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EFFECT OF WEED MANAGEMENT PRACTICES ON WEED GROWTH AND YIELD OF RABI MAIZE IN SCARCE RAINFALL ZONE OF ANDHRA PRADESH

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ABSTRACT

Field experiment was conducted during *rabi*, 2017-18 at wetland farm of S.V. Agricultural College, Tirupati, Andhra Pradesh. The experiment was laid out in a randomized block design with three replications. There were 10 treatments consisting of pre emergence application of atrazine @ 1.0 kg a.i ha^{-1} *fb* post emergence application of tembotrione @ 120 g, topramezone @ 30 g, halosulfuron methyl @ 67.5 g, 2, 4-D amine salt @ 580 g, tembotrione @ 60 g + 2, 4-D amine salt @ 290 g, topramezone @ 15 g + 2, 4-D amine salt @ 290 g, halosulfuron methyl @ 34 g a.i ha^{-1} + 2, 4-D amine salt @ 290 g a.i ha^{-1}, pre emergence application of atrazine @ 1.0 kg a.i ha^{-1} *fb* one HW at 30 DAS, hand weeding twice at 15 and 30 DAS and control. The results revealed that broad-spectrum weed control and higher kernel yield of maize was recorded with hand weeding twice at 15 and 30 DAS, which was however comparable with application of atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 30 g a.i ha^{-1} as post emergence and atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 120 g a.i ha^{-1} as post emergence without any significant disparity among them.

KEYWORDS: Chemical weed management, maize, yield, weed dry weight

INTRODUCTION

Maize is the third most economically important cereal crop after rice and wheat. It is a miracle crop being used as a food and feed as well as preparation of vast industrial products like starch, oil, protein, alcoholic beverages, food sweeteners, Pharmaceutical, cosmetic, textiles, package and paper industries. Over 85 per cent of corn produced in our country is consumed directly as food in various forms like roasted cobs, popcorns, chapattis, corn flakes etc. Among the different production constraints, weeds were the important biological production constraints which limit the yield of maize. Weed infestation is supreme importance among biotic factors that are responsible for low maize grain yield. Worldwide maize production is hampered upto 40% due to competition from weeds which are the most important pest group of this crop.

Generally weeds reduce crop yields by competing for light, nutrients, water and carbon dioxide as well as interfering with harvesting and increasing the cost involved in crop production. Overall, weeds impose the highest loss potential (37%), which is higher than the loss potentials due to animal pests (18%), fungal and bacterial pathogens (16%) and viruses (2%) (Tesfay *et al.,* 2014). The critical period for weed control starts from four to six leaf stage and continues until ten leaf stage or flowering of corn (Gantoli *et al.,* 2013). Control of weeds in the fields of maize is, therefore, very essential for obtaining good crop harvest. Weed control practices in maize resulted in 77 to 96.7 per cent higher grain yield than the weedy check. Hand weeding is most popular among the farmers for weed control but it is expensive, laborious and time-consuming. In the developing countries like India acute shortage for labour occurs where the peak labor requirement is often for hand weeding. Herbicides weed control is an important alternative to manual weeding because it is cheaper, faster and gives better weed control. At present pre emergence herbicides especially atrazine is being used continuously for control of weeds in maize that leads to shift in emergence of weed pattern in crop and cropping system. Therefore farmers are in need of early post emergence herbicides for effective control of weeds at 15 to 25 days of crop where weeds offer severe competition for resources. Keeping this in view, present investigation was carried out to study the effect of sequential application of pre and post emergence herbicides on weeds, growth and yield in maize.

