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Research Paper

Weed Management in Maize through Tank Mixtures

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ABSTRACT

A field experiment was conducted on black soil at Main Agricultural Research Station, Dharwad during *kharif* season of 2015 to study effect of tank mixtures on weed control in maize. The treatments consisted of sole application of herbicides *viz.*, atrazine, 2,4-D, tembotrione, topramezone in comparison with their tank mixtures and standard check of recommended weed management practice- atrazine 1.25 kg ha^{-1} (PRE) + 1HW + 1IC, sequential application-atrazine 1kg ha^{-1} (PRE) *fb* 2,4-D 500 g ha^{-1},Weed free and weedy check. Spraying was done at 16 DAS. The results of the experiment shows that among tank mixtures, topramezone + 2,4-D recorded significantly lower weed density, Weed dry matter, higher grain yield next to recommended weed management practices. Herbicide mixtures performed better than sole applications.

Keywords: Early post emergent herbicides, Topramezone, Tembotrione, Tank mixture, Weed density, Weed dry weight.

INTRODUCTION

Maize (*Zea mays L*) is a cereal with highest genetic yield potential. In India maize is grown over an area of 8.6 m ha with production of 21.7 m t and average productivity of 2500 kg ha^{-1}. It contributes to about 2.4% of world's production. In Karnataka, maize occupies an area of 1.3 m ha with production of 4.4 m t and an average productivity of 3500 kg ha^{-} [7] (Anon., 2015). With maximum potential, productivity could not be reached due to many abiotic and biotic factors. Among the biotic factors, weeds are the major constraints of production. Almost all types of weeds *viz.*, grassy, BLWs and sedges infest the maize fields. The extent of nutrient loss varies from 30-40% of the applied nutrients [3] (Mundra *et al.*, 2002). Weeds pose a great challenge especially to the resource poor farmers not only by reducing crop productivity as a result of competition with the crop, but also in lowering profitability due to costs associated with the management [5] (Bremer, 2008; [4] Plessis, 2003). Hence weeds must be controlled during the critical period of crop weed competition *i.e.*, first 3-6 weeks before the crop canopy has developed thick enough to smoother the weeds [2] (Shad *et al.*, 1993). Now, the choice of weed control largely depends on effectiveness and economics. Due to increased cost and non-availability of manual labour for hand weeding, herbicides are preferred as they control the weeds timely and effectively but also reduce the cost of weed control irrespective of situation.

Usage of pre-emergent herbicide assumes greater importance in view of their effectiveness from initial stages and use of post-emergence or tank mixture herbicides

may help in avoiding the problem of weeds at later stages. But manual labour has become costly and scarce for spraying operations also. Under such circumstances, there is need for early post-emergence herbicides on tank mixture basis to control weeds for longer period of the crop growth
Keeping above facts in view, an investigation was planned to study the effect of tank mixtures on weed control in maize.

MATERIALS & METHODS

The field experiment was conducted at Main Agricultural Research Station, Dharwad under rainfed conditions during *kharif* season of 2015. The soil of the experimental site was medium deep black clay soil with pH 7.3; it was medium in available nitrogen (283.4 kg ha^{-1}), available phosphorus (28.5 kg ha^{-1}) and high in available potassium (340.23 kg ha^{-1}). Maize hybrid variety 900-M Gold was sown at the rate of 20 kg ha^{-1} with spacing of 60 cm X 20 cm. The experiment comprised of Single application of herbicides *viz.,* T_1-atrazine 1 kg ha^{-1}, T_2-topramezone 25 g ha^{-1}, T_3-2,4-D 1 kg ha^{-1}, T_4-tembotrione 100 g ha^{-1} and their tank mixtures with half of their dosage *i.e.,* T_5-topramezone 12.5 g ha^{-1} + atrazine 500 g ha^{-1}, T_6-topramezone 12.5 g ha^{-1} + 2,4-D 500 g ha^{-1}, T_7-tembotrione 50 g ha^{-1} + atrazine 500 g ha^{-1} and T_8-tembotrione 50 g ha^{-1} + 2,4-D 500 g ha^{-1}, T_9-sequential application of atrazine 1 kg ha^{-1} (PRE) *fb* 2,4-D 500 g ha^{-1} (POST). These treatments were checked against T_{10}-recommended weed management practice *i.e.,* atrazine 1.25 kg ha^{-1} + 1 IC + 1 HW, T_{11}-weed free and T_{12}-weedy check (IC: Intercultivation, HW: Hand weeding, RPP: Recommended weed management practice). T_1-T_8- Early post emergent herbicides (sprayed at 16 DAS). Pre emergent herbicide (PRE) was sprayed on the day of sowing. Post emergent spray (POST) was given at 35 DAS using knapsack sprayer.
The WCI was calculated by using the formula given by [1] Mani *et al.* (1976)

$$\text{Weed control index (WCI)} = \frac{(\text{WDMc} - \text{WDMt})}{\text{WDMc}} \times 100$$

