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Studies on Weed Management in Irrigated Maize

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Research Article

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Abstract

Field experiments were conducted during summer, 2014 and 2015at the Annamalai University Experimental Farm, Department of Agronomy, Faculty of Agriculture. Annamalai Nagarto study the response of irrigated maize *(Zea mays* L) to various weed management practices, laid out in randomized block design with three replications. The experiment comprises of eleven treatments. Among the different weed control treatments, pre-emergence application of atrazine 1.0 kg ha^{-1} on 3 DAS + post emergence application of 2,4-D @ 0.75 kg ha^{-1} on 21 DAS excelled other treatments by recording higher values of growth and yield components such as plant height, LAI, DMP, cob length, number of grains cob^{-1}, cob diameter etc., and the least weed population, weed biomass and nutrient depletion by weeds with the highest weed control index (91.38%) favouring higher yield attributes and grain yield (6342 kg ha-1). This was followed by pre-emergence application of metribuzin 1.0 kg ha^{-1} on 3 DAS + post emergence application of 2,4-D @ 0.75 kg ha^{-1} on 21 DAS. Unweeded control recorded the highest weeds counts and weed biomass resulting in very poor grain yield (2180 kg ha^{-1}).

Keywords: Atrazine; Metribuzin; Weed management; Maize

Introduction

Maize (*Zea mays* L.) is one of the most popular and third important cereal crops next to rice and wheat in the world. Maize is grown throughout the world over a wide range of climatic conditions [1]. In World, maize is grown over an area of 168 million ha with a production of 945.8 million tones. In India, maize occupies an area of 8.38 million ha with a production of 19.78 million tonnes and the productivity is 2361 ha^{-1}.In Tamil Nadu, maize is cultivated in an area of 0.22 million hectares with production of 0.81 million tonnes and the productivity of 4.5 t ha^{-1}, and also it occupies fourth position in Indian maize production. Many factors are responsible for the low yield of maize in India. Among them, the most critical for the low yield appears to be the weed growth competing with the crop for nutrients, water, sunlight and space. The weeds not only compete with the crop for various crop input but also interfere with growth, yield component and lead to nutrient losses from soil besides causing all elopathic effect to crop. So it is vital that, maize should be kept free of weeds for initial 20 to 40 days of crop emergence for higher yields.

Therefore, the present study was undertaken to study the effect of pre-emergence herbicide at different dosage on weeds of maize, to find out the effect of different rates of herbicide application on the growth and development of weeds and to work out economics of various weed control treatment.

Materials and Methods

Field experiments were conducted at the Experimental farm, Department of Agronomy, Annamalai University, Annamalainagar. The soil of the experimental field is clay loam in texture with low in available nitrogen, medium in available phosphorus, high in available potassium and low in available sulphur. The experiment comprising of eleven treatments viz., unweeded control (T_1), hand weeding on20 and 40 DAS (T_2), pre-emergence application of atrazine 1.0 kg ha^{-1} on 3 DAS (T_3), pre-emergence application of atrazine 1.0 kg ha^{-1} on 3 DAS + hand weeding on 30 DAS (T_4), pre-emergence application of atrazine 1.0 kg ha^{-1} on 3 DAS + post emergence application of 2,4-D @ 0.75 kg ha^{-1} on 21 DAS (T_5), pre-emergence application of metribuzin 1.0 kg ha^{-1} on 3 DAS (T_6), pre-emergence application of metribuzin 1.0 kg ha^{-1} on 3 DAS + hand weeding on 30 DAS (T_7), pre- emergence application of metribuzin 1.0 kg ha^{-1} on 3 DAS + post emergence application of 2,4-D @ 0.75 kg ha^{-1} on 21 DAS (T_8), pre-emergence application of alachlor 1.5 kg ha^{-1} on 3 DAS (T9), pre-emergence application of alachlor 1.5 kg ha^{-1} on 3 DAS + hand weeding on 30 DAS (T10), pre-emergence application of alachlor 1.5 kg ha^{-1} on 3 DAS + post emergence application of 2,4-D @ 0.75 kg ha^{-1} on 21 DAS (T_{11}).The trial was laid out in a randomized block design with three replication plot size was 5 x 4 m for crop seed rate is 7.5 kg ha^{-1} (Hybrid Maize NK 6240). N, P, K were applied in the form of urea, single super phosphate and muriate of potash at 250:75:75 NPK ha^{-1} respectively was followed as RDF. The pre-emergence herbicide viz., atrazine, metribuzine and alachlor were sprayed on 3 DAS and the post emergence herbicide 2,4-D was sprayed on 21 DAS with 500 liters of water ha^{-1} through knapsack sprayer fitted with flood jet nozzle separately in specified plots as per the treatments schedule. All the agronomic practices were carried out uniformly to raise the crop.

Results and Discussion

The weed flora of the experimental field comprised of *Echinochloa crusgalli, Trianthema portulacastrum, Cyperus rotundus, Cleome viscosa, Phyllanthus niruri and cynodon dactylon.* Among the weed species *Echinochloa crusgalli*, *cynodon dactylon,Trianthema portulacastrum, and Cyperus rotundus,* were the predominant weeds. The result of the present study revealed that the presence of grass weed, *Cyperus rotundus* was the predominant weed flora which formed more than 50 per cent of total population.

