

Short Communication

Effect of dose and time of imazethapyr on weed and yield in summer season blackgram (*Vigna mungo* L.)

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Received: 02 January 2024

Accepted: 30 March 2024

Handling Editor:

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Black gram (*Vigna mungo* L.) is probably a native of India. It is a self-pollinated and heaving epigeal type of germination. This crop is also known as urdbean, mash, munngobean, black mapte etc. It is another important short-duration pulse crop grown in many parts of India. This crop is grown in a cropping system as a mixed crop and catch crop. Its seeds are highly nutritious with protein (25-26%), carbohydrates, minerals, and vitamins. Seeds are used in the preparation of many popular dishes. It is one of the most important components in the preparation of famous south Indian dishes, viz dosa, idli, vada etc. In India, the production of black is 2.27 million tonnes (Department of Agriculture, Cooperation & Farmer's Welfare, *Annual Report* 2021). In Nagaland it is cultivated 830 ha areas and production is 680 metric tonne (Directorate of Agriculture 2019-20, Nagaland).

The presence of weeds in the crop lowers the yield by competing with them for space, moisture, light, and nutrients. Therefore, weed management at an appropriate time using a suitable method is the most important agronomic aspect in time that plays an important role in exploiting the yield potential of black gram, provided other inputs are not limiting. In blackgram, weeds could be controlled by hand weeding (Chand *et al.* 2004). However, hand weeding is laborious, time-consuming costly, and tedious. Moreover, many times labour is not available during the critical period of weed

ABSTRACT

A field experiment was conducted to study the effect of dose and time of imazethapyr on weed and yield in the summer season black gram. The predominant weed species in the experimental field were *Eleusine indica*, *Amaranthus viridis*, *Commelina benghalensis*, *Alternanthera sessilis* etc. The minimum weed population was observed with two-hand weeding at 20 and 40 DAS which was closely followed by imazethapyr @ 100 g a.i. ha⁻¹ at 25 DAS and imazethapyr @ 75 g a.i. ha⁻¹ at 15 DAS. Imazethapyr 100 g a.i. ha⁻¹ at 25DAS recorded the pod length, number of seeds pod⁻¹, test weight, harvest index, seed and stover yield. Application of imazethapyr @ 100 g a.i. ha⁻¹ at 25 DAS gave a higher B:C ratio (1.03) as compared to two-hand weeding at 20 and 40 DAS.

Key words: Blackgram, Imazethapyr, Two-hand weeding

removal. Furthermore, weather conditions (rain) do not permit timely hand weeding due to wet field conditions. Delayed removal of weeds is not as effective in controlling weeds and obtaining higher yields as the timely removal of weeds. Under these conditions, the use of herbicides offers an alternative for possible effective control of weeds. Therefore, post-emergence herbicides are required to control the second flush of weeds in pulses and to reduce human labour (Singh *et al.* 2014). Several herbicides like pendimethalin, fluchloralin, metalachor and alachlor have been used for controlling weeds associated with black gram but were found not much effective in controlling various weeds in black gram. Therefore, it was important to evaluate the efficacy of suitable post-emergence herbicides as alone or in mixture for effectively controlling dominant and diversified weed flora in black gram. The available pre and post emergence herbicides like pendimethalin, oxyfluorfen, fluchloralin have been reported to check the emergence of annual grasses and broad-leaved weeds in black gram. Presently, imazethapyr reported is very effective post emergence herbicide for controlling some grassy and broad leaf weeds in blackgram (Suryavanshi *et al.* 2018). However, no study was conducted on using imazethapyr herbicide for controlling weeds in the summer season black gram in Nagaland. Hence this study aimed to study the effect of dose and time of imazethapyr on weed and yield in the summer season black gram.