Where,
WDMc = Weed dry weight (unit/m^2) in control plot
WDMt = Weed dry weight (unit/m^2) in treated plot

Statistical Analysis The experiment consisted of 12 treatments laid out in randomized block design.

RESULT

Different weed management treatments significantly influenced weed density (total of grasses, sedges and BLWs) at 30 and 60 DAS (Table 1). At 30 DAS, the data indicated that the weed density was significantly lower with application of tank mixtures when compared to sole application of herbicides. Among tank mixtures, topramezone 12.5 g/ha + 2,4-D 500 g/ha recorded significantly lower weed density (6.00/0.5m^2) which was on par with tembotrione 50 g/ha + 2,4-D 500 g/ha (7.00/0.5m^2), atrazine 1 kg/ha *fb* 2,4-D 500 g/ha (7.33/0.5m^2) and recommended weed management practice *viz.,* atrazine 1.25 kg/ha + 1IC + 1HW (5.67/0.5m^2). Significantly higher number of weeds was recorded in weedy check (22.67/0.5 m^2). At 60 DAS, weed density was nil in weed free (0.00/0.5 m^{-2}) compared to all other treatments. Significantly lower weed density was observed in recommended weed management practice *i.e.,* atrazine 1.25 kg/ha + IC + HW (5.67/0.5 m^2). The next best treatments was topramezone 12.5 g/ha + 2,4-D 500 g /ha (7.67/0.5 m^2) and which was significantly superior over topramezone 12.5 g/ha alone (10.33/0.5 m^2), atrazine 1.25 kg/ha alone (12.67/0.5 m^2), 2,4-D 1 kg/ha alone (11.00/0.5 m^2) and on par with the other tank mixtures. The total weed density was significantly higher with weedy check (28.00/0.5 m^2).
At both the crop growth stages, the dry weight of weeds differed significantly due to different weed management treatments (Table 1). At 30 DAS, weed dry weight was significantly lower with treatments receiving herbicide mixture, topramezone

12.5 g ha^{-1} + 2,4-D 500 g ha^{-1} (3.62 g 0.5 m^{-2}) which was on par with recommended weed management practice (3.40 g 0.5 m^2). However, topramezone alone 25 g ha^{-1} (5.27 g 0.5 m^{-2}), atrazine alone 1.00 kg ha^{-1} (4.96 g 0.5 m^{-2}), tembotrione 100 g ha^{-1} alone (5.64 g 0.5 m^{-2}) and 2,4-D alone 1.0 kg ha^{-1} (5.85 g 0.5 m^{-2}) recorded significantly higher weed dry weight compared to tank mixtures. Weed dry weight was significantly higher in weedy check (15.70 g 0.5 m^{-2}) compared to all other treatments.

Table 1: Weed density, weed dry weight, weed control index and grain yield as influenced by herbicides in kharif maize

