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Studies on the effect of weed management practices on weed dynamics of irrigated greengram

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Abstract
A field experiment was conducted during the month of June to August, 2021 at Annukudy village, Thiruvarur district, Tamil Nadu. The treatments included of better combinations consisting of physical and chemical method of weed control. The examinations meant the significance of pre-emergence application of Pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + post-emergence application of imazethapyr 10% SL @ 0.05 kg a.i ha^{-1} on 21 DAS which could help the harvests in decreasing the different weed population and at last diminished the complete weed biomass which brought about expansion in crop yield. Pre-emergence application of Pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + post-emergence application of imazethapyr 10% SL @ 0.05 kg a.i ha^{-1} on 21 DAS recorded the highest weed control index. Higher weed control index under chemical method might be due to effective weed control achieved under these weed treatment in terms of reduced biomass of weeds.

Keywords: Irrigated greengram, Pendimethalin, imazethapyr, weed management and weed control index

Introduction
Greengram (*Vigna radiata* (L.)) is a popular pulse crop that may be cultivated in both tropical and subtropical climates. After chickpea, pigeon pea and Blackgram. Greengram, commonly known as Mungbean, is India's fourth most widely grown pulse crop. The area under greengram in India is 30.48 lakh hectares with a production of 13.45 lakh tonnes with productivity of 441 kg ha^{-1} (GOI, 2019) [2]. The total area under greengram in Tamil Nadu is 1.95 lakh hectares with the production of 0.89 lakh tonnes and the productivity of 444 kg ha^{-1}. Greengram can be grown during both rainy and summer seasons. Being a short duration crop, it fits well in traditional rice-wheat cropping systems and provides farmers with additional income. Being a leguminous crop, it can play a major role in nitrogen fixation from 20 to 80 kg ha^{-1}, thus improving system sustainability. Greengram improves the soil health and maintain its environment. Greengram grains contain 22 to 28% protein, 60 to 65% carbohydrates, 1.0 to 1.5% fat, 3.5 to 4.5% fibre and 4.5 to 5.5% ash (USDA, 2019) [11]. It is also rich source of aromatic amino acids, *viz.* Leucine, isoleucine and tryptophan. Weeds are considered to be one of the key causes responsible for low yield of irrigated greengram because to their detrimental impacts. Weeds compete with crops for resources including nutrients, water, light and space which resulted in lowering production. They are naturally more resilient and competitive, but if not managed appropriately, they can result in severe yield losses. The extent of the losses is mostly determined by the weed flora, the length of weed-crop competition and the intensity of the competition. Mohan Kumar and Hiremath (2018) [8] reported that the loss of greengram yield due to weeds ranges from 65 to 79%. Teame *et al.* (2019) [10] reported that the Mungbean should be kept weed free twice, namely 10 to 20 days after sowing and 30 to 40 days after sowing. Chemical weed management is also most well-liked attributable to its higher potency alongside less price and time involvement. Also, it causes no mechanical harm to the crop that happens throughout manual weeding. Moreover, the management is more practical because the weeds even at intervals the rows don't seem to be killed during mechanical control and would profit the crop by providing correct aeration and conservation of moisture. Hence, the present investigation has been carried out to evaluate the better weed management practice on total weed count, weed biomass and weed control index.

Materials and Methods

The experiment was conducted at Annukudy village, Thiruvarur district, Tamil Nadu during the month of June to August, 2021. The experimental field is geographically situated at 10°40'N latitude and 79°34'E longitude and at an altitude of + 3.0 meters above the mean sea level. The crop period received a rain fall of 14.8 mm distributed over two rainy days during crop season. The mean maximum and minimum temperature recorded during the cropping season were 36.4 °C and 25.8 °C and the mean relative humidity ranged from 70.7 to 77.7%. The soil of the experimental field was clay in texture with pH of 7.7 and EC of 0.42 dS m^{-1}. The experimental soil was low in available nitrogen, medium in available phosphorous and medium in available potassium. The experiment was laid out in Randomized Block Design with three replications.

The experiment consisted of ten weed management treatments [*viz.*, T_1: Unweeded control, T_2: Two hand hoeing on 15 and 30 DAS, T_3: Pendimethalin 30% EC @ 1 kg a.i ha^{-1} on 3 DAS, T_4: Pendimethalin 38.7% CS @ 0.75 kg a.i ha^{-1} on 3 DAS, T_5: Imazethapyr 10% SL @ 0.05 kg a.i ha^{-1} on 21 DAS, T_6: Pendimethalin 30% EC @ 1 kg a.i ha^{-1} on 3 DAS + One hand hoeing on 30 DAS, T_7: Pendimethalin 38.7% CS @ 0.75 kg a.i ha^{-1} on 3 DAS + One hand hoeing 30 DAS, T_8: Pendimethalin 30% EC @ 1 kg a.i ha^{-1} on 3 DAS + Imazethapyr 10% SL @ 0.05 kg a.i ha^{-1} on 21 DAS, T_9: Pendimethalin 38.7% CS @ 0.75 kg a.i ha^{-1} on 3 DAS + Imazethapyr 10% SL @ 0.05 kg a.i ha^{-1} on 21 DAS, T_{10}: One hand hoeing on 15 DAS + Imazethapyr 10% SL @ 0.05 kg a.i ha^{-1} on 21 DAS] were evaluated on irrigated greengram. Greengram variety VBN 4 was sown in the first week of June and 30 cm row to row spacing and 10 cm plant to plant spacing with a seed rate of 20 kg ha^{-1}. Irrigation was given immediately after sowing. All other standard cultural practices were followed during the cropping season. Pre and post emergence application of Pendimethalin and imazethapyr was done with the help of knapsack sprayer fitted with a flood fan nozzle with a spray volume of 500 l ha^{-1}. In manual weed control treatments, weeds are uprooted within the row and between the rows using with hand hoe as per days mentioned in each treatment. The weed count (density) was taken from the tagged spot of 0.25 m^2 in the randomly selected each net plot and were calculated and converted into square meter basis for convenience. In order to draw a valid conclusion, the weed count data were subjected to $(\sqrt{X+0.5})$ as suggested by Gomez and Gomez (1984) [3] before statistical analysis. For weed biomass, the weeds were air dried completely till they attained constant weight and finally recorded for each treatment and converted into kg ha^{-1}. Weed control index was calculated by the formulae suggested by Misra and Josh (1979) [7]. The observations were recorded on total weed count, weed biomass and weed control index by adopting appropriate procedure.

Results and Discussion

Effect on weeds

Weed flora present in the experimental field was composite in nature comprising of grasses, sedges and broad leaved weeds (BLW). The major grass weeds are *Echinochloa colonum*, sedges *Cyperus rotundus* and broad leaved weeds *Heliotropium ovalifolium* and *Merremia emarginata* were the dominant weed species in the experimental field. This wide range of weeds in irrigated greengram was also reported by Chhodavadia *et al*. (2013) [1].

Effect on total weed count

Significantly maximum total weed count was recorded under Unweeded control (T_1) where as it significantly lowest with treatment, T_8-pre-emergence application of Pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + post-emergence application of imazethapyr 10% SL @ 0.05 kg a.i. ha^{-1} on 21 DAS of 17.13 m^{-2} on 30 DAS (Table 1). The studies signified the importance of pre-emergence application of Pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + post-emergence application of imazethapyr 10% SL @ 0.05 kg a.i ha^{-1} on 21 DAS which could benefit the crops in reducing the different weed density and ultimately reduced the weeding frequency during crop weed competition of crop. It might be due to efficient and prolonged weed control by pre-emergece herbicides efficiently, supplemented with post-emergece herbicides control the late emergent flushes of weeds. Pendimethalin is an herbicide of aniline group used as pre-emergence to control initial flush of weeds and it controls initial flush of annual grasses and some of the broadleaf weeds. The primary mode of action is to inhibit cell division and cell elongation cause effect on root and shoot growth. Imazethapyr belongs to the chemical group of imidazolinone herbicides and its mechanism of action is the inhibition of branched-chain amino acid biosynthesis which inturn cause chlorotic and necrotic effect on meristematic areas followed by a slow general foliar chlorosis and necrosis. This findings were similar with Kumar *et al*. (2017) [5].

Effect on weed biomass

Significantly the highest weed biomass was recorded with unweeded control (T_1) where as it significantly lowest with treatment, pre-emergence application of pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + post-emergence application of imazethapyr 10% SL @ 0.05 kg a.i. ha^{-1} on 21 DAS on 30 DAS (25.62 kg ha^{-1}). This might be due to effective control of weed seeds germination in the early stages of crop growth followed by the distinctive effect of post-emergence herbicide logged with less density as well as by the domination of crop over weed and broad spectrum efficiency of pre-emergence and post emergence herbicide application and hence, reduced the weed density and weed dry weight considerably as evinced from the data. The death of susceptible weed species by imazethapyr application was due to the inhibition of acetolactate synthase (ALS) enzyme which is essential for leucine, valine and isoleucine synthesis in weeds in greengram which is in line with the findings of Muthuram *et al*. (2018) [9] and Kalaisudarson *et al*. (2020) [4].

