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# Influence of Weed Control Practices on Weed Growth and Productivity of Sweet Corn (*Zea mays* L. *saccharata*)

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**ABSTRACT**

A field experiment was conducted at Agricultural College Farm, Bapatla on sandy clay loam soils during the *kharif* 2013-14 to study the effect of weed control treatments on sweet corn growth and yield. Hand weedings at 15 and 30 DAS recorded the lowest density, dry weight of weeds and the highest weed control efficiency which resulted in enhanced level of plant growth, yield attributes, yield and it was comparable with pre-emergence application of atrazine @ 1.25 kg a.i $ha^{-1}$ followed by 2,4-D amine salt @ 0.5 kg a.i $ha^{-1}$ at 25-30 DAS and atrazine @ 1.25 kg a.i $ha^{-1}$ followed by intercultivation at 30 DAS. The highest benefit cost ratio was recorded with atrazine @ 1.25 kg a.i $ha^{-1}$ followed by 2,4-D amine salt @ 0.5 kg a.i $ha^{-1}$ at 25-30 DAS (3.9) and was followed by atrazine @ 1.25 kg a.i $ha^{-1}$ followed by intercultivation at 30 DAS (3.6) and two hand weedings at 15 and 30 DAS (3.4).

**Key words :** Atrazine, Sweet corn, Weed control treatments.

Maize (*Zea mays* L.) is one of the most important cereal crops occupying a prominent position in global agriculture. In India maize is grown in 8.35 M.ha with an annual production of 21.05 M.t and ranks third after Rice and Wheat in terms of production. (Ministry of agriculture, Government of India, 2012-2013).

Traditionally maize is cultivated worldwide for its grain and used for human consumption, in formulating animal and poultry feeds, in addition to industrial uses like preparation of ethanol etc. Recently special corns such as Sweet corn (*Zea mays* L. *saccharata*) have emerged as alternative food source, especially for affluent society. It is also called by others names like sugar corn and pole corn. Sweet corn has become a distinctly beloved vegetable and gained popularity among nutritive and health conscious urban masses in India and of late sweet corn consumption is increasing in rural areas also and is gaining great market potential. It can be profitable for the farmers, particularly for those cultivating lands in semi urban areas. Because of the short duration of the crop as it is harvested at milky stage around 75-80 DAS, sweet corn fits into the intensive cropping systems very well.

Wider row spacing and slow crop growth during the initial 3-4 weeks (Nagalakshmi *et al.,* 2006) makes the sweet corn highly sensitive for weed competition up to 6 weeks of initial crop growth period. Weeds can establish and grow rapidly during this period and can cause immense loss to crop growth and yield. Hence, through weed management is compulsory during critical period to realize optimum yields in sweet corn. The yield losses reported in maize due to uncontrolled weed growth ranged from 30 to 100% (Rout and Satapathy, 1996).

## MATERIAL AND METHODS

A field experiment was conducted during *kharif* 2013-14 at Agricultural College Farm, Bapatla. The soil was sandy clay loam (sand 77 %, silt 8 %, clay 15 %) with pH 7.3, organic carbon 0.48% and 255, 52.5 and 537.5 kg $ha^{-1}$ of available N, $P_2O_5$ and $K_2O$ respectively. The experiment was laid out in Randomized block design with eleven treatments replicated thrice. Sweet corn variety 'Sugar 75' was used for the study and seeds were dibbled at spacing of 60 cm X 20 cm manually. A uniform dose of 120 kg N, 60 kg each of $P_2O_5$ and $K_2O$ $ha^{-1}$ were applied in the form of urea, single super phosphate and muriate of potash. Entire quantity of phosphorus and potash and 1/3$^{rd}$ of nitrogen was applied as basal, remaining nitrogen was applied in two equal splits at knee high and tassel emergence stages. All the recommended package of practices except weed control were adopted during experimental study. Calibrated quantity of herbicides were applied as aqueous spray (500 L ha$^{-1}$) with knapsack sprayer fitted with flat fan nozzle. Pre-emergence application of atrazine @ 1.25 kg a.i ha$^{-1}$, pendimethalin @ 0.75 kg a.i ha$^{-1}$, alachlor @ 1.5 kg a.i ha$^{-1}$ was done with 24 hours after sowing of sweet corn and post-emergence application of 2,4-D amine salt @ 0.5 kg a.i ha$^{-1}$ at 26 DAS. Green cobs along with husk were harvested at milky stage. Data on weeds was recorded with quadrant (0.25 m$^2$) at four places per plot. Weeds were counted and removed for recording their dry weights. Data pertaining to weed density and dry weight was subjected to square root transformation $\sqrt{x + 0.5}$ and weed control efficiency was subjected to arc sin transformation for statistical analysis.

