



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(3): 122-124
Received: 13-03-2019
Accepted: 15-04-2019

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

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Abstract

A field experiment was conducted at College farm, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad during *kharif* 2017. The experiment was laid out in randomized block design with nine treatments and three replications. The soil of the experimental field was sandy loam in texture, neutral in reaction (pH 7.38) and available nitrogen (264.6 kg/ha), phosphorus (30.9 kg/ha) and potassium (299.8 kg/ha). Green, dry fodder and crude protein yield was significantly higher (68.26 t/ha, 15.51 t/ha and 1364 kg/ha respectively) with hand weeding at 20 and 40 DAS and it was closely followed by topramezone 33.6% SC @ 25.2 g *a.i* ha⁻¹ + atrazine 50% WP @ 500 g *a.i* ha⁻¹ tank mix as PoE at 20 DAS (64.94 t/ha, 14.76 t/ha and 1312 kg/ha respectively) and tembotrione 42% SC @ 105 g *a.i* ha⁻¹ + atrazine 50% WP @ 500 g *a.i* ha⁻¹ tank mix as PoE at 20 DAS (63.38 t/ha, 14.41 t/ha and 1286 kg/ha respectively). Hand weeding at 20 and 40 DAS recorded highest uptake of N, P, K by crop (218.38 kg/ha, 42.73 kg/ha and 178.86 kg/ha respectively), which was on par with topramezone 33.6% SC @ 25.2 g *a.i* ha⁻¹ + atrazine 50% WP @ 500 g *a.i* ha⁻¹ tank mix as PoE at 20 DAS (210.03 kg/ha, 40.07 kg/ha and 168.71 kg/ha respectively) and tembotrione 42% SC @ 105 g *a.i* ha⁻¹ + atrazine 50% WP @ 500 g *a.i* ha⁻¹ tank mix as PoE at 20 DAS (205.87 kg/ha, 38.43 kg/ha and 161.44 kg/ha).

Keywords: Randomized block design, green fodder yield, dry fodder yield, crude protein yield, nitrogen (N), phosphorus (P), potassium (K), nutrient uptake, topramezone, tembotrione, atrazine, hand weeding.

Introduction

The agricultural production systems in India are based upon mixed farming in which two major enterprises are crops and livestock. Livestock production is the backbone of Indian agriculture contributing 7% to national GDP and a source of employment for 70% of rural people. The production of good quality fodder is of great importance for the development of livestock industry in the country. India ranks first in milk production. Fodder plays an important role in economizing the cost of production of livestock products especially of milk. Maize (*Zea mays* L.) is one of the most important dual-purpose cereal crops all over the world. The green fodder maize (African tall) contains dry matter (22.2%), crude protein (7.1%), crude fiber (30.2%), in-vitro dry matter digestibility (65.0%), neutral detergent fibre (67.6%), acid detergent fibre (38.3%) and total ash (6.0) (Chaudhary *et al.* 2012) [3]. Maize crop when it is growing for fodder purpose, most of the farmers not applying any kind of weed management practice leading to less green and dry fodder yield per unit area. The quantities of growth factors used by weeds are thus unavailable to the crop, the extent of nutrient loss varies from 30-40% of the applied nutrients (Mundra *et al.*, 2002) [6]. Management of weeds by hand weeding and mechanical weeding though effective, some time, it may be restricted due to moist soil and time consuming. Chemical weed control has been proved effective in reducing weed competition in the early stages and increasing crop yields.

2. Materials and Methods

A field experiment was conducted during *kharif* 2017 at College farm, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad. The experiment was laid out in randomized block design with nine treatments and replicated thrice. Before sowing, field was thoroughly ploughed, leveled and fertilized with recommended doses of NPK at the rate of 15-60-40 kg/ha. The basal dose of fertilizers, consisting of full dose of P₂O₅ through SSP, full dose of K₂O through MOP and 1/3rd of N through urea was applied manually. The remaining dose of N was applied in two splits at 35 DAS and 55 DAS. Sowing of fodder maize (African tall) was done on 13th July 2017. All the recommended package of practices were adopted to raise the crop except weed control. All the herbicides were applied with a knapsack sprayer fitted with a flat fan nozzle attached with the wood. Pre-emergence and post-emergence herbicides dissolved in 500 lit water/ha were applied at one day after sowing and at 20 DAS respectively.

