



Weed management with pre- and post-emergence herbicides in blackgram

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ABSTRACT

A field experiment was conducted during rainy seasons of 2014 and 2015 at College of Agriculture, Gwalior (M.P.) to study the effect of herbicides in blackgram. The experiment was laid out with 12 treatments, viz. imazethapyr with four application rates 70 and 80 g/ha as pre-emergence (PE) and 70 and 80 g/ha as post-emergence (PoE); imazethapyr + imazamox (RM) 70 and 80 g/ha as PE, and 70 and 80 g/ha as PoE, pendimethalin 1000 g/ha as PE, pendimethalin + imazethapyr (RM) 1000 g/ha PE, two hand weedings at 20 and 40 DAS (weed free) and weedy check in a randomized block design. Two hand weeding at 20 and 40 DAS were found to be very efficient in controlling the dominant grassy weeds and gave maximum seed yield (924 kg/ha) *fb* ready mix herbicides *i.e.* imazethapyr + imazamox 80 g/ha as PoE (905 kg/ha) and pendimethalin + imazethapyr 1000 g/ha as PE (879 kg/ha). Net returns and B:C ratio were the highest for the application of pendimethalin + imazethapyr (1000 g/ha PE) (3.32) *fb* application of imazethapyr + imazamox (80 g/ha PoE) (3.11).

Key words: Blackgram, Hand weeding, Imazethapyr, Imazamox, Pendimethalin, Weeds

Blackgram (*Vigna mungo*) is usually accompanied by luxuriant weed growth during rainy season owing to abundant rainfall received during monsoon leading to serious crop losses by weeds. Unchecked weeds have been reported to cause a considerable reduction in seed yield which in case of summer blackgram could be 46-53% (Bhandari *et al.* 2004, Kumar and Tewari 2004) whereas, in rainy season the losses could be 43.2-64.1%. (Chand *et al.* 2004, Rathi *et al.* 2004). The crop is most sensitive for weed competition during 15 to 45 days after sowing.

Imazethapyr, a broad-spectrum herbicide, has soil and foliar activity that allows flexibility in its application timing and has low mammalian toxicity (Tan *et al.* 2005). Nandan *et al.* (2011) reported that post-emergence application of imazethapyr at 25 g/ha had no adverse effect on growth characters and resulted statistically similar grain yield to that of twice hand weeding (20 and 40 DAS). Pendimethalin is basically pre-emergence herbicide. In rainfed condition, if weeds have not yet germinated, this herbicide may be effective when applied after first shower. Among different methods of weed control, the chemical method is becoming popular among farmers because of increasing labour. In order to increase the productivity of blackgram timely weed control is essential. Keeping the above facts in view, the field experiments were conducted to determine the efficacy of pre- and post-emergence herbicides against weeds in blackgram.

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MATERIALS AND METHODS

The field experiments were conducted during rainy seasons of 2014 and 2015 at Research Farm College of Agriculture, Gwalior (M.P.) to find out the effective dose of different herbicides and their time of application. The soil texture was sandy clay loam, low in available nitrogen (234 kg/ha), medium in phosphorus (14 kg/ha) and potash (240 kg/ha). The 12 treatments replicated thrice in a completely RBD were, viz. imazethapyr at 70 and 80 g/ha as PE, imazethapyr 70 and 80 g/ha as PoE, imazethapyr + imazamox (RM) 70 and 80 g/ha as PE, imazethapyr + imazamox (RM) 70 and 80 g/ha as PoE, pendimethalin 1000 g/ha as PE, pendimethalin + imazethapyr (RM) 1000 g/ha PE, two hand weeding at 20 and 40 DAS (weed free) and weedy check. The blackgram variety 'T-9' was sown on 19th July in 2014 and on 14th July in 2015 keeping row to row spacing of 30 cm with 18 kg/ha seed rate. Crop was harvested during second week of October 2014 and 2015. The recommended dose of fertilizer was 20: 50: 20 NPK kg/ha, respectively. Pre-emergence herbicides were applied within 48 hours of sowing and post-emergence herbicides were applied at 20 DAS. Observations for different weed species weed population and their dry weight were recorded at 40 DAS and at the harvest. Weed control efficiency and economics of different weed control treatments were also worked out. Since treatment effects for both years were same, so pooled analysis of data was made.