Treatments	Weed density (No./0.5m^2)		Dry weight (g/0.5m^2)		Weed control index (%)		Yield (kg/ha)
	30 DAS	60DAS	30 DAS	60DAS	30 DAS	60DAS	
T1	3.08(9.00)	3.62(12.67)	2.34(4.96)	2.99(8.45)	68.40	48.76	5269
T2	3.08(9.00)	3.29(10.33)	2.40(5.27)	2.75(7.10)	66.40	56.93	4494
T3	3.24(10.00)	3.40(11.00)	2.52(5.85)	2.77(7.17)	62.85	55.04	4298
T4	3.08(9.00)	3.34(10.67)	2.48(5.64)	2.75(7.12)	64.34	60.54	4455
T5	2.97(8.33)	3.40(11.00)	2.24(4.53)	2.92(8.02)	71.21	54.11	5061
T6	2.55(6.00)	2.86(7.67)	2.03(3.62)	2.32(4.89)	77.01	70.28	5582
T7	2.86(7.67)	3.03(8.67)	2.22(4.44)	2.49(5.70)	71.85	63.17	5310
T8	2.74(7.00)	2.97(8.33)	2.20(4.36)	2.49(5.70)	72.28	61.02	5451
T9	2.79(7.33)	2.97(8.33)	2.24(4.50)	2.44(5.47)	71.32	67.37	5535
T10	2.48(5.67)	2.48(5.67)	1.97(3.40)	2.03(3.61)	78.33	78.84	5789
T11	0.71(0.00)	0.71(0.00)	0.71(0.00)	0.71(0.00)	100.00	100.00	6032
T12	4.81(22.67)	5.34(28.0)	4.02(15.70)	4.12(16.50)	-	-	3630
S.Em.±	0.10	0.07	0.05	0.06	1.60	1.86	64.80
C.D.(0.05)	0.30	0.21	0.16	0.16	4.77	5.46	190

*Transformed values $\sqrt{(x+0.5)}$, figures in the parenthesis indicate original values

At 60 DAS, significantly lower weed dry weight was recorded in recommended weed management practice *i.e.*, atrazine 1.25 kg ha^{-1} + 1IC + 1 HW. Application of tank mixture, topramezone 12.5 g ha^{-1} + 2,4-D 500 g ha^{-1} effective in control of weeds with lower weed dry weight (4.89 g 0.5 m^{-2}) which was on par with other tank mixtures *viz.*, tembotrione 50 g ha^{-1} + 2,4-D 500 g ha^{-1} (5.70 g 0.5 m^{-2}), tembotrione 12.5 g ha^{-1} + atrazine 500 g ha^{-1} (5.70 g 0.5 m^{-2}) and also with atrazine 1.25 kg ha^{-1} *fb* 2,4-D 500 g ha^{-1} (5.47 g 0.5 m^{-2}) but, these treatments recorded significantly lower weed dry weight compared to application of topramezone alone 25 g ha^{-1}, tembotrione 100 g ha^{-1} alone atrazine alone 1.25 kg ha^{-1} and 2,4-D alone 1.0 kg ha^{-1} (7.10, 7.12, 8.45 and 7.17 g 0.5 m^{-2}, respectively). Significantly higher weed dry weight was noticed with weedy check (16.50 g 0.5 m^{-2}).

Weed control index is a derived parameter and compares different treatments of weed management on the weed dry weight across them. At 30 DAS, the WCI was significantly higher with recommended weed management practice (atrazine 1.25 kg ha^{-1} + IC + HW) with WCI value of 78.33 per cent and was on par with application of topramezone 12.5 g ha^{-1} + 2,4-D 500 g ha^{-1} (77.01 %) followed by tembotrione 50 g ha^{-1} + 2,4-D 500 g ha^{-1} (72.28 %) which were in turn on par with other tank mixtures *viz.*, topramezone + atrazine (71.21 %), tembotrione + atrazine (72.28 %). Application of topramezone alone 25 g ha^{-1} or atrazine alone 1.25 kg ha^{-1} or 2,4-D alone 1.0 kg ha^{-1} alone recorded significantly lower WCI compared to tank mixtures. At 60 DAS, weed free treatment significantly recorded higher WCI (100 %) compared to all other treatments followed by recommended weed management practice (78.84 %) *i.e.*, application of atrazine 1.25 kg ha^{-1} + IC + HW. Topramezone 12.5 g ha^{-1} + 2,4-D 500 g ha^{-1} (70.28 %) resulted in higher WCI compared to rest of tank mixtures and was on par with sequential application of atrazine *fb* 2,4-D (67.3 %). The treatment receiving herbicide mixtures were significantly superior over the application of topramezone alone (56.93 %) or atrazine alone (48.76 %) or 2,4-D alone (55.04 %) or tembotrione alone (60.54 %) with respect to WCI (Table 1).