**Weed Control Efficiency**

Based on the weed drymatter recorded at 30, 60 DAS and at harvest, weed control efficiency (WCE) was calculated using the following formula and expressed in percentage (AICRPWC, 1988).

$$\text{WCE (\%)} = \frac{\text{DWC - DWT}}{\text{DWC}} \times 100$$

## RESULTS AND DISCUSSION

**Weed flora**

The predominant weed species observed in the experimental field were *Cyperus rotundus* among sedges, *Trianthema portulacastrum, Cleome viscosa, Euphorbia hirta* and *Phyllanthus niruri* among dicots and *Cynodon dactylon, Panicum repens* and *Dactyloctenium aegyptium* among grasses. Overall, the predominant weed species observed in the field was *Cyperus rotundus*.

**Effect on weeds**

Among the weed control methods, two hand weedings at 15 and 30 DAS ($T_2$) resulted in the lowest weed density, weed drymatter and the highest weed control efficiency throughout the crop growth period. This might be due to fact that the first hand weeding at 15 DAS eliminated all the early emerged weeds while the second hand weeding at 30 DAS removed the later germinated weeds keeping the weed density below the critical level of competition. The results are in conformity with the findings of Nagalakshmi *et al*. (2006) and Sandhya Rani *et al.* (2013).

Two hand weedings at 15 and 30 DAS was closely followed by sequential application of pre-emergence herbicides followed by post-emergence application of 2,4-D amine salt in reducing weed density and weed drymatter and higher weed control efficiency. Among these treatments lowest weed density, weed drymatter and higher weed control efficiency recorded in pre-emergence application of atrazine @ 1.25 kg a.i ha$^{-1}$ followed by 2,4-D amine salt @ 0.5 kg a.i ha$^{-1}$ at 25-30 DAS. The better performance of this combination might be due to the effective control of weeds achieved by atrazine up to 25-30 DAS and 2,4-D amine salt from thereafter and it was on par with of pre-emergence application of atrazine @ 1.25 kg a.i ha$^{-1}$ followed by intercultivation at 30 DAS. The present findings are in conformity with the findings of Sreenivas and Satyanarayana (1994) and Sinha *et al*. (2003).

**Yield attributes and yield**

Two hand weedings at 15 and 30 DAS ($T_2$) recorded the highest number of kernel rows, kernels per row, total kernels per cob, green cob weight, green cob and green fodder yield and which was comparable with that of the pre-emergence application of atrazine @ 1.25 kg a.i ha$^{-1}$ followed by 2,4-D amine salt @ 0.5 kg a.i ha$^{-1}$ at 25-30 DAS ($T_9$) and atrazine @ 1.25 kg a.i ha$^{-1}$ as pre-emergence followed by intercultivation at 30 DAS ($T_6$). The lowest yield and yield attributes were recorded with weedy check ($T_1$).

