Madras Agric. J., 105 (1-3): 16-19, March 2018

# Effect of Pre and Early Post Emergence Herbicides on Weeds and Productivity of Blackgram under Irrigated Conditions

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**A field experiment was conducted at Agricultural College and Research Institute, Killikulam during Purattasipattam (September 2017 - November 2017) to evaluate the effect of pre and early post emergence herbicides on weeds and productivity of blackgram under irrigated conditions. Twelve treatments were tested in randomized block design with three replications. Among the weed control treatments, PE application of oxyfluorfen @ 0.18 kg ha$^{-1}$ + EPOE application of Imazethapyr @ 0.05 kg ha$^{-1}$ on 20 DAS recorded significantly lower total weed density (22.92 m$^2$), total weed dry weight (19.94 g m$^{-2}$) and higher weed control efficiency (93.2 %) than rest of the treatments including weedy check but it was on par with the PE application of pendimethalin @ 1.0 kg ha$^{-1}$ + EPOE Imazethapyr @ 0.05 kg ha$^{-1}$ on 20 DAS as compared to weed free check. The same treatments also resulted in significantly higher grain and haulm yields.**

**Key words:** Blackgram, Herbicides, Weed density, Weed control efficiency and Grain yield.

Blackgram (*Vigna mungo* L.) is the most preferred legume crop cultivated in tropical and sub-tropical regions. India is not only the largest producer but also the largest consumer of blackgram in the world. In Tamil Nadu blackgram is cultivated in all the agro-ecosystems. Their cultivation also enriches the soil fertility by the addition of nitrogen and organic matter. The most important factor responsible for poor yield in blackgram is due to inadequate weed control. Weeds offer severe competition to the crops during early stage of growth and reduce the yield of blackgram to an extent of 75 per cent and sometimes leads to total failure of the crop. The initial 4 to 5 weeks are considered to be crucial for crop weed competition in blackgram (Patel *et al*. 2015). The magnitude of losses largely depends on the composition of weed flora, period of crop weed competition and its intensity. The manual weeding and mechanical hoeing are found to be laborious, time consuming, costly and tedious. However labour is not easily available at the critical period of weed management. Furthermore, weather conditions do not permit timely hand weeding due to wet field conditions. Use of herbicides offers an alternative and possible method to control weeds effectively. Therefore, in the present study, effect of various herbicides was compared with weed free check and weedy check for evaluating the reduction of weed density and dry weight and obtaining higher yields in blackgram.

## Material and Methods

A field experiment was conducted at Agricultural College and Research Institute, Killikulam during Purattasipattam (September 2017 – November 2017) to study the effect of pre and early post emergence herbicides on weeds and productivity of irrigated blackgram. The experiment was laid out in randomized block design with three replications. It consisted of twelve treatments *viz.,* $T_1$- PE Pendimethalin @ 1.0 kg ha$^{-1}$ + Hand weeding on 30 DAS, $T_2$- PE Isoproturon @ 0.375 kg ha$^{-1}$ + Hand weeding on 30 DAS, $T_3$- PE Oxyfluorfen @ 0.18 kg ha$^{-1}$ + Hand weeding on 30 DAS, $T_4$- PE Pendimethalin @ 1.0 kg ha$^{-1}$ + EPOE Quizalofop-ethyl @ 0.05 kg ha$^{-1}$ on 20 DAS, $T_5$- PE Isoproturon @ 0.375 kg ha$^{-1}$ + EPOE Quizalofop-ethyl @ 0.05 kg ha$^{-1}$ on 20 DAS, $T_6$- PE Oxyfluorfen @ 0.18 kg ha$^{-1}$ + EPOE Quizalofop-ethyl @ 0.05 kg ha$^{-1}$ on 20 DAS, $T_7$- PE Pendimethalin @ 1.0 kg ha$^{-1}$ + EPOE Imazethapyr @ 0.05 kg ha$^{-1}$ on 20 DAS, $T_8$- PE Isoproturon @ 0.375 kg ha$^{-1}$ + EPOE Imazethapyr @ 0.05 kg ha$^{-1}$ on 20 DAS, $T_9$- PE Oxyfluorfen @ 0.18 kg ha$^{-1}$ + EPOE Imazethapyr @ 0.05 kg ha$^{-1}$ on 20 DAS, $T_{10}$- Hand weeding twice on 15 DAS and 30 DAS, $T_{11}$- Weed free check, $T_{12}$-Unweeded control. Blackgram variey KKM 1 was sown under irrigated condition. Herbicides were applied as per the treatment schedule. Weed density, weed dry weight and yield of blackgram were recorded.