Table 1: Effect of different weed management practices on green, dry fodder yield (t ha⁻¹) and crude protein yield (kg/ha) at harvest of fodder maize

T. No.	Treatments	Green fodder yield (t ha ⁻¹)	Dry fodder yield (t /ha)	Crude protein yield (kg/ha)
T ₁	Atrazine 50% WP @ 1.0 kg a.i ha ⁻¹ as PE at 1-2 DAS fb intercultivation at 30 DAS	55.33	12.58	1156
T ₂	Topramezone 33.6% SC @ 25.2 g a.i ha ⁻¹ + atrazine 50 % WP @ 500 g a.i ha ⁻¹ tank mix as PoE at 15-20 DAS	64.94	14.76	1312
T ₃	Tembotrione 42% SC @ 105 g a.i ha ⁻¹ + atrazine 50% WP @ 500 g a.i ha ⁻¹ tank mix as PoE at 15-20 DAS	63.38	14.41	1286
T ₄	Atrazine 50% WP @ 1 kg a.i ha ⁻¹ as PE at 1-2 DAS fb 2,4-D Na salt 80 % WP @ 1.0 kg a.i ha ⁻¹ as PoE at 15-20 DAS	51.39	11.68	1079
T ₅	Intercropping of fodder maize with fodder cowpea (1:1) and application of pendimethalin 30% EC @ 1.0 kg a.i ha ⁻¹ as PE at 1 DAS	47.80	10.86	943
T ₆	Broadcasting of pillipesara in fodder maize and application of pendimethalin 30% EC @ 1.0 kg a.i ha ⁻¹ as PE at 1 DAS	50.45	11.47	972
T ₇	Intercultivation at 20 and 40 DAS	45.21	10.28	990
T ₈	Hand weeding at 20 and 40 DAS	68.26	15.51	1364
T ₉	Unweeded control	28.71	6.52	518
	SEm±	2.90	0.66	59
	CD (p=0.05)	8.70	1.99	178

3. Result and Discussion

Green fodder yield

All weed management practices significantly influenced the green fodder yield of fodder maize. Among the treatments tried, hand weeding at 20 and 40 DAS recorded highest green fodder yield (68.26 t/ha), which might be due to better weed control and efficient utilization of nutrients resulted in better crop growth. This remain on par with topramezone 33.6% SC @ 25.2 g a.i ha⁻¹ + atrazine 50% WP @ 500 g a.i ha⁻¹ tank mix as PoE at 20 DAS (64.94 t /ha) and tembotrione 42% SC @ 105 g a.i ha⁻¹ + atrazine 50% WP @ 500 g a.i ha⁻¹ tank mix as PoE at 20 DAS (63.38 t /ha). These results are in conformity with the findings of Ayenhhbad and Behrooz (2011).

Dry fodder yield

All weed management practices significantly alter the dry fodder yield of crop at harvest during experimentation. Hand weeding at 20 and 40 DAS recorded highest dry fodder yield (15.51 t/ha), which remain on par with topramezone 33.6% SC @ 25.2 g a.i ha⁻¹ + atrazine 50% WP @ 500 g a.i ha⁻¹ tank mix as PoE at 20 DAS (14.76 t /ha) and tembotrione 42% SC @ 105 g a.i ha⁻¹ + atrazine 50% WP @ 500 g a.i ha⁻¹ tank mix as PoE at 20 DAS (14.41 t /ha). The higher plant dry matter yield in hand weeding might be due to increased availability of nutrients to the crop by reducing weed growth efficiently. Similar results were reported earlier by Malviya and Singh (2007) [4], Swetha (2015) [9] and Baldaniya *et al.* (2018) [2].

Crude protein yield

At Harvest, significantly highest crude protein yield was

recorded with hand weeding at 20 and 40 DAS (1364 kg ha⁻¹), which was on par with topramezone 33.6% SC @ 25.2 g a.i ha⁻¹ + atrazine 50% WP @ 500 g a.i ha⁻¹ tank mix as PoE at 20 DAS (1312 kg ha⁻¹) and tembotrione 42% SC @ 105 g a.i ha⁻¹ + atrazine 50% WP @ 500 g a.i ha⁻¹ tank mix as PoE at 20 DAS (1286 kg ha⁻¹). Significantly lowest crude protein yield was recorded with unweeded control (518.94 kg ha⁻¹) over other treatments. This was mainly because of lowest nitrogen uptake in unweeded control and highest nitrogen uptake in hand weeding at 20 and 40 DAS.

