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EFFECT OF POST- EMERGENCE HERBICIDES SPRAYING BY DRONE ON WEED INDICES, GROWTH AND YIELD OF MAIZE (*ZEA MAYS L.*)

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ABSTRACT

This study explored a perspective of effect of post- emergence herbicides spraying by drone on weed indices, growth and yield of maize (*Zea mays L.*) 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., T₁ - Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone, T₂ - Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) without adjuvant by using drone, T₃ - Spraying of topramezone 33.6% SC 25.2 g ha⁻¹ + atrazine 50% WP 500 g ha⁻¹ (TM) with adjuvant by using drone, T₄ - Spraying of topramezone 33.6% SC 25.2 g ha⁻¹ + atrazine 50% WP 500 g ha⁻¹ (TM) without adjuvant by using drone, T₅ - Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using knapsack sprayer, T₆ -Spraying of topramezone 33.6% SC 25.2 g ha⁻¹ + atrazine 50% WP 500 g ha⁻¹ (TM) by using knapsack sprayer, T₇ -Weedy check and T₈ -Weed free (HW at 20 and 40 DAS) laid out in a randomized block design with three replications. The results revealed that the weed free treatment (HW at 20 and 40 DAS) recorded significantly higher plant height at 90 DAS and it was on par with spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using knapsack sprayer, mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone and mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ without adjuvant by using drone and they were superior over rest of the treatments. Significantly highest leaf area, dry matter production at 90 DAS was recorded in weed free treatment (HW at 20 and 40 DAS) *fb* spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using knapsack sprayer but it was on par with mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone and mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ without adjuvant by using drone. Significantly lowest weed dry matter was recorded in weed free treatment (HW at 20 and 40 DAS) *fb* spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using knapsack sprayer but it was on par with mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone and mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ without adjuvant by using drone. Highest weed control efficiency and lowest weed index was recorded in weed free treatment (HW at 20 and 40 DAS) followed by spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using knapsack sprayer, mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone and mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ without adjuvant by using drone. Significantly highest cob length, cob and kernel and stover yield was recorded in weed free treatment (HW at 20 and 40 DAS) followed by spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using knapsack sprayer, mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone and mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ without adjuvant by using drone. Hence, it can be concluded that among the herbicide treatments, mesotrione 2.27% + atrazine 22.7% SC

875 g ha⁻¹ (RM) with and without adjuvant by using drone and knapsack sprayer were equally superior in terms of improved growth and yield of maize apart from higher weed control efficiency and lower weed index.

Keywords : Drone, Growth parameters, Knapsack sprayer, weed control efficiency, weed index, Yield.

Introduction

Maize (*Zea mays* L.) is one of the most important among the cereal crops 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⁻¹ (Ministry of Agriculture & Farmers Welfare, Govt. of India.2022-2023). 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 wider 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 CO₂, interfere with harvesting and increase the cost of cultivation (Kumawat *et al.*, 2019).

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). The critical period for crop weed competition is the first six weeks after crop planting owing to initial slow growth and wider row spacing coupled with congenial weather for weed growth (Dass *et al.*, 2012). 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. Post-emergence 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). Mesotrione and atrazine (*Calaris xtra*) is an 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). 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 in maize during *kharif* 2023 to evaluate the efficacy of post emergence herbicides sprayed with drone.

Material and Methods

The experiment was carried out in the *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⁻¹ 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 laid out in a randomized block design with three replications. T₁ - Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone, T₂ - Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) without adjuvant by using drone, T₃ - Spraying of topramezone 33.6% SC 25.2 g ha⁻¹ + atrazine 50% WP 500 g ha⁻¹ (TM) with adjuvant by using drone, T₄ - Spraying of topramezone 33.6% SC 25.2 g ha⁻¹ + atrazine 50% WP 500 g ha⁻¹ (TM) without adjuvant by using drone, T₅ - Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using, knapsack sprayer, T₆ -Spraying of topramezone 33.6% SC 25.2 g ha⁻¹ + atrazine 50% WP 500 g ha⁻¹ (TM) by

using knapsack sprayer, T₇ -Weedy check and T₈ - Weed free (HW at 20 and 40 DAS).

