

Effect of integrated weed management practices on growth, physiology and yield of direct sown finger millet (*Eleusine coracana* L.)

ABSTARCT

To determine "Effect of integrated weed management practices in direct sown finger millet". The field experiment was conducted during *rabi* 2022 at South Farm, Karunya Institute of Technology and Sciences, Coimbatore. The soil of the experimental field was sandy clay loam in texture, pH 6.9, level of organic content (0.37%), available N (336 kg ha⁻¹), P (91 kg ha⁻¹) and K (261 kg ha⁻¹). The experiment was laid out in completely randomized block design. T₁ (PE pendimethalin @ 0.75 kg ha⁻¹ 8 DAS + Hand weeding (HW) @ 35 DAS), T₂ (PoE 2,4-D @ 2 kg ha⁻¹ 40 DAS + Hand weeding (HW) @ 35 DAS), T₃ (PE pretilachlor @ 0.75 kg ha⁻¹ 8 DAS + Hand weeding (HW) @ 35 DAS), T₄ (PoE 2,4-D @ 2 kg ha⁻¹ 40 DAS + Twin wheel hoe weeding (TWHW) @ 30 DAS), T₅ (PE pendimethalin @ 0.75 kg ha⁻¹ 8 DAS + Twin wheel hoe weeding @ 30 DAS), T₆ (PE pretilachlor @ 0.75 kg ha⁻¹ 8 DAS + Twin wheel hoe weeding (TWHW) @ 30 DAS), T₇ (Hand weeding (HW) @ 25 and 40 DAS), T₈ (Twin wheel hoe weeding (TWHW) @ 25 and 40 DAS), T₉ (Hand weeding (HW) @ 25 DAS + Twin wheel hoe weeding (TWHW) @ 40 DAS), T₁₀ (Unweeded control). The result shows that the weed control practices significantly decreases weeds also higher control of weed infestation was observed in PE pretilachlor @ 0.75kg ha⁻¹ 8 DAS + Twin wheel hoe weeding @ 30 DAS. The maximum dry matter production, CGR, RGR, NPK uptake and grain yield (2368 kg ha⁻¹) were also found higher in PE pretilachlor @ 0.75kg ha⁻¹ 8 DAS + Twin wheel hoe weeding @ 30 DAS. From this study it is concluded that application of pre emergence herbicide pretilachlor along with twin wheel hoe weeder increases the crop growth and yield

Keywords: dry matter production; finger millet; grain yield; integrated weed management

1. INTRODUCTION

"Finger millet (*Eleusine coracana*) locally known as *ragi* is an annual herbaceous belongs to poaceae family In India, finger millet is a significant small millet crop cultivated on 1.15 million ha of agricultural area with a yield of 1724 kg ha⁻¹ and a production of 1.99 million tonnes in 2020–21" (Oak and Bansal, 2022). After rice, maize, wheat, sorghum, and barley, it is India's sixth most important crop. It is frequently cultivated as an individual crop, a mixed crop, or in a rotation with pulses and oilseeds. Finger millet is not a season bound crop and hence can be cultivated throughout the year, if moisture is available.

Finger millet is widely cultivated crop of the tropical and subtropical regions of the world, being grown in Africa, Madagascar, Sri Lanka, Malaysia, china and Japan besides large area in India. It is extensively grown in Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, Bihar, Gujarat and Maharashtra and in the hilly regions of Uttar Pradesh and Himachal Pradesh. Nutritionally, finger millet is good source of nutrients

especially of calcium, other minerals and fiber. Total carbohydrate content of finger millet is 72 to 79.5%, protein content from 5.6 to 12.70%, 44.7% essential amino acids, crude fat content is 1.3 to 1.8%.

Due to the finger millet's initial slow development, which promotes weed growth in early stages of growth fighting for sunlight, nutrients, and water, weeds are a key limitation and have a negative impact on productivity. Applying pre and post-herbicides together with inter-cultural operations will limit the weed growth. Pre-emergence herbicides are applied 0-3 days after sowing and have been shown to effective weed control for a certain period of time depending on the weed flora. To control these late-emerging weeds, either post-emergence herbicide spraying or inter-cultural operations should be used to minimize yield loss due to weed infestation. To control weed infestation, suitable management practices should be carried out. An experiment has been conducted in this situation to find out how integrated weed management techniques influence directly sowed finger millet.

