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## Evaluation of post emergence herbicides spraying in maize (*Zea mays* L.) by using drone

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### Abstract

This study explored a perspective of Evaluation of post emergence herbicides spraying in maize (*Zea mays* L.) by using drone undertaken during *kharif* 2023 at Maize Research Centre, Agricultural Research Institute (ARI), Professor Jayashankar Telangana State Agriculture University (PJTSAU), Rajendranagar, Hyderabad. The experiment comprised of eight treatments i.e. T<sub>1</sub> - Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) with adjuvant by using drone, T<sub>2</sub> - Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) without adjuvant by using drone, T<sub>3</sub> - Spraying of topramezone 33.6% SC 25.2 g ha<sup>-1</sup> + atrazine 50% WP 500 g ha<sup>-1</sup> (TM) with adjuvant by using drone, T<sub>4</sub> - Spraying of topramezone 33.6% SC 25.2 g ha<sup>-1</sup> + atrazine 50% WP 500 g ha<sup>-1</sup> (TM) without adjuvant by using drone, T<sub>5</sub> - Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) by using, knapsack sprayer, T<sub>6</sub> - Spraying of topramezone 33.6% SC 25.2 g ha<sup>-1</sup> + atrazine 50% WP 500 g ha<sup>-1</sup> (TM) by using knapsack sprayer, T<sub>7</sub> - Weedy check and T<sub>8</sub> - Weed free (HW at 20 and 40 DAS) laid out in a randomized block design with three replications. The results revealed that significantly higher yield and yield attributes were observed with T<sub>8</sub> -weed free treatment (HW at 20 and 40 DAS) which was superior over all other treatments *fb* T<sub>5</sub>- spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) by using knapsack sprayer but it was statistically on par with T<sub>1</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) with adjuvant by using drone and T<sub>2</sub> - Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) without adjuvant by using drone. Economics of various treatments indicated that T<sub>5</sub>- spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) by using knapsack sprayer recorded higher B-C ratio (2.94) but it was statistically on par with T<sub>1</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) with adjuvant by using drone (2.94) and T<sub>2</sub> - Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) without adjuvant by using drone (2.94).

**Keywords:** Drone, knapsack, post emergence herbicides, adjuvant, yield, economics, *kharif* maize

### Introduction

Maize (*Zea mays* L.) among the cereal crops is one of the most important in the world agricultural economy both as food and fodder crop and biofuel (ethanol production) and is regarded as “queen of cereals”. It is one of the most versatile cereal crops having wider adaptability under diverse soil and climatic condition. Maize ranks third in the cereal’s world production after rice and wheat, but in productivity it surpasses all cereals. The area under maize in India accounts to 10.74 M ha with 38.08 Mt production, productivity of 3545 kg ha<sup>-1</sup> (Ministry of Agriculture & Farmers Welfare, Govt. of India. 2022-2023) [1]. In India, productivity of maize is low as compared to world which can be attributed to several limiting factors. One of the most important among these has been the poor weed management which poses a major threat to crop productivity. Maize being a wide spaced crop with slow early growth, favours the growth of weeds even before crop emergence. Weeds reduce crop yield by competing for light, water, nutrients and CO<sub>2</sub>, interfere with harvesting and increase the cost of cultivation (Kumawat *et al.*, 2019) [2].

In India, maize is primarily cultivated during the *kharif* season where wide range of weed flora *viz.*, *Panicum* spp., *Echinochloa colona*, *Cyperus rotundus*, *Cynodon doctylon*, *Commelina benghalensis* and *Trianthema portulacastrum* dominate during early crop growth stages, whereas *Dactyloctenium aegyptium* towards the tasseling and maturity (Singh *et al.*, 2015) [3].

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The critical period for crop weed competition is the first six weeks after sowing owing to initial slow growth and wider row spacing coupled with congenial weather for weed growth (Dass *et al.*, 2012) [4]. Among different weed management options, chemical weed management is turning out to be more reliable because of the benefits in terms of time, labour efficiency and economic weed suppression. Postemergence herbicide application is an essential option in crops like maize, as escaped weeds or the later flushes of weeds may compete with the crop and contribute seed to the weed seed bank (Vahedi *et al.*, 2013) [5]. Mesotrione and atrazine (Calaris xtra) is India's first pre-mix contact herbicide, which acts by penetrating the leaf surface and the active ingredient moves to the meristematic regions of the plant where growth occurs and inhibit the growth of weeds. Tank mix application of topramezone with lower dose of atrazine was reported to be more effective and providing broad spectrum weed control than alone application of individual chemicals (Swetha *et al.*, 2018) [6]. In the current scenario, to overcome the scarcity of water and farm labour, an alternate method of application of herbicide is needed. In order to save water, time and energy, application of herbicides by drones is the best alternate method. Keeping these points in view the present experiment was undertaken during *kharif* 2023.

