International Journal of Bio-resource and Stress Management

https://pphouse.org/ijbsm.php

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IJBSM April 2023, 14(4):554-561 Print ISSN 0976-3988 Online ISSN 0976-4038 Article AR3280

Research Article Stress Management

DOI: HTTPS://DOI.ORG/10.23910/1.2023.3280

Effect of Tembotrione on Weed Growth and Productivity of *Kharif* Maize (*Zea mays* L.)

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ABSTRACT

A field experiment was conducted in maize (*Zea mays* L.) during both *kharif* (June–September, 2014 and 2015) seasons in a randomized block design with nine treatments, including the herbicide tembotrione as early post-emergence at 80, 100 and 120 g ha^{-1} both as sole and in combination with atrazine at 500 g ha^{-1}, atrazine at 1000 g ha^{-1}, hand-weeding twice at 25 and 40 DAS and unweeded control with three replications. The experimental field was heavily infested with *Ludwigia parviflora* (Jacq.) Raven, *Cynodon dactylon* (L.) Pers., *Cyperus rotundus* (L.) and *Fimbristylis miliacea* (L.) Vahl. The yield of maize was reduced by around 48% due to weed infestation. From the experiment, it was found that combined application of tembotrione and atrazine was much more effective than sole application of herbicide at any of the levels that were evaluated. Tembotrione at a rate of 80–100 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1}+atrazine at 500 g ha^{-1} recorded the lowest weed density, weed biomass and weed index; highest values of growth and yield parameters as well as the yield of maize. Therefore, early post–emergence application of tembotrione at 80–100 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1}+atrazine 500 g ha^{-1} appeared to be the most effective weed management approach for higher weed control efficiency, yield, gross and net return of *kharif* maize in lateritic soil of West Bengal.

KEYWORDS: *Kharif* maize, stefesmero surfactant, tembotrione, weed management

***Citation* (VANCOUVER):** Sharma et al., Effect of Tembotrione on Weed Growth and Productivity of *Kharif* Maize (*Zea mays* L.). *International Journal of Bio-resource and Stress Management,* 2023; 14(4), 554-561. HTTPS://DOI.ORG/10.23910/1.2023.3280.

Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

Conflict of interests: The authors have declared that no conflict of interest exists.

RECEIVED on 04th October 2022 RECEIVED in revised form on 12th March 2023 ACCEPTED in final form on 28th March 2023 PUBLISHED on 18th April 2023

1. INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops cultivated worldwide. It is not only an important source of human nutrition, but also raw materials used in the production of a wide variety of industrial goods, animal feed and as biofuel (Biswas et al., 2022). Due to its high adaptability and genetic potentiality, maize is popularly known as "Queen of cereals" (Kumar et al., 2022). Following rice and wheat, maize is India's third most significant cereal crop (Singh et al., 2021) and is cultivated in an area of about 9.86 million ha (mha) with a production of 28.77 million tones (mt) (Anonymous, 2021). In West Bengal, the total area under maize is about 0.30 mha, which produces 2.01 mt (Anonymous, 2021). Weed is one of the main stress causing organisms among several biotic and abiotic variables that inhibit maize production. In general, weed can greatly reduce maize output and result in the maize plant dying completely (Sharma and Rayamajhi, 2022). The key period for crop weed competition in maize is between 15 and 45 days after sowing (DAS), and continuous weed development, particularly during the essential weed free period, results in a 68.11% drop in maize grain output (Bada et al., 2022). *Echinochloa colona* (L.) Link, *Cyperus rotundus* (L.), *Commelina benghalensis* (L.), *Trianthema portulacastrum* (L.) and *Ludwigia parviflora* (Jacq.) Raven are common weeds of *kharif* maize which cause grain yield loss of 28–100% (Pandey et al., 2001, Dass et al., 2012, Hargilas, 2016). Considering the limitations of cultural methods, chemical weed management is an important alternative. Herbicides reduce the labour required for weed control operations, save energy, increase maize output and lower the cost of cereal farming while also successfully and profitably controlling weeds and protecting the environment (Hetta et al., 2022). The use of herbicides is an effective method for controlling weed infestation, which enables a quicker breakthrough and contributes to an increase in maize yield (Kantwa et al., 2020). Sole application of atrazine does not provide effective and desirable level of control of many weeds like *C. rotundus* and *E. colona* in wet season throughout the critical period of crop–weed competition (Upasani et al., 2017). Additionally, consistent use of a single herbicide may result in the development of weed species that are resistant to herbicides as well as a change in the weed flora (Duary, 2008, Singh and Longkumer, 2021). Proper selection of herbicides, their time and rate of application are the important consideration for lucrative return on maize production. On the other hand, the effectiveness of sole application of a single herbicide against complex weed flora during the key time of competition has very rarely been shown (Kumar et al., 2016). Mix application of herbicides is emerging as a very important strategy for dealing with the issue of complex weeds in several crops, including maize. Atrazine is very popular herbicide to control weed in maize. But it is not effective against some grassy, broadleaf and sedges (Singh et al., 2012). Tembotrione is a post-emergence selective herbicide that was recently released for use in maize. It is intended to be mixed with atrazine, which is the preferred herbicide for usage in maize. However, it is of the utmost importance to investigate the effectiveness of the herbicide at varying concentrations against a variety of weed species in maize, either alone or in combination with atrazine. In context of this, the current study was carried out with the goal of determining the impact that a tank mix application of tembotrione and atrazine has on the growth of weeds and the yield of maize.