2. MATERIALS AND METHOD

A field experiment was conducted during *Rabi* season of 2022 in field no. R24 at South farm of Karunya Institute of Technology and Sciences, Coimbatore. The experimental site is geographically located in the Western agro-climatic zone of Tamil Nadu at 10° 56' N latitude and 76° 44' E longitude with an elevation of 474 m above mean sea level. The soil of the experimental site was clay loam in texture with neutral soil pH (6.9). The available nitrogen is 336 kg ha⁻¹, available phosphorus is 91 kg ha⁻¹ and available potassium is 261 kg ha⁻¹. The organic content was 0.37%. The experiment was laid out in Randomized Complete Block Design with ten treatments and three replications viz., T₁: PE pendimethalin @ 0.75 kg ha⁻¹ 8 DAS + Hand weeding (HW) @ 35 DAS, T₂: PoE 2,4-D @ 2 kg ha⁻¹ 40 DAS + Hand weeding (HW) @ 35 DAS, T₃: PE pretilachlor @ 0.75 kg ha⁻¹ 8 DAS + Hand weeding (HW) @ 35 DAS, T₄: PoE 2,4-D @ 2 kg ha⁻¹ 40 DAS + Twin wheel hoe weeding (TWHW) @ 30 DAS, T₅: PE pendimethalin @ 0.75 kg ha⁻¹ 8 DAS + Twin wheel hoe weeding @ 30 DAS, T₆: PE pretilachlor @ 0.75 kg ha⁻¹ 8 DAS + Twin wheel hoe weeding (TWHW) @ 30 DAS, T₇: Hand weeding (HW) @ 25 and 40 DAS, T₈: Twin wheel hoe weeding (TWHW) @ 25 and 40 DAS, T₉: Hand weeding (HW) @ 25 DAS + Twin wheel hoe weeding (TWHW) @ 40 DAS, T₁₀: Unweeded control. Finger millet CO 14 with a medium duration of 110 days was used as a test variety which was sown at inter-row spacing of 30 cm x 15 cm. The pre-emergence herbicide was applied 3 DAS. The post-emergence was mixed with 750 liter of water ha⁻¹ and sprayed at 40 DAS using knap-sack sprayer. Hand weeding and twin wheel hoe weeding was done as per the treatment schedule. The data obtained in the study were statistically analyzed using AGRES at 5% level of significance suggested by Gomez and Gomez (1984).

3. RESULT AND DISCUSSION

3.1 Dry matter production

The integrated weed management practices significantly enhanced the dry matter production in finger millet. The maximum dry matter accumulation was recorded in pre-emergence application of pretilachlor

0.75 kg ha⁻¹ on 8DAS + Twin wheel hoe weeder on 30 DAS (T₆) (9588 kg ha⁻¹). The better weed management practices will control weed growth throughout the crop growth period and leads to higher dry matter production in crops. Similar findings were noticed by Dubey *et al.* (2005), Sanjoy (2005 and 2009), Singh *et al.* (2005) and Sunil *et al.* (2011) and the minimum dry matter accumulation was noticed in unweeded control (T₁₀) (2324 kg ha⁻¹). The dry matter accumulation was lesser in unweeded control when compared to all other weed control treatments. These findings are similar with Lakshmi *et al.* (2008) on rice.

3.2 Grain yield

Among different integrated weed management practices on direct seeded finger millet significantly influenced. The pre-emergence application of pretilachlor 0.75 kg ha⁻¹ on 8 DAS + Twin wheel hoe weeding on 30 DAS (T₆) recorded highest grain yield 2368 kg ha⁻¹ was on par with pre-emergence application pendimethalin 0.75 kg ha⁻¹ on 8 DAS + Twin wheel hoe weeding on 30 DAS (T₅) recorded grain yield of about 2209 kg ha⁻¹ (Table 1). The higher grain yield in these treatments was due to better control of weed growth in all stages of finger millet which results in better availability of nutrients and resources helps to increase the yield in crop. These results are in conformity with Singh *et al.* (2005). Hence the lower grain yield was recorded in unweeded control (T₁₀) (698 kg ha⁻¹).

3.3 Crop growth rate

During 0-30 DAS, 30-60 DAS and 60 DAS-harvest the maximum CGR was recorded in pre-emergence application of pretilachlor 0.75 kg ha⁻¹ on 8 DAS + Twin wheel hoe weeding on 30 DAS (T₆) (0.46 g m⁻² d⁻¹, 0.69 g m⁻² d⁻¹ and 2.30 g m⁻² d⁻¹) which was on par with pre-emergence application pendimethalin 0.75 kg ha⁻¹ on 8 DAS + Twin wheel hoe weeding on 30 DAS (T₅) (0.40 g m⁻² d⁻¹, 0.60 g m⁻² d⁻¹, 2.00 g m⁻² d⁻¹). Due to greater light absorption and higher LAI, the maximum crop growth rate was caused by an increased accumulation of dry matter. Weed growth was reduced, nutrients were more readily available and soil moisture was higher, which facilitated faster crop growth as a result of more crop biomass. These findings match the results presented by Pallavi *et al.*, (2016). The lower range of CGR was recorded in unweeded control (T₁₀) (0.11 g m⁻² d⁻¹, 0.76 g m⁻² d⁻¹, 0.56 g m⁻² d⁻¹) (Figure 1).

3.4 Relative growth Rate

The highest RGR on 0-30 DAS, 30-60 DAS and 60 DAS-harvest was recorded in pre-emergence application of pretilachlor 0.75 kg ha⁻¹ on 8 DAS + Twin wheel hoe weeding on 30 DAS (T₆) (0.0644 g g⁻¹ day⁻¹, 0.0340 g g⁻¹ day⁻¹, 0.02291 g g⁻¹ day⁻¹) which was on par with pre-emergence application pendimethalin 0.75 kg ha⁻¹ on 8 DAS + Twin wheel hoe weeding on 30 DAS (T₅) (0.0596 g g⁻¹ day⁻¹, 0.0300 g g⁻¹ day⁻¹, 0.02291 g g⁻¹ day⁻¹) (Figure 1). According to Berger *et al.* (2007), annual weeds often have high RGR, particularly at the seedling stage, hence improving crop RGR can have a significant impact on weed competition and resource capture. Veerabadhran and Kennedy (2001) observed that higher values of physiological parameters were increasing the yield in sorghum were confirmed findings.

The lowest RGR was recorded in unweeded control (T₁₀) (0.0172 g g⁻¹ day⁻¹, 0.0121 g g⁻¹ day⁻¹, 0.02291 g g⁻¹ day⁻¹).

3.5 NPK uptake by crops

During harvest among different weed control treatment PE pretilachlor @ 0.75 kg ha⁻¹ 8 DAS + Twin wheel hoe weeding @ 30 DAS (T₆) significantly records higher nitrogen uptake (79.4 kg ha⁻¹) which was on par with PE pendimethalin @ 0.75 kg ha⁻¹ 8 DAS + Twin wheel hoe weeding @ 30 DAS (T₅) recorded 76.2 kg ha⁻¹ followed by PE pretilachlor @ 0.75 kg ha⁻¹ 8 DAS + Hand weeding @ 35 DAS (T₃) recorded 72.4 kg ha⁻¹. At harvest PE pretilachlor @ 0.75 kg ha⁻¹ 8 DAS + Twin wheel hoe weeding @ 30 DAS (T₆) significantly records higher phosphorous uptake 17.4 4 kg ha⁻¹ followed by PE pendimethalin @ 0.75 kg ha⁻¹ 8 DAS + Twin wheel hoe weeding @ 30 DAS (T₅) recorded 16.2 4 kg ha⁻¹. At harvest uptake of potassium was significantly higher in PE pretilachlor @ 0.75 kg ha⁻¹ 8 DAS + Twin wheel hoe weeding @ 30 DAS (T₆) 57.4 kg ha⁻¹ followed by PE pendimethalin @ 0.75 kg ha⁻¹ 8 DAS + Twin wheel hoe weeding @ 30 DAS (T₅) 56.1 kg ha⁻¹. Significant increase in total N, P and K uptake was due to significantly lower weed population and weed dry weight, lesser toxicity, increased grain yield and straw yield Madhu Kumar *et al.* (2013). These results are in line with findings of Bhanu Rekha *et al.* (2003), Rana *et al.* (2000) and Sunil *et al.* (2010). Whereas unweeded control (T₁₀) recorded lower nitrogen, phosphorous and potassium uptake 18.4 kg ha⁻¹, 4.54 kg ha⁻¹ and 11.2 kg ha⁻¹.

Table 1: Effect of integrated weed management practices on dry matter production (Kg ha⁻¹) and grain yield (Kg ha⁻¹) at harvest in finger millet

Treatment	DMP (Kg ha ⁻¹)	Grain yield (Kg ha ⁻¹)
T ₁ - PE pendimethalin 0.75 kg ha ⁻¹ @ 8 DAS + HW @ 35 DAS	6924	1810
T ₂ - PoE 2,4-D 2 kg ha ⁻¹ @ 40 DAS + HW @ 35 DAS	4858	1436
T ₃ - PE pretilachlor @ 0.75 kg ha ⁻¹ 8 DAS + HW @ 35 DAS	5949	1835
T ₄ - PoE 2,4-D @ 2 kg ha ⁻¹ 40 DAS + TWHW @ 30 DAS	3826	1468
T ₅ - PE pendimethalin @ 0.75 kg ha ⁻¹ 8 DAS + TWHW @ 30 DAS	8313	2209
T ₆ - PE pretilachlor @ 0.75 kg ha ⁻¹ 8 DAS + TWHW @ 30 DAS	9588	2368
T ₇ - TWHW @ 25 and 40 DAS	3156	942
T ₈ - TWHW @ 25 and 40 DAS	3031	971
T ₉ - HW @ 25 DAS + TWHW @ 40 DAS	2400	827
T ₁₀ - Unweeded control	2324	698
SEd	269	153
CD (P=0.05)	528	322

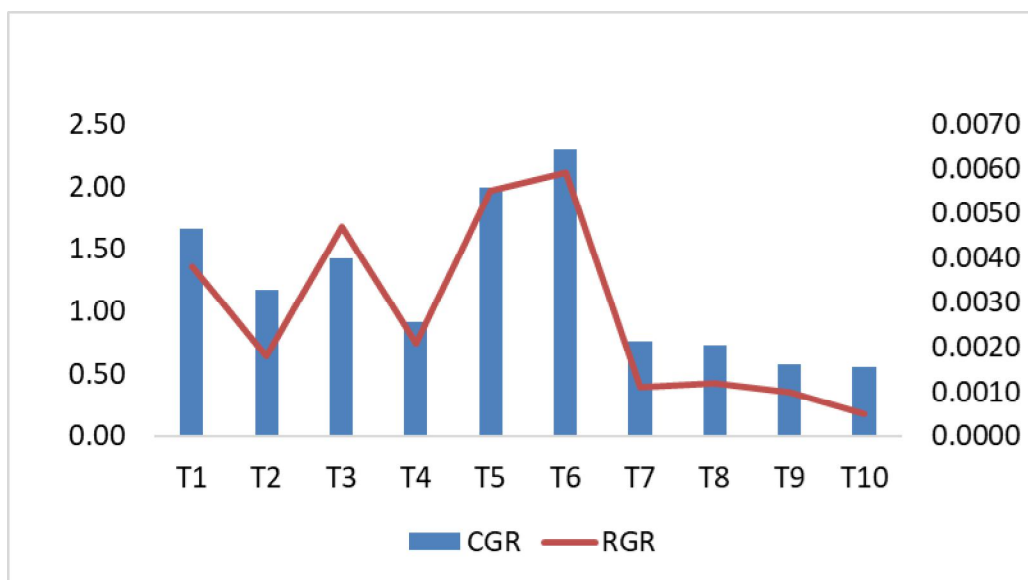


Fig 1: Effect of integrated weed management practices on crop growth rate and relative growth rate in finger millet

T₁ = PE pendimethalin @ 0.75 kg ha⁻¹ + HW, T₂ = PoE 2,4-D @ 2 kg ha⁻¹ + HW, T₃ = PE pretilachlor @ 0.75 kg ha⁻¹ + HW, T₄ = PoE 2,4-D @ 2 kg ha⁻¹ + TWHW, T₅ = PE pendimethalin @ 0.75 kg ha⁻¹ + TWHW, T₆ = PE pretilachlor @ 0.75kg ha⁻¹ + TWHW, T₇ = HW, T₈ = TWHW, T₉ = HW + TWHW & T₁₀ = Unweeded control

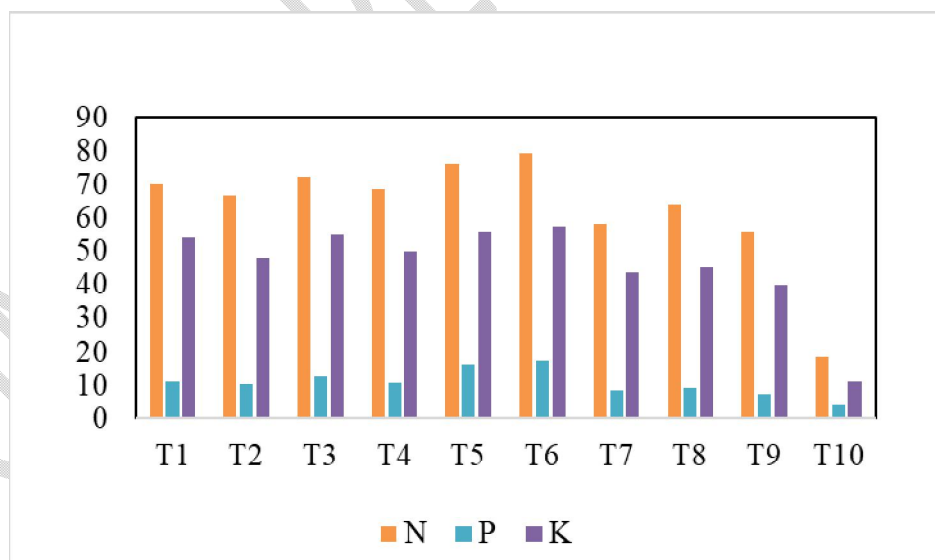


Fig 2: Effect of integrated weed management practices on nitrogen, phosphorus and potassium uptake in finger millet

T₁ = PE pendimethalin @ 0.75 kg ha⁻¹ + HW, T₂ = PoE 2,4-D @ 2 kg ha⁻¹ + HW, T₃ = PE pretilachlor @ 0.75 kg ha⁻¹ + HW, T₄ = PoE 2,4-D @ 2 kg ha⁻¹ + TWHW, T₅ = PE pendimethalin @ 0.75 kg ha⁻¹ + TWHW, T₆ = PE pretilachlor @ 0.75kg ha⁻¹ + TWHW, T₇ = HW, T₈ = TWHW, T₉ = HW + TWHW & T₁₀ = Unweeded control

4. Conclusion

Based on the result it is found that pre emergence application of pretilachlor 0.75 kg ha⁻¹ on 8 DAS + Twin wheel hoe weeding on 30 DAS shows the best integrated weed management practices for better weed control in the experimental plot and improves dry matter accumulation, CGR, RGR, NPK uptake and grain yield gives high productivity and profitability in direct sown finger millet production under irrigated condition. The experimental trial on weed management practices in the field identifies the most prevalent weed species, thereby helping the farmers to design an effective integrated weed management system for finger millet cultivation in the specified region.

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