Effect on weed control index

Adoption of weed management practices had significant effect on weed control index (Fig. 1). Pre-emergence application of pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + post-emergence application of imazethapyr 10% SL @ 0.05 kg a.i. ha^{-1} on 21 DAS registered the highest weed control index of 90.02 on 30 DAS. This might be due to effective weed control achieved under these weed treatment in terms of reduced biomass of weeds and the continuance of earlier effect made the pre emergence herbicide performed evenly with post emergence herbicides at later stages of the crop growth accounted with very low weed biomass. Results were almost similarly reported by Manpreet Jaidka and Manoj Sharma (2018) [6].

Table 1: Efficacy of weed management practices on total weed count, weed biomass and weed control index on 30 DAS in irrigated greengram

`Treatments	Total weed count (m^{-2})	Weed biomass (kg ha^{-1})	Weed control index
T_1 - Unweeded control	11.94 (142.26)	256.68	-
T_2 - Two hand hoeing on 15 and 30 DAS	6.89 (46.92)	73.21	71.48
T_3 - Pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS	8.41 (70.24)	111.19	56.68
T_4 - Pendimethalin 38.7% CS @ 0.75 kg a.i. ha^{-1} on 3 DAS	9.52 (90.15)	128.88	49.79
T_5 - Imazethapyr 10% SL @ 0.05 kg a.i. ha^{-1} on 21 DAS	10.68 (113.61)	150.65	41.31
T_6 - Pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + One hand hoeing on 30 DAS	6.13 (37.06)	55.19	78.50
T_7 - Pendimethalin 38.7% CS @ 0.75 kg a.i. ha^{-1} on 3 DAS + One hand hoeing on 30 DAS	6.70 (44.37)	71.38	72.19
T_8 - Pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + Imazethapyr 10% SL @ 0.05 kg a.i. ha^{-1} on 21 DAS	4.20 (17.13)	25.62	90.02
T_9 - Pendimethalin 38.7% CS @ 0.75 kg a.i. ha^{-1} on 3 DAS + Imazethapyr 10% SL @ 0.05 kg a.i. ha^{-1} on 21 DAS	5.08 (25.34)	38.63	84.95
T_{10} - One hand hoeing on 15 DAS + Imazethapyr 10% SL @ 0.05 kg a.i. ha^{-1} on 21 DAS	7.06 (49.29)	76.95	70.02
S.Em±	0.15	3.46	-
CD(P=0.05)	0.44	10.36	-

(Figures in the parenthesis indicate the original values)

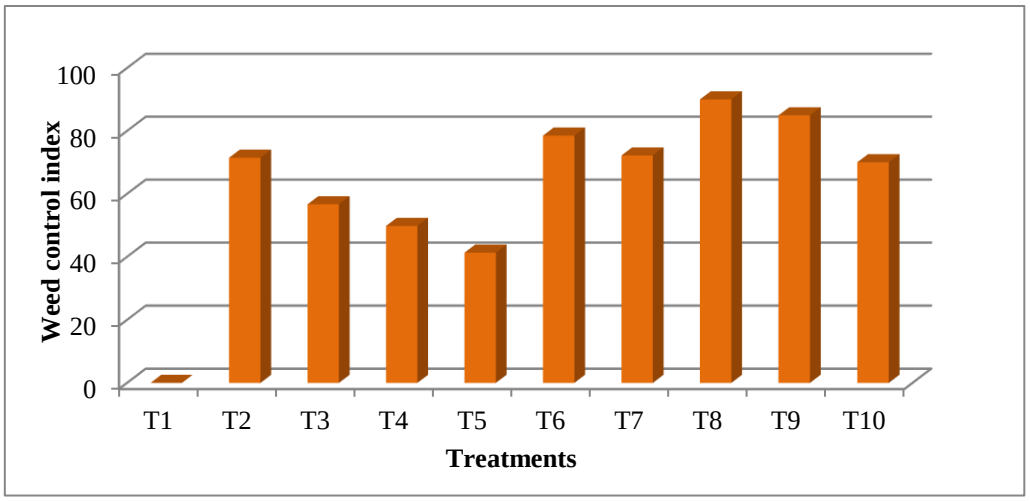

Fig 1: Effect of weed management practices on weed control index

Conclusion

Based on the results of the experiment, it was concluded that pre-emergence application of pendimethalin 30% EC @ 1 kg a.i. ha^{-1} on 3 DAS + post-emergence application of imazethapyr 10% SL @ 0.05 kg a.i. ha^{-1} on 21 DAS in irrigated greengram is beneficial for obtaining lower total weed count, weed biomass and higher weed control index.

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