2. MATERIALS AND METHODS

2.1. Experimental period and location

Experiment in the field was conducted during *kharif* (June–September, 2014 and 2015) at the Agricultural farm of Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, West Bengal, India. The farm lies in a sub-humid, semi-arid area of West Bengal and is located at 23°39' north latitude and 87°42' east longitude. It has an average elevation of 58.90 meters above mean sea level. The soil had sandy loam texture, slightly acidic (pH 6.8), low organic carbon (0.46%), medium available potassium (129.5 kg ha^{-1}), high available phosphorus (28.42 ha^{-1}) and low available nitrogen (149.6 kg ha^{-1}).

2.2. Experimental design and treatments details

The experiment was conducted in a randomized block design with three replicates with nine different treatments, *viz.* tembotrione at 80 g ha^{-1}+stefesmero surfactant 733 g ha^{-1}, tembotrione at 80 g ha^{-1}+stefesmero surfactant 733 g ha^{-1}+atrazine 500 g ha^{-1}, tembotrione at 100 g ha^{-1}+stefesmero surfactant 733 g ha^{-1}, tembotrione at 100 g ha^{-1}+stefesmero surfactant 733 g ha^{-1}+atrazine 500 g ha^{-1}, tembotrione at 120 g ha^{-1}+stefesmero surfactant 733 g ha^{-1}, tembotrione at 120 g ha^{-1}+stefesmero surfactant 733 g ha^{-1}+atrazine 500 g ha^{-1}, atrazine 1000 g ha^{-1}, hand-weeding 25 and 40 DAS and unweeded control.

2.3. Package and practices

A total of 120 kg N, 60 kg P_2O_5 and 40 kg K_2O ha^{-1} were applied to the maize.Total P_2O_5, K_2O and one third N was applied as basal dose during last land preparation and remaining N was given as two splits (knee height and tasseling stage) as band placement. Sowing was done with following all the recommended agronomic package and practices. All herbicides were applied with a knapsack sprayer equipped with a flat fan nozzle and a spray volume of 500 l ha^{-1}.

2.4 . Observations and procedure of data recorded

Observations on weeds were recorded by placing the quadrat of size 50×50 cm^2. The values were converted to express the density in number of weeds m^{-2}. Weeds were cleaned by washing, kept in sunlight for few hours and were kept in a hot air oven for drying at 70°C for 72 hours or more till constant weights were recorded. The values of weed biomass were converted to express the biomass of weeds g m^{-2}.

2.5. Methods of statistical analysis

Statistical analysis of the data was done as described by Gomez and Gomez (1984) at a 5% level of significance. Two years data were subjected to pool analysis and the pooled data have been presented in the Tables and figures. The data have been square root transformed before statistical analysis. The original data have been given in parentheses in each table along with the transformed values.

3. RESULTS AND DISCUSSION

3.1. Weed flora in experimental site

The experimental field was infested with weeds belonging to three different categories. Broadleaved weeds comprised of major share (61.86%) of weed flora composition followed by sedges (24.97 %) and grass (13.17%) when observation was recorded at 30 DAS in unweeded control. There were a total of nine different species of weeds, including *Cynodon dactylon* (L.) Pers., and *Echinochloa colona* (L.) Link among the grasses; *Cyperus iria* (L.) and *Fimbristylis miliacea* (L.) Vahl among the sedges and major broadleaf weeds included *Ludwigia parviflora* (Jacq.) Raven, *Commelina nudiflora* (L.), *Cyanotis axillaris* (L.) D. Don ex Sweet, *Phyllanthus niruri* (L.) and *Melochia corchorifolia* (L.). *Ludwigia parviflora, C. dactylon* and *F. miliacea* were predominant weed throughout the cropping period. Ahmed and Susheela (2012) and Haji et al. (2012) observed the presence of similar type of weed flora in maize. Predominance of these weeds in lateritic soil of West Bengal during *kharif* was also reported by Duary et al. (2015), Duary et al. (2016), Malik et al. (2021).