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MATERIALS AND METHODS

The field experiment was conducted during *rabi,* 2017-18 at wetland farm of S.V. Agricultural College, Tirupati, which is geographically situated at 13.6°N latitude and 79.3°E longitude, at an altitude of 182.9 m above the mean sea level in the Southern Agro-Climatic Zone of Andhra Pradesh, India. The soil of the experimental site was sandy clay loam in texture, neutral in soil reaction, low in organic carbon (0.25%) and available nitrogen (174 kg ha^{-1}), medium in available phosphorus (20.5 kg ha^{-1}) and potassium (186 kg ha^{-1}). The experiment was laid out in randomized block design with ten treatments replicated thrice *viz.*, atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* one HW at 30 DAS (T_1), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 120 g a.i ha^{-1} as post emergence (T_2), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 30 g a.i ha^{-1} as post emergence (T_3), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* halosulfuron methyl @ 67.5 g a.i ha^{-1} as post emergence (T_4), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* 2, 4- D amine salt @ 580 g a.i ha^{-1} as post emergence (T_5), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 60g + 2,4-D amine salt @ 290 g a.i ha^{-1} as post emergence (T_6), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 15 g + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence (T_7), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* halosulfuron methyl @ 34 g a.i ha^{-1} + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence (T_8), hand weeding twice at 15 and 30 DAS (T_9) and control (T_{10}). Bold and healthy certified seeds of maize hybrid DHM - 117 was sown by dibbling at a spacing of 60 cm × 20 cm with the seed rate of 15 kg ha^{-1} on 19th November, 2017, with a plot size of 5.4 m × 4. 6 m. Recommended dose of 240 kg N, 80 kg P_2O_5 and 80 kg K_2O ha^{-1} was supplied through urea, single super phosphate and muriate of potash to all the plots, respectively to all the plots of maize uniformly. Pre emergence herbicide was applied within 24 hours after sowing and early post emergence herbicides were applied at 21 DAS of maize.

The weed population was counted with the help of 0.5 m × 0.5 m quadrant thrown randomly at two places in each plot and converted to population or density per m^{-2}. While recording weed population, the biomass was harvested from each quadrant. The different species of weeds collected for assessing the density of weeds were dried separately in hot air oven at 65ºC till constant dry weight was reached and converted in to gm^{-2}. Five randomly selected plants were tagged in each treatment, from each replication in the net plot area and used for making observations on various growth parameters and yield attributes of maize. Due to large variation in values of density and dry weight of weeds, the corresponding data was subjected to square root transformation (“0.5 + x) and the corresponding transformed values were used for statistical analysis as suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Weed floral composition of the experimental site:

The predominant weed species in the experimental site were *Brachiaria ramosa, Cyanodon dactylon, Dactyloctenium aegyptium* (L) Beauv, *Digitaria sanguinalis* (L.) scop, *Cyperus rotundus* L, *Boerhavia erecta* L, *Borreria hispida* (L.) K. Schum, *Celosia argentea* L., *Cleome viscosa* L., *Clitoria ternata* L., *Commelina benghalensis* L., *Corchorus aestuans* L., *Digera arvensis, Euphorbia hirta* L., *Phyllanthus niruri* L., *Trichodesma indicum* L. and *Tridax procumbens* L.

Weed density and dry weight at 20 DAS

Hand weeding twice at 15 and 30 DAS (T_9), registered significantly lower density and biomass of grasses and sedges, whereas weedy check (T_{10}) recorded significantly higher density and dry weight of weeds than rest of all the treatments (**Table-1**). Among the various weed management practices tried, significantly higher density and dry weight of broad leaved weeds was noticed with weedy check (T_{10}). The density and dry weight of total weeds at 20 DAS was significantly lowest with hand weeding twice at 15 and 30 DAS (T_9). The rest of the weed management practices were par with each other in the order of ascent in recording weed density and weed biomass.

Weed density and dry weight at 80 DAS

Hand weeding twice at 15 and 30 DAS (T_9) recorded significantly lower density and dry weight of grassy weeds which was closely followed by atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 30 g a.i ha^{-1} as post emergence (T_3), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 120 g a.i ha^{-1} as post emergence (T_2) and atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* one HW at 30 DAS (T_1), without any

Table 1. Weed density and dry weight at 20 DAS of maize as influenced by different weed management practices

