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

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Abstract
The field experiment was conducted during *Kharif* 2019 at Experiment farm of Agronomy Department, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. To study 'Effect of Weed Management Practices on Growth and Yield of Maize (*Zea mays* L.)'**.** The experiment was laid out in a randomized block design with twelve treatments and three replications**.** In the field experiment chemical weed management practices Pre and Post emergence herbicides treatments *viz*.; treatment (T1) PE Atrazine @ 0.50 kg a.i./ha + 1HW+ 1Hoeing at (6WAS), (T2) PE Atrazine @ 0.75 kg a.i/ha + 1HW + 1Hoeing at (6WAS), (T3) PE Atrazine @ 0.50.kg a.i /ha, (T4) PE Atrazine @ 0.75 kg a.i /ha, (T5) POE 2,4-D (sodium salt) @ 1.0 kg/ha at 20 DAS + 1HW+1 Hoeing at (6WAS), (T6) POE 2,4-D (Sodium salt) @1.0 kg/ha at 20 DAS, (T7) POE Tembotrione @ 110 g/ha at 20 DAS, (T8) POE Tembotrione @ 120 g/ha at 20DAS, (T9) POE Tembotrione @ 130 g/ha at 20 DAS, (T10) 1 Hand weeding+1 Hoeing, (T11) Weed free and (T12) Weed check. Results indicated that the Weed free and PE Atrazine @ 0.75 Kg a.i/ha+1 Hand Weeding + 1Hoeing at (6WAS) was found significantly superior over the rest of treatments in respect of growth, yield and yield attributes.

Keywords: Weed management practices, maize, growth, yield, harvest index

Introduction
Maize (*Zea mays* L.) is one of the oldest food grains and the only cultivated species in its genus. Maize is an annual grass which has been domesticated as a crop over several thousand years, originating in Central America (Mexico). It is known by various common names but the most popular name is maize or corn earlier maize was regarded as "Queen of Cereals", but now in some literature, it is regarded as "King of Cereals" because of its high production potential and wider adaptability (Paliwal, 2000) [3].

Maize is known for its wider adaptability and multipurpose uses as food, feed, fodder and industrial products. More than 35 products of daily use are derived from maize i.e. starch, lactic acid, glucose, acetic acid, dextrose, sorbitol, dextrine, high fructose syrup, maltodextrine, germ oil, germ application in industries such as alcohol, textile, paper, pharmaceuticals, organic chemicals, cosmetics and edible oils.

Maize is the crop of future as mentioned by father of green revolution renowned Nobel Laureate Dr. Norman E. Borlaug. It plays a vital role in ensuring food security as well as nutritional security through the quality protein (Rawool,2004). Green maize plants are used as succulent fodder, rosted green cobs are liked by people. It is also good feed for piggery, poultry and other animals. It contains about 12 per cent protein, 8 per cent oil, 70 per cent CHO, 2.3 per cent crude fibre, 10.4 per cent albumins and 1.4 per cent ash (Om prakash *et al.*, 2006) [2].

The total area under maize production in India 9.13 million ha and 27.80 million tonnes production with 2390 kg ha-1 is the productivity. (Ref.: Ministry of agriculture and farmers welfare 2018-19).

The mansoon season maize suffers from severe weed competition and depending upon the intensity, nature, stage and duration of weed infestation; yield losses vary from 28- 100% (Patel *et al*., 2006) [6]. The weeds are associated with crops since time and create acute problem in rainy season crops. The yield of maize under Indian condition may be attributed by number of factors among harmful effect on the growing plants and interference with land use, weed rank as prime enemies in crop production. A wide spaced crop suffers from heavy weed infestation due to slow initial growth particularly during *Kharif* season.

Weeds utilise a lot of growth factors, which aren't available to the crop. Some of the grassy weeds found in maize field are *Cyperus rotundus* L., *Cynodon dactylon, Commelina benghalensis, Cyanotis oxillaris, Denebra Arabica, Tridax procumbens* L., *Lagasca mollis, Euphorbia hirta* L., *Euphorbia geniculata, Parthenium hysterophorus* L., *Digera arvensis* L., *Phyllanthus niruri* L., *Celosia argentina and Acalyfa indica* are among the deadly weeds of the world infest the maize field and thus, increase the cost of production, as hand weeding is not effective against these weeds. Sequential use of Pre and post emergence herbicides at temporal variation may help in avoiding the problem of weeds throughout the growth stages. Timely weed management practices play an important role in the successful cultivation of crops.