3.2. Effect on weeds

The unweeded control had the highest observed total weed density and biomass at 30, 60 and 90 DAS. Among the herbicidal treatments, application of tembotrione at 120 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1}+atrazine 500 g ha^{-1} registered significantly the lowest value of grass, broadleaf, sedge and total weed density. However, it was at par with tembotrione at 100 g ha^{-1}+stefesmero at 733 g ha^{-1}+atrazine at 500 g ha^{-1} for grassy weed only at 30, 60 and 90 DAS (Table 1, 2 and 3). Higher dose of tembotrione at 120 g ha^{-1}+stefesmero at 733 g ha^{-1}+atrazine 500 g ha^{-1} registered the lowest biomass of grass, broadleaf, sedges and total weed which was statistically on par with tembotrione at

Table 1: Effect of treatments on density and biomass of weeds in maize at 30 DAS

Treatments	Weed density (No.m^{-2})				Weed biomass (g m^{-2})			
	Grass	BLW	Sedge	Total	Grass	BLW	Sedge	Total
Tembotrione at 80 g ha^{-1}+stefes mero at 733 g ha^{-1}	4.70 (21.67)	11.98 (143.0)	3.18 (9.67)	13.22 (174.3)	1.74 (2.70)	4.85 (23.26)	0.93 (0.38)	5.25 (26.34)
Tembotrione at 80 g ha^{-1}+stefes mero at 733 g ha^{-1}+atrazine at 500 g ha^{-1}	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
Tembotrione at 100 g ha^{-1}+stefes mero at 733 g ha^{-1}	3.82 (14.33)	11.02 (121.0)	1.82 (3.0)	11.78 (138.3)	1.70 (1.95)	4.57 (20.40)	0.77 (0.10)	4.80 (22.45)
Tembotrione at 100 g ha^{-1}+stefes mero at 733 g ha^{-1}+atrazine at 500 g ha^{-1}	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
Tembotrione at 120 g ha^{-1}+stefes mero at 733 g ha^{-1}	1.72 (3.00)	9.88 (98.00)	0.71 (0.0)	10.03 (101.0)	1.10 (0.84)	4.22 (17.71)	0.71 (0.0)	4.31 (18.60)
Tembotrione at 120 g ha^{-1}+stefes mero at 733 g ha^{-1}+atrazine at 500 g ha^{-1}	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
Atrazine at 1000 gha^{-1}	0.71 (0.0)	2.00 (4.3)	0.71 (0.0)	2.00 (4.3)	0.71 (0.0)	0.96 (0.45)	0.71 (0.0)	0.96 (0.45)
Two hand-weeding at 25 and 40 DAS	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
Unweeded control	6.51 (42.0)	14.04 (197.3)	8.93 (79.67)	17.86 (319.0)	2.86 (7.75)	5.66 (31.57)	2.10 (3.95)	10.62 (43.27)
SEm±	0.21	0.34	0.17	0.37	0.12	0.21	0.05	0.28
CD (p=0.05)	0.63	1.11	0.59	1.12	0.37	0.60	0.13	0.84

