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WEED CONTROL EFFICIENCY OF SULFENTRAZONE AND ITS INFLUENCE ON YIELD ATTRIBUTES AND YIELD OF FODDER MAIZE (*ZEA MAYS* L.)

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SUMMARY

A field experiment was conducted on sandy clay loam soil from March to July 2022 to study the weed control efficiency of Sulfentrazone and its effect on yield parameters and yield of fodder maize at Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA & RI), Karaikal. The experiment included sixteen treatments comprising sulfentrazone applied with six doses (180, 210, 240, 270, 300, and 360 g/ha) on the day of sowing and 3rd DAS. It also included the application of atrazine (250 g/ha), hand weeding twice at 20 and 40 DAS (farmer's practice), weed-free throughout the crop growth, and unweeded control (without weed management). The experiment was statistically tested using a Randomized Block Design with three replications. From the present study, it was concluded that the effective and economical control of weeds with higher seed yield of fodder maize was obtained by the application of Sulfentrazone 39.6% (w/w) SC @ 180 g a.i./ha on the day of sowing or 3rd DAS.

Key words: Sulfentrazone, fodder maize, weed control efficiency, yield attributes, yield

Livestock is a significant factor in boosting farmers' economy in India and is the primary source of income for two-thirds of the rural population. It is essential for nutritional security, especially for small and marginal farmers. The cultivation of high-quality fodder is essential for the development of the livestock industry in tropical nations since animal productivity is significantly associated with the availability of fodder. By 2050, India would require a total of 631 m.t. and 1012 m.t of dry fodder and green fodder, respectively. However, the present availability of green fodder is 734.1 m.t. and dry fodder is 326.4 m.t. (Singh *et al*., 2022). So, there exists a substantial disparity between the supply and demand of fodder in the country.

Maize is a preferred crop among those used for annual cereal fodder because of its quick-growing nature, high yield, and ability to produce palatable, nutritional fodder. Furthermore, due to its greater adaptability to a wide range of environmental factors, cropping seasons, and water requirements, it is a useful crop for providing nutrient-rich fodder all year round. Seed is the most critical input to enhance the production potential of all crops, including fodder. Therefore, an assured supply of fodder seeds of improved varieties/ hybrids to farmers at a reasonable price is crucial for enhancing fodder production.

The importance of weed management seldom requires any mention, especially under the present-day high-input farming system. If weeds are not controlled, excessive weed growth in a maize field can result in a 25-80% reduction in crop production, or even a complete crop failure (Karlen and Camp, 1985). Manual weed control is a problem particularly in large farm holdings because of a shortage of labor. Hence, the use of herbicides is recommended. Herbicides are effective and cheaper with scarce labor for farm operations. Maximum weed competition in fodder maize occurs within the period of 2 - 6 weeks after sowing (Amiri *et al*., 2014). Hence, early control of weeds was suggested in fodder maize.

There are several herbicides applied on fodder maize cultivation to control weeds such as atrazine and pendimethalin which were found to be effective for weed control. Sulfentrazone belonging to the triazolinone group of herbicides can effectively control the most important perennial and annual species of broadleaf weeds, sedges, and grasses (Bhuiyan *et al*., 2017).

Keeping in view the above-mentioned

thoughts from the literature, this present study was designed to evaluate the effect of sulfentrazone on weed control, yield component, and yield of fodder maize.

MATERIALS AND METHODS

A field experiment was conducted at Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal from March to July 2022. The experimental site is located at 10°55'N latitude, 79°49'E longitude, and with an altitude of 4 meters above the mean sea level, Karaikal has a tropical climate with a mean maximum and minimum temperature of 33.1 and 23.9° C, respectively. The mean annual rainfall is 1384.6 mm, annual evaporation is 1888.8 mm and the annual bright sunshine hours is 2514.3. The soil has a sandy clay loam texture with a pH of 7.10 and EC of 0.11 dSm^{-1}. The soil fertility was low in available nitrogen (171.3 kg/ha), high in available phosphorus (35.2 kg/ha), and medium in available potassium (189.7 kg/ha), respectively.

The experiment included sixteen treatments comprising of Sulfentrazone 39.6% (w/w) SC @ 180 g a.i. ha^{-1} on the day of sowing (T_1), Sulfentrazone 39.6% (w/w) SC @ 180 g a.i./ha on 3rd DAS (T_2), Sulfentrazone 39.6% (w/w) SC @ 210 g a.i. ha^{-1} on the day of sowing (T_3), Sulfentrazone 39.6% (w/w) SC @ 210 g a.i./ha on 3rd DAS (T_4), Sulfentrazone 39.6% (w/w) SC @ 240 g a.i. ha^{-1} on the day of sowing (T_5), Sulfentrazone 39.6% (w/w) SC @ 240 g a.i./ha on 3rd DAS (T_6), Sulfentrazone 39.6% (w/w) SC @ 270 g a.i./ha on the day of sowing (T_7), Sulfentrazone 39.6% (w/w) SC @ 270 g a.i./ha on 3rd DAS (T_8), Sulfentrazone 39.6% (w/w) SC @ 300 g a.i./ha on the day of sowing (T_9), Sulfentrazone 39.6% (w/w) SC @ 300 g a.i./ha on 3rd DAS (T_{10}), Sulfentrazone 39.6% (w/w) SC @ 360 g a.i./ha on the day of sowing (T_{11}), Sulfentrazone 39.6% (w/w) SC @ 360 g a.i./ha on 3rd DAS (T_{12}), Atrazine @ 250 g a.i./ha on 3rd DAS (T_{13}), Hand weeding twice @ 20 DAS and 40 DAS (T_{14}), Weed free check (T_{15}) and Unweeded control (T_{16}) in a randomized block design with three replications.

African tall variety of fodder maize were manually sown on the sides of ridges by adopting a spacing of 60 cm × 20 cm. Standard agronomic procedures except weed management were followed for the experimental fodder maize crop.

A quadrat of size 0.25 m^2 was placed randomly at four places in the sampling area of each plot and the weeds present within the frames of the quadrat were counted and recorded and the mean values were expressed in m^2. The weeds collected from each plot were air-dried and then oven-dried at 70°C for 72 hours and expressed in g m^2. Weed control efficiency was computed using the following formula:

$$WCE\ (\%) = \frac{DMC - DMT}{DMC} \times 100$$

Where,
DMC= Dry matter of weeds in the control plot and,
DMT= Dry matter of weeds in the treated plot

Observations on cob length, cob girth, number of grain rows cob^{-1}, number of grains row^{-1}, test weight, seed yield, and stover yield were taken plot-wise.

RESULTS AND DISCUSSION

Weed control efficiency

Weed control efficiency is the measure of the effectiveness of weed control treatments based on the dry weight of weeds. The value of weed control efficiency normally ranges from 0 to 100 and in principle, a weedy check always has weed control efficiency as 0 and weed free check as 100. Therefore, the higher the value of the weed control efficiency of treatment, the greater the weed control efficiency of that treatment. The data revealed that weed control efficiency decreased from 30 DAS to maturity as the age of the crop progressed (Fig. 1).

The highest weed control efficiency was recorded with a weed-free check. Maintenance of weed-free conditions throughout the crop growth period could be attributed to this. These results are in conformity with the findings of Malviya *et al.* (2012).

Among the sulfentrazone doses, the highest weed control efficiency was observed with the pre-emergence application of sulfentrazone @ 360 g a.i./ha on 3rd DAS (Fig. 1) which was closely followed by sulfentrazone @ 360 g a.i./ha on the day of sowing. The efficacy of these doses in managing weeds in the early stage of the crop and later emerged weeds in these plots failed to accumulate more dry matter due to crop canopy or inter-specific competition by the crop. These results corroborate the findings of Sindhu *et al.* (2015) and Karashanbhai (2016).

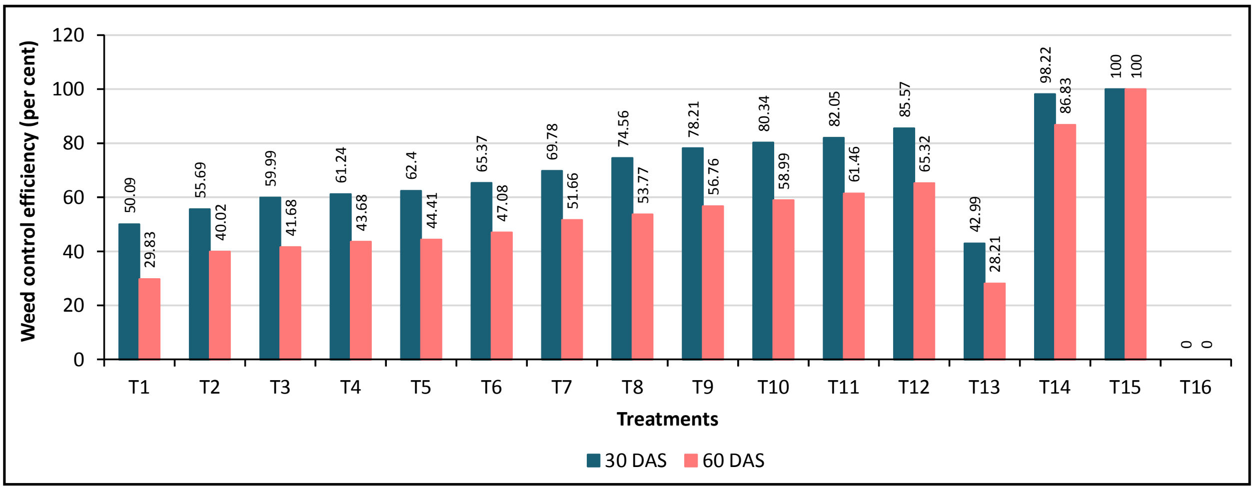

Fig. 1. Effect of herbicidal treatments on the weed control efficiency at 30 and 60 DAS.

The least weed control efficiency among the chemical treatments was observed with the application of atrazine 0.25 kg a.i./ha as pre-emergence on 3rd DAS which might be due to its inefficiency in controlling weeds.

Effect on yield attributes and yield

Cob length, cob girth, number of grains row^{-1} and test weight were significantly influenced by the herbicidal treatments except for the number of grain rows cob^{-1}.

The highest cob length, cob girth, number of grains row$^{-1,}$ and test weight were observed with the application of sulfentrazone @ 180 g a.i./ha on the day of sowing (Table 1). This was found to be statistically on par with sulfentrazone @ 180 g a.i./ha applied on 3rd DAS. The reduction in yield parameters in higher doses might be attributed to the sufficient damage caused to the plants by the phytotoxicity effect.

Yield is the net result of various interactions *viz*., soil characters, weather parameters, crop weed competition, leaf area, and various metabolic and biochemical interactions that take place during crop

TABLE 1

Effect of sulfentrazone on the yield parameters of fodder maize

Treatments	Cob length (cm)	Cob girth (cm)	No. of rows/ cob	No. of grains/ cob	Test weight (g)
T_1–Sulfentrazone 39.6% (w/w) SC @ 180 g a.i./ha on the day of sowing	13.6	12.8	12.1	26.5	30.1
T_2–Sulfentrazone 39.6% (w/w) SC @ 180 g a.i./ha on 3rd DAS	13.3	12.8	12.1	26.5	29.1
T_3–Sulfentrazone 39.6% (w/w) SC @ 210 g a.i./ha on the day of sowing	13.2	12.7	12.0	24.5	27.3
T_4–Sulfentrazone 39.6% (w/w) SC @ 210 g a.i./ha on 3rd DAS	12.9	12.6	12.0	24.3	26.8
T_5–Sulfentrazone 39.6% (w/w) SC @ 240 g a.i./ha on the day of sowing	12.3	12.5	12.0	24.3	25.6
T_6–Sulfentrazone 39.6% (w/w) SC @ 240 g a.i./ha on 3rd DAS	12.2	12.4	12.0	23.8	25.2
T_7–Sulfentrazone 39.6% (w/w) SC @ 270 g a.i./ha on the day of sowing	11.9	12.3	11.9	23.7	25.0
T_8–Sulfentrazone 39.6% (w/w) SC @ 270 g a.i./ha on 3rd DAS	11.9	12.3	11.9	22.9	24.8
T_9–Sulfentrazone 39.6% (w/w) SC @ 300 g a.i./ha on the day of sowing	11.8	12.3	11.9	22.5	24.4
T_{10}–Sulfentrazone 39.6% (w/w) SC @ 300 g a.i./ha on 3rd DAS	11.8	12.2	11.6	22.1	24.2
T_{11}–Sulfentrazone 39.6% (w/w) SC @ 360 g a.i./ha on the day of sowing	11.8	12.0	11.6	21.5	24.1
T_{12}–Sulfentrazone 39.6% (w/w) SC @ 360 g a.i./ha on 3rd DAS	11.7	12.0	11.5	21.3	24.0
T_{13}–Atrazine @ 250 g a.i./ha on 3rd DAS	11.7	11.9	11.2	20.9	23.5
T_{14}–Hand weeding twice @ 20 DAS and 40 DAS	11.7	11.9	11.0	20.5	23.9
T_{15}–Weed free	15.6	13.4	13.3	28.4	31.4
T_{16}–Unweeded control	11.4	10.9	10.9	20.3	23.2
S. Ed	0.96	0.50	0.57	1.47	1.73
C. D. (P = 0.05)	1.94	1.00	NS	2.96	3.48

TABLE 2
Effect of sulfentrazone on the yield of fodder maize

Treatments	Seed yield (kg/ha)	Stover yield (kg/ha)
T_1–Sulfentrazone 39.6% (w/w) SC @ 180 g a.i./ha on the day of sowing	1705.6	10561.7
T_2–Sulfentrazone 39.6% (w/w) SC @ 180 g a.i./ha on 3rd DAS	1653.1	10253.1
T_3–Sulfentrazone 39.6% (w/w) SC @ 210 g a.i./ha on the day of sowing	1607.4	9672.8
T_4–Sulfentrazone 39.6% (w/w) SC @ 210 g a.i./ha on 3rd DAS	1595.1	9487.7
T_5–Sulfentrazone 39.6% (w/w) SC @ 240 g a.i./ha on the day of sowing	1504.9	9129.6
T_6–Sulfentrazone 39.6% (w/w) SC @ 240 g a.i./ha on 3rd DAS	1465.4	9025.8
T_7–Sulfentrazone 39.6% (w/w) SC @ 270 g a.i./ha on the day of sowing	1459.3	8574.1
T_8–Sulfentrazone 39.6% (w/w) SC @ 270 g a.i./ha on 3rd DAS	1381.5	8502.5
T_9–Sulfentrazone 39.6% (w/w) SC @ 300 g a.i./ha on the day of sowing	1328.4	8172.8
T_{10}–Sulfentrazone 39.6% (w/w) SC @ 300 g a.i./ha on 3rd DAS	1296.9	8154.3
T_{11}–Sulfentrazone 39.6% (w/w) SC @ 360 g a.i./ha on the day of sowing	1265.4	7993.8
T_{12}–Sulfentrazone 39.6% (w/w) SC @ 360 g a.i./ha on 3rd DAS	1250.0	7969.1
T_{13}–Atrazine @ 250 g a.i./ha on 3rd DAS	1240.7	7051.9
T_{14}–Hand weeding twice @ 20 DAS and 40 DAS	1038.3	6700.0
T_{15}–Weed free	1970.4	15116.0
T_{16}–Unweeded control	912.3	4900.7
S. Ed	156.58	982.00
C. D. (P = 0.05)	315.47	1978.54

growth. The yield was significantly influenced by weed management practices.

The yield varied significantly among various treatments. The higher stover and seed yield was obtained with weed-free check owing to weed-free condition, the crop efficiently utilized nutrients, moisture, light, and space in turn influenced the luxuriant growth of the crop indicated by higher total dry matter production, plant height, higher number of leaves, leaf area index. These results are in conformity with the findings of Sanodiya *et al*. (2013) and Singh *et al*. (2014).

The weedy check recorded significantly the lowest seed yield over the other treatments. This might be due to poor weed control, and severe weed competition as evidenced by higher weed density and dry weight which resulted in reduced crop growth and yield attributing characters thereby resulting in lower seed yield. A similar response was observed by Singh *et al*. (2010) and Malviya *et al*. (2012).

Among the different doses of sulfentrazone, the application of Sulfentrazone @ 180 g a.i./ha on the day of sowing recorded the highest seed and stover yield (Table 2) despite lower weed control efficiency. Meanwhile, Sulfentrazone @ 360 g a.i./ha applied on the 3rd DAS recorded the lowest seed and stover yield. This might be the result of herbicide injury and late recovery of plants from the phytotoxicity effect of sulfentrazone at higher doses causing a reduction in plant growth and yield attributes. These results corroborate the findings of Nalini *et al*. (2017) where the application of sulfentrazone in soybean at a higher dose resulted in a yield reduction of up to 55 to 60 per cent when compared to other treatments. A similar result in a reduction of yield of soybean was recorded by Dalazen *et al*. (2020) where the increase in the dose of sulfentrazone resulted in a decrease in grain yield.

CONCLUSION

From this study, it can be concluded that all the treatments significantly performed better when compared with the weedy check. Phytotoxicity symptoms were exhibited in fodder maize only by sulfentrazone application at all doses. As far as yield attributes and yield are concerned, the application of sulfentrazone @ 180 g *a.i.*/ha on the day of sowing or on the 3rd DAS was found to be superior, despite showing phytotoxicity effects on fodder maize.

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