39
T ₁₀ : Weedy check	2.33	3.35	4.20
SEd±	0.24	0.32	0.55
CD at 5%	0.51	0.68	1.16

Table 2: Effect of weed control treatment on number of secondary branches (plant⁻¹) of crop.

Treatments	45 DAS	At maturity
T ₁ : Pendimethalin 1000 g/ha	3.57	4.62
T ₂ : Imazethapyr 100 g/ha	3.67	4.75
T ₃ : Quizalofop 50 g/ha	3.47	4.50
T ₄ : Pendimethalin 1000 g/ha + Imazethapyr 100 g/ha	4.31	5.58
T ₅ : Pendimethalin 1000 g/ha + Quizalofop 50 g/ha	3.70	4.79
T ₆ : Pendimethalin 1000 g/ha + One hand weeding at 20 DAS	4.10	5.32
T ₇ : Imazethapyr 100 g/ha + Quizalofop 50 g/ha	3.82	4.92
T ₈ : Two hand weeding (20 & 40 DAS)	4.23	5.47
T ₉ : Weed free	4.77	6.17
T ₁₀ : Weedy check	3.15	4.12
SEd±	0.26	0.47
CD at 5%	0.54	1.0

Table 3: Effect of weed control treatment on yield attributes of crop.

Treatments	Number of pod plant ⁻¹	Weight of pod(g) plant ⁻¹	Number of grain pod ⁻¹	Test weight (g)
T ₁ : Pendimethalin 1000 g/ha	16.77	7.11	4.79	40.13
T ₂ : Imazethapyr 100 g/ha	17.31	7.35	4.95	40.23
T ₃ : Quizalofop 50 g/ha	16.36	6.95	4.67	39.96
T ₄ : Pendimethalin 1000 g/ha + Imazethapyr 100 g/ha	20.29	8.57	5.78	41.23
T ₅ : Pendimethalin 1000 g/ha + Quizalofop 50 g/ha	17.39	7.36	4.90	40.30
T ₆ : Pendimethalin 1000 g/ha + One hand weeding at 20 DAS	19.33	8.17	5.51	40.56
T ₇ : Imazethapyr 100 g/ha + Quizalofop 50 g/ha	18.01	7.61	5.13	40.48
T ₈ : Two hand weeding (20 & 40 DAS)	19.86	8.40	5.66	41.42
T ₉ : Weed free	22.35	9.45	6.37	41.96
T ₁₀ : Weedy check	15.19	6.43	4.33	38.16
SEd±	1.05	0.50	0.34	0.57
CD at 5%	2.22	1.07	0.72	1.20

Table 4: Effect of weed control treatments on Grain yield, Straw yield and Harvest index of black gram.

Treatments	Grain yield (q ha ⁻¹)	Straw yield (q ha ⁻¹)
T ₁ : Pendimethalin 1000 g/ha	8.20	29.10
T ₂ : Imazethapyr 100 g/ha	8.42	29.32
T ₃ : Quizalofop 50 g/ha	7.87	28.53
T ₄ : Pendimethalin 1000 g/ha + Imazethapyr 100 g/ha	10.52	34.68
T ₅ : Pendimethalin 1000 g/ha + Quizalofop 50 g/ha	9.78	33.12
T ₆ : Pendimethalin 1000 g/ha + One hand weeding at 20 DAS	10.42	34.36
T ₇ : Imazethapyr 100 g/ha + Quizalofop 50 g/ha	10.35	34.05
T ₈ : Two hand weeding (20 & 40 DAS)	10.62	35.52
T ₉ : Weed free	10.95	36.45
T ₁₀ : Weedy check	6.85	26.40
SEd±	0.482	0.760
CD at 5%	1.012	1.596

CONCLUSION

It can be concluded that pendimethalin 1000 g/ha PE + imazethapyr 100 g/ha POE or pendimethalin 1000 g/ha PE + one hand weeding at 20 DAS found suitable for weed control in summer black gram as these provide higher branches, pod/plant pod weight/ plant, number of grain/ pods, test weight (g), seed yield and stover yield.

Acknowledgement. The author(s) gratefully acknowledge the Department of Agronomy, Chandra Shekhar Azad University of Agriculture and Technology, Uttar Pradesh, India for providing the research facilities for this research.

Conflicts of Interest. None.

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How to cite this article: Vishal Singh, Naushad Khan, Satya Prakash Gupta and Ankit Kumar (2022). Impact of Pre and Post emergence Herbicide Combinations on Yield of Black Gram. *Biological Forum – An International Journal*, 14(2): 1398-1401.