Treatments	Density (No. m^{-2})				Dry weight (g m^{-2})			
	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T_1 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* one HW at 30 DAS	6.68 (43.67)	9.38 (87.00)	1.00 (0.00)	11.35 (128.00)	2.75 (6.59)	4.19 (16.55)	1.00 (0.00)	4.91 (23.14)
T_2 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 120 g a.i ha^{-1} as post emergence	6.63 (43.00)	9.42 (87.67)	1.00 (0.00)	11.46 (130.33)	2.76 (6.67)	4.16 (16.42)	1.00 (0.00)	4.90 (23.09)
T_3 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 30 g a.i ha^{-1} as post emergence	6.63 (43.00)	9.49 (89.00)	1.00 (0.00)	11.62 (134.00)	2.77 (6.69)	4.33 (17.90)	1.00 (0.00)	5.06 (24.60)
T_4 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* halosulfuron methyl @ 67.5 g a.i ha^{-1} as post emergence	6.68 (43.67)	9.45 (88.67)	1.00 (0.00)	11.53 (132.00)	2.73 (6.50)	4.25 (17.16)	1.00 (0.00)	4.95 (23.65)
T_5 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* 2, 4-D amine salt @ 580 g a.i ha^{-1} as post emergence	6.76 (44.67)	9.54 (90.0)	1.00 (0.00)	11.61 (134.00)	2.77 (6.68)	4.19 (16.79)	1.00 (0.00)	4.93 (23.47)
T_6 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 60 g + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence	6.66 (43.33)	9.42 (88.00)	1.00 (0.00)	11.42 (129.67)	2.77 (6.67)	4.23 (16.96)	1.00 (0.00)	4.96 (23.63)
T_7 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 15 g + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence	6.61 (42.67)	9.44 (88.33)	1.00 (0.00)	11.52 (132.00)	2.78 (6.77)	4.24 (17.05)	1.00 (0.00)	4.97 (23.82)
T_8 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* halosulfuron methyl @ 34 g a.i ha^{-1} + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence	6.63 (43.00)	9.60 (91.33)	1.00 (0.00)	11.51 (131.67)	2.74 (6.51)	4.21 (17.10)	1.00 (0.00)	4.93 (23.61)
T_9 : Hand weeding twice at 15 and 30 DAS	1.91 (2.67)	5.47 (29.00)	1.00 (0.00)	5.71 (31.67	1.44 (1.07)	2.44 (4.97)	1.00 (0.00)	2.65 (6.04)
T_{10} : Weedy check	7.76 (59.33)	10.50 (109.33)	2.94 (7.67)	13.30 (176.00)	4.10 (15.89)	5.47 (29.06)	1.3 (0.71)	6.82 (45.66)
SEm ±	0.15	0.22	0.03	0.18	0.10	0.25	0.03	0.22
C.D (P = 0.05)	0.45	0.65	0.10	0.55	0.29	0.76	0.09	0.66

Data in parenthesis are pre-transformed original values, which were transformed to $\sqrt{X + 0.5}$ and analysed statistically significant disparity among themselves. The next best treatments in suppressing the grass count was atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 15 g + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence (T_7), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 60 g + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence (T_6), which were significantly lower than atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* 2, 4-D amine salt @ 580 g a.i ha^{-1} as post emergence (T_5), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* halosulfuron methyl @ 34 g a.i ha^{-1} + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence (T_8), without any significant disparity between them, but recorded statistically lower density of grasses than atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* halosulfuron methyl @ 67.5 g a.i ha^{-1} as post emergence (T_4). Effective control of sedges with recommended dose and half of the recommended dose of halosulfuron methyl, with no effect on grasses favoured to increase grass count in the field. The highest density and dry weight of grasses was registered with weedy check (T_{10}), than rest of the weed management practices tried (Table-2).

Sedge count and dry weight were significantly lower with atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* halosulfuron methyl @ 67.5 g a.i ha^{-1} as post emergence (T_4). This might be owed to the fact that halosulfuron methyl is effective in reducing the sedge count than other pre or post emergence herbicides. Hand weeding twice at 15 and 30 DAS (T_9), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* halosulfuron methyl @ 34 g a.i ha^{-1} + 2,4-D amine salt @ 290 g a.i ha^{-1} as post emergence (T_8), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 30 g a.i ha^{-1} as post emergence (T_3), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 120 g a.i ha^{-1} as post emergence (T_2) and atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* one HW at 30 DAS (T_1) were the next best treatments in reducing the sedge density and dry weight without any significant disparity among themselves.

Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 15 g + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence (T_7) and atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 60 g + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence (T_6) were comparable with one another and recorded significantly lower sedge count and dry weight than atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* 2, 4-D amine salt @ 580 g a.i ha^{-1} as post emergence (T_5) and unweeded check (T_{10}).

Weedy check (T_{10}) recorded significantly higher broad leaved weed count than all other weed management practices. Hand weeding twice at 15 and 30 DAS (T_9) and atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* one HW at 30 DAS (T_1) were comparable with one another and recorded significantly lower broad leaved weed count than weedy check (T_{10}). Broad leaved weed count was not recorded in the rest of the weed management practices during the two consecutive years of study. This was mainly due to the fact that pre emergence application of atrazine @ 1.0 kg a.i ha^{-1} showed a greater impact in controlling the broad leaved weeds not only in the initial stages but also at later stages of crop growth.

The total weed population and dry weight at 80 DAS was the lowest with hand weeding twice at 15 and 30 DAS (T_9), which was however, at par with atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 30 g a.i ha^{-1} as post emergence (T_3), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 120 g a.i ha^{-1} as post emergence (T_2) and atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* one HW at 30 DAS (T_1), without any significant disparity among the treatments. Lowest density of total weeds at 80 DAS was mainly attributed to the reason that effective control of weeds with two hand weedings or sequential application of herbicides caused marked reduction in density of weeds at all the stages of crop growth. Similar results were reported by Kumar *et al.* (2013) and Singh *et al.* (2012). The total weeds count and dry weight was significantly higher with weedy check (T_{10}). Similar results of higher density and dry weight of weeds in weedy check were noticed with Puscal *et al.* (2018).

Yield attributes and yield

Hand weeding twice at 15 and 30 DAS (T_9) recorded significantly higher number of kernels row^{-1} , number of kernels cob^{-1}, test weight, kernel and stover yield of maize which was found to be on par with atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 30 g a.i ha^{-1} as post emergence (T_3), atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 120 g a.i ha^{-1} as post emergence (T_2) and atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* one HW at 30 DAS (T_1), which in turn were comparable with another among the treatments (**Table-3**). It might be due to minimum crop-weed competition throughout the crop growing period as evident by lowest density and dry weight of weeds which favoured better utilization of nutrients, moisture, light and which in turn

Table 2. Weed density and dry weight at 80 DAS of maize as influenced by different weed management practices