The field experiment comprised seven weed control treatments with three replications. The experiment was laid out in randomized block design. The experimental field was separated into three equal parts and each part divided into seven equal plots measuring 4.5 m x 3 m and maintained 0.2 m spacing between the plots. Altogether there are 21 plots and in each replication, the treatments are allotted randomly by adopting randomization principle. Weed density was taken at 25 and 50 DAS stages randomly selected spots in early plot by counting the number of weeds inside an area of 0.5 m x 0.5 m quadrat and the values were expressed in number m⁻². The weed count data were subjected to square root transformation. The weeds falling within the frames of the quadrat were cutting close at ground level, collected and dried in hot air oven at 80 C for 72 hrs. Oven dried weight was recorded and converted to g m⁻².

The experimental field was infested with various weeds species like broad leaf weed, sedges, and grasses. The broad leaf weeds species observed in experimental field *Amaranthus spp.*, *Alternanthera philoxeroides*, *Ageratum conyzoides*, *Abutilon indicum*, *Alternanthera sessilis*, *Borreria hispida*, *Commelina benghalensis*, *Leucus aspera*, *Sida acuta*, *Portulaca oleracea*, *Phyllanthus niruri* (Yokha *et al.* 2015, Patel *et al.* 2016, Mohanty *et al.* 2020). The common sedges experimental field were *Cyperus rotundus* and *Cyperus irria*. The grassy weed included *Eleusine indica*, *Digitaria sanguinalis*, *Cynodon dactylon* in

experimental field. The mean data of 25 DAS showed that (Table 1) various weed treatment had significant effect on density of *Eleusine indica*, *Amaranthus viridis*, *Commelina benghalensis*, *Alternanthera sessilis* and other weed species. Weedy check recorded the highest weed density. The lowest population was under imazethapyr @ 75 g *a.i.* ha⁻¹ at 15 DAS which was at par with imazethapyr @ 50 g *a.i.* ha⁻¹ at 15 DAS. This was due to higher dose and perfect time of imazethapyr is effectively controlled weed. This result was conformity with (Singh *et al.* 2016, Hedayetullah and Kumar 2023). The counting of weed density at 50 DAS showed significant difference in the population of the lowest density of weed was observed in Imazethapyr @ 100 g *a.i.* ha⁻¹ applied at 25 DAS which was at par with Imazethapyr @ 75 g *a.i.* ha⁻¹ applied at 15 DAS and significantly superior over the rest treatments. This was due to the early-stage application of imazethapyr with a low dose was not effective because many weed seeds did not germinate while a higher dose was found effective at later growth stages of the crop (Aggarwal *et al.* 2014, Singh *et al.* 2022).

Mean data of weeds counted at 25 DAS showed that various weed treatments had a significant effect on weed dry weight of *Eleusine indica*, *Amaranthus viridis*, *Commelina benghalensis*, *Alternanthera sessilis* (Table 2). The weedy check had the highest weed dry weight and significantly lower dry weight of *Eleusine indica* Imazethapyr @ 75 g *a.i.* ha⁻¹ applied at 15 DAS with at par Imazethapyr @ 50 g *a.i.* ha⁻¹

Table 1. Effect of dose and time of imazethapyr on weed population species 25 and 50 DAS

Treatment	25 DAS (No. of weeds/m ²)				50 DAS (No. of weeds/m ²)			
	<i>Eleusine indica</i>	<i>Amaranthus viridis</i>	<i>Commelina benghalensis</i>	<i>Alternanthera sessilis</i>	<i>Eleusine indica</i>	<i>Amaranthus viridis</i>	<i>Commelina benghalensis</i>	<i>Alternanthera sessilis</i>
Weedy check	6.96 (48.50)	5.84 (33.63)	3.18 (9.97)	2.46 (5.63)	9.30 (86.00)	5.89 (34.97)	3.26 (10.17)	2.92 (8.07)
Two hand weeding @ 20 and 40 DAS	3.04 (8.77)	2.30 (5.10)	1.54 (1.87)	1.42 (1.53)	3.92 (14.87)	3.09 (9.03)	1.53 (1.87)	1.39 (1.47)
Imazethapyr @ 50 g <i>a.i.</i> ha ⁻¹ at 10 DAS	4.93 (23.87)	3.56 (12.20)	2.14 (4.17)	1.77 (2.67)	7.00 (48.77)	4.90 (23.53)	2.38 (5.17)	1.90 (3.10)
Imazethapyr @ 75 g <i>a.i.</i> ha ⁻¹ at 10 DAS	4.85 (23.07)	3.07 (8.97)	1.86 (2.97)	1.61 (2.17)	5.94 (34.77)	4.67 (21.30)	2.20 (4.37)	1.84 (2.90)
Imazethapyr @ 50 g <i>a.i.</i> ha ⁻¹ at 15 DAS	4.42 (19.07)	3.54 (12.00)	1.77 (2.63)	1.45 (1.60)	5.72 (32.23)	4.60 (20.63)	2.12 (4.03)	1.78 (2.73)
Imazethapyr @ 75 g <i>a.i.</i> ha ⁻¹ at 15 DAS	3.92 (14.87)	2.89 (7.97)	1.60 (2.07)	1.33 (1.27)	5.10 (25.27)	3.74 (13.50)	1.83 (2.90)	1.51 (1.80)
Imazethapyr @ 100 g <i>a.i.</i> ha ⁻¹ at 25 DAS	6.70 (45.03)	5.16 (26.13)	2.81 (7.40)	2.20 (4.40)	4.97 (24.50)	3.34 (10.67)	1.68 (2.40)	1.41 (1.50)
SEm±	0.19	0.19	0.13	0.13	0.20	0.14	0.11	0.11
CD (0.05)	0.58	0.58	0.39	0.41	0.61	0.42	0.34	0.34

*Values were square root transformed \sqrt{X} (actual weed count) +0.5, original values mentioned parentheses

applied at 15 DAS and Imazethapyr @ 75 g *a.i.* ha⁻¹ applied at 10 DAS superior over treatments. On the other hand, mean data of weeds counted at 50 DAS showed significant differences in the dry weight weight of *Elusine indica*, *Amaranthus viridis*, *Commelina benghalensis*, *Alternanthera sessilis* and was observed lowest in Imazethapyr @ 100 g *a.i.* ha⁻¹ applied at 25 DAS which was at par with Imazethapyr @ 75 g *a.i.* ha⁻¹ applied at 15 DAS was significantly superior over the other treatments due to low weed density (Aggarwal *et al.* 2014).

Different weed management treatments showed a significant effect on the number of pods (Table 3). The maximum pod plant⁻¹ was in two-hand weeding at 20 and 40 DAS (16.27). Among the herbicidal treatments, imazethapyr @ 100 g *a.i.* ha⁻¹ applied at 25 DAS (16.03) which was at par with imazethapyr @ 75 g *a.i.* ha⁻¹ applied at 15 DAS (15.70) gave the highest pods plant⁻¹ which was at par with two-hand weeding while the lowest number of pods was recorded in weedy check. This might be due to lesser competition from the weeds on account of effective weed management practices. Similar findings were reported by Lal *et al.* (2017) where the highest number of pods was recorded in two-hand weeding at 20 and 40 DAS and the lowest was recorded in weedy check. There was a significant effect on pod length due to different weed management treatments. The highest pod length (5.37) was recorded Imazethapyr @ 100 g *a.i.* ha⁻¹ applied at 25 DAS which was at par with

Imazethapyr @ 75 g *a.i.* ha⁻¹ applied at 15 DAS (5.30), Imazethapyr @ 50 g *a.i.* ha⁻¹ applied at 15 DAS (5.27), Imazethapyr @ 75 g *a.i.* ha⁻¹ applied at 15 DAS (5.17) and Imazethapyr @ 50 g *a.i.* ha⁻¹ at 10 DAS (5.13). Severe infestation of weeds causes stress to the crop plant, and thus pod length is reduced which was evidenced in the weedy check treatment. The shortest pod length was recorded in the weedy check (4.10 cm). This is in agreement with the findings of Sharma *et al.* (2016).