Maize hybrid (DHM-117) was hand dibbled with two seeds per hill at a depth of 5 cm on 11th 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, P₂O₅ and K₂O ha⁻¹. N, P and K fertilizers were applied in the form of urea (46% N), single super phosphate (16% P₂O₅) and muriate of potash (60% K₂O), 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⁻¹ (RM) with and without adjuvant and topramezone 33.6% SC 25.2 g ha⁻¹ + atrazine 50% WP 500 g ha⁻¹ (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⁻¹ using drone with DG 95015EVS nozzle and 500 l ha⁻¹ using knapsack sprayer with flat fan nozzle. The height of five representative randomly selected and tagged plants from individual treated plots were measured at 90 DAS from the base of plant to the tip of the fully opened last leaf before tasseling and the tip of the tassel after tasseling. The leaf area was estimated using leaf area meter (LICOR 3100 automatic leaf area meter). Five destructive plant samples collected at 90 DAS were used to find out the total dry matter production. After plant sampling, the samples were oven dried at 60°C to attain constant weight and dry weight was recorded and expressed in kg ha⁻¹. Using 1 m² quadrat, destructive sampling was done by uprooting the weeds at 90 DAS. Collected weed samples were shade dried (after clipping of the roots) for a day and then oven dried at 60°C to attain a constant weight. Final weights were recorded and converted to g m⁻². The data was subjected to square root transformation ($\sqrt{X+1}$). Weed control efficiency (%) was computed by using following formula (Umarani and Boi, 1982).

$$\text{WCE} = \frac{\text{Dry weight of weeds in unweeded control (g m}^{-2}\text{)} - \text{Dry weight of weeds in treatment (g m}^{-2}\text{)}}{\text{Dry weight of weeds in unweeded control (g m}^{-2}\text{)}} \times 100$$

Weed index was computed by using the formula (Gill and Vijay Kumar, 1969).

$$\text{WI}(\%) = \frac{X - Y}{X} \times 100$$

Where,

X= Yield from weed free or minimum weed

competition plot (kg ha⁻¹)

Y= Yield from the treatment for which WI is to be worked out (kg ha⁻¹)

Results and Discussion

Plant height (cm)

Examination of the plant height data (Table 1) revealed that T₈-weed free treatment (HW at 20 and 40 DAS) recorded significantly higher plant height 90 DAS (195.4 cm) and it was on par with T₅- spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using knapsack sprayer (192.4 cm), T₁- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone (191.6 cm) and T₂- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ without adjuvant by using drone (190.2 cm) and they were superior over rest of the treatments. This was due to weed free condition provided at critical period for crop weed competition (20 and 40 DAS) which led to reduced weed growth and better vegetative growth of maize crop and broad-spectrum control of weeds (grasses, sedges and broad-leaved weeds) that reduced crop weed competition during the early stages of the crop. Significantly lowest plant height at 90 DAS was observed with T₇- weedy check (132.7 cm). Increased crop - weed competition for nutrients, water, space and light resulted in suppression of crop growth during initial stages. The present results align with the findings of Swetha *et al.* (2018) and Bhavitha *et al.* (2022).

Leaf area (cm² plant⁻¹)

The data demonstrated that significantly highest leaf area at 90 DAS was recorded in T₈- weed free treatment (HW at 20 and 40 DAS) (6636.8 cm² plant⁻¹) owing to minimum crop-weed competition throughout the crop growth period. These results were supported from Swetha *et al.* (2018).

Among the different post-emergence herbicides, significantly highest leaf area at 90 DAS (6095.4 cm² plant⁻¹) was recorded with T₅- spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using knapsack sprayer but it was on par with T₁- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone (6009.2 cm² plant⁻¹ respectively) and T₂- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ without adjuvant by using drone (5979.4 cm² plant⁻¹). Higher leaf area in these treatments was due to broad spectrum nature of these herbicides coupled with minimal crop weed competition during the early stages of the crop. Significantly lowest leaf area at 90 DAS was recorded with T₇- weedy check (3556.7 cm² plant⁻¹). Lowest leaf

area recorded in the weedy check may be attributed to high crop weed competition for the growth resources that reflected in poor growth. The present results find support from the findings of Swetha *et al.* (2018) and Bhavitha *et al.* (2022).

Plant dry matter (kg ha⁻¹)

Examination of the data (Table 1) revealed that, T₈- weed free treatment (HW at 20 and 40 DAS) recorded significantly higher dry matter production at 90 DAS (8186 kg ha⁻¹). Taller plants and higher leaf area in weed free treatment reflected in highest dry matter accumulation. The results of present investigation are in agreement with the findings of Swetha *et al.* (2018), Kommireddy (2018) and Bhavitha *et al.* (2022).

Among the different post-emergence herbicides, significantly highest dry matter production at 90 DAS (7392 kg ha⁻¹) was recorded with T₅ - spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using knapsack sprayer but it was on par with T₁- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone (7389 kg ha⁻¹) and T₂- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ without adjuvant by using drone (7375 kg ha⁻¹) and they were superior over remaining treatments. Taller plants, higher leaf area apart from better light interception and assimilation promoted higher dry matter accumulation (Shahid Rasool and Hafiz 2016).

Significantly lowest dry matter production at 90 DAS was noticed with T₇- weedy check (4938 kg ha⁻¹). This was due to shorter plants and lower leaf area which reflected in lowest dry matter accumulation. The results of present investigation are in agreement with the findings of Kommireddy (2018).

Weed dry matter (g m⁻²)

The data on weed dry matter at 90 DAS indicated that significantly lowest total weed dry matter was recorded (16.84 g m⁻²) in T₈- weed free (HW at 20 and 40 DAS) treatment due to removal of weeds which reduced competition between weeds and crop. Similar results were also reported by Swetha *et al.* (2018).

Among the different post-emergence spraying of herbicides, significantly lowest total weed dry matter at 90 DAS (34.58 g m⁻²) was recorded with T₅- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using knapsack sprayer but was statistically comparable with T₁- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone (34.85 g m⁻²) and T₂- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) without adjuvant by using drone (35.81 g m⁻²) and they were superior

over rest of the treatments. Lowest total weed dry matter recorded in above treatments was due to broad spectrum control of weeds lead to less weed density and lowest weed dry matter. Significantly highest total weed dry matter at 90 DAS (197.88 g m⁻²) was recorded in T₇- Weedy check. This was due to increased weed density throughout the crop growth period which in turn reflected in significantly highest total weed dry matter. These results are in line with the findings of Akhtar *et al.* (2017)

Weed control efficiency (%)

Among the treatments, higher weed control efficiency (91.48 %) was recorded in T₈- weed free treatment (HW at 20 and 40 DAS) and this could be ascribed to the weed free condition achieved during the critical period of crop growth over rest of the treatments. Similar results were also reported by Akhtar *et al.* (2017), Triveni *et al.* (2017) and Supriya *et al.* (2021).

Among the different post-emergence herbicides, higher weed control efficiency at 90 DAS (82.52 %) was recorded with T₅- spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using knapsack sprayer but was comparable with T₁- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone (82.38 %) and T₂- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) without adjuvant by using drone (81.90 %) and they were superior over remaining treatments. Higher weed control efficiency registered in these treatments could be attributed to lower weed density and weed dry weight owing to better weed control. Lower weed control efficiency was recorded in T₇- weedy check. This was due to increased weed number and dry weight during the crop growth period. The present results corroborate with the findings of Akhtar *et al.* (2017).

Weed index (%)

Perusal of the data on weed index revealed that lowest weed index was recorded in T₈- weed free treatment (HW at 20 and 40 DAS). This could be attributed to the improved crop growth as a consequence of effective weed control and reduction in the crop weed competition. This enabled the crop to absorb more nutrients resulting in higher yield due to lowest weed index over rest of the treatments.

Among the different post-emergence spraying of herbicides, lowest weed index (3.52 %) was recorded with T₅- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using knapsack sprayer, T₁- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone (4.13 %) and T₂- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) without

adjuvant by using drone (4.40 %). Lowest weed index in these treatments was due to the improved crop growth as a consequence of effective control of weed and reduction in the crop weed competition which reflected in higher yield. Highest weed index (50.86 %) was recorded in T₇- weedy check. This could be attributed to the slow growth of crop in the early stages which offered much scope for the development of weeds besides non -adoption of any weed control measures which resulted in higher yield loss which in turn resulted in highest weed index. Similar results collaborate with the findings of Tarundeep *et al.* (2019), Pranaswi *et al.* (2022) and Hiremath *et al.* (2024).

Cob length (cm) and cob and kernel and stover yield (kg ha⁻¹)

Significantly highest cob length (17.6 cm) was recorded in T₈ -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.

Among the different post-emergence spraying of herbicides significantly highest cob length (17.0 cm) were recorded with T₅- spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using knapsack sprayer but it was on par with T₁- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone (16.8 cm) and T₂- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ without adjuvant by using drone (16.7 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. Significantly lowest

cob length (11.4 cm) was recorded in T₇-weedy check. Stiff competition imposed by weeds resulted in poor source and sink development with resultant lower cob length. The results are in line with those of Bhavitha *et al.* (2021) and Nayak *et al.* (2022).

Significantly highest cob, kernel and stover yield (10550, 8795 and 10055 kg ha⁻¹) were recorded in T₈-weed free treatment (HW at 20 and 40 DAS) which was superior over all other treatments. Higher cob, kernel and stover yield in weed free treatment was due to relatively lesser competition from weeds at critical stages of crop coupled with higher yield attributes. Similar results were also reported by Hatti *et al.* (2014) and Bhavitha *et al.* (2021).

Among the different post emergence spraying of herbicides significantly highest cob, kernel and stover yield (10161, 8485 and 9685 kg ha⁻¹) was recorded with T₅-spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) by using knapsack sprayer but it was on par with T₁- mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) with adjuvant by using drone (10098, 8431 and 9629 kg ha⁻¹) and T₂-mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) without adjuvant by using drone (10056, 8408 and 9517 kg ha⁻¹) and they were superior over remaining treatments (Table 2). 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) and Kurre *et al.* (2017). Significantly lowest cob, kernel and stover yield (5911, 4321 and 5279 kg ha⁻¹) were recorded in weedy check. This was due to heavy weed infestation, which exhausted the growth resources for crop. These findings are in accordance with Kiranjith *et al.* (2016) and Nayak *et al.* (2022).

Table 1 : Growth parameters, weed dry matter, weed control efficiency at 90 DAS and weed index as influenced by different weed management practices in maize.

S. No.	Treatments	Plant height (cm)	Leaf area (cm ² plant ⁻¹)	Plant Dry matter (Kg ha ⁻¹)	Weed dry matter (g m ⁻²)	Weed control efficiency (%)	Weed index (%)
T ₁	Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha ⁻¹ (RM) with adjuvant by using drone	191.6	6009.2	7389	5.99 (34.85)	82.38	4.13
T ₂	Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha ⁻¹ (RM) without adjuvant by using drone	190.2	5979.4	7375	6.07 (35.81)	81.90	4.40
T ₃	Spraying of topamezone 33.6% SC 25.2 g ha ⁻¹ + atrazine 50% WP 500 g ha ⁻¹ (TM) with adjuvant by using drone	178.3	5470.6	6598	6.93 (46.97)	76.26	8.58
T ₄	Spraying of topamezone 33.6% SC 25.2 g ha ⁻¹ + atrazine 50% WP 500 g ha ⁻¹ (TM) without adjuvant by using drone	176.2	5249.2	6580	6.99 (47.91)	75.78	8.75

T ₅	Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha ⁻¹ (RM) by using knapsack sprayer	192.4	6095.4	7392	5.96 (34.58)	82.52	3.52
T ₆	Spraying of topamezone 33.6% SC 25.2 g ha ⁻¹ + atrazine 50% WP 500 g ha ⁻¹ (TM) by using knapsack sprayer	179.4	5503.6	6633	6.84 (45.77)	76.86	7.87
T ₇	Weedy check	132.7	3556.7	4938	14.10 (197.88)	-	50.86
T ₈	Weed free (HW at 20 and 40 DAS)	195.4	6636.8	8186	4.22 (16.84)	91.48	-
	SE (m) ±	3.3	153.1	240	0.06	-	-
	CD (P=0.05%)	10.0	464.5	728	0.18	-	-

Note: Original values are given in parenthesis, which are transformed to ($\sqrt{X+1}$).

** RM-Ready mix, TM-Tank mix, SC-Soluble concentrate, WP-Wettable powder, HW-Hand weeding, NS-Non significant.

Table 2: Cob length and cob and kernel and stover yield of maize as influenced by different weed management practices

S. No	Treatments	Cob length (cm)	Cob yield (kg ha ⁻¹)	Kernel yield (Kg ha ⁻¹)	Stover yield (kg ha ⁻¹)
T ₁	Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha ⁻¹ (RM) with adjuvant by using drone	16.8	10098	8431	9629
T ₂	Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha ⁻¹ (RM) without adjuvant by using drone	16.7	10056	8408	9517
T ₃	Spraying of topamezone 33.6% SC 25.2 g ha ⁻¹ + atrazine 50% WP 500 g ha ⁻¹ (TM) with adjuvant by using drone	15.9	9686	8040	9116
T ₄	Spraying of topamezone 33.6% SC 25.2 g ha ⁻¹ + atrazine 50% WP 500 g ha ⁻¹ (TM) without adjuvant by using drone	15.8	9641	8025	9096
T ₅	Spraying of mesotrione 2.27% + atrazine 22.7% SC 875 g ha ⁻¹ (RM) by using knapsack sprayer	17.0	10161	8485	9685
T ₆	Spraying of topamezone 33.6% SC 25.2 g ha ⁻¹ + atrazine 50% WP 500 g ha ⁻¹ (TM) by using knapsack sprayer	16.0	9734	8102	9183
T ₇	Weedy check	11.4	5911	4321	5279
T ₈	Weed free (HW at 20 and 40 DAS)	17.6	10550	8795	10055
	SE (m) ±	0.2	105	93	96
	CD (P=0.05%)	0.5	319	283	292

** RM-Ready mix, TM-Tank mix, SC-Soluble concentrate, WP-Wettable powder, HW-Hand weeding, NS-Non significant.

Conclusion

Based on results of the present investigation, it can be concluded that among the herbicide treatments, mesotrione 2.27% + atrazine 22.7% SC 875 g ha⁻¹ (RM) sprayed with and without adjuvant by using drone and knapsack sprayer were equally superior and recorded higher growth parameters, weed control efficiency, yield of maize apart from lower weed index.

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