Short communication

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# Bio-efficacy of herbicides against weeds in blackgram

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Blackgram [*Vigna mungo* (L.) Hepper] is an important pulse crop in India. It is mostly cultivated during summer as well as in *Kharif* season. It has high nutritive value with high content of proteins, vitamins and minerals. The production of blackgram is not sufficient as against its demand. The national average yield of blackgram has been stagnating around 0.7-0.8 t/ha over the years and it is far behind the research yield. Blackgram being a short duration and initially slow growing, it is heavily infested with many grasses and broad-leaved weeds, which compete with the crop during initial growth stage resulting in reduced seed yield of blackgram. Unchecked weeds have been reported to cause a considerable reduction in the seed yield to the tune of 43.2 to 64.1% during *Kharif* season (Chand *et al*. 2004). The degree of reduction in seed yield of blackgram due to weeds depends upon the density and duration of weed species. Hence, timely removal of weeds using a suitable weed control method is very much crucial to harvest optimum yields of blackgram. Hand weeding is laborious, time consuming, costly and tedious job, furthermore, timely unavailability of labour as well as season continuous rains do not permit timely hand weeding. Looking to situation, use of herbicides offers an alternative for possible effective control of weeds in blackgram. Therefore, an attempt has been made to study the bio-efficacy of different herbicides against weeds of blackgram grown in *Kharif* season.

The present investigation was carried out during *Kharif* season of 2011 at B.A. College of Agriculture, Anand Agricultural University, Anand (Gujarat). The soil of the experimental field was sandy-loam in texture having low available nitrogen, medium available phosphorus and high potassium with pH 8.2. The experiment was laid out in randomized complete block design with four replications. Treatments consisted of pendimethalin 500 g/ha PE *fb* IC + HW at 30 DAS, pendimethalin 1000 g/ha PE, quizalofop-ethyl 38 g/ha POE *fb* IC + HW at 30 DAS, quizalofop-ethyl 50 g/ha POE, imazethapyr 50 g/ha POE *fb* IC + HW at 30 DAS, imazethapyr at 100 g/ha POE, oxyflurofen 100 g/ha PE *fb* IC + HW at 30 DAS, oxyflurofen 200 g/ha PE, fenoxaprop-p-ethyl 50 g/ha POE *fb* IC + HW at 30 DAS, fenoxaprop-p-ethyl 100 g/ha POE, HW at 20 and 40 DAS and weedy check. The blackgram cv. '*T-9*' was sown manually keeping the distance of 45 cm using 20 kg row/ha during fourth week of July, 2011. Entire quantity of nitrogen (20 kg/ha) and phosphorous (40 kg/ha) were applied at the time of sowing. Herbicides were applied with a manually operated knapsack sprayer fitted with flat fan nozzle at a spray volume of 500 l/ha as per treatments. The other package of practices were adopted to raise the crop as per the recommendations. After sowing of the seed immediately a light irrigation was given to the crop for uniform germination, and next day the pre-emergence herbicides were applied. The crop was harvested on third week of October. The observations on number of weeds and dry matter of weeds were taken from randomly selected four spots by using 0.25 $m^2$ quadrats from net plot area. Weed control efficiency (WCE) was calculated on the basis of formulae suggested by Mani *et al*. (1973). The seed and haulm yield was recorded from the net plot area and subjected to statistical analysis. Net realization and BCR values were also worked out by considering the prevailing market price on the basis of seed and haulm yields.

The predominant weed flora of the experimental field consisted of *Cyperus iria* L., *Digera arvensis* L., *Commelina benghalensis* L., *Eleusine indica* (L), *Digitaria sanguinalis* L., *Dactyloctenium aegyptium* L., *Phyllanthus niruri* L. and *Eargrostis major P. Beauv*.