### Materials and Methods

The experiment was carried out in *kharif* 2023 at Maize Research Centre, Agricultural Research Institute (ARI), Professor Jayashankar Telangana State Agriculture University (PJTSAU), Rajendranagar, Hyderabad. The experimental site was geographically located at 17° 3' N latitude, 78° 39' E longitude and an altitude of 494 m above mean sea level (MSL). According to Troll's climatic classification, it falls under Semi-Arid Tropical region (SAT). The weekly mean maximum temperature during the experimental period ranged from 26.4 °C to 33.2 °C with an average of 30.42 °C while, the weekly mean minimum temperature during the crop growth period ranged from 16.6 °C to 23.7 °C with an average of 22.15 °C. The

weekly mean bright sunshine hours day<sup>-1</sup> varied from 0.3 to 8.2 hours, with an average of 4.9 hours. The mean weekly pan evaporation (mm) (USWB Class-B open pan evaporimeter) during the crop growth period was 4.05 mm. With regard to rainfall, 588 mm was received in 27 rainy days during July to October, 2023. The experiment comprised of eight treatments *i.e.* T<sub>1</sub> - Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) with adjuvant by using drone, T<sub>2</sub> - Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) without adjuvant by using drone, T<sub>3</sub> - Spraying of topramezone 33.6% SC 25.2 g ha<sup>-1</sup> + atrazine 50% WP 500 g ha<sup>-1</sup> (TM) with adjuvant by using drone, T<sub>4</sub> - Spraying of topramezone 33.6% SC 25.2 g ha<sup>-1</sup> + atrazine 50% WP 500 g ha<sup>-1</sup> (TM) without adjuvant by using drone, T<sub>5</sub> - Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) by using, knapsack sprayer, T<sub>6</sub> - Spraying of topramezone 33.6% SC 25.2 g ha<sup>-1</sup> + atrazine 50% WP 500 g ha<sup>-1</sup> (TM) by using knapsack sprayer, T<sub>7</sub> - Weedy check and T<sub>8</sub> - Weed free (HW at 20 and 40 DAS) laid out in a randomized block design with three replications.

Maize hybrid DHM-117 was hand dibbled two seeds per hill at a depth of 5 cm on 11<sup>th</sup> July, 2023 in ridge and furrow method adopting a spacing of 60 cm x 20 cm. The recommended dose of fertilizer for maize was 200:60:50 kg N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O ha<sup>-1</sup>. N, P and K fertilizers were applied in the form of urea (46% N), single super phosphate (16% P<sub>2</sub>O<sub>5</sub>) and muriate of potash (60% K<sub>2</sub>O), respectively. Pre-emergence herbicide atrazine was applied immediately after irrigation within 48 hours @ 1.0 kg a.i to all the treatments except weed check and weed free (HW at 20 and 40 DAS). Post-emergence herbicides mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) with and without adjuvant, and topamezone 33.6% SC 25.2 g ha<sup>-1</sup> + atrazine 50% WP 500 g ha<sup>-1</sup> (TM) with and without adjuvant were applied at 21 DAS as per the treatments. The dose of herbicides was calculated as per the treatments and applied as aqueous spray @ 40 l ha<sup>-1</sup> using drone with DG 95015EVS nozzle and 500 l ha<sup>-1</sup> using knapsack sprayer with flat fan nozzle.

