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ISSN : 2350-0743

International Journal of Recent Advances in Multidisciplinary Research

Vol. 03, Issue 08, pp.0695-0696, August, 2016

RESEARCH ARTICLE

EFFECT OF WEED MANAGEMENT ON YIELD ATTRIBUTES AND NUTRIENT UPTAKE IN IRRIGATED MAIZE

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ARTICLE INFO

Article History:

Received 20th May, 2016
Received in revised form
17th June, 2016
Accepted 29th July, 2016
Published online 30th August, 2016

Keywords:

Atrazine, Metribuzin,
Weed management, Maize.

ABSTRACT

Field experiments were conducted during summer, 2014 and 2015 to study the response of irrigated maize *(Zea mays* L) to various weed management practices, laid out in randomized block design with three replications that 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 weed counts and weed biomass resulting in very poor grain yield (2180 kg ha^{-1}).

INTRODUCTION

Maize (*Zea mays* L.) is the third important cereal crop next to rice and wheat in the World. Maize has becoming very popular cereal crop in India because of the increasing market price and high production potential of hybrid varieties in both irrigated as well as rainfed conditions, and also because of its high production potential compared to any other cereal crop and adaptability to wide range of environments. Since the crop has very high genetic yield potential, it is called as the "Queen of cereals". Corn is the most versatile crop with wider adaptability to varied agro ecological regions and diverse growing seasons. Besides serving as human food and animal feed, the importance of this crop also lies in its wide industrial applications. For example, corn oil is used in margarine, corn syrup sweeteners in marmalade, and corn syrup solids in instant non-dairy coffee creamer. Responding to its multiple uses, the demand for corn is constantly increasing in the global market. Excluding environmental variables, yield losses in corn are caused mainly by competition with weeds. Weed interference is a severe problem in corn, especially in the early part of the growing season, due to slow early growth rate and wide row spacing. Weeds compete with the corn plants for resources such as light, nutrients, space, and moisture that influence the morphology and phenology of crop, reduce the yield, make harvesting difficult, and mar the quality of grains. Furthermore, high weed infestation increases the cost of cultivation, lowers value of land, and reduces the returns of corn producers.

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In order to realize the yield potential of corn, weed management becomes indispensable. Weed species infesting the corn crop are functions of a complex interaction among soil characteristics, climate, and cultural practices. These factors vary across regions and influence the composition and number of predominant weeds of economic importance to corn production. The critical period may be defined as the time period after crop emergence during which crop must be kept weed-free to prevent yield losses, described as losses greater than 5%. Weeds that emerge at the time of crop germination or within a few days of crop emergence cause greater yield loss than weeds emerging later in the growing season the critical period is useful in defining the crop growth stages most vulnerable to weed competition. Therefore, the present study was undertaken to study the effect of pre-emergence herbicide at different dosage on weeds of irrigated 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

A field experiment 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

Effect of weed management on yield attributes and nutrient uptake in irrigated maize