## Results and Discussion

### *Weed flora*

The common weed flora found in the experimental field consisted of *Cynodon dactylon, Dactyloctenium aegyptium* and *Echinochloa colona* under grasses, *Cyperus rotundus* and *Cyperus iria* under sedges and *Amaranthus viridis, Boerhavia diffusa, Celosia argentia, Cleome viscosa, Digera arvensis, Phyllanthus madraspatensis, Phyllanthus niruri* and *Corchorus olitorius* under broad leaved weeds. This is in line with the findings of Pradeesh kumar and Chinnamuthu (2014) and Charan Teja *et al.* (2016).

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In this study, sedge weeds dominated the weed flora. The next dominant weed category was broad leaved weeds followed by grasses.

***Total weed density***

The total weed density was significantly influenced by the adoption of different weed management practices at all stages of observation *viz.,* 15, 30 and 45 DAS (Table.1). Among the various weed management practices, weed free check recorded zero weed density at all the stages of observation. This might be due to reduced weed density through effective destruction of weeds by hand weeding as reported by Devendra Kumar *et al.* (2015). At 15 DAS, PE application of Oxyfluorfen @ 0.18 kg ha$^{-1}$ + EPOE Imazethapyr @ 0.05 kg ha$^{-1}$ on 20 DAS ($T_9$) recorded

**Table 1. Effect of pre and early post emergence herbicides on total weed density (No.m$^{-2}$), total weed dry weight (g m$^{-2}$) and weed control efficiency (%) in irrigated blackngram**

| Treatments | Total weed density (No.m$^{-2}$) | | | Total weed dry weight (g m$^{-2}$) | | | WCE* (%) |
|---|---|---|---|---|---|---|---|
| | 15 DAS | 30 DAS | 45 DAS | 15 DAS | 30 DAS | 45DAS | |
| $T_1$ | 74.12 | 99.58 | 36.60 | 61.52 | 86.63 | 31.84 | |
| | (8.64) | (10.00) | (6.09) | (7.87) | (9.33) | (5.69) | 89.14 |
| $T_2$ | 85.56 | 124.01 | 74.67 | 71.87 | 107.89 | 66.46 | |
| | (9.28) | (11.16) | (8.67) | (8.51) | (10.41) | (8.18) | 77.85 |
| $T_3$ | 62.02 | 99.26 | 36.15 | 50.86 | 86.36 | 31.45 | |
| | (7.91) | (9.99) | (6.05) | (7.17) | (9.32) | (5.65) | 89.28 |
| $T_4$ | 74.33 | 49.82 | 63.68 | 61.69 | 42.35 | 56.04 | |
| | (8.65) | (7.09) | (8.01) | (7.89) | (6.55) | (7.52) | 81.11 |
| $T_5$ | 86.1 | 82.38 | 97.98 | 72.32 | 70.85 | 87.20 | |
| | (9.31) | (9.10) | (9.92) | (8.53) | (8.45) | (9.36) | 70.94 |
| $T_6$ | 62.36 | 49.52 | 63.29 | 51.14 | 42.09 | 55.70 | |
| | (7.93) | (7.07) | (7.99) | (7.19) | (6.53) | (7.50) | 81.23 |
| $T_7$ | 73.78 | 31.25 | 24.11 | 61.24 | 26.56 | 20.98 | |
| | (8.61) | (5.63) | (4.96) | (7.86) | (5.20) | (4.63) | 92.85 |
| $T_8$ | 85.81 | 74.95 | 73.35 | 72.08 | 64.46 | 65.28 | |
| | (9.29) | (8.69) | (8.59) | (8.52) | (8.06) | (8.11) | 78.24 |
| $T_9$ | 61.77 | 30.89 | 22.92 | 50.65 | 26.26 | 19.94 | |
| | (7.89) | (5.60) | (4.84) | (7.15) | (5.17) | (4.52) | 93.20 |
| $T_{10}$ | 134.98 | 66.58 | 48.38 | 99.89 | 57.26 | 42.57 | |
| | (11.64) | (8.19) | (6.99) | (10.02) | (7.60) | (6.56) | 85.65 |
| $T_{11}$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| | (0.71) | (0.71) | (0.71) | (0.71) | (0.71) | (0.71) | 100 |
| $T_{12}$ | 154.12 | 233.81 | 337.16 | 110.97 | 173.02 | 252.87 | |
| | (12.42) | (15.30) | (18.37) | (10.54) | (13.17) | (15.91) | - |
| SEd | 0.20 | 0.16 | 0.18 | 0.17 | 0.14 | 0.16 | - |
| **CD(P=0.05)** | 0.42 | 0.33 | 0.37 | 0.36 | 0.29 | 0.32 | - |

