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**R Easwari**
Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, India

**M Saravana Perumal**
Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, India

**K Suseendran**
Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, India

**B Ananda Ganesa Raja**
Department of Entomology, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, India

**Corresponding Author:**
**R Easwari**
Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, India

# Effect of pre and post emergence herbicides on weed parameters and growth of irrigated greengram

**R Easwari, M Saravana Perumal, K Suseendran and B Ananda Ganesa Raja**

**Abstract**
Field experiment was conducted at the Vadapalai village, Villupuram district during July-September, 2021 to evaluate the performance of different pre and post emergence herbicides on weeds and productivity of greengram under irrigated conditions. Weed spectrum of the experimental field consisted of three groups of weeds like grasses, sedges and broad-leaved weeds. The grass weeds were *Cyanodon dactylon*, *Echinochloa colona*, *Dactyloctenium aegyptium* and the major sedge was *Cyperus rotundus*. Among the broad-leaved weeds *Cleome viscosa*, *Trianthema portulacastrum* and *Phyllanthus niruri* were found. Application of Pendimethalin @ 1 kg a.i. ha$^{-1}$ on 3 DAS + Imazethapyr @ 70 g a.i. ha$^{-1}$ on 20 DAS registered the maximum growth of irrigated greengram due to reduced weed growth, weed dry matter production and reduction in nutrient depletion by weeds and increased nutrient uptake by crop and this was on par with Hand weeding twice at 15 and 30 DAS.

**Keywords:** Weeds, greengram, pendimethalin, imazethapyr, nutrient depletion

## Introduction
Pulses are commonly known as food legumes or seeds of the pod bearing plant belongs to the family of Fabaceae and are widely spread throughout the world. They have a high protein content ranging from 20-40 per cent. Pulses are a wonderful gift of nature with the unique ability of biological nitrogen fixation, deep root system, mobilization of insoluble soil nutrients and bringing qualitative changes in soil properties which make them known as "soil fertility restorers" (Deepak Kumar *et al*., 2018) [2]. The United Nations declared 2016 as the "International Year of Pulses" (IYP) to increase the public awareness of the nutritional benefits of pulses as part of sustainable food production aimed at food security and nutrition. Weed management is an important factor for enhancing the productivity of greengram as weeds compete for nutrients, water, light and space with the crop during the early growth period. Yield losses in greengram due to weeds have been estimated to range between 30-50 per cent (Kumar *et al*., 2004) [1].

## Materials and Methods
The present study entitled, "Efficacy of pre and post emergence herbicide for weed control in greengram" under irrigated conditions was carried out from July-September, 2021 at a farmer's field in Vadapalai village, Villupuram District, Tamil Nadu. The field experiment was carried out at Vadapalai village, Villupuram District, Tamil Nadu. The experiment farm is geographically located at 12$^0$28$^{'}$ North Latitude and 79$^0$ 33$^{'}$ East Longitude and with an altitude of 120.5 m above mean sea level. The soils of the experimental field were sandy loam. The field experiment was laid out in Randomized Block Design with three replications.
The treatment comprised of Pendimethalin @ 1 kg a.i. ha$^{-1}$ on 3 DAS ($T_1$), Pendimethalin @ 1 kg a.i. ha$^{-1}$ on 3 DAS + Imazethapyr @ 70 g a.i. ha$^{-1}$ on 20 DAS ($T_2$), Imazethapyr @ 50 g a.i.ha$^{-1}$ on 20 DAS ($T_3$), Imazethapyr + Imazamox @ 70 g a.i. ha$^{-1}$ on 20 DAS ($T_4$), Pendimethalin @ 1 kg a.i. ha$^{-1}$ PE + 1 Hand weeding at 30 DAS ($T_5$), Sodium Acifluorfen 16.5% + Clodinafop-propargyl 8% EC @ 750 ml ha$^{-1}$ on 20 DAS ($T_6$), Sodium Acifluorfen 16.5% + Clodinafop-propargyl 8% EC @ 1000 ml ha$^{-1}$ on 20 DAS ($T_7$), Hand weeding twice at 15 and 30 DAS ($T_8$), Unweeded control ($T_9$).