Treatments	No of Grains cob $^{-1}$	Cob length (cm)	Cob Diameter (cm)	Green Cob yield (kg /ha)	Nutrient uptake (kg/ha)			Economics (BCR)
					N	P	K	
T_1-Unweeded control	138.5	15.7	3.1	2180	125.3	26.4	105.4	1.12
T_2-Hand weeding twice on 20 and 40 DAS	341	21.8	6.2	5782	140.5	43.3	125.8	2.66
T_3-Atrazine @ 1.0 kg ha-1 on 3 DAS	283.7	19.2	4.5	4626	133.1	36.8	114.9	2.29
T_4-Atrazine @ 1.0 kg ha-1 on 3 DAS + Hand weeding on 30 DAS	326.9	21.2	5.8	5585	138.8	41.8	123.1	2.65
T_5-Atrazine @ 1 kg ha-1 on 3 DAS + 2,4-D @ 0.75 kg ha-1 on 21 DAS	382.6	23.2	7.1	6342	145.7	47.7	133.5	3.18
T_6-Metribuzin @ 1.0 kg ha-1 on 3 DAS	269	18.4	4	4401	131.2	35.1	112.1	2.10
T_7-Metribuzin @ 1.0 kg ha-1on 3 DAS + Hand weeding on 30 DAS	312.6	20.6	5.4	5265	136.9	40.2	120.4	2.38
T_8-Metribuzin @ 1.0 kg ha-1 on 3 DAS + 2,4-D @ 0.75 kg ha-1 on 21 DAS	368.8	22.8	6.8	6182	144.1	46.3	131	2.91
T_9-Alachlor @ 1.5 kg ha-1 on 3 DAS	254.4	17.5	3.5	4230	129.2	33.3	109.2	2.03
T_{10}-Alachlor @ 1.5 kg ha-1on 3 DAS + Hand weeding on 30 DAS	298.2	19.9	4.9	4835	135	38.5	117.7	2.30
T_{11}-Alachlor @ 1.5 kg ha-1 on 3 DAS + 2,4-D @ 0.75 kg ha-1 on 21 DAS	354.9	22.3	6.5	6026	142.3	44.8	128.4	2.87
SEd	6.21	0.19	0.12	69	0.7	0.6	1.1	
CD	13.55	0.44	0.28	153	1.6	1.4	2.5	

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, and 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., atazine, metribuzine and alachlor were sprayed on 3 DAS and the post emergence herbicide 2, 4-D was sprayed on 21 DAS with 500 litres 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

Heavier and longer maize cobs with more number of grains and higher test weight were obtained with pre-emergence application of atrazine @ 1.0 kg ha^{-1} on 3 DAS + post-emergence application 2,4-D @ 0.75 kg ha^{-1} on 21 DAS. It might be due to better control of weeds from its germination phase. It also provided favourable environment for recording higher yield attributes of maize against unweeded control which, obviously experienced severe weed competition from germination phase to all the crop growth stages. Similar reduction of cob length and girth, number of grains cob^{-1}, 100 grain weight, and grain weight cob^{-1} were reported by Yoganathan (2014). In irrigated maize, among the weed control treatments, pre-emergence application of atrazine 1.0 kg ha^{-1} on 3 DAS + post-emergence application of 2,4-D at 0.75 kg ha^{-1} on 21 DAS recorded higher grain yield of 6342 kg ha^{-1} whereas unweeded control recorded the lowest yield. Similar results were reported by Surjit Singh *et al*., (2010). Quantity of nutrient uptake by crops is the reflection of crop biomass and nutrient content at each growth stage. The uptake of major nutrients by the maize crop being a function of crop DMP and nutrient concentration of the plants. Lower dry weight and uptake of nutrients by weeds, in the weed controltreatments eventually permitted the crop for more uptakes of nutrients owing to more availability. Pre-emergence application of atrazine 1.0 kg ha^{-1} on 3 DAS + post-emergence application of 2,4-D at 0.75 kg ha^{-1}for maize crop resulted in higher plant dry matter and consequently higher N, P and K nutrients uptake by plants. Obviously unweeded control resulted in lowest plant dry matter with least nutrient uptake by maize which might be due to maximum utilization of resources by weeds rather than crops, as a result of high degree of weed competition. Similar results were also reported by Malipatil and Patil (1990). The weed growth resulted in reduced vegetative growth and nutrient availability to the plants. This shows the importance of weed management for increasing dry matter production of maize plants, thereby increasing the crop yield of irrigated maize.

Economics: Economic efficiency and viability of crop cultivation are mainly the outcome of yield of crops with larger management costs. Higher crop productivity with lesser cost of cultivation could result in better economic parameters like higher net returns and B: C ratio. Under irrigated situation, Atrazine @ 1 kg ha^{-1} on 3 DAS + 2,4 - D @ 0.75 kg ha^{-1} on 21 DAS gave maximum net return and B:C ratio (Rs. 61208 and 3.18), which was most profitable weed control practices. The result is in line with the findings of Hawaldar and Agasimani (2012). The time and cost spent on weeding operation is high in hand weeding twice. Higher cost of cultivation for hand weeding might be due to high labour requirement for weeding.

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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