Grain yield of maize was significantly influenced by different weed management treatments (Table 24). Weed

free treatment recorded higher grain yield compared to all other treatments (6,032 kg ha^{-1}). Significantly higher grain yield was recorded with recommended weed management practice *i.e.,* atrazine 1.25 kg ha^{-1} + IC + HW (5,789 kg ha^{-1}). Tank mixtures topramezone 12.5 g ha^{-1} + 2,4-D 500 g ha^{-1} (5,582 kg ha^{-1}). The next best treatments were tembotrione 50 g ha^{-1} + 2,4-D 500 g ha^{-1} (5,451 kg ha^{-1}), tembotrione 50 g ha^{-1} + atrazine 500 g ha^{-1} (5,310 kg ha^{-1}) and topramezone 12.5 g ha^{-1} + atrazine 500 g ha^{-1} (5,061 kg ha^{-1}). These treatments recorded significantly higher grain yield compared to topramezone alone (4,494 kg ha^{-1}), 2,4-D alone (4,298 kg ha^{-1}) and (4,455 kg ha^{-1}) respectively. Grain yield of maize was significantly lower in weedy check (3,630 kg ha^{-1}) compared to rest of the treatments.

Effect of T_6- Topramezone + 2,4-D on grasses, BLWs and sedges at 50 DAS

DISCUSSION

The treatments receiving herbicide mixtures *viz.* topramezone + 2,4-D was significantly superior in terms of weed density, total dry weight of weeds and WCI (Table 1) over all other herbicide treatments next to recommended weed management practice and weed free check. This is due to the fact that topramezone is effective against grassy weeds and BLWs whereas, 2,4-D is effective in controlling BLWs and also effects sedges to some extent. Similarly in the herbicide mixtures topramezone + atrazine, tembotrione + 2,4-D and tembotrione + atrazine performed better than sole application because topramezone and tembotrione controls grassy weeds and BLWs effectively; 2,4-D and atrazine controls BLWs effectively hence achieving a broad spectrum weed control.

The (WCI) was significantly higher in the treatments receiving herbicide mixtures of topramezone + 2,4-D followed by tembotrione + 2,4-D at 30 DAS and can be comparable with recommended weed management practice. This can be attributed to the lower weed density and lower dry weight of weeds at this stage. The WCI obtained with herbicide mixtures *viz.*, tembotrione + 2,4-D, tembotrione + atrazine

and topramezone + atrazine are on par with each other. This indicates the weeds both grasses and BLWs could be effectively controlled with these herbicides mixtures which brings about the same result as that of recommended weed management practice where in atrazine was applied as pre-emergent spray and subsequently operations like inter-cultivation and hand weeding were taken up. [6] Madhavi *et al.* (2014) also reported similar results.

Grain yield of maize was significantly lower in weedy check (3,630 kg ha^{-1}) compared to rest of the treatments. The significantly higher grain yield of maize in these treatments was mainly due to minimum crop-weed competition throughout the crop growth period which is evident from significantly lower weed dry weight. This enabled the crop to utilize nutrients, moisture, light and space to maximum. Single application of herbicides was inferior to tank mixtures because of more weed infestation and lack of broad spectrum weed control during crop growth period. The herbicides when used alone controlled a specific group of weeds, allowing other group to come up.

CONCLUSION

Early post emergent spray of tank mixtures i.e., topramezone + 2,4-D, tembotrione + 2,4-D and tembotrione + atrazine were superior to other herbicide treatments in terms of weed density, dry matter, weed control efficiency and grain yield of maize. Tank mixtures were found to be more effective than sole application of herbicides which is a viable alternative for farmers.

REFERENCES

1. Mani VS. Chakraborty TK and Gautam KC. Double edged weed tillers in peas. *Indian Fmg*, 1976; 26 (5): 19-21.
2. Shad RA, Chatha MQ and Nawaz H. Weed management studies in maize. *Pakistan J. Agric. Res.*1997; 14 (1): 44-50.
3. Mundra SL, Vyas AK, Maliwal PL. Effect of weed and nutrient management on weed growth and productivity of maize (*Zea mays* L.*). Indian J. Weed Sci*, 2003; 35 (1/2): 57-61.
4. Plessis DJ. Maize Production (South Africa). [Online] Available, 2003; www.arc.agric.za/maize.
5. Bremer J. Seven major factors affect corn yield. [Online] Available, 2008; www. hpj. com/ *Seven Major Factors Affect Corn Yield* (High plains/ Midwest AG Journal).
6. Madhavi M, Ramprakash T, Srinivas A and Yakadri M. Topramezone (33. 6% SC) + Atrazine (50% WP) tank mix efficacy on maize. *Biennial Conference of Indian Society of Weed Sci.* 2013; pp: 23-24.
7. Anonymous. India Maize Summit 2015; [Online] Available: www.fcci.com.

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