**Table 1:** Yield attributes and yield of maize as influenced by weed management practices

S. No.	Treatments	Cob length (cm)	Cob girth (cm)	No. of Cobs plant <sup>-1</sup>	No. of kernel rows cob <sup>-1</sup>	Number of kernels row <sup>-1</sup>	100 seed weight (g)	Cob yield (kg ha <sup>-1</sup> )	Kernel yield (kg ha <sup>-1</sup> )	Stover yield (kg ha <sup>-1</sup> )	Harvest index (%)
T <sub>1</sub>	Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha <sup>-1</sup> (RM) with adjuvant by using drone	16.4	14.2	0.95	14.5	33.5	33.9	10098	8431	9629	46.7
T <sub>2</sub>	Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha <sup>-1</sup> (RM) without adjuvant by using drone	16.5	14.0	0.93	14.4	33.1	33.7	10056	8408	9517	46.9
T <sub>3</sub>	Spraying of topamezone 33.6% SC 25.2 g ha <sup>-1</sup> + atrazine 50% WP 500 g ha <sup>-1</sup> (TM) with adjuvant by using drone	14.8	12.4	0.94	14.0	31.1	33.3	9686	8040	9116	46.9
T <sub>4</sub>	Spraying of topamezone 33.6% SC 25.2 g ha <sup>-1</sup> + atrazine 50% WP 500 g ha <sup>-1</sup> (TM) without adjuvant by using drone	14.8	12.4	0.94	14.0	31.1	32.0	9641	8025	9096	46.9
T <sub>5</sub>	Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha <sup>-1</sup> (RM) by using knapsack sprayer	16.7	14.2	0.94	14.7	34.1	34.6	10161	8485	9685	46.7
T <sub>6</sub>	Spraying of topamezone 33.6% SC 25.2 g ha <sup>-1</sup> + atrazine 50% WP 500 g ha <sup>-1</sup> (TM) by using knapsack sprayer	14.9	12.5	0.93	14.2	31.3	33.7	9734	8102	9183	46.9
T <sub>7</sub>	Weedy check	11.4	11.8	0.93	12.0	27.8	31.5	5911	4321	5279	45.0
T <sub>8</sub>	Weed free (HW at 20 and 40 DAS)	18.1	15.6	0.96	14.9	35.8	35.5	10550	8795	10055	46.7
	SE m (±)	0.4	0.3	0.01	0.2	0.4	0.8	105	93	96	2.5
	CD (p=0.05%)	1.3	1.1	NS	1.01	1.3	NS	319	283	292	NS

\*\* RM-Ready mix, TM-Tank mix, SC-Soluble concentrate, WP-Wettable powder

## Results and Discussion

Significantly highest cob length and cob girth indicated in (Table 1) (18.1 and 15.6 cm) were recorded in T<sub>8</sub> -weed free treatment (HW at 20 and 40 DAS) which was superior over all other treatments. Minimum crop-weed competition throughout the crop growth period enabled the congenial environment for better expression of growth stature and yield attributes which resulted in significantly higher cob length and cob girth. The results are in line with those of Bhavitha *et al.* (2021) [7] and Nayak *et al.* (2022) [8]. Among the different post-emergence spraying of herbicides significantly highest cob length and cob girth (16.7 and 14.2 cm) were recorded with T<sub>5</sub>- spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) by using knapsack sprayer but it was on par with T<sub>1</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) with adjuvant by using drone (16.4 and 14.2 cm) and T<sub>2</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> without adjuvant by using drone (16.5 and 14.0 cm) and they were superior over remaining treatments. This was due to better weed suppression through significant reduction in weed dry weight and weed population and consequent reduction in crop-weed competition which resulted in significantly higher cob length and cob girth. The present findings align with the results reported by Swetha *et al.* (2018) [6] and Bhavitha *et al.* (2021) [7]. Significantly lowest cob length and cob girth (11.4 and 11.8 cm) were recorded in T<sub>7</sub>-weedy check. Stiff competition imposed by weeds resulted in poor source and sink development with resultant lower cob length and cob girth. The results are in line with those of Bhavitha *et al.* (2021) [7] and Nayak *et al.* (2022) [8].

Data recorded on number of cobs plant<sup>-1</sup> indicated that there were no significant differences among the treatments.

Significantly highest number of kernel rows cob<sup>-1</sup> (14.9) was recorded in T<sub>8</sub>- weed free treatment (HW at 20 and 40 DAS) which was statistically on par with the T<sub>5</sub>- spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) by using knapsack sprayer (14.7), T<sub>1</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) with adjuvant by using drone (14.5), T<sub>2</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) without adjuvant by using drone (14.4), T<sub>6</sub>- Spraying of topramezone 33.6% SC 25.2 g ha<sup>-1</sup> + atrazine 50% WP 500 g ha<sup>-1</sup> (TM) by using knapsack sprayer (14.2), T<sub>3</sub> - Spraying of topramezone 33.6% SC 25.2 g ha<sup>-1</sup> + atrazine 50% WP 500 g ha<sup>-1</sup> (TM) with adjuvant by using drone (14.0) and T<sub>4</sub> - Spraying of topramezone 33.6% SC 25.2 g ha<sup>-1</sup> + atrazine 50% WP 500 g ha<sup>-1</sup> (TM) without adjuvant by using drone (14.0).

It was due to number of kernel rows cob<sup>-1</sup> is a genetical character it will not differ significantly in all the herbicide treatments with the weed free treatment. The present findings align with the findings of Damalas *et al.* (2017) [9], Akhtar *et al.* (2017) [10], Swetha *et al.* (2018) [6] and Bhavitha *et al.* (2021) [7]. While, significantly lowest number of kernel rows cob<sup>-1</sup> (12) were recorded in weedy check. It was due to higher crop weed competition resulting in poor source and sink development. The results are in line with those of Nayak *et al.* (2022) [8].

Significantly highest number of kernels row<sup>-1</sup> (35.8) was recorded in T<sub>8</sub>- weed free treatment (HW at 20 and 40 DAS) which was superior over all other treatments. It was due to significantly highest cob length recorded in same treatment which results in highest number of kernels row<sup>-1</sup> (Table 1). The results are in line with those of Bhavitha *et al.* (2021) [7] and Nayak *et al.* (2022) [8]. Among the different post emergence spraying of herbicides significantly highest number of kernels row<sup>-1</sup> (34.1) was recorded with T<sub>5</sub>- spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) by using knapsack

sprayer but it was on par with T<sub>1</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) with adjuvant by using drone (33.5) and T<sub>2</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) without adjuvant by using drone (33.1) and they were superior over remaining treatments. It was due to higher weed control efficiency and lower weed competition which resulted better growth and development of maize. The present findings align with the results reported by Akhtar *et al.* (2017) [10], Swetha *et al.* (2018) [6]. Significantly lowest number of kernels row<sup>-1</sup> (27.8) was recorded in weedy check.

Data recorded on 100 seed weight indicated that there was no significant difference among all the treatments. Similar observation made by Bhavitha *et al.* (2021) [7].

Significantly highest cob, kernel and stover yield (10550, 8795 and 10055 kg ha<sup>-1</sup>) was recorded in T<sub>8</sub>- weed free treatment (HW at 20 and 40 DAS) which was superior over all other treatments. The reason for higher cob, kernel and stover yield in case of weed free treatment was due to relatively much less competition from weeds at critical stages of crop-weed competition and also recorded higher yield attributes. Similar results were also reported by Hatti *et al.* (2014) [11] and Bhavitha *et al.* (2021) [7]. Among the different post emergence spraying of herbicides significantly highest cob, kernel and stover yield (10161, 8485 and 9685 kg ha<sup>-1</sup>) was recorded with T<sub>5</sub>-spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) by using knapsack sprayer but it was on par with T<sub>1</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) with adjuvant by using drone (10098, 8431 and 9629 kg ha<sup>-1</sup>) and T<sub>2</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) without adjuvant by using drone (10056, 8408 and 9517 kg ha<sup>-1</sup>) and they were superior over remaining treatments (Table 1). This was due to effective control of weeds during the critical period of crop weed competition apart from improved growth parameters and yield attributes. These findings are in accordance with Akhtar *et al.* (2017) [10] and Kurre *et al.* (2017) [12]. Significantly lowest cob, kernel and stover yield (5911, 4321 and 5279 kg ha<sup>-1</sup>) was recorded in weedy check. This was due to heavy weed infestation, which exploited the growth resources. These findings are in accordance with Kiranjith *et al.* (2016) [13] and Nayak *et al.* (2022) [8].

Data recorded on harvest index indicated that there was no significant difference among all the treatments. These results corroborate with the findings Kommireddy *et al.* (2018) [14].

Higher cost of cultivation (74393 ₹ ha<sup>-1</sup>) was recorded with T<sub>8</sub>-weed free (HW at 20 and 40 DAS) *fb* T<sub>5</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) by using knapsack sprayer (63593 ₹ ha<sup>-1</sup>) and T<sub>1</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) with adjuvant by using drone (63136 ₹ ha<sup>-1</sup>) and T<sub>2</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) without adjuvant by using drone (63018 ₹ ha<sup>-1</sup>) recorded higher cost of cultivation. Lowest cost of cultivation was recorded with weedy check (53393 ₹ ha<sup>-1</sup>). The results indicated that higher labour cost when compared to herbicide treatments and application cost was comparatively more for knapsack than drone spraying. It was attributed to increased labour wages for herbicide application. No weeding and no spraying during crop growth period in weedy check recorded lowest cost of cultivation. The results of present investigation are also in agreement with the findings of Paul *et al.* (2023) [15].