Materials and Methods

A field trial was conducted at the farm of the Department of Agronomy, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (MS) during *Kharif* seasons of 2019. The soil of experimental field was black, clay in texture, well drained, low in available nitrogen (315.40 kg ha-1), medium in available phosphorus (11.70 kg ha-1), high in potash (429.60 kg ha-1), organic carbon (0.65%) and slightly alkaline in reaction (pH 8.06).

The topography of the experiment field was fairly uniform and leveled. The total rainfall during the study period was 904.4 mm.

The experiment was laid out in randomized block design with three replications in a fixed lay out and treatments were consisting twelve (T1) PE Atrazine @ 0.50 kg a.i /ha +1Hand weeding +1Hoeing at (6WAS), (T2) PE Atrazine @ 0.75 kg a.i /ha + 1Hand weeding +1Hoeing at (6WAS), (T3)PE Atrazine @ 0.50 kg a.i /ha, (T4)PE Atrazine @ 0.75 kg a.i /ha, **(**T5) POE 2,4-D (sodium salt) @ 1.0 kg/ha at 20 DAS+1Hand Weeding +1Hoeing at (6WAS), **(**T6) POE 2,4-D (sodium. salt) @ 1.0 kg/ha at 20 DAS, (T7) POE Tembotrione @ 110 g/ha at 20DAS, (T8) POE Tembotrione @ 120 g/ha at 20 DAS, (T9) POE Tembotrione @ 130 g/ha at 20DAS, (T10)1Hand + 1Hoeing, (T11) weed free, (T12) weed check. PE: Pre - emergence POE: Post- emergence.

Maize hybrid Komal) was sown on 7th july 2019 in various treatments with recommended seed rate 25 kg ha-1 and spacing of 60 x 30 cm. Seeds were inoculated with thirum @ 3 g kg-1 and *Azotobacter* culture @ 25 kg ha-1. The N, P and K were given in the form of urea, single super phosphate and muriate of potash at the time of sowing. The observations on growth, yield and yield attributes were taken on five randomly selected plants from each treatment. After harvest and threshing of crop, seed yield was recorded from net plot wise and converted to grain yield per hectare.

Results and Discussion

The results as well as discussion of the various treatments have been presented under following heads:

Effect of weed on growth

Growth characters like mean plant height(cm), number of functional leaves, leaf area (dm2) and dry matter accumulation (g) per plant of maize showed a significantly for different treatments are tabulated in Table 1. Treatment (T2) PE Atrazine @ 0.75 kg a.i./ha + 1HW+ 1Hoeing at (6 WAS) produced more plant height than other treatment. This is might be due to the fact that weeds suppressed the vegetative growth of plants by the competition between crop and weeds for soil moisture, plant nutrients, solar radiation and space during active growth period. These results are in conformation with the results of Triveni *et al.* (2017) [5]. The mean number of functional leaves per plant directly indicates the behavioral adaption. Treatment (T11) weed free and (T2) PE Atrazine @ 0.75 kg a.i./ha + 1HW+ 1Hoeing at (6 WAS) proved superior over all the treatments in producing more functional leaves plant-1. This might be due to good availability of moisture. It was observed that treatment (T2) PE Atrazine @ 0.75 Kg a.i./ha+1HW+1Hoeing at (6WAS) had maximum leaf area plant-1 (dm2) than over the rest of treatment. Treatment (T2) PE Atrazine @ 0.75 Kg a.i./ha + 1HW+1Hoeing at (6 WAS) recorded more dry matter accumulation than other treatment in maize.

Table 1: Effect of weed management practices on growth parameters of maize

Treatments	Plant height (cm)	No. of functional leaves plant-1	Leaf area (dm2) plant-1	Dry matter (g) plant-1
T1-PE Atrazine @ 0.50 kg a.i /ha + 1HW+1Hoeing at (6 WAS)	211.40	15.80	82.65	223.42
T2-PE Atrazine @ 0.75 kg a.i /ha + 1HW+1Hoeing at (6 WAS)	216.76	16.40	84.76	232.47
T3-PE Atrazine @ 0.50 kg a.i/ha	208.56	15.06	80.65	221.29
T4-PE Atrazine @ 0.75 kg a.i/ha	214.00	16.03	83.96	228.61
T5-POE 2,4-D (sodium salt) @ 1.0 kg/ha at 20 DAS+1HW+1Hoeing at (6WAS)	207.66	14.50	80.37	218.70
T6-POE 2,4-D (sodium. salt) @ 1.0kg/ha at 20 DAS	202.80	13.46	79.86	207.86
T7- POE Tembotrione @ 110 g/ha at 20 DAS	197.66	13.73	78.28	209.60
T8- POE Tembotrione @ 120 g/ha at 20 DAS	200.03	14.16	78.77	211.87
T9- POE Tembotrione @ 130 g/ha at 20 DAS	208.66	15.56	80.15	217.98
T10-1 Hand weeding + 1 Hoeing	199.30	13.16	77.66	205.51
T11-Weed free	219.36	16.60	85.99	241.25
T12-Weed check	178.16	12.23	66.94	170.63
S.E(M) ±	6.03	0.75	2.93	11.35
C.D. at 5%	17.69	2.22	8.61	33.29
GM	205.36	15.80	80.00	215.76

Yield attributing characters and yield

Yield attributing characters like number of cobs per plant, test weight (g) grain yield, straw yield, biological yield kg per hectare and harvest index of maize showed significant variations for different treatments are tabulated in Table 2.