Treatments	Total weed count		Weed biomass (60 DAS)	WCI	LAI at 60 DAS	DMP at 60 DAS	Green Cob yield kg ha^{-1}	Stover yield kg ha^{-1}
	30 DAS	60 DDASA						
T_1 - Unweeded control	93.23 (9.7)	180.83 (13.46)	71.9	-	2.6	1568.2	2180	7372
T_2 - Hand weeding twice on 20 and 40 DAS	23.23 (4.87)	57.13 (7.5)	22.36	81.49	7.3	5985.2	5782	8749
T_3- Atrazine @ l .0 kg ha^{-1} on 3 DAS	57.34 (7.6)	110.82 (10.5)	45.35	62.46	4.8	4785.6	4626	8116
T_4- Atrazine @ 1.0 kg ha^{-1} on 3 DAS + Hand weeding on 30 DAS	31.44 (5.6)	69.45 (8.3)	27.35	77.36	6.7	5685.6	5585	8592
T_5- Atrazine @ 1 kg ha^{-1} on 3 DAS + 2,4 - D @ 0.75 kg ha^{-1} on 21 DAS	12.3 (3.5)	26.9 (5.2)	10.41	91.38	8.1	6885.8	6342	9216
T_6 - Metribuzin @ 1.0 kg ha^{-1} on 3 DAS	66.31 (8.1)	127.37 (11.3)	54.1	55.22	4.1	4485.8	4401	7956
T_7- Metribuzin @ 1.0 kg ha^{-1} on 3 DAS + Hand weeding on 30 DAS	39.34 (6.3)	80.95 (9.0)	32.85	72.81	6.1	5385.9	5265	8434
T_8- Metribuzin @ 1.0 kg ha^{-1} on 3 DAS + 2,4-D @ 0.75 kg ha^{-1} on 21 DAS	14.2 (3.8)	31.05 (5.6)	13.51	88.81	7.5	6585.4	6182	9060
T_9- Alachlor @ 1.5 kg ha^{-1} on 3 DAS	75.67 (8.7)	150.91 (12.3)	64.95	46.24	3.4	4185.1	4230	7775
T_{10}- Alachlor @ 1.5 kg ha^{-1} on 3 DAS + Hand weeding on 30 DAS	48.46 (6.9)	96.37 (9.8)	38.75	67.92	5.4	5085.3	4835	8275
T_{11}- Alachlor @ 1.5 kg ha^{-1} on 3 DAS + 2,4-D @ 0.75 kg ha^{-1} on 21 DAS	18.68 (4.3)	44.15 (6.6)	17.46	85.54	7	6280.8	6026	8905
SEd	0.69	0.93	1.35	-	0.1	294	69	74
CD(p=0.05)	1.57	2.12	2.91	-	0.3	670.5	153	155

Table 1: Studies on weed management in irrigated maize.

Chemical methods of weed control significantly reduced the weed density over unweeded control. Distinct reduction of total weed density by pre-emergence application of atrazine @ 1.0 kg ha^{-1} on 3DAS + post-emergence application of 2,4 -D @ 0.75 kg ha ^{1} on 21 DAS(T_5), gave better results over other weed control treatments and recorded the least individual weed count at 30 DAS, least weed biomass and highest weed control index (Table 1) might be due to the control of weeds at the germination phase by the pre-emergence application of herbicides and significant reduction at later growth stages as late germinating weeds were controlled by 2,4-D causes cambial activity and reduce thickness of cell wall, it prevents opening of stomata in presence of light. The inhibition of carbohydrate synthesis weakens the plant and the root system is also weakens, resulting in subsequent death of weeds, readily absorbed and translocated within the phloem through the tissues and causes disruption of its phloem tissues and consequent dislocation of photosynthesis symptoms and kills even perennial weeds efficiently.

Higher values on yield components were observed in pre-emergence application of atrazine @ 1.0 kg ha^{-1} on 3 DAS+ post-emergence application of 2,4 -D @ 0.75 kg ha^{-1} on 21 DAS. Taller plants with broader leaf area might have accumulated higher plant dry matter consistently at all the growth stages of maize with pre-emergence application of atrazine @ 1.0 kg ha^{-1} on 3 DAS + post-emergence application of 2,4-D @ 0.75 kg ha^{-1} on 21 DAS. Better weed control with favourable soil environment might have resulted in reduced crop weed competition for the growth factors such as light, space and nutrients which in turn helped in efficient photosynthetic activity recording taller plants. From the (Table 1) it is evident that high competition of weeds reduced the input availability to plants, thus reduced the plant height to a greater extent. The plots having higher weed control efficiency get more resources and produced taller plants was earlier reported by Kannur (2008) [2]. Unweeded control showed significant reduction of plant height at all the growth stages of the crop. These results are in line with the findings of Singh and Singh (2003) [3] who reported that decrease in plant height might be due to the fact that weeds suppressed the vegetative growth of plants by competition to light, moisture and nutrients.

Conclusion

From the experimental results, it can be concluded that pre-emergence application of atrazine @ 1.0 kg ha^{-1} on 3DAS + post-emergence application of 2,4 -D @ 0.75 kg ha^{-1} on 21 DAS is an agronomically sound and economically viable weed management practices to the maize growing farmers to enhance the productivity of maize.

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