- Figure in parenthesis are √(X+0.5) transformed values
- * Data not statistically analysed

$T_1$- PE Pendimethalin @ 1.0 kg ha$^{-1}$ + Hand weeding on 30 DAS, $T_2$- PE Isoproturon @ 0.375 kg ha$^{-1}$ + Hand weeding on 30 DAS, $T_3$- PE Oxyfluorfen @ 0.18 kg ha$^{-1}$ + Hand weeding on 30 DAS, $T_4$- PE Pendimethalin @ 1.0 kg ha$^{-1}$ + EPOE Quizalofop-ethyl @ 0.05 kg ha$^{-1}$ on 20 DAS, $T_5$- PE Isoproturon @ 0.375 kg ha$^{-1}$ + EPOE Quizalofop-ethyl @ 0.05 kg ha$^{-1}$ on 20 DAS, $T_6$- PE Oxyfluorfen @ 0.18 kg ha$^{-1}$ + EPOE Quizalofop-ethyl @ 0.05 kg ha$^{-1}$ on 20 DAS, $T_7$- PE Pendimethalin @ 1.0 kg ha$^{-1}$ + EPOE Imazethapyr @ 0.05 kg ha$^{-1}$ on 20 DAS, $T_8$- PE Isoproturon @ 0.375 kg ha$^{-1}$ + EPOE Imazethapyr @ 0.05 kg ha$^{-1}$ on 20 DAS, $T_9$- PE Oxyfluorfen @ 0.18 kg ha$^{-1}$ + EPOE Imazethapyr @ 0.05 kg ha$^{-1}$ on 20 DAS, $T_{10}$- Hand weeding twice on 15 DAS and 30 DAS, $T_{11}$- Weed free check, $T_{12}$-Unweeded control.

significantly lower total weed density of 61.77 $m^{-2}$. At 30 and 45 DAS, PE application of Oxyfluorfen @ 0.18 kg $ha^{-1}$ + EPOE Imazethapyr 0.05 kg $ha^{-1}$ on 20 DAS ($T_9$) significantly reduced the total weed density (30.89 and 22.92 $m^{-2}$ respectively). This was on par with the PE application of pendimethalin @ 1.0 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS ($T_7$), (31.25 $m^{-2}$ and 24.1 $m^{-2}$ respectively) compared to other treatment combination. This might be due to the control of weeds at germination phase by the application of pre emergence herbicides and significant reduction at later growth stages as late germinating weeds were controlled by early post emergence application of herbicides. Similar findings were reported by Rao *et al.* (2010) and Charan Teja *et al.* (2016).

**Table 2. Effect of pre and early post emergence herbicides on grain yield (kg $ha^{-1}$) and haulm yield (kg $ha^{-1}$) in irrigated blackngram**

| Treatments | Grain yield (kg $ha^{-1}$) | Haulm yield (kg $ha^{-1}$) |
|---|---|---|
| T1 | 628 | 2029 |
| T2 | 475 | 1550 |
| T3 | 657 | 2122 |
| T4 | 540 | 1736 |
| T5 | 423 | 1351 |
| T6 | 570 | 1835 |
| T7 | 703 | 2275 |
| T8 | 490 | 1577 |
| T9 | 722 | 2314 |
| T10 | 581 | 1876 |
| T11 | 743 | 2380 |
| T12 | 302 | 1099 |
| SEd | 21 | 66 |
| CD(P=0.05) | 44 | 136 |

$T_1$- PE Pendimethalin @ 1.0 kg $ha^{-1}$ + Hand weeding on 30 DAS, $T_2$- PE Isoproturon @ 0.375 kg $ha^{-1}$ + Hand weeding on 30 DAS, $T_3$- PE Oxyfluorfen @ 0.18 kg $ha^{-1}$ + Hand weeding on 30 DAS, $T_4$- PE Pendimethalin @ 1.0 kg $ha^{-1}$ + EPOE Quizalofop-ethyl @ 0.05 kg $ha^{-1}$ on 20 DAS, $T_5$- PE Isoproturon @ 0.375 kg $ha^{-1}$ + EPOE Quizalofop-ethyl @ 0.05 kg $ha^{-1}$ on 20 DAS, $T_6$- PE Oxyfluorfen @ 0.18 kg $ha^{-1}$ + EPOE Quizalofop-ethyl @ 0.05 kg $ha^{-1}$ on 20 DAS, $T_7$- PE Pendimethalin @ 1.0 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS, $T_8$- PE Isoproturon @ 0.375 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS, $T_9$- PE Oxyfluorfen @ 0.18 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS, $T_{10}$- Hand weeding twice on 15 DAS and 30 DAS, $T_{11}$- Weed free check, $T_{12}$-Unweeded control.

***Total weed dry weight***

Adoption of different weed management practices exerted significant influence on the total weed dry weight at all the stages of observation (Table. 1). At 15, 30 and 45 DAS, total weed dry weight was zero with weed free check. At 15 DAS, PE application of Oxyfluorfen @ 0.18 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS ($T_9$), PE application of Oxyfluorfen @ 0.18 kg $ha^{-1}$ + handweeding on 30 DAS ($T_3$) and PE application of Oxyfluorfen @ 0.18 kg $ha^{-1}$ + EPOE Quizalofop-ethyl @ 0.05 kg $ha^{-1}$ on 20 DAS ($T_6$) were found to be the next best treatments with a total weed dry weight of 50.65, 50.86 and 51.14 g $m^{-2}$, respectively. At 30 and 45 DAS, PE application of Oxyfluorfen @ 0.18 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS ($T_9$) recorded lower total weed dry weight of 26.26 and 19.94 g $m^{-2}$, respectively. PE application of pendimethalin @ 1.0 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS ($T_7$) with a total weed dry weight of 26.56 and 20.98 g $m^{-2}$, respectively. These two were on par with each other. In these treatments, application of herbicides at both early and later stages checked the weeds effectively resulting in lesser weed density and lesser weed dry weight which was also reported by Devendra Kumar *et al.* (2015) and Rai *et al.* (2016).

***Weed control efficiency***

Weed control efficiency indicates the magnitude of reducing weed density effectively by different weed control treatments over weedy check. Among the weed management practices, PE application of Oxyfluorfen @ 0.18 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS ($T_9$) and PE application of pendimethalin @ 1.0 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS ($T_7$) registered more reduction of weed density and resulted in higher WCE (93.20 and 92.85 % respectively). This might be due to the greater reduction of wide spectrum of weeds at early stages of crop growth, which reduced the weed biomass. Similar finding was reported by Rai *et al.* (2016).

***Blackgram yield***

Weed free check had a favorable effect on the grain and haulm yields. The economic yield in the weed free treatment was found to be superior over all other treatments (Table 2). This result is in line with the findings of Balyan *et al.* (2016). Among various weed management practices followed, PE application of Oxyfluorfen @ 0.18 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS ($T_9$) recorded significantly higher grain yield as well as haulm yield (722 and 2314 kg $ha^{-1}$, respectively). This treatment was followed by the PE application of pendimethalin @ 1.0 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS ($T_7$), (703 and 2275 kg $ha^{-1}$). The percentage of yield increase due to weed free check, PE application of Oxyfluorfen @ 0.18 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS ($T_9$) and PE application of pendimethalin @ 1.0 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS ($T_7$) were 146.03, 139.07 and 132.8 per cent, respectively, over unweeded control. This was achieved by the way of effective early and later weed control through pre and post emergence herbicides which might have reduced the crop-

weed competition. The increase in yield was mainly attributed to better control of weeds throughout the crop growth resulting in better availability of nutrients, moisture and light to the crop growth. Earlier findings by Devendra Kumar *et al.* (2015) and Charan Teja *et al.* (2016) agreed with the present findings.

## Conclusion

From the above results, it could be concluded that PE application of Oxyfluorfen @ 0.18 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS ($T_9$) or PE application of pendimethalin @ 1.0 kg $ha^{-1}$ + EPOE Imazethapyr @ 0.05 kg $ha^{-1}$ on 20 DAS ($T_7$) was found to be the viable weed management practice for achieving higher productivity of irrigated blackgram.

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Received : February 15, 2018; Revised : February 28, 2018; Accepted : March 12, 2018