Higher yield and yield attributes in hand weeding twice and sequential application of herbicides and intercultivation might be due to greater availability of nutrients under lower weed competition, which might have promoted higher production and better translocation of photosynthates from source to sink resulted in the

Table 1. Weed dynamics as influenced by different weed control treatments in sweet corn.

| Treatments | *Weed drymatter (g m$^{-2}$) | | | *Weed density (No. m$^{-2}$) ** | | | Weed control efficiency (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 30 DAS | 60 DAS | Harvest | 30 DAS | 60 DAS | Harvest | 30 DAS | 60 DAS | Harvest |
| $T_1$ - Weedy check | 19.5 (381.7) | 20.1 (405.0) | 21.5 (464.3) | 13.2 (173.3) | 10.5 (110.2) | 10.0 (99.5) | 0.0 (0.0) | 0.0 (0.0) | 0.0 (0.0) |
| $T_2$ - Hand weeding at 15 & 30 DAS | 3.3 (12.7) | 5.0 (26.0) | 8.5 (72.0) | 3.0 (8.7) | 4.8 (23.6) | 4.2 (18.2) | 80.4 (96.7) | 75.8 (93.5) | 66.5 (83.6) |
| $T_3$ - Atrazine @ 1.25 kg a.i ha$^{-1}$ (PE) | 11.1 (122.3) | 12.9 (165.2) | 14.0 (195.3) | 6.8 (47.1) | 9.0 (80.9) | 8.4 (70.0) | 55.4 (67.5) | 50.2 (58.9) | 48.7 (56.3) |
| $T_4$ - Pendimethalin @ 0.75 kg a.i ha$^{-1}$ (PE) | 11.6 (132.3) | 13.0 (170.0) | 14.1 (200.0) | 7.7 (60.0) | 9.0 (81.3) | 8.5 (72.0) | 53.5 (64.5) | 49.8 (58.1) | 48.0 (55.0) |
| $T_5$ - Alachlor @ 1.5 kg a.i ha$^{-1}$ (PE) | 11.7 (137.7) | 13.1 (172.0) | 14.2 (207.0) | 7.8 (61.0) | 9.1 (83.0) | 8.5 (73.0) | 53.0 (63.7) | 49.5 (57.6) | 47.1 (53.5) |
| $T_6$ - Atrazine @ 1.25 kg a.i ha$^{-1}$ fb intercultivation at 30 DAS | 6.9 (48.4) | 8.4 (70.7) | 11.3 (126.7) | 4.3 (18.6) | 6.4 (40.6) | 6.2 (38.3) | 69.2 (87.0) | 65.3 (82.4) | 58.4 (72.4) |
| $T_7$ - Pendimethalin @ 0.75 kg a.i ha$^{-1}$ fb intercultivation at 30 DAS | 9.2 (85.7) | 10.7 (115.8) | 12.2 (149.0) | 5.7 (33.0) | 7.9 (62.1) | 7.2 (51.2) | 61.7 (77.0) | 57.6 (70.8) | 54.9 (66.6) |
| $T_8$ - Alachlor @ 1.5 kg a.i ha$^{-1}$ fb intercultivation at 30 DAS | 9.4 (87.7) | 11.0 (119.5) | 12.4 (154.0) | 5.8 (33.7) | 8.0 (64.1) | 7.3 (53.2) | 61.5 (77.2) | 57.0 (70.3) | 54.1 (65.2) |
| $T_9$ - Atrazine @ 1.25 kg a.i ha$^{-1}$ fb 2,4-D amine salt @ 0.5kg a.i ha$^{-1}$ at 25-30 DAS (POE) | 6.8 (46.0) | 7.9 (66.3) | 10.5 (110.7) | 4.2 (17.7) | 6.2 (38.7) | 6.0 (34.4) | 69.8 (87.8) | 66.4 (82.7) | 60.3 (75.2) |
| $T_{10}$ - Pendimethalin @ 0.75 kg a.i ha$^{-1}$ fb 2,4-D amine salt @ 0.5 kg a.i ha$^{-1}$ at 25-30 DAS (POE) | 9.1 (83.8) | 10.5 (109.7) | 11.9 (140.0) | 5.7 (32.2) | 7.6 (58.6) | 7.1 (50.5) | 62.1 (77.5) | 58.5 (72.5) | 56.5 (69.4) |
| $T_{11}$ - Alachlor @ 1.5 kg a.i ha$^{-1}$ fb 2,4-D amine salt @ 0.5 kg a.i ha$^{-1}$ at 25-30 DAS (POE) | 9.3 (86.3) | 10.6 (113.3) | 12.0 (142.7) | 5.8 (33.2) | 7.7 (60.3) | 7.2 (51.0) | 61.8 (77.3) | 58.2 (75.1) | 56.1 (68.8) |
| SEm± | 0.6 | 0.6 | 0.7 | 0.3 | 0.4 | 0.4 | 2.6 | 2.1 | 2.1 |
| CD (p=0.05) | 1.6 | 1.8 | 1.4 | 0.9 | 1.3 | 1.1 | 7.5 | 6.0 | 6.1 |
| CV (%) | 10.0 | 9.9 | 7.0 | 9.2 | 9.7 | 8.7 | 6.4 | 6.7 | 7.3 |