RESULTS AND DISCUSSION

Weed flora

The major weed flora of experimental site were *Cynodon dactylon* (1.70%), *Setaria gluaca* (2.41%), *Echinochloa crus-galli* (16.3%), *Echinochloa crusgalli* (16.3%), *Sateria gluaca* (2.4%) *Arachne racemosa* (8.8%) as grasses, and *Digera arvensis* (2.4%), *Celosia argentic* (1.0%), *Commelina benghalensis* (1.4%), *Phyllanthus niruri* (3.5%) were emerged as major broad-leaf weeds (BLWs). *Cyperus rotundus* (43.3%) was most dominating sedge among all the weeds.

Effect on weeds

All the weed management practices significantly reduced the weed population and dry weight of weeds over the weedy check. The lowest weed population and weed dry weight were obtained with two hand weeding at 20 and 40 DAS which was significantly superior to other weed control treatments. Similar results were reported by Rajib *et al.* (2014). Among the herbicides applied alone, post-emergence application was found more effective than pre-emergence application of imazethapyr. Application of imazethapyr 80 g/ha as PoE resulted in the lowest density of grassy weeds as well as BLWs and sedges *fb* imazethapyr 70 g/ha as PoE, imazethapyr 80 g/ha as PE and imazethapyr 70 g/ha PRE. Alone application of pendimethalin 1000 g/ha as PE and imazethapyr PE was recorded less effective than other treatments but was significantly superior to weedy check. Among various ready-mix (RM) herbicides the pre-emergence application of pendimethalin + imazethapyr (pre-mix) 1000 g/ha

was the most effective and recorded 92.6, 95.8 and 87.1% suppression of grassy, BLWs and sedges, respectively compared to weedy check. The application of post-emergence imazethapyr + imazamox 80 g/ha was equally effective in reducing weed density and dry weight of weeds.

Minimum weed dry matter accumulation was achieved with two hand weeding at 20 and 40 DAS. Among various pre-mix applications of herbicides, minimum weed dry matter accumulation was recorded with pendimethalin + imazethapyr applied as pre-emergence 1000 g/ha, which was at par with imazethapyr + imazamox applied as post-emergence 80 g/ha. Whereas, among alone application of imazethapyr 70 g/ha as post-emergence *fb* its respective higher dose applied 80 g/ha was found more effective in reducing the dry matter accumulation of weeds. Twice hand weeding was found most effective in reducing the dry matter accumulation of weeds. However, all the weed control treatments were proved to be significantly superior to weedy check.

The highest weed control efficiency (94.96%) was recorded with two hand weeding at 20 and 40 DAS *fb* pendimethalin + imazethapyr application 1000 g/ha as PE (85.88%) and imazethapyr + imazamox 80 g/ha as PoE (85.78%).

Effect on yield attributes and yield

During the experimentation all the growth and yield attributing parameters *i.e.* number of plants/row length, plant height, number of pods/plant, number of seeds/pod, and seed yield were found significantly higher under weed management practices compared

Table 1. Effect of different herbicide treatments on weed density, dry weight and weed control efficiency at 40 DAS

| Treatment | Weed density (no./m ²) | | | Total weed density (no./m ²) | Total weed dry weight (g/m ²) | WCE (%) at 40 DAS |
|---|------------------------------------|-------------|-------------|--|---|-------------------|
| | Grassy | BLWs | Sedges | | | |
| Imazethapyr 70 g/ha PE | 1.17(93.0) | 1.10(73.0) | 1.33(133.0) | 1.69(299.0) | 29.40 | 69.39 |
| Imazethapyr 80 g/ha PE | 1.14(85.0) | 1.03(66.0) | 1.27(115.0) | 1.63(266.0) | 28.30 | 70.54 |
| Imazethapyr 70 g/ha PoE | 1.10(84.0) | 0.90(43.0) | 1.27(113.0) | 1.60(240.0) | 20.65 | 78.50 |
| Imazethapyr 80 g/ha PoE | 1.09(76.0) | 0.77(31.0) | 1.20(98.0) | 1.53(205.0) | 17.47 | 81.81 |
| Imazethapyr + imazamox (RM) 70 g/ha PE | 1.30(124.0) | 1.19(90.0) | 1.49(194.0) | 1.83(408.0) | 38.25 | 60.18 |
| Imazethapyr + imazamox (RM) 80 g/ha PE | 1.33(129.0) | 1.11(76.0) | 1.39(147.0) | 1.77(352.0) | 30.88 | 67.85 |
| Imazethapyr + imazamox (RM) 70 g/ha PoE | 1.16(89.0) | 0.83(38.0) | 1.13(83.0) | 1.54(210.0) | 17.20 | 82.09 |
| Imazethapyr + imazamox (RM) 80 g/ha PoE | 0.89(55.0) | 0.65(25.0) | 1.00(61.0) | 1.34(141.0) | 13.66 | 85.78 |
| Pendimethalin 1000 g/ha PE | 1.26(114.0) | 1.13(77.0) | 1.51(201.0) | 1.81(392.0) | 42.74 | 55.51 |
| Pendimethalin + imazethapyr (RM) 1000 g/ha PE | 0.87(53.0) | 0.64(22.0) | 1.01(63.0) | 1.36(138.0) | 13.56 | 85.88 |
| Two hand weeding 20 and 40 DAS | 0.51(22.0) | 0.30(8.0) | 0.69(30.0) | 0.99(60.0) | 4.84 | 94.96 |
| Weedy check | 1.74(340.0) | 1.63(254.0) | 1.68(291.0) | 2.17(885.0) | 96.06 | - |
| LSD (p=0.05) | 0.19 | 0.21 | 0.12 | 0.10 | 8.57 | - |

PE: Pre-emergence; PoE: Post-emergence; DAS - Days after sowing; Valus in parentheses were original and transformed for analysis, WCE - Weed control efficiency

to weedy check. Pooled data of two years indicated that there was no significant difference between all weed control treatments except weedy check. Among different herbicide treatments, the highest pods/plant was obtained with twice hand weeding (20 and 40 DAS) *fb* pre-mix imazethapyr + imazamox 80 g/ha as post-emergence and pendimethalin + imazethapyr at 1000 g/ha as pre-emergence (Table 2).

Two hand weedings at 20 and 40 DAS resulted maximum number of grains/pod compared to all herbicidal treatments. These results confirmed the findings of Rajib *et al.* (2014). Among different pre-mix, maximum number of grains/pod was recorded with the post emergence application of imazethapyr + imazamox 80 g/ha *fb* pre-emergence pendimethalin + imazethapyr 1000 g/ha. However, among alone application of herbicides, post-emergence application of imazethapyr 70 g/ha gave the recorded number of grains/pod *fb* higher dose of imazethapyr 80 g/ha (Table 2).

Among different treatments, the highest seed yield as 924 kg/ha was recorded under two hand weeding at 20 and 40 DAS, but among different herbicide treatments application of imazethapyr + imazamox at 80 g/ha as PoE recorded maximum seed yield *fb* pre-emergence herbicide application of pendimethalin + imazethapyr at 1000 g/ha. The alone application of imazethapyr 80 g/ha as post-emergence resulted in higher yield compared to application of lower dose of imazethapyr 70 g/ha as post-emergence. The lowest grain yield 374 kg/ha was recorded under weedy check.

