



Effect of weed management practices on growth and yield of maize (*Zea mays* L.)

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Abstract

During the *Kharif* season of 2021, a field experiment was undertaken at a farmer's field in Kurmalur village (Perambalur) to assess the effects of various weed control strategies on maize (*Zea mays* L.) growth and productivity. The study was carried out in randomised block design with ten treatments and three replications. Among the treatments tested, hand weeding on 15 and 30 DAS recorded the highest weed control efficiency on 30 and 45 DAS (86.7 and 93.7) with low weed density (21.7 and 12.1) on 30 and 45 DAS. Pre-emergence treatment of atrazine followed by post-emergence application of tembotrine had the greatest weed control effectiveness (85.5 and 93.2) on 30 and 45 DAS with low weed density values among the herbicides studied (23.6 and 13.0). Hand weeding twice on 15 and 30 DAS produced the maximum dry matter production at harvest (8934 kg ha⁻¹), number of grains cob⁻¹ (239) and grain yield (4482 kg ha⁻¹) which was comparable to pre-emergence atrazine followed by post-emergence tembotrine treatment.

Keywords: weed density, WDMP, WCE, yield

Introduction

Maize (*Zea mays* L.) is one of the most adaptable developing crops, able to thrive in a broad range of agroclimatic conditions. Maize is known across the globe as the "Queen of Cereals" because it has the largest genetic production potential of all cereals. (Mritunjay Kumar, 2018) [8]. It is grown on almost 190 million hectares in 165 countries, with a greater range of soil, temperature, biodiversity, and management approaches, contributing 39 percent to world grain output. Maize accounts for 9% of agricultural GDP with a market value of 100 billion at current prices in India. Wider row spacing and crop coincidence with rainy season leads to severe crop-weed competition and weed infestation, which is one of the major factors contributing to maize yield decline. Farmers have a difficult challenge in controlling grasses, broad-leaved weeds (BLWs), and sedges, particularly when too much or too little soil moisture, as well as a shortage of labour during crop development, block intercultural efforts (Swetha.,2015) [11]. Chemical weed management using pre- and post-emergence herbicides may provide efficient and cost-effective weed control tactics throughout important stages of crop weed competition, which human or mechanical weeding may not be able to do owing to higher cultivation expenses. (Triveni *et al.* 2017) [12]. Farmers in rainfed areas depend on pre-emergence (PE) herbicides to control weeds in the absence of human weeding (Rana *et al.* 2017) [9], however it is often unsuccessful owing to farm-level constraints. Post-emergence (PoE) herbicides sprayed 2030 days after sowing (DAS) seem to be a more realistic option for controlling weed pressure throughout the final phases of crop growth in these circumstances. (Kumar and Angadi 2014). The goal of this research was to find out how effective pre- and post-emergence herbicides are, as well as

how they affect weed biology, maize development and yield.

Materials and Methods

The field experiment was conducted at farmer's field in Kurmalur village, Perambalur district (Tamil Nadu) during the *kharif* season of 2021. The experimental field is situated at 11°14' North latitude and 78°47' East longitude, at a height of 143 metres above sea level. The weed management approaches are divided into 10 treatments in a randomised block design with three replications, namely T₁ control, T₂ Hand weeding on 15 and 30 DAS, T₃ Pre emergence application of Atrazine 0.5 kg a.i/ha on 3 DAS *fb* Post emergence application of Tembotrine 105 g/ha on 20 DAS, T₄ Pre emergence application of Atrazine 0.5 kg a.i/ha on 3 DAS *fb* post emergence application of 2,4-D @ 1 kg/ha on 20 DAS, T₅ Pre emergence application of Atrazine 0.5 kg a.i/ha on 3 DAS *fb* Halosulfuron methyl 75% WDG @ 90 g/ha on 20 DAS, T₆ Post emergence application of Tembotrine 105 g/ha (3rd Leaf stage of weeds), T₇ Post emergence application of Tembotrine 105 g/ha + Atrazine 0.5 kg a.i/ha (3rd Leaf stage of weeds), T₈ Post emergence application of Tembotrine 105 g/ha (3rd Leaf stage of weeds) *fb* Hand weeding on 30 DAS, T₉ Halo sulfuron methyl 75% WDG @ 90 g/ha on 20 DAS, T₁₀ Mesotrione + Atrazine 3.5 l/ha on 3rd leaf stage of weeds. Using a knapsack sprayer equipped with a flat fan nozzle and 500 litres of water ha⁻¹, the needed amount of pre and post emergence herbicides were sprayed according to the treatment schedule. Pre-emergence herbicide atrazine was applied on 3 DAS according to the schedule, and post-emergence herbicides 2,4-D, Halosulfuron methyl, Tembotrine, and Mesotrione + Atrazine were applied

according to the treatment plan. Weeding was done by hand on 15 and 30 DAS. At sampling time (30 and 60 DAS), weed dry weight was determined by placing 0.25 m² quadrat randomly at each plot, where the weeds were uprooted, cleaned and dried at 70°C for 48 hours. On the basis of the economic threshold level of pest and disease, need-based plant protection measures were implemented. The maize hybrid NK 6240 was chosen for testing and seeded at a spacing of 60 x 20 cm. Urea, single superphosphate, and muriate of potash were used to apply the appropriate fertiliser dosage. Basally, half of the prescribed N was administered, as well as the full doses of P₂O₅ and K₂O. The rest of the N was used as a top dressing.

Result and Discussion

Total Weed Density

All the weed management practices significantly influenced the total weed count at 15, 30 and 45 DAS (Table.1). The total weed count recorded at 15 DAS showed distinct variation between various weed management practices. Application of Atrazine 0.5 kg a.i ha⁻¹ at 3 DAS namely T₃, T₄, T₅, T₈ recorded lower weed count of 27.4, 29.2, 30.5 and 31.1. Atrazine, a potent photosynthetic electron transport inhibitor at the photosystem II receptor site in sensitive weeds, kills a variety of broad-leaved weeds and grasses, whereas the maize crop's glutathione transferases quickly detoxify the herbicide, making it more selective. (Jhariya Roshani *et al.* 2018) [4]. At 30 DAS, hand weeding on 15 and 30 DAS (T₂) significantly recorded lower weed count of 21.7 m⁻². Hand weeding removed the weeds completely and created more favourable conditions for the crop growth and ultimately resulted in lower density of weeds during the crop growth period. However, it was statistically on par with Pre emergence application of Atrazine 0.5 kg a.i/ha on 3 DAS *fb* Post emergence application of Tembotrine 105 g/ha on 20 DAS (T₃). This might be because herbicidal applications, both alone (higher dosage) and in combination, were successful in lowering overall weed population in a timely manner. Madhavi *et al.* (2014) [7]. and Singh *et al.* (2015) [10] all found similar findings.

Weed Control Efficiency

Weed control efficiency measures how well different weed control treatments reduce weed density as compared to unweeded control treatments. As a result, the treatment with

the greatest weed control efficiency is regarded the best weed control treatment. The efficacy of weed management is strongly connected with crop growth and production. Weed control efficiency was observed at 45 DAS, and among the various weed management strategies, hand weeding twice on 15 and 30 DAS (T₂) had the highest weed control effectiveness with 93.7 percent (Table.1). It was mostly due to total weed removal throughout the key crop phase, which resulted in decreased weed density on 45 DAS and greater weed control efficacy. With 93.2 percent, it was followed by pre-emergence treatment of Atrazine 0.5 kg a.i/ha on 3 DAS *fb* post-emergence application of Tembotrine 105 g/ha on 20 DAS (T₃).

Effect on crop

Hand weeding twice on 15 and 30 DAS (T₂) was shown to have a substantial impact on maize include data on growth and yield attributes and yield characteristics. At 3 DAS, a pre-emergence application of Atrazine 0.5 kg a.i/ha was applied, followed by a post-emergence treatment of Tembotrine 105 g/ha on 20 DAS (T₃). At 15 and 30 DAS, the greatest dry matter output was recorded in manual weeding twice (T₂). It was then followed by a pre-emergence treatment of 0.5 kg a.i/ha of atrazine on 3 DAS and a post-emergence application of Tembotrine 105 g/ha on 20 DAS (T₃). Hand weeding twice on 15 and 30 DAS increased the number of grains cob-1, grain yield, and stover yield. It was then followed by a pre-emergence treatment of 0.5 kg a.i/ha of atrazine on 3 DAS and a post-emergence application of Tembotrine 105 g/ha on 20 DAS (T₃).

At 15 and 30 DAS, the greatest dry matter output was recorded in manual weeding twice followed by a pre-emergence treatment of 0.5 kg a.i/ha of atrazine on 3 DAS and a post-emergence application of Tembotrine 105 g/ha on 20 DAS (T₃). Hand weeding twice on 15 and 30 DAS increased the number of grains cob-1, grain yield, and stover yield followed by a pre-emergence treatment of 0.5 kg a.i/ha of atrazine on 3 DAS and a post-emergence application of Tembotrine 105 g/ha on 20 DAS. These results were in close conformity with the findings of Hatti *et al.*(2014) [3], Ehsas *et al.*(2016) [2], Kumar *et al.* (2017) and Biswas *et al.* (2018) [1].

Table 1: Effect of different weed management practices on growth and yield of maize

Treatments	Weed Density (No. m ²)			Weed Control Efficiency (%)			Dry Matter Production (kg ha ⁻¹)	Number of grains cob-1	Grain Yield (kg ha ⁻¹)	Stover Yield (kg ha ⁻¹)
	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS				
T ₁	118.3 (10.9)	163.7 (12.8)	193.7 (13.9)	0.00	0.00	0.00	3098	142	1386	2972
T ₂	111.6 (10.5)	21.7 (4.7)	12.1 (3.5)	76.7	86.7	93.7	8934	239	4482	5720
T ₃	27.4 (5.2)	23.6 (4.9)	13.0 (3.6)	75.3	85.5	93.2	8916	232	4469	5708
T ₄	29.2 (5.4)	34.7 (5.9)	18.9 (4.4)	5.6	77.8	90.2	8080	194	3960	5164
T ₅	30.5 (5.5)	36.6 (6.1)	32.7 (5.7)	1.7	73.0	83.0	8012	191	3942	5132
T ₆	116.2 (10.8)	44.0 (6.6)	19.4 (4.4)	2.8	77.5	89.9	7522	174	3691	4821
T ₇	113.7 (10.6)	33.3 (5.8)	17.3 (4.2)	73.6	78.7	91.0	8478	209	4178	5431
T ₈	31.1 (5.6)	36.8 (6.1)	17.2 (4.2)	74.1	79.6	91.1	8496	214	4217	5448
T ₉	117.5 (10.8)	44.9 (6.7)	33.1 (5.8)	0.6	72.5	91.1	7496	172	3677	4802
T ₁₀	114.9 (10.7)	36.2 (6.0)	19.1 (4.4)	3.9	77.6	82.9	7977	189	3907	5107
S.Ed	0.17	0.12	0.10				163.07	4.01	81.20	102.90
CD (0.05)	0.48	0.35	0.30				345.26	8.43	171.92	217.87

The data were subjected to square root transformation; Figures in the parentheses are original values. T₁ control, T₂ Hand weeding on 15 and 30 DAS, T₃ Pre emergence application of Atrazine 0.5 kg a.i/ha on 3 DAS *fb* Post emergence application of Tembotrine 105 g/ha on 20 DAS, T₄ Pre emergence application of Atrazine 0.5 kg a.i/ha on 3 DAS *fb* post emergence application of 2,4-D @ 1 kg/ha on 20 DAS, T₅ Pre emergence application of Atrazine 0.5 kg a.i/ha on 3 DAS *fb* Halosulfuron methyl 75% WDG @ 90 g/ha on 20 DAS, T₆ Post emergence application of Tembotrine 105 g/ha (3rd Leaf stage of weeds), T₇ Post emergence application of Tembotrine 105 g/ha + Atrazine 0.5 kg a.i/ha (3rd Leaf stage of weeds), T₈ Post emergence application of Tembotrine 105 g/ha (3rd Leaf stage of weeds) *fb* Hand weeding on 30 DAS, T₉ Halo sulfuron methyl 75% WDG @ 90 g/ha on 20 DAS, T₁₀ Mesotrione + Atrazine 3.5 l/ha on 3rd leaf stage of weeds.

Conclusion

From this experiment, when there is a scarcity of labour during applying period the best option to obtain more yield of maize by controlling of weeds through the application of pre emergence application of Atrazine 0.5 kg a.i/ha on 3 DAS *fb* Post emergence application of Tembotrione 105 g/ha on 20 DAS.

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