Nutrient uptake

At harvest, significantly higher N, P, K uptake (218.38 kg ha⁻¹, 42.73 kg ha⁻¹ and 178.86 kg ha⁻¹ respectively) by crop was estimated with two hand weedings at 20 and 40 DAS, which was on par with topramezone 33.6% SC @ 25.2 g a.i ha⁻¹ + atrazine 50% WP @ 500 g a.i ha⁻¹ tank mix as PoE at 20 DAS (210.03 kg ha⁻¹, 40.07 kg ha⁻¹ and 168.71 kg ha⁻¹ respectively) and tembotrione 42% SC @ 105 g a.i ha⁻¹ + atrazine 50% WP @ 500 g a.i ha⁻¹ tank mix as PoE at 20 DAS (205.87 kg ha⁻¹, 38.43 kg ha⁻¹ and 161.44 kg ha⁻¹ respectively). Significantly lowest uptake of N, P, K (83.03 kg ha⁻¹, 15.80 kg ha⁻¹ and 68.16 kg ha⁻¹) by crop at harvest was noticed in unweeded control. The lowest nutrient uptake in unweeded control was due to poor dry matter yield of crop and reduced nutrient uptake as a result of heavy weed competition. Higher nutrient uptake in hand weeding at 20 and 40 DAS was mainly because of higher dry matter production and less crop weed competition. These results are in accordance with the results indicated by Sinha *et al.* (2005) [8], Malaviya *et al.* (2012), Samanth *et al.* (2015) [7], Swetha (2015) [9], Umesh *et al.* (2015) [10].

Table 2: Effect of different weed management practices on nitrogen, phosphorus and potassium uptake (kg ha⁻¹) by crop at harvest of fodder maize.

T. No.	Treatments	N	P	K
T ₁	Atrazine 50% WP @ 1.0 kg a.i ha ⁻¹ as PE at 1-2 DAS fb Intercultivation at 30 DAS	185.07	33.40	151.87
T ₂	Topramezone 33.6% SC @ 25.2 g a.i ha ⁻¹ + atrazine 50% WP @ 500 g a.i ha ⁻¹ tank mix as PoE at 15-20 DAS	210.03	40.07	168.71
T ₃	Tembotrione 42% SC @ 105 g a.i ha ⁻¹ + atrazine 50% WP @ 500 g a.i ha ⁻¹ tank mix as PoE at 15-20 DAS	205.87	38.43	161.44
T ₄	Atrazine 50% WP @ 1 kg a.i ha ⁻¹ as PE at 1-2 DAS fb 2,4-D Na salt 80 % WP @ 1.0 kg a.i ha ⁻¹ as PoE at 15-20 DAS	172.77	32.28	141.88
T ₅	Intercropping of fodder maize with fodder cowpea (1:1) and application of pendimethalin 30% EC @ 1.0 kg a.i ha ⁻¹ as PE at 1 DAS	151.00	28.95	133.17
T ₆	Broadcasting of pillipesara in fodder maize and application of pendimethalin 30% EC @ 1.0 kg a.i ha ⁻¹ as PE at 1 DAS	155.57	30.40	139.24
T ₇	Intercultivation at 20 and 40 DAS	158.51	30.73	139.85
T ₈	Hand weeding at 20 and 40 DAS	218.38	42.73	178.86
T ₉	Unweeded control	83.03	15.80	68.16
	SEm±	9.54	2.04	7.54
	CD (p=0.05)	28.59	6.12	22.61

4. Conclusion

From the experimental results, it can be concluded that hand weeding at 20 and 40 DAS was better with regard to fodder, protein yield and nutrient uptake. Though hand weeding recorded better results, but its practical feasibility for weed management is less in places where the availability of labour is major problem. In such cases topramezone 33.6% SC @ 25.2 g a.i ha⁻¹ + atrazine 50% WP @ 500 g a.i ha⁻¹ tank mix as PoE at 20 DAS and tembotrione 42% SC @ 105 g a.i ha⁻¹ + atrazine 50% WP @ 500 g a.i ha⁻¹ tank mix as PoE at 20 DAS were better over other treatments.

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