Table 2: Effect of treatments on density and biomass of weeds in maize at 60 DAS

Treatments	Weed density (No. m^{-2})				Weed biomass (g m^{-2})			
	Grass	BLW	Sedge	Total	Grass	BLW	Sedge	Total
Tembotrione at 80 g ha^{-1}+stefes mero at 733 g ha^{-1}	51.00	158.00	49.00	258.00	13.04	75.44	14.38	102.77
Tembotrione at 80 g ha^{-1}+stefes mero at 733 g ha^{-1}+atrazine at 500 g ha^{-1}	12.33	35.00	16.33	63.67	2.40	15.86	3.01	21.94
Tembotrione at 100 g ha^{-1}+stefes mero at 733 g ha^{-1}	29.33	147.33	33.33	210.33	6.89	74.26	7.35	88.15
Tembotrione at 100 g ha^{-1}+stefes mero at 733 g ha^{-1} +atrazine at 500 g ha^{-1}	11.00	31.00	14.67	56.67	1.87	13.83	2.71	18.41
Tembotrione at 120 g ha^{-1}+stefes mero at 733 g ha^{-1}	27.33	128.00	23.33	178.67	7.38	57.45	5.48	70.31
Tembotrione at 120 g ha^{-1}+stefes mero at 733 g ha^{-1} +atrazine at 500 g ha^{-1}	7.33	15.00	6.67	29.00	1.77	8.90	1.67	11.34
Atrazine at 1000 gha^{-1}	21.33	42.00	14.67	78.00	3.86	19.16	3.16	26.18
Two hand-weeding at 25 and 40 DAS	13.00	31.33	30.67	75.00	3.18	14.87	7.64	25.69
Unweeded control	82.33	212.00	98.33	392.67	35.65	115.10	53.35	202.94
SEm±	1.58	3.74	2.34	6.07	0.51	2.43	0.83	4.01
CD (p=0.05)	4.72	11.20	7.02	18.2	1.52	7.27	2.48	12.03

Table 3: Effect of treatments on density and biomass of weeds in maize at 90 DAS

Treatments	Weed density (No.m^{-2})				Weed biomass (g m^{-2})			
	Grass	BLW	Sedge	Total	Grass	BLW	Sedge	Total
Tembotrione at 80 g ha^{-1}+stefes mero at 733 g ha^{-1}	50.67	123.67	39.33	213.67	12.74	77.66	12.52	102.88
Tembotrione at 80 g ha^{-1}+stefes mero at 733 g ha^{-1}+atrazine at 500 g ha^{-1}	8.67	36.33	10.00	55.00	2.37	15.91	2.13	20.41
Tembotrione at 100 g ha^{-1}+stefes mero at 733 g ha^{-1}	23.33	102.33	31.67	157.33	6.28	72.15	9.37	90.74
Tembotrione at 100 g ha^{-1}+stefes mero at 733 g ha^{-1}+atrazine at 500 g ha^{-1}	6.33	28.67	9.33	44.33	1.81	13.07	1.95	16.93
Tembotrione at 120 g ha^{-1}+stefes mero at 733 g ha^{-1}	26.33	85.67	26.33	138.33	6.04	61.30	8.22	75.19
Tembotrione at 120 g ha^{-1}+stefes mero at 733 g ha^{-1}+atrazine at 500 g ha^{-1}	5.67	27.67	9.33	42.67	1.70	12.23	1.90	15.82
Atrazine at 1000 g ha^{-1}	15.67	45.33	11.00	72.00	3.08	22.86	3.78	29.72
Two hand-weeding at 25 and 40 DAS	25.67	52.00	23.33	101.00	6.10	20.84	7.40	34.35
Unweeded control	79.00	171.00	80.67	330.67	28.27	109.46	68.65	205.16
SEm±	1.15	3.28	1.07	6.32	0.42	1.97	0.75	3.77
CD(p=0.05)	3.42	9.71	3.19	18.94	1.25	5.89	2.24	11.32

100 g ha^{-1}+stefes mero surfactant at 733 g ha^{-1}+atrazine 500 g ha^{-1}, tembotrione at 80 g ha^{-1}+stefesmero at 733 g ha^{-1}+atrazine 500 g ha^{-1}. However, hand-weeding twice was also on par with those treatments except total weed biomass at 60 DAS and all categories of weed at 90 DAS. It is in the same line with the finding of Singh et al. (2012). The combined application of tembotrione and atrazine at the highest dose registered the highest weed control efficiency (100% at 30 DAS, 94.4% at 60 DAS and 92.3% at 90 DAS) among the herbicidal treatments, but it was very close to that of tembotrione at 100 g ha^{-1}+stefesmero at 733 g ha^{-1}+atrazine at 500 g ha^{-1} and tembotrione at 80 g ha^{-1}+stefesmero surfactant at 733 g+atrazine at 500 g ha^{-1} (Figure 1). Singh et al. (2012), Sanodiya et al. (2013) and Woznica and Idziak (2014) also reported similar results of satisfactory weed control with herbicide mixture and reduced rates of herbicide with adjuvants in maize.