Different weed management treatments showed a significant effect on the number of seeds pods⁻¹ (Table 3). The highest number of seeds pods⁻¹ (6.31) was recorded Imazethapyr @ 100 g *a.i.* ha⁻¹ applied at 25 DAS which was at par Imazethapyr @ 75 g *a.i.* ha⁻¹ applied at 15 DAS (6.21), Imazethapyr @ 50 g *a.i.* ha⁻¹ applied at 15 DAS (6.16), Imazethapyr @ 75 g *a.i.* ha⁻¹ applied at 10 DAS (6.14) and Imazethapyr @ 50 g *a.i.* ha⁻¹ applied at 10 DAS (6.08), while the lowest number of seeds pod⁻¹ was recorded in weedy check (3.43). This might be due to better control of weeds from the earlier stage resulting in good plant growth and a higher number of seeds pod⁻¹ (Sangeetha *et al.* 2012). Different weed management treatments showed a significant effect on test weight. The maximum test weight (41.67) was recorded Imazethapyr @ 100 g *a.i.* ha⁻¹ applied at 25 DAS which was at par Imazethapyr @ 75 g *a.i.* ha⁻¹ applied at 15 DAS (41.07), Imazethapyr @ 75 g *a.i.* ha⁻¹ applied at 10 DAS (39.77), Imazethapyr @ 50 g *a.i.* ha⁻¹ applied at 15 DAS (39.67), and Imazethapyr

Table 2. Effect of dose and time of imazethapyr on weed dry matter of weed 25 and 50 DAS

Treatment	Weed dry matter at 25 DAS (g/m ²)				Weed dry matter at 50 DAS (g/m ²)			
	<i>Elusine indica</i>	<i>Commelina benghalensis</i>	<i>Amaranthus viridis</i>	<i>Alternanthera sessilis</i>	<i>Elusine indica</i>	<i>Commelina benghalensis</i>	<i>Amaranthus viridis</i>	<i>Alternanthera sessilis</i>
Weedy check	4.06 (16.16)	1.54 (1.96)	3.37 (10.86)	1.32 (1.25)	10.24 (104.61)	3.51 (11.84)	6.95 (48.50)	3.01 (8.56)
Two hand weeding @ 20 DAS and 40 DAS	0.80 (0.15)	0.72 (0.02)	0.76 (0.08)	0.75 (0.07)	0.97 (0.45)	0.78 (0.11)	0.86 (0.24)	0.78 (0.12)
Imazethapyr @ 50 g <i>a.i.</i> ha ⁻¹ at 10 DAS	2.23 (4.47)	1.17 (0.86)	1.74 (2.52)	0.98 (0.45)	7.00 (48.84)	2.54 (5.94)	5.68 (31.77)	2.01 (3.56)
Imazethapyr @ 75 g <i>a.i.</i> ha ⁻¹ at 10 DAS	2.14 (4.11)	0.97 (0.45)	1.63 (2.17)	0.90 (0.31)	6.52 (42.09)	2.35 (5.02)	5.36 (28.27)	1.89 (3.08)
Imazethapyr @ 50 g <i>a.i.</i> ha ⁻¹ at 15 DAS	2.11 (3.95)	0.96 (0.42)	1.58 (1.99)	0.86 (0.25)	5.62 (31.16)	2.21 (4.38)	5.26 (27.20)	1.73 (2.50)
Imazethapyr @ 75 g <i>a.i.</i> ha ⁻¹ at 15 DAS	1.97 (3.44)	0.90 (0.30)	1.49 (1.72)	0.82 (0.18)	4.99 (24.47)	2.01 (3.54)	4.14 (16.67)	1.57 (1.98)
Imazethapyr @ 100 g <i>a.i.</i> ha ⁻¹ at 25 DAS	3.91 (14.97)	1.52 (1.83)	3.19 (9.67)	1.25 (1.07)	4.93 (23.80)	1.90 (3.20)	3.74 (13.54)	1.45 (7.1)
SEm±	0.18	0.07	0.06	0.04	0.17	0.08	0.14	0.07
CD (0.05)	0.54	0.23	0.18	0.11	0.53	0.25	0.42	0.22

*Values were square root transformed \sqrt{X} (actual weed count) +0.5, original values mentioned parentheses