Weed persistence index (WPI) and herbicide efficiency index (HEI)

Weed persistence index (WPI) and herbicide efficiency index (HEI) express the tolerance of weeds to different herbicidal treatments as well as their efficacy to eradicate the weeds (Table 2). Among the various pre-mix combination of imazethapyr + imazamox applied 80 g/ha recorded lowest WPI (0.394%) *fb* its lowest dose applied 70 g/ha. Among all treatments, highest WPI was recorded with pendimethalin 1000 g/ha *fb* pre-emergence application of imazethapyr + imazamox 70 g/ha. Regarding HEI, pre-emergence application of imazethapyr + imazamox applied 70 g/ha produced higher HEI than all other herbicidal treatments *fb* pendimethalin + imazethapyr applied 1000 g/ha. However, twice hand weeding (20 and 40 DAS) proved to be superior to all the herbicidal treatments.

Economics

Application of pendimethalin + imazethapyr (RM) 1000 g/ha as pre-emergence was proved economically the best treatment due to the highest B:C Ratio 2.32 *fb* imazethapyr + imazamox (RM) 80 g/ha as post-emergence with B:C ratio of 2.11. The minimum B:C ratio (0.57) was recorded under weedy check (Table 2).

It was concluded that two hand weeding at 20 and 40 DAS gave maximum seed yield (924 kg/ha) *fb* PoE use of imazethapyr + imazamox (RM) 80 g/ha (905 kg/ha) and pendimethalin + imazethapyr 1000 g/ha as PE can be practiced for weed control in blackgram.

Table 2. Effect of different herbicide treatments on growth, yield attributes, yield herbicidal efficiency index, weed persistence index and B:C ratio of black gram

| Treatment | No of Plants (in row length) | Plant height (cm) | No. of pods/ plant | No. of grains/ pod | Seed yield (kg/ha) | HEI | WPI | B:C Ratio |
|---|------------------------------------|-------------------------|--------------------------|--------------------------|--------------------------|-------|-------|--------------|
| Imazethapyr 70 g/ha PE | 8.78 | 69.87 | 23.47 | 6.40 | 625 | 2.19 | 0.393 | 1.30 |
| Imazethapyr 80 g/ha PE | 8.33 | 70.40 | 23.00 | 6.47 | 690 | 2.87 | 0.392 | 1.50 |
| Imazethapyr 70 g/ha PoE | 9.33 | 72.20 | 29.53 | 6.67 | 765 | 4.86 | 0.292 | 1.79 |
| Imazethapyr 80 g/ha PoE | 9.67 | 67.53 | 30.60 | 6.60 | 859 | 7.13 | 0.258 | 2.08 |
| Imazethapyr + imazamox (RM) 70 g/ha PE | 9.33 | 68.53 | 26.00 | 6.47 | 537 | 1.09 | 0.472 | 0.91 |
| Imazethapyr + imazamox (RM) 80 g/ha PE | 9.11 | 69.07 | 29.93 | 6.67 | 557 | 1.52 | 0.394 | 0.95 |
| Imazethapyr + imazamox (RM) 70 g/ha PoE | 8.67 | 72.87 | 31.13 | 6.53 | 788 | 6.18 | 0.252 | 1.77 |
| Imazethapyr + imazamox (RM) 80 g/ha PoE | 9.33 | 74.60 | 35.73 | 6.80 | 905 | 9.98 | 0.230 | 2.11 |
| Pendimethalin 1000 g/ha PE | 8.11 | 70.73 | 25.67 | 6.40 | 521 | 0.88 | 0.533 | 0.86 |
| Pendimethalin + imazethapyr (RM) 1000 g/ha PE | 8.67 | 74.20 | 34.60 | 6.73 | 879 | 9.57 | 0.225 | 2.32 |
| Two hand weeding 20 and 40 DAS | 9.33 | 74.67 | 38.30 | 6.93 | 924 | 29.19 | 0.110 | 1.57 |
| Weedy check | 8.22 | 75.60 | 20.60 | 4.73 | 374 | - | - | 0.57 |
| LSD (p=0.05) | NS | NS | 11.95 | 0.52 | 134 | - | - | |

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