## Results and Discussion

### Weed Density, Weed Dry Matter, Weed Control Efficiency and Nutrient Removal by Weeds

In our present study, irrespective of weed management practices application of Pendimethalin @ 1 kg a.i. $ha^{-1}$ on 3 DAS + Imazethapyr @ 70 g a.i. $ha^{-1}$ on 20 DAS ($T_2$) has recorded the lowest weed density. This recorded the total weed density of about 3.37 $m^{-2}$ and 7.55 $m^{-2}$ on 30 and 45 DAS respectively. The combined application of pre-emergence and early post emergence herbicides enabled the weed free condition throughout the crop period and also the weed seed bank is reduced for the further crop. This result is in agreement with the previous findings reported by Verma and Kushwaha (2018) [3]. This was on par with Hand weeding twice at 15 and 30 DAS ($T_8$). Invariably unweeded control ($T_9$) registered the highest total weed density at all stages of observation *viz.*, 30 and 45 DAS. (Table 1)

All the treatments significantly reduced the weed dry matter production. Weed dry weight was considerably reduced in Pendimethalin @ 1 kg a.i. $ha^{-1}$ on 3 DAS + Imazethapyr @ 70 g a.i. $ha^{-1}$ on 20 DAS ($T_2$) which recorded the dry matter of 42.30 and 57.03 kg $ha^{-1}$ on 30 and 45 DAS. This might be due to the control of weeds during the early stage by early post emergence application which prevented the emergence of monocot and grassy weeds by inhibiting root and shoot growth. Similar results were indicated by Verma and Kushwaha (2018) [3], Singh *et al*. (2017) [4] and Punia *et al*. (2017). This was on par with Hand weeding twice at 15 and 30 DAS ($T_8$). The highest weed dry matter production was recorded in unweeded control ($T_9$). (Table 2)

The maximum WCE obtained by the above promising weed management practices was due to a greater reduction of grasses, sedges and broad-leaved weeds in all the stages of crop growth. The highest weed control efficiency recorded was 97.19 and 94.77 on 30 and 45 DAS. This might be due to the combined application of Pendimethalin and Imazethapyr. Since the combined application was found to be superior to individual application of herbicides. These results are in accordance with the findings of Mishra *et al*. (2017) [6] and Singh *et al*. (2019) [7]. (Table 2)

Weed densities and proportionate biomass production by individual weeds constitute the total weed dry weight, which in turn with its nutrient content decide the amount of nutrient depletion by weeds. The least nutrient removal by weeds obtained was 11.86 kg $ha^{-1}$ N, 4.96 kg $ha^{-1}$ $P_2O_5$, 8.31 kg $ha^{-1}$ $K_2O$ respectively which was due to efficient control of weed emergence and its growth which resulted in reduced weed dry matter production and minimal nutrient removal by weeds. These results are in conformity with Kaur *et al*. (2010) [8] and Jinger *et al*. (2016) [9]. (Table 2).

### Growth attributes

The results showed that the weed management practices had a favourable effect on growth parameters. Among the different treatments, a perusal of data revealed the application of Pendimethalin @ 1 kg a.i. $ha^{-1}$ on 3 DAS + Imazethapyr @ 70 g a.i. $ha^{-1}$ on 20 DAS ($T_2$) recorded the tallest plant height (Table 3) which was statistically superior to the rest of the treatments. This might be due to the better weed control at different growth stages of the crop. This effective suppression of weeds provided competition free conditions and hence plant can utilize available resources *viz.*, light, moisture, space and more nutrients at all stages which resulted in increased plant height. This is in line with the findings of earlier worker. This was statistically on par with Hand weeding twice at 15 and 30 DAS ($T_8$). Unweeded control ($T_9$) showed a significant reduction in plant height due to high competition by weeds and suppression of growth due to lesser availability of growth contributing factors to plants thus reducing the plant height to greater extent.

Improved nutrient uptake and vigour due to elimination of weed competition right from the beginning of the crop might have contributed the favourable growth components, higher nutrient uptake and consequently higher plant height, LAI and crop DMP (Table 3) in the application of Pendimethalin @ 1 kg a.i. $ha^{-1}$ on 3 DAS + Imazethapyr @ 70 g a.i. $ha^{-1}$ on 20 DAS ($T_2$). The increase in growth attributes under these treatments might be attributed due to reduction in weed competitiveness with the crop.

At all growth stages of the crop, the crop dry matter production differed significantly due to different weed control treatments. Among the treatments, maximum crop dry matter was observed with the application of Pendimethalin @ 1 kg a.i. $ha^{-1}$ on 3 DAS + Imazethapyr @ 70 g a.i. $ha^{-1}$ on 20 DAS ($T_2$). This might be due to minimizing competition of weeds with main crop for resources *viz.*, space, light, nutrients and moisture with adaption of effective weed control. Thus, reduced crop-weed competition resulted into overall improvement in crop growth as reflected by increased dry matter accumulation. This was in accordance with the earlier findings of Nagendar *et al*. (2017) [12] and Singh and Yadav, (2015) [11].