Treatments	Density (No. m^{-2})				Dry weight (g m^{-2})			
	Grasses	Sedges	BLW	Total	Grasses	Sedges	BLW	Total
T_1 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* one HW at 30 DAS	3.04 (8.33)	3.56 (11.67)	1.63 (1.67)	4.58 (20.00)	4.64 (20.60)	3.69 (12.63)	1.68 (1.83)	6.01 (35.07)
T_2 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 120 g a.i ha^{-1} as post emergence	2.94 (7.67)	3.51 (11.33)	1.00 (0.00)	4.32 (17.67)	4.57 (19.87)	3.67 (12.50)	1.00 (0.00)	5.77 (32.37)
T_3 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 30 g a.i ha^{-1} as post emergence	2.63 (6.00)	3.46 (11.00)	1.00 (0.00)	4.24 (17.00)	4.40 (18.33)	3.65 (12.30)	1.00 (0.00)	5.62 (30.63)
T_4 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* halosulfuron methyl @ 67.5 g a.i ha^{-1} as post emergence	8.26 (67.33)	1.97 (3.00)	1.00 (0.00)	8.45 (70.33)	8.68 (74.43)	2.29 (4.27)	1.00 (0.00)	8.92 (78.70)
T_5 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* 2, 4-D amine salt @ 580 g a.i ha^{-1} as post emergence	7.65 (57.67)	7.04 (48.67)	1.00 (0.00)	10.35 (106.33)	7.71 (58.47)	5.76 (32.27)	1.00 (0.00)	9.57 (90.73)
T_6 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 60 g + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence	4.95 (23.67)	6.19 (37.33)	1.00 (0.00)	7.86 (61.00)	6.28 (38.47)	4.62 (20.33)	1.00 (0.00)	7.73 (58.80)
T_7 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 15 g + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence	4.93 (23.33)	6.08 (36.00)	1.00 (0.00)	7.77 (59.33)	6.19 (37.43)	4.38 (18.47)	1.00 (0.00)	7.54 (55.90)
T_8 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* halosulfuron methyl @ 34 g a.i ha^{-1} + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence	7.84 (60.67)	3.36 (10.33)	1.00 (0.00)	8.47 (71.00)	7.91 (61.53)	3.10 (8.60)	1.00 (0.00)	8.43 (70.13)
T_9 : Hand weeding twice at 15 and 30 DAS	2.51 (5.33)	3.21 (09.33)	1.52 (1.33)	4.12 (16.00)	4.37 (18.17)	3.08 (8.47)	1.64 (1.70)	5.41 (28.33)
T_{10} : Weedy check	9.69 (93.00)	8.08 (64.33)	4.58 (20.33)	13.36 (177.67)	10.59 (111.47)	6.44 (40.03)	4.30 (17.53)	13.04 (169.43)
SEm ±	0.22	0.15	0.39	0.22	0.23	0.16	0.07	0.21
C.D (P = 0.05)	0.67	0.45	0.13	0.67	0.68	0.48	0.20	0.64

Data in parenthesis are pre-transformed original values, which were transformed to $\sqrt{X + 0.5}$ and analysed statistically

Table 3. Effect of different weed management practices on yield attributes and yield of maize

Treatments	No. of kernels row^{-1}	No. of kernels cob^{-1}	Test weight (g)	Kernel yield (kg ha^{-1})	Stover yield (kg ha^{-1})
T_1 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* one HW at 30 DAS	32.7	461	32.2	8161	8253
T_2 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 120 g a.i ha^{-1} as post emergence	33.6	469	32.7	8389	5116
T_3 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 30 g a.i ha^{-1} as post emergence	34.3	478	33.1	4836	6730
T_4 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* halosulfuron methyl @ 67.5 g a.i ha^{-1} as post emergence	25.2	377	23.2	6941	3620
T_5 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* 2, 4-D amine salt @ 580 g a.i ha^{-1} as post emergence	24.8	375	22.6	8518	2280
T_6 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 60 g + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence	29.0	411	28.1	189	566
T_7 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 15 g + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence	29.2	412	28.5	10617	10717
T_8 : Atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* halosulfuron methyl @ 34 g a.i ha^{-1} + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence	21.1	331	19.2	10738	7612
T_9 : Hand weeding twice at 15 and 30 DAS	34.6	489	34.3	7571	9008
T_{10} : Weedy check	17.2	281	15.4	9099	5391
SEm ±	0.9	10	0.78	10861	3940
C.D (P = 0.05)	2.7	29	2.35	370	1110

* PE- Pre emergence, PoE – Post emergence

might increased the yield attributes of maize. The next best treatments in recording higher yield attributes and yield of maize were atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* topramezone @ 15 g + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence (T_7) which was at par with atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* tembotrione @ 60 g + 2, 4-D amine salt @ 290 g a.i ha^{-1} as post emergence (T_6) and were significantly superior to atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* halosulfuron methyl @ 67.5 g a.i ha^{-1} as post emergence (T_4) and atrazine @ 1.0 kg a.i ha^{-1} as pre emergence *fb* 2, 4-D amine salt @ 580 g a.i ha^{-1} as post emergence (T_5), which inturn were comparable with one another.

The yield attributes were significantly lowest with control (T_{10}). The lowest values of yield components in control might be due to severe stiff competition for both above and below ground resources. Similar results were reported by Kamble *et al.* (2015) and Hajji *et al.* (2012).

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