Significantly higher gross and net returns (193871 and 119478 ₹ ha<sup>-1</sup>) were realized in T<sub>8</sub>- weed free treatment (HW at 20 and 40 DAS) (table 2). Higher production of kernel as well as stover yield lead to increased monetary returns in weed free treatment. Similar findings were reported by Swetha *et al.* (2015) [6] and

Bhavitha *et al.* (2022) [17]. Among the different post emergence spraying of herbicides significantly higher gross returns and net returns were recorded in T<sub>5</sub>- spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) by using knapsack sprayer (187015 and 123422 ₹ ha<sup>-1</sup>) but it was on par with T<sub>1</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) with adjuvant by using drone (185844 and 122708 ha<sup>-1</sup>) and T<sub>2</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) without adjuvant by using drone (185245 and 122227 ₹ ha<sup>-1</sup>) and they were superior over remaining treatments. Superiority of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) in terms of kernel and stover yield reflected in increased monetary returns. Similar findings were reported by Paul *et al.* (2023) [15] and Kumar *et al.* (2022) [16]. Significantly lower gross and net returns were fetched in weedy check (95588 and 42195 ₹ ha<sup>-1</sup>) due to lesser kernel and stover yield. The results are in

conformity with the findings of Paul *et al.* (2023) [15] and Kumar *et al.* (2022) [16].

Among all the treatments, significantly higher B-C ratio was obtained with T<sub>1</sub>- spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) with adjuvant by using drone (2.94) but it was statistically on par with T<sub>2</sub>- spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) without adjuvant by using drone (2.94) and T<sub>5</sub>- mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) by using knapsack sprayer (2.94) which was due to superiority in kernel yield, gross and net returns in above treatments. Significantly lowest B-C ratio was recorded in weedy check (1.79). Due to reduced kernel and stover yields, and ultimately lower B-C ratio. The results are in conformity with the findings of Kumar *et al.* (2022) [16] and Paul *et al.* (2023) [15].

**Table 2:** Economics of maize as influenced by different weed management practices during *kharif*, 2023

S. No.	Treatments	Cost of cultivation (₹ ha <sup>-1</sup> )	Gross returns (₹ ha <sup>-1</sup> )	Net returns (₹ ha <sup>-1</sup> )	B-C ratio
T <sub>1</sub>	Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha <sup>-1</sup> (RM) with adjuvant by using drone	63136	185844	122708	2.94
T <sub>2</sub>	Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha <sup>-1</sup> (RM) without adjuvant by using drone	63018	185245	122227	2.94
T <sub>3</sub>	Spraying of topramezone 33.6% SC 25.2 g ha <sup>-1</sup> + atrazine 50% WP 500 g ha <sup>-1</sup> (TM) with adjuvant by using drone	61911	177159	115248	2.86
T <sub>4</sub>	Spraying of topramezone 33.6% SC 25.2 g ha <sup>-1</sup> + atrazine 50% WP 500 g ha <sup>-1</sup> (TM) without adjuvant by using drone	61793	176826	115033	2.86
T <sub>5</sub>	Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha <sup>-1</sup> (RM) by using knapsack sprayer	63593	187015	123422	2.94
T <sub>6</sub>	Spraying of topramezone 33.6% SC 25.2 g ha <sup>-1</sup> + atrazine 50% WP 500 g ha <sup>-1</sup> (TM) by using knapsack sprayer	62368	178515	116147	2.86
T <sub>7</sub>	Weedy check	53393	95588	42195	1.79
T <sub>8</sub>	Weed free (HW at 20 and 40 DAS)	74393	193871	119478	2.61
	SE m (±)	-	2023	2023	0.03
	CD (p=0.05%)	-	6137	6137	0.10

\*\* RM-Ready mix, TM-Tank mix, SC-Soluble concentrate, WP-Wettable powder

## Conclusion

From the results of present experiment, it can be concluded that spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha<sup>-1</sup> (RM) either by knapsack sprayer or drone with and without adjuvant is beneficial in improving maize yields apart from monetary returns in maize

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