3.3. *Effect on crop*

All the weed management treatments exhibited significant

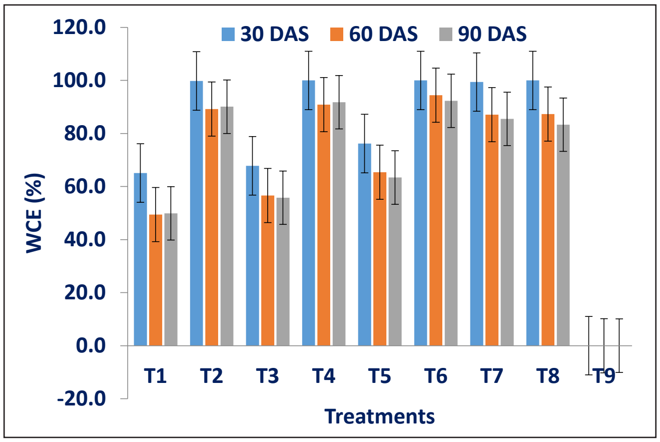

Figure 1: Weed control efficiency of different treatments in maize field at 30, 60 and 90 DAS

variation in growth and yield attributes and ancillary parameters like girth of cob, kernels cob^{-1}, kernel rows cob^{-1} and 500 kernel weight. The unweeded control recorded the lowest values of plant height, yield components and yield which might be due to severe competition exerted by grassy, broadleaf and sedge weeds throughout the growth period on maize by shading of weeds or overcrowding in crop–weed ecosystem and competing with the crop for space, light and nutrients. Tembotrione at 100 g ha^{-1}+stefesmero at 733 g ha^{-1}+atrazine 500 g ha^{-1} registered the highest plant height and was at par with the lower and higher doses of combined application of tembotrione with stefesmero surfactants and atrazine. The treatment tembotrione at 120 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1}+atrazine at 500 g ha^{-1} and hand-weeding twice resulted in the highest average girth of cob, which were statistically at par with tembotrione at 100 g ha^{-1}+stefesmero at 733 g ha^{-1}+atrazine 500 g ha^{-1}and tembotrione at 80 g ha^{-1}+stefesmero at 733 g ha^{-1}+atrazine 500 g ha^{-1} (Table 4). The highest number of kernels cob^{-1} and number of kernel rows cob^{-1} were recorded in two hand-weeding at 25 and 40 DAS which was statistically at par with tembotrione at 80, 100 and 120 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1}+atrazine500 g ha^{-1}. Combined application of tembotrione and atrazine at 100 g ha^{-1}and 500 g ha^{-1} along with stefesmero surfactant at 733 g ha^{-1} recorded the highest seed index which was statistically at par with all

Table 4: Yield components and yield of maize and weed index of different treatments

Treatments	Plant height at harvest (cm)	Average girth of cob (cm)	No. of kernel rows cob^{-1}	No. of kernels cob^{-1}	Seed index (g)	Grain yield (kg ha^{-1})	Weed index (%)
Tembotrione at 80 g ha^{-1}+stefes mero at 733 g ha^{-1}	141.6	10.27	10.67	290.9	14.17	3450	24.62
Tembotrione at 80 g ha^{-1}+stefes mero at 733 g ha^{-1}+atrazine at 500 g ha^{-1}	168.3	14.38	13.00	376.7	16.12	4105	10.31
Tembotrione at 100 g ha^{-1}+stefes mero at 733 g ha^{-1}	151.5	11.41	11.33	303.1	14.50	3772	17.59
Tembotrione at 100 g ha^{-1}+stefes mero at 733 g ha^{-1}+atrazine at 500 g ha^{-1}	169.2	14.96	13.33	380.1	16.22	4577	0.0
Tembotrione at 120 g ha^{-1}+stefes mero at 733 g ha^{-1}	154.8	12.08	12.00	314.7	15.57	3808	16.80
Tembotrione at 120 g ha^{-1}+stefes mero at 733 g ha^{-1}+atrazine at 500 g ha^{-1}	162.0	15.04	12.33	368.4	15.90	4315	5.72
Atrazine at 1000 gha^{-1}	150.3	12.15	11.67	307.7	14.81	3803	16.91
Two hand-weeding at 25 and 40 DAS	162.8	15.04	13.67	383.9	16.20	4522	1.20
Unweeded control	132.9	9.69	9.33	257.3	13.04	2379	48.02
SEm±	6.94	0.76	0.59	16.17	0.62	162	
CD(p=0.05)	20.9	2.25	1.76	48.50	1.82	484	-