Table 3. Effect of dose and time of imazethapyr on yield attributes and yield

Treatment	Number of pods plant ⁻¹	Pod length (cm)	Number of seeds pod ⁻¹	Test weight (g)	Seed yield (kg ha ⁻¹)	Stover yield (kg ha ⁻¹)
Weedy check	11.83	4.10	4.43	34.33	309.00	1316.67
Two hand weeding @ 20 and 40 DAS	16.27	5.43	6.48	42.53	760.72	2060.37
Imazethapyr @ 50 g <i>a.i.</i> ha ⁻¹ at 10 DAS	13.98	5.13	6.08	39.00	488.24	1690.13
Imazethapyr @ 75 g <i>a.i.</i> ha ⁻¹ at 10 DAS	14.37	5.17	6.14	39.77	480.35	1751.03
Imazethapyr @ 50 g <i>a.i.</i> ha ⁻¹ at 15 DAS	14.27	5.27	6.16	39.67	499.79	1887.77
Imazethapyr @ 75 g <i>a.i.</i> ha ⁻¹ at 15 DAS	15.70	5.30	6.21	41.07	614.11	1896.70
Imazethapyr @ 100 g <i>a.i.</i> ha ⁻¹ at 25 DAS	16.03	5.37	6.31	41.67	628.71	1992.37
SEm±	0.53	0.23	0.35	1.33	41.17	105.75
CD (P=0.05)	1.63	0.70	1.09	4.10	126.88	325.89

@ 50 g *a.i.* ha⁻¹ applied at 10 DAS (39.00). It was lowest in the weedy check (34.33). Thus herbicidal application of Imazethapyr effectively controls weeds, especially in the early stages resulting in healthy plants that produce bigger and well-developed seeds.

There was a significant effect on seed yield due to different weed management treatments (table 3). Seed yield was highest in Imazethapyr @ 100 g *a.i.* ha⁻¹ applied at 25 DAS (628.71) which was at par with Imazethapyr @ 75 g *a.i.* ha⁻¹ applied at 15 DAS (614.1). It was significantly inferior to all other herbicidal treatments and seed yield was recorded lowest in weedy check (309 kg ha⁻¹). This is due to effective control of weeds during the critical crop-weed competition period by using imazethapyr which resulted in increased yield when applied at optimum dose and time by establishing good crop plant population, Higher dry matter accumulation, and well-defined growth attributes. This is in agreement with the findings of Sangeetha *et al.* (2012, 2013) who reported that the application of imazethapyr at optimum doses gave higher seed yield and weedy check recorded the lowest seed yield.

There was a significant effect on stover yield due to different weed Management treatments (Table 3). Stover yield was highest in Imazethapyr @ 100 g *a.i.* ha⁻¹ applied at 25 DAS (1992.37 kg/ha) which was at par with Imazethapyr @ 75 g *a.i.* ha⁻¹ applied at 15 DAS (1896.70 kg/ha), Imazethapyr @ 50 g *a.i.* ha⁻¹ applied at 15 DAS (1887.77 kg/ha), Imazethapyr @ 75 g *a.i.* ha⁻¹ applied at 10 DAS (1751.03 kg/ha). Imazethapyr @ 50 g *a.i.* ha⁻¹ applied at 10 DAS (1690.13 kg/ha) was significantly inferior to all other herbicidal treatments, while stover

yield was recorded lowest in weedy check (1316.67 kg ha⁻¹). Effectively controlled weeds leading to availability of more nutrients water, space and light for the crops enabling them to establish well and grow in a definite manner accumulating higher plant dry matter and subsequently increasing the stover yield. This is in agreement with the findings of (Sangeetha *et al.* 2012, Sangeetha *et al.* 2013) where application of imazethapyr optimum doses gave higher stover yield and weedy check recorded the lowest stover yield.

CONCLUSION

Based on results, it can be concluded that application of imazethapyr @ 100 g *a.i.* ha⁻¹ at 25 DAS significant increased the weed control efficiency and seed yield of blackgram. Further, the same treatment gave highest net returns (₹ 21,053 ha⁻¹) and B:C ratio (1.03).

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