This was on par with Hand weeding twice at 15 and 30 DAS ($T_8$). The lowest crop dry matter production was recorded in unweeded control ($T_9$). This least crop DMP is mainly due to poor weed control which resulted in the highest crop weed competition.

**Table 1:** Weed population $m^{-2}$ as influenced by weed management practices

| Treatment Schedule | Grasses | | Sedges | | Broad leaved weeds | | Total weed population | |
|---|---|---|---|---|---|---|---|---|
| | 30 DAS | 45 DAS | 30 DAS | 45 DAS | 30 DAS | 45 DAS | 30 DAS | 45 DAS |
| **$T_1$:** Pendimethalin @ 1 Kg a.i. $ha^{-1}$ on 3 DAS. | 3.47 (11.54) | 3.82 (14.09) | 2.78 (7.22) | 2.98 (8.38) | 2.46 (5.55) | 3.47 (11.54) | 4.98 (24.32) | 5.87 (34.01) |
| **$T_2$:** Pendimethalin @ 1 Kg a.i. $ha^{-1}$ on 3 DAS + Imazethapyr @ 70 g a.i. $ha^{-1}$ on 20 DAS. | 1.25 (1.06) | 1.78 (2.67) | 1.23 (1.01) | 1.52 (1.81) | 1.34 (1.30) | 1.89 (3.07) | 1.96 (3.37) | 2.83 (7.55) |
| **$T_3$:** Imazethapyr @ 50 g a.i. $ha^{-1}$ on 20 DAS. | 4.22 (17.30) | 4.46 (19.39) | 3.34 (10.66) | 3.63 (12.68) | 2.81 (7.40) | 3.81 (14.01) | 5.99 (35.36) | 6.83 (46.08) |
| **$T_4$:** Imazethapyr + Imazamox @ 70 g a.i. $ha^{-1}$ on 20 DAS. | 2.82 (7.45) | 3.18 (9.61) | 2.27 (4.65) | 2.47 (5.60) | 2.15 (4.12) | 3.11 (9.17) | 4.08 (16.22) | 4.98 (24.38) |
| **$T_5$:** Pendimethalin @ 1 Kg a.i. $ha^{-1}$ PE + 1 Hand weeding at 30 DAS. | 2.09 (3.87) | 2.49 (5.70) | 1.76 (2.60) | 2.14 (4.08) | 1.71 (2.42) | 2.32 (4.88) | 3.06 (8.88) | 3.89 (14.66) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **T6:** Sodium Acifluorfen 16.5% + Clodinafop-propargyl 8% EC @ 750 ml ha$^{-1}$ on 20 DAS. | 5.03 (24.80) | 5.18 (26.33) | 4.05 (15.90) | 4.24 (17.48) | 3.13 (9.30) | 4.19 (17.05) | 7.10 (50.00) | 7.83 (60.86) |
| **T7:** Sodium Acifluorfen 16.5% + Clodinafop-propargyl 8% EC @ 1000 ml ha$^{-1}$ on 20 DAS. | 2.70 (6.79) | 3.09 (9.05) | 2.18 (4.25) | 2.58 (6.16) | 2.07 (3.78) | 2.70 (6.79) | 3.92 (14.82) | 4.74 (21.99) |
| **T8:** Hand weeding twice at 15 and 30 DAS. | 1.48 (1.69) | 1.90 (3.11) | 1.34 (1.30) | 1.63 (2.16) | 1.43 (1.54) | 1.97 (3.38) | 2.24 (4.53) | 3.02 (8.65) |
| **T9:** Unweeded control. | 8.01 (63.66) | 9.03 (81.04) | 5.01 (24.60) | 5.25 (27.06) | 5.71 (32.10) | 6.06 (36.22) | 10.99 (120.36) | 12.03 (144.32) |
| SEm± | 0.17 | 0.18 | 0.11 | 0.14 | 0.07 | 0.09 | 0.11 | 0.13 |
| CD (P= 0.05) | 0.50 | 0.55 | 0.34 | 0.43 | 0.21 | 0.29 | 0.33 | 0.38 |