All the weed management practices caused significant reduction in monocot and dicot weeds and their dry weight recorded at various intervals. Significantly lower density of monocot and dicot weeds were recorded in twice hand weeding done at 20 and 40 DAS, however it was statistically at par with oxyfluorfen 200 g/ha at 25 DAS. Hand weeding

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carried out at 20 and 40 DAS recorded significantly lower density of monocot weeds as compared to sole application of pendimethalin 1000 g/ha, quizalofop-ethyl 50 g/ha, imazethapyr 100 g/ha, fenoxaprop-p-ethyl 100 g/ha, and weedy check. Similar results were also noticed for density of dicot weeds except treatments of imazethapyr 100 g/ha and oxyfluorfen 200 g/ha, both were at par with twice hand weeding treatment at 50 DAS. Further, it was observed that significantly lower dry weight of monocot weeds was recorded under hand weeding carried out at 20 and 40 DAS, which was at par with oxyfluorfen 100 g/ha as PE *fb* IC + HW at 30 DAS and oxyfluorfen 200 g/ha as PE. Similarly, twice hand weeding treatment also recorded significantly lower dry weight of dicot weeds followed by pre-emergence application of pendimethalin 500 g/ha *fb* IC + HW at 30 DAS, post-emergence application of imazethapyr 50 g/ha *fb* IC + HW at 30 DAS, oxyfluorfen 100 g/ha PE *fb* IC + HW at 30 DAS and oxyfluorfen 200 g/ha PE. The lower dry weight of weeds under hand weeding treatment might be due to the lowest density of monocot as well as dicot weeds. These results were in close agreement with those reported by Singh and Shweta (2005) and Mishra and Chandrabhanu (2006).

At 50 DAS, significantly lower dry weight of monocot weeds were observed under hand weeding carried out at 20 and 40 DAS, which was at par with the pre-emergence application of pendimethalin 500 g/ha *fb* IC + HW at 30 DAS, quizalofop-ethyl 38 g/ha as POE *fb* IC + HW at 30 DAS, imazethapyr 50 g/ha as POE *fb* IC + HW at 30 DAS, oxyfluorfen 100 g/ha as PE *fb* IC + HW at 30 DAS and fenoxaprop-p-ethyl 50 g/ha as POE *fb* IC + HW at 30 DAS. At same interval, dry weight of dicot weeds recorded under interculture and hand weeding carried out at 20 and 40 DAS was significantly lower but remained at par with pre-emergence application of pendimethalin 500 g/ha *fb* IC + HW at 30 DAS, quizalofop-ethyl 38 g/ha as POE *fb* IC + HW at 30 DAS, imazethapyr 50 g/ha as POE *fb* IC + HW at 30 DAS, oxyfluorfen 100 g/ha as PE *fb* IC + HW at 30 DAS and fenoxaprop-p-ethyl 50 g/ha as POE *fb* IC + HW at 30 DAS. The lower