The results revealed that, treatment (T11) weed free was significantly superior and was founds that at par with treatment (T2) PE Atrazine @ 0.75 kg a.i./ha + 1HW+

1Hoeing at (6WAS) recorded the maximum number of cobs plant-1 over the rest of treatment. The 100 grains weight (g) were influenced significantly by different treatments. Weed free recorded higher number of 100 grain weight (g) (27.96 g) followed by (T2) PE Atrazine @ 0.75 kg a.i./ha + 1HW+ 1Hoeing at (6WAS) grain weight (26.14 g). The effect of weed management practices on growth and yield of maize I.e. seed, straw and biological yields (kg ha-1) as presented in Table 2 and it was found at par treatment (T2) PE Atrazine @ 0.75 kg a.i./ha + 1HW+ 1Hoeing at (6 WAS). The increase in yield (kg ha-1) was attributed due to increased growth parameters and yield attributes of maize. This might be due to a more favourable overall growth due to a favourable seed bed resulting from decreased bulk density, increased pore space, better aeration, increased infiltration rate, with more space, light interception, and the benefit of more conserved moisture during dry spell periods, as well as its support at critical growth stages such as tasseling and silking. This ultimately resulted in higher values of yield attributing characters and which in turn resulted in higher yields of maize crop. Similarly highest harvest index 40.20 was observed in treatment (T11) weed free followed by treatment (T2) PE Atrazine @ 0.75 kg a.i./ha + 1HW+ 1Hoeing at (6 WAS). The similar results are in accordance with the findings of Birendra *et al.* (2013), Samant *et al*. (2015) and Triveni *et al.* (2017) [1, 7, 5].

Table 2: Effect of weed management practices on yield attributing characters and yield of Maize

Treatments	Test weight (g)	Grain Yield (kg ha-1)	Straw yield (Kg ha-1)	Biological yield (Kg ha-1)	Harvest index (%)
T1-PE Atrazine @ 0.50 kg a.i /ha +1HW+1Hoeing at (6 WAS)	25.52	5289	8588	13877	38.11
T2-PE Atrazine @ 0.75 kg a.i /ha +1HW+1Hoeing at (6 WAS)	26.14	5876	8739	14615	40.20
T3-PE Atrazine @ 0.50 kg a.i/ha	25.39	5066	8512	13578	37.31
T4-PE Atrazine @ 0.75 kg a.i/ha	25.88	5522	8639	14161	38.99
T5-POE 2,4-D (sodium salt) @ 1.0 kg/ha at 20 DAS+1HW+1Hoeing at (6WAS)	25.33	4961	8495	13456	36.86
T6-POE 2,4-D (sodium. salt) @ 1.0 kg/ha at 20 DAS	24.74	4696	8358	13054	35.97
T7- POE Tembotrione @ 110 g/ha at 20 DAS	24.07	4346	8158	12504	34.75
T8- POE Tembotrione @ 120 g/ha at 20 DAS	24.46	4571	8322	12893	35.45
T9- POE Tembotrione @ 130 g/ha at 20 DAS	24.84	4814	8393	13207	36.44
T10-1 Hand weeding + 1 Hoeing	23.40	4174	8099	12273	34.00
T11-Weed free	27.96	6233	9062	15295	40.75
T12-Weed check	21.47	3445	7265	10710	32.16
S.E(M) ±	1.04	87.05	13.56	551.63	-
C.D. at 5%	3.07	255.35	39.77	1618.00	-
GM	24.93	4916.00	8385.00	13301.90	36.75

Conclusion

This experiment illustrated that maize growth parameters, yield attributes and yield were significantly influenced by the various treatments of weed management practices. The combination of chemical plus cultural treatment (T2) PE Atrazine @ 0.75 kg a.i./ha + 1HW+ 1Hoeing at (6 WAS) had recorded higher plant growth characters, yield and yield attributes than rest of treatments. On the basis of single year experiment results, it can be concluded that has significant positive effect on yield, yield attributing characters and economics of maize crop as compared to rest of the treatments.

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