* Square root transformed values **Arc sin transformed values

The figures in parentheses are original values

improvement of yield. Severe weed competition reduced growth characters and drymatter accumulation in weedy check which resulted in the lowest cob weight. Similar results were also reported by Pandey *et al.* (2002) and Sunitha *et al.* (2010).

Even though sequential application of pendimethalin @ 0.75 kg a.i ha$^{-1}$ followed by post-emergence application of 2,4-D amine salt @ 0.5 kg a.i ha$^{-1}$ 25-30 DAS ($T_{10}$) or intercultivation at 30 DAS ($T_7$) and pre-emergence application of alachlor @ 1.25 kg ha$^{-1}$ followed by post-emergence application of 2,4-D amine salt @ 0.5 kg a.i ha$^{-1}$ 25-30 DAS ($T_8$) or intercultivation at 30 DAS ($T_{11}$) recorded significantly higher yield over weedy check ($T_1$), all these treatments are statistically inferior when compared to $T_2$, $T_9$ and $T_6$.

Pre-emergence herbicides alone could not improve the yield as they failed to reduce the weed germination and growth during the later part of the critical period of crop weed competition. The lowest

Table 2. Yield attributing characters as influenced different weed control treatments in sweet corn.

| Treatments | Kernels | | | Green cob weight (g) | Yield (kg ha$^{-1}$) | | *Weed index (%) | Returns (Rs. ha$^{-1}$) | | BCR (Rs.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | rows cob$^{-1}$ | row$^{-1}$ | cob$^{-1}$ | | Green cob | Green fodder | | Gross | Net | |
| $T_1$ - Weedy check | 11.9 | 24.6 | 292.4 | 120.0 | 7272 | 9972 | 45.7 (51.8) | 112072 | 40458 | 2.0 |
| $T_2$ - Hand weeding at 15 & 30 DAS | 15.2 | 35.3 | 538.2 | 219.0 | 15092 | 18830 | 0.0 (0.0) | 232029 | 147791 | 3.4 |
| $T_3$ - Atrazine @ 1.25 kg a.i ha$^{-1}$ (PE) | 13.5 | 29.1 | 391.7 | 158.7 | 9346 | 12497 | 38.1 (38.1) | 143939 | 71575 | 2.6 |
| $T_4$ - Pendimethalin @ 0.75 kg a.i ha$^{-1}$ (PE) | 13.2 | 27.7 | 366.1 | 155.0 | 9285 | 12422 | 38.4 (38.5) | 143002 | 70275 | 2.6 |
| $T_5$ - Alachlor @ 1.5 kg a.i ha$^{-1}$ (PE) | 13.1 | 27.0 | 352.7 | 153.0 | 9216 | 12210 | 38.6 (39.1) | 141903 | 61619 | 2.5 |
| $T_6$ - Atrazine @ 1.25 kg a.i ha$^{-1}$ fb intercultivation at 30 DAS | 15.0 | 33.0 | 496.2 | 203.7 | 14626 | 18688 | 9.7 (3.1) | 224996 | 145132 | 3.6 |
| $T_7$ - Pendimethalin @ 0.75 kg a.i ha$^{-1}$ fb intercultivation at 30 DAS | 14.7 | 31.0 | 457.4 | 181.3 | 12243 | 15616 | 25.1 (19.1) | 188330 | 108103 | 3.0 |