**Table 1. Density, dry weight of weeds and weed control efficiency as influenced by weed management**

| Treatment | Monocot weeds | | | | Dicot weeds | | | | Weed control efficiency (WCE %) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Density (no./m$^2$) | | Dry weight (g/m$^2$) | | Density (no./m$^2$) | | Dry weight (g/m$^2$) | | | | |
| | 25 DAS | 50 DAS | 25 DAS | 50 DAS | 25 DAS | 50 DAS | 25 DAS | 50 DAS | 25 DAS | 50 DAS | At harvest |
| Pendimethalin 500 g/ha (PE) *fb IC* + HW 30 DAS | 4.09$^{e}$ (16.2) | 2.12$^{f}$ (4.0) | 3.28$^{e}$ | 0.88$^{f}$ | 2.74$^{ef}$ (7.0) | 2.60$^{fg}$ (6.2) | 1.19$^{ef}$ | 1.08$^{h}$ | 90.1 | 91.3 | 59.4 |
| Pendimethalin 1000 g/ha (PE) | 4.85$^{e}$ (23.0) | 3.28$^{e}$ (10.2) | 4.56$^{e}$ | 2.24$^{e}$ | 5.07$^{d}$ (25.2) | 4.74$^{d}$ (22.0) | 4.29$^{d}$ | 3.81$^{d}$ | 80.1 | 73.2 | 54.2 |
| Quizalofop-ethyl 38 g/ha (POE) *fb* IC + HW at 30 DAS | 7.35$^{cd}$ (53.5) | 2.01$^{f}$ (3.5) | 10.8$^{cd}$ | 0.78$^{f}$ | 6.08$^{c}$ (36.5) | 2.82$^{fg}$ (7.4) | 6.21$^{c}$ | 1.82$^{h}$ | 62.2 | 88.5 | 64.2 |
| Quizalofop-ethyl 50 g/ha (POE) | 6.54$^{d}$ (42.2) | 4.59$^{c}$ (21.5) | 11.6$^{d}$ | 4.71$^{c}$ | 7.78$^{b}$ (60.0) | 6.10$^{c}$ (36.7) | 7.10$^{c}$ | 6.36$^{c}$ | 58.4 | 51.0 | 40.8 |
| Imazethapyr 50 g/ha (POE) *fb* IC + HW at 30 DAS | 6.73$^{d}$ (44.7) | 2.09$^{f}$ (3.9) | 9.03$^{d}$ | 0.85$^{f}$ | 7.60$^{b}$ (57.3) | 2.45$^{fg}$ (5.5) | 1.45$^{ef}$ | 0.95$^{h}$ | 76.7 | 92.0 | 59.4 |
| Imazethapyr 100 g/ha (POE) | 6.84$^{d}$ (46.2) | 3.74$^{e}$ (13.5) | 9.34$^{d}$ | 2.96$^{e}$ | 3.61$^{e}$ (12.5) | 2.60$^{fg}$ (6.2) | 2.13$^{e}$ | 1.08$^{g}$ | 74.5 | 82.1 | 54.6 |
| Oxyfluorfen 100 g/ha (PE) *fb* IC + HW at 30 DAS | 6.74$^{d}$ (44.9) | 2.10$^{f}$ (3.9) | 2.01$^{ef}$ | 0.86$^{f}$ | 3.23$^{e}$ (9.9) | 2.47$^{fg}$ (5.6) | 1.19$^{ef}$ | 1.21$^{h}$ | 91.3 | 90.8 | 61.6 |
| Oxyfluorfen 200 g/ha (PE) | 3.61$^{ef}$ (12.5) | 4.27$^{d}$ (17.7) | 2.52$^{ef}$ | 3.89$^{d}$ | 2.75$^{f}$ (7.1) | 2.24$^{fg}$ (4.5) | 0.87$^{f}$ | 0.77$^{g}$ | 92.5 | 79.3 | 58.2 |
| Fenoxaprop-p-ethyl 50 g/ha (POE) *fb* IC + HW at 30 DAS | 8.38$^{b}$ (69.7) | 2.17$^{f}$ (4.2) | 14.1$^{b}$ | 0.92f | 5.68$^{cd}$ (31.7) | 2.36$^{fg}$ (5.1) | 5.40$^{cd}$ | 0.89$^{h}$ | 56.7 | 84.2 | 62.5 |
| Fenoxaprop-p-ethyl 100 g/ha (POE) | 8.03$^{bc}$ (64.0) | 5.39$^{b}$ (28.5) | 15.5$^{bc}$ | 6.24$^{b}$ | 7.50$^{b}$ (55.7) | 7.95$^{b}$ (62.7) | 6.90$^{cd}$ | 10.86$^{b}$ | 50.2 | 24.4 | 48.3 |
| HW at 20 and 40 DAS | 1.94$^{f}$ (3.25) | 1.66$^{f}$ (2.2) | 0.66$^{f}$ | 0.49$^{f}$ | 1.87$^{f}$ (3.0) | 1.65$^{g}$ (2.2) | 0.51$^{f}$ | 0.39$^{h}$ | 97.4 | 96.1 | 84.3 |
| Weedy check | 12.95$^{a}$ (167.2) | 11.54$^{a}$ (132.7) | 31.6$^{a}$ | 37.17$^{a}$ | 8.97$^{a}$ (80.0) | 9.47$^{a}$ (89.2) | 13.39$^{a}$ | 15.44$^{a}$ | - | - | - |
| LSD (P=0.05) | 18.1 | 17.2 | 18.1 | 17.3 | 15.9 | 18.0 | 15.5 | 9.59 | - | - | - |

*Figures in the parentheses are original values. All Figures are subjected to transformed values to square root $\sqrt{x+0.5}$. DAS- Days after sowing, *fb*- followed by, HW: Hand weeding, IC: Interculture

**Table 2. Growth, yield attributes and seed yield of blackgram as influenced by weed management**

| Treatment | No. of plants/m row length | Plant height (cm) | | Dry weight of nodule (mg/ plant) | No of branches /plant | Number of pods/ plant | Test weight (g) | Protein content (%) | Seed yield (t/ha) | Haulm yield (t/ha) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 30 DAS | At harvest | | | | | | | |
| Pendimethalin 500 g/ha (PE) *fb* IC + HW at 30 DAS | 8.68 | 49.1$^{ab}$ | 83.5$^{abc}$ | 47.0 | 5.01$^{a}$ | 40.0$^{ab}$ | 41.6 | 23.1 | 1.67$^{ab}$ | 3.36$^{ab}$ |
| Pendimethalin 1000 g/ha (PE) | 9.55 | 45.5$^{abc}$ | 91.8$^{a}$ | 48.0 | 4.23b$^{c}$ | 31.0$^{c}$ | 41.3 | 22.4 | 1.19$^{de}$ | 2.26$^{f}$ |
| Quizalofop-ethyl 38 g/ha (POE) *fb* IC + HW at 30 DAS | 8.93 | 48.5$^{ab}$ | 87.5$^{ab}$ | 44.5 | 5.14$^{a}$ | 39.6$^{ab}$ | 37.2 | 20.8 | 1.69$^{ab}$ | 3.46$^{ab}$ |
| Quizalofop-ethyl 50 g/ha (POE) | 9.23 | 47.8$^{ab}$ | 78.9$^{abcd}$ | 45.7 | 3.90$^{c}$ | 28.0$^{cd}$ | 38.1 | 21.9 | 0.96$^{e}$ | 1.55$^{g}$ |
| Imazethapyr 50 g/ha (POE) *fb* IC + HW at 30 DAS | 9.08 | 44.8$^{abc}$ | 82.4$^{abc}$ | 46.3 | 4.82$^{ab}$ | 38.6$^{ab}$ | 40.7 | 22.5 | 1.65$^{ab}$ | 3.36$^{ab}$ |
| Imazethapyr 100 g/ha (POE) | 9.23 | 40.3b$^{c}$ | 76.0$^{abcd}$ | 47.2 | 4.38$^{abc}$ | 32.4$^{c}$ | 39.7 | 22.7 | 1.26$^{cd}$ | 2.75$^{de}$ |
| Oxyfluorfen 100 g/ha (PE) *fb* IC + HW 30 DAS | 9.48 | 39.5$^{c}$ | 76.9$^{abcd}$ | 46.8 | 4.80$^{ab}$ | 38.8$^{ab}$ | 40.9 | 21.5 | 1575$^{bc}$ | 3.09$^{cd}$ |
| Oxyfluorfen 200 g/ha (PE) | 9.33 | 41.5$^{bc}$ | 68.8$^{cd}$ | 47.5 | 4.78$^{ab}$ | 31.4$^{c}$ | 40.2 | 22.5 | 1.46$^{bc}$ | 2.52$^{ef}$ |
| Fenoxaprop- p-ethyl 50 g/ha (POE) *fb* IC + HW at 30 DAS | 8.63 | 50.6$^{a}$ | 79.9$^{abcd}$ | 45.6 | 4.82$^{ab}$ | 39.3$^{ab}$ | 37.3 | 20.3 | 1.64$^{ab}$ | 3.36$^{ab}$ |
| Fenoxaprop- p- ethyl 100 g/ha (POE) | 9.60 | 46.3$^{abc}$ | 72.1$^{bcd}$ | 44.2 | 3.93$^{c}$ | 30.0$^{cd}$ | 37.5 | 20.1 | 0.97$^{e}$ | 1.51$^{g}$ |
| HW at 20 and 40 DAS | 9.75 | 52.3$^{a}$ | 88.5$^{a}$ | 48.6 | 5.05$^{a}$ | 43.4$^{a}$ | 42.2 | 23.6 | 1739$^{a}$ | 3.65$^{a}$ |
| Weedy check | 8.55 | 42.0$^{bc}$ | 65.7$^{d}$ | 43.2 | 3.70$^{c}$ | 25.5$^{d}$ | 37.9 | 20.3 | 0.71$^{f}$ | 1.21$^{h}$ |
| LSD (P=0.05) | 7.10 | 10.1 | 12.1 | 9.92 | 9.93 | 8.73 | 2.29 | 3.26 | 0.12 | 0.79 |

dry weight of weeds might be due to prolonged persistence of above herbicides contributing to weed-free condition during crop weed competition period as well as integration with hand weeding at 30 DAS. Similar results were reported by Ramanathan and Chandrashekharan (1998), Rana *et al.* (2008) and Yadav *et al.* (1997). Significantly higher weed dry weight of monocot, dicot and total weeds were recorded under weedy check.

Plant population, dry weight of root nodules, test weight and protein content in seeds were not influenced due to various weed management treatments (Table 2). The treatment, hand weeding carried out at 20 and 40 DAS recorded maximum plant height, number of branches/plant and number of pods/plant followed by pendimethalin 500 g/ha as PE *fb* IC + HW at 30 DAS, quizalofop-ethyl 38 g/ha as POE *fb* IC + HW at 30 DAS, imazethapyr 50 g/ha as POE *fb* IC + HW at 30 DAS, imazethapyr 100 g/ha as POE, oxyfluorfen100 g/ha as PE *fb* IC + HW at 30 DAS, oxyfluorfen 200 g/ha as PE and fenoxaprop-p-ethyl 50 g/ha as POE *fb* IC + HW at 30 DAS. The higher growth and yield attributes under said treatments may be attributed to reduced weed density and lesser weed biomass production. Further, it was observed that significantly higher seed yield (1.74 t/ ha) and haulm yield (3.65 t/ha) was recorded under treatment of hand weeding carried out at 20 and 40 DAS and was at par with the treatments of pendimethalin 500 g/ha as PE *fb* IC + HW at 30 DAS, quizalofop-ethyl 38 g/ha as POE *fb* IC + HW at 30 DAS, imazethapyr 50 g/ha as POE *fb* IC + HW at 30 DAS and fenoxaprop-p-ethyl 50 g/ha POE *fb* IC + HW at 30 DAS. Significantly, the lowest seed yield (0.71 t/ha) and haulm yield (1.21 t/ha) was recorded under weedy check, due to higher infestation of weeds causing strong competition of weeds with crop for growth factors. These results were in accordance with the findings reported by Sharma and Yadava (2006) and Rana *et al.* (2008).

## SUMMARY

A field experiment was conducted during 2011 at Anand, Gujarat to study the bio-efficacy of different herbicides against weeds of blackgram grown in *Kharif* season. Density and dry weight of weeds were significantly reduced by twice hand weeding carried out at 20 and 40 DAS than that of recorded in other treatments except pre-emergence application of pendimethalin 500 g/ha *fb* IC + HW at 30 DAS, quizalofop-ethyl 38 g /ha as POE *fb* IC + HW at 30 DAS, imazethapyr 50 g/ha as POE *fb* IC + HW at 30 DAS, oxyfluorfen 100 g/ha as PE *fb* IC + HW at 30 DAS) and fenoxaprop-p-ethyl 50 g/ha as

POE *fb* IC + HW at 30 DAS. Twice hand weeding treatment was found superior to other treatments in respect of reducing the density and dry weight of weeds and recording higher seed and haulm yields.

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