**Table 2:** Weed dry matter production (kg ha$^{-1}$), WCE and Nutrient removal by weeds as influenced by weed management practices

| Treatment Schedule | Weed dry matter | | Weed control efficiency | | Nutrient removal by weeds | | |
|---|---|---|---|---|---|---|---|
| | 30 DAS | 45 DAS | 30 DAS | 45 DAS | N | P | K |
| **T1:** Pendimethalin @ 1 Kg a.i. ha$^{-1}$ on 3 DAS. | 97.12 | 125.82 | 79.79 | 76.43 | 25.94 | 9.82 | 17.92 |
| **T2:** Pendimethalin @ 1 Kg a.i. ha$^{-1}$ on 3 DAS + Imazethapyr @ 70 g a.i. ha$^{-1}$ on 20 DAS. | 42.30 | 57.03 | 97.19 | 94.77 | 11.86 | 4.96 | 8.31 |
| **T3:** Imazethapyr @ 50 g a.i. ha$^{-1}$ on 20 DAS. | 112.01 | 140.79 | 70.62 | 68.07 | 29.75 | 11.73 | 20.48 |
| **T4:** Imazethapyr + Imazamox @ 70 g a.i. ha$^{-1}$ on 20 DAS. | 81.01 | 108.23 | 86.52 | 83.10 | 20.82 | 8.17 | 15.80 |
| **T5:** Pendimethalin @ 1 Kg a.i. ha$^{-1}$ PE + 1 Hand weeding at 30 DAS. | 60.47 | 77.13 | 92.61 | 89.84 | 16.48 | 6.08 | 11.46 |
| **T6:** Sodium Acifluorfen 16.5% + Clodinafop-propargyl 8% EC @ 750 ml ha$^{-1}$ on 20 DAS. | 130.38 | 162.98 | 58.46 | 57.83 | 35.38 | 13.84 | 23.86 |
| **T7:** Sodium Acifluorfen 16.5% + Clodinafop-propargyl 8% EC @ 1000 ml ha$^{-1}$ on 20 DAS. | 75.59 | 97.25 | 87.68 | 84.76 | 20.41 | 8.04 | 15.64 |
| **T8:** Hand weeding twice at 15 and 30 DAS. | 47.78 | 63.15 | 96.24 | 94.01 | 12.25 | 5.07 | 8.50 |
| **T9:** Unweeded control. | 387.69 | 478.54 | - | - | 41.68 | 16.93 | 27.72 |
| SEm± | 3.08 | 4.67 | - | - | 0.36 | 0.14 | 0.25 |
| CD (P= 0.05) | 9.25 | 14.01 | - | - | 1.09 | 0.43 | 0.76 |

**Table 3:** Plant height (cm), Leaf area index and crop dry matter production (kg ha$^{-1}$) as influenced by weed management practices

| Treatment Schedule | Plant height (cm) | | LAI | Crop dry matter production (kg ha$^{-1}$) at harvest |
|---|---|---|---|---|
| | 30 DAS | 45 DAS | | |
| **T1:** Pendimethalin @ 1 kg a.i. ha$^{-1}$ on 3 DAS | 14.71 | 30.49 | 2.53 | 1796 |
| **T2:** Pendimethalin @ 1 kg a.i. ha$^{-1}$ on 3 DAS + Imazethapyr @ 70 g a.i. ha$^{-1}$ on 20 DAS | 18.85 | 42.51 | 3.71 | 2398 |
| **T3:** Imazethapyr @ 50 g a.i. ha$^{-1}$ on 20 DAS | 13.51 | 28.19 | 2.12 | 1548 |
| **T4:** Imazethapyr + Imazamox @ 70 g a.i. ha$^{-1}$ on 20 DAS | 15.73 | 34.09 | 2.83 | 1965 |
| **T5:** Pendimethalin @ 1 Kg a.i. ha$^{-1}$ PE + 1 Hand weeding at 30 DAS | 17.20 | 38.51 | 3.31 | 2181 |
| **T6:** Sodium Acifluorfen 16.5% + Clodinafop-propargyl 8% EC @ 750 ml ha$^{-1}$ on 20 DAS | 12.26 | 24.83 | 1.8 | 1337 |
| **T7:** Sodium Acifluorfen 16.5% + Clodinafop-propargyl 8% EC @ 1000 ml ha$^{-1}$ on 20 DAS | 16.05 | 35.21 | 2.95 | 2017 |
| **T8:** Hand weeding twice at 15 and 30 DAS | 18.39 | 41.53 | 3.62 | 2349 |
| **T9:** Unweeded control | 11.23 | 22.47 | 1.47 | 1068 |
| SEm± | 0.34 | 0.72 | 0.08 | 41.24 |
| CD (P= 0.05) | 1.01 | 2.17 | 0.24 | 124.69 |

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