other treatments except tembotrione at 80 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1} and unweeded control. A drop in production of roughly 48% was induced in *kharif* maize due to weed infestation. The post-emergence application of tembotrione at 100 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1} +atrazine 500 g ha^{-1} resulted in the highest grain yield (4577 kg ha^{-1}), which was comparable to tembotrione at 80 g ha^{-1}+stefesmero at 733 g ha^{-1}+atrazine 500 g ha^{-1}, tembotrione at 120 g ha^{-1}+stefesmero at 733 g ha^{-1}+atrazine 500 g ha^{-1} and hand-weeding at 25 and 40 DAS. The lowest weed index was recorded with the post-emergence application of tembotrione at 100 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1}+atrazine 500 g ha^{-1} which was very close to that of tembotrione at 120 g ha^{-1}+stefesmero at 733 g ha^{-1}+atrazine 500 g ha^{-1} and hand-weeding at 25 and 40 DAS (Table 4).This finding was in accordance with those of Sharma et al. (2000), Deshmukh et al. (2009), Singh et al. (2012), Woznica and Idziak (2014) and Sharma et al. (2018) who reported higher yield of maize with sole application of arazine and when mixed with tembotrione along with surfactant. These treatments had a higher weed control efficiency, which resulted in an increase in accessibility of space, light and nutrients. This led to higher values of growth characteristics, a greater number of kernels and eventually a larger yield. The lowest grain yield (2379 kg ha^{-1}) was recorded under unweeded control.

3.4. Economics

Hand-weeding twice at 25 and 40 DAS incurred the highest cost of cultivation due to higher wages of laborers to do the task (Table 5). Sole application of atrazine at 1000 g ha^{-1} registered the lowest cost of cultivation among the weed management treatments. Tembotrione at 100 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1}+atrazine 500 g ha^{-1} recorded the higher gross return which was statistically at par with two hand-weeding at 25 and 40 DAS, tembotrione at 120 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1}+atrazine 500 g ha^{-1} and tembotrione at 80 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1}+atrazine 500 g ha^{-1}. The highest net return and return per rupee invested were obtained from tembotrione at 100 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1}+atrazine 500 g ha^{-1} which was statistically at par with tembotrine at 120 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1}+atrazine 500 g ha^{-1} and tembotrione at 80 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1}+atrazine 500 g ha^{-1}. Higher net return was due to higher grain and stover yield of the crop obtained from the above treatments and lower cost of cultivation over hand-weeding twice. Though the higher gross return was obtained from the hand-weeding at 25 and 40 DAS but the cost of cultivation was much higher than other treatments resulting in lower net return. Similar finding of higher economic return with chemical weed management in maize was reported by Riaz et al. (2007) and Haji et al. (2012). The lowest gross return, net return and return $rupee^{-1}$ invested were received from unweeded plot due to poor growth of the crop, greater competition between maize and weeds which led to produce the lower grain and stover yield.

Table 5: Economics of maize cultivation under different treatments

Treatments	Cost of cultivation (₹ ha^{-1})	Gross return (₹ ha^{-1})	Net return (₹ ha^{-1})	Return ₹$^{-1}$ invested
Tembotrione at 80 g ha^{-1}+stefes mero at 733 g ha^{-1}	21105	49762	28657	2.36
Tembotrione at 80 g ha^{-1}+stefes mero at 733 g ha^{-1}+atrazine at 500 g ha^{-1}	21405	58680	37275	2.74
Tembotrione at 100 g ha^{-1}+stefes mero at 733 g ha^{-1}	21623	54259	32636	2.51
Tembotrione at 100 g ha^{-1}+stefes mero at 733 g ha^{-1}+atrazine at 500 g ha^{-1}	21923	65073	43150	2.97
Tembotrione at 120 g ha^{-1}+stefes mero at 733 g ha^{-1}	22108	54783	32675	2.48
Tembotrione at 120 g ha^{-1}+stefes mero at 733 g ha^{-1}+atrazine at 500 g ha^{-1}	22408	61581	39173	2.75
Atrazine at 1000 gha^{-1}	19636	54671	35035	2.78
Two hand-weeding at 25 and 40 DAS	28216	64213	35997	2.28
Unweeded control	19036	34776	15740	1.83
SEm±		2402	2402	0.11
CD(p=0.05)	–	7210	7210	0.32

1US$= 62.56 INR (average value of the harvesting month of the crop)

4. CONCLUSION

Tembotrione at 100 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1}+atrazine at 500 g ha^{-1} significantly reduced the weed infestation, recorded lower weed density and biomass with higher values of weed control efficacy, yield attributes and yield of maize which were similar with tembotrione both at 80 and 120 g ha^{-1}+stefesmero surfactant at 733 g ha^{-1}+atrazine 500 g ha^{-1}

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