| $T_8$ - Alachlor @ 1.5 kg a.i ha$^{-1}$ fb intercultivation at 30 DAS | 14.5 | 30.3 | 457.7 | 180.7 | 11927 | 15414 | 27.2 (21.0) | 183529 | 110745 | 2.9 |
| $T_9$ - Atrazine @ 1.25 kg a.i ha$^{-1}$ fb 2,4-D amine salt @ 0.5kg a.i ha$^{-1}$ at 25-30 DAS (POE) | 15.1 | 34.0 | 513.8 | 208.3 | 14687 | 18695 | 7.80 (2.7) | 225914 | 151745 | 3.9 |
| $T_{10}$ - Pendimethalin @ 0.75 kg a.i ha$^{-1}$ fb 2,4-D amine salt @ 0.5 kg a.i ha$^{-1}$ at 25-30 DAS (POE) | 15.0 | 31.8 | 479.4 | 182.3 | 12317 | 15667 | 25.4 (18.4) | 189455 | 114923 | 3.3 |
| $T_{11}$ - Alachlor @ 1.5 kg a.i ha$^{-1}$ fb 2,4-D amine salt @ 0.5 kg a.i ha$^{-1}$ at 25-30 DAS (POE) | 14.4 | 31.7 | 439.2 | 182.0 | 12154 | 15492 | 25.8 (19.6) | 186958 | 112369 | 3.2 |
| SEm± | 0.4 | 1.2 | 20.1 | 6.8 | 682 | 886 | 2.0 | | | |
| CD (p=0.05) | 1.1 | 3.4 | 57.8 | 19.6 | 1961 | 2548 | 5.6 | - | - | - |
| CV (%) | 4.6 | 6.7 | 8.0 | 8.7 | 10.1 | 10.2 | 13.2 | | | |

*The data are arc sin transformed values. The figures in parentheses are original values yield was recorded with the weedy check ($T_1$) clearly reflecting the competition by unchecked weed growth to the crop same results were also reported by Sunitha *et al*. (2010).

**Economics**

Even though the highest gross returns Rs. 232029 $ha^{-1}$ were recorded with two hand weedings at 15 and 30 DAS ($T_2$), the net returns recorded was the highest with pre-emergence application of atrazine @ 1.25 kg a.i $ha^{-1}$ followed by 2,4-D amine salt @ 0.5 kg a.i $ha^{-1}$ at 25-30 DAS (Rs. 151745 $ha^{-1}$) followed by two hand weedings at 15 and 30 DAS (Rs. 147791 $ha^{-1}$) and atrazine @ 1.25 kg a.i $ha^{-1}$ followed by intercultivation at 30 DAS (Rs. 145132 $ha^{-1}$).

The highest benefit cost ratio was recorded with atrazine @ 1.25 kg a.i $ha^{-1}$ followed by 2,4-D amine salt @ 0.5 kg a.i $ha^{-1}$ at 25-30 DAS (3.9) and was followed by atrazine @ 1.25 kg a.i $ha^{-1}$ followed by intercultivation at 30 DAS (3.6) and two hand weedings at 15 and 30 DAS (3.4). Even though the highest gross returns were recorded with two hand weedings at 15 and 30 DAS ($T_2$) the net returns were less when compared to atrazine @ 1.25 kg a.i $ha^{-1}$ followed by 2,4-D amine salt @ 0.5 kg a.i $ha^{-1}$. This could be attributed to the high cost of labour for manual weeding and low cost of herbicides which reduced the cost of cultivation. The better benefit cost ratio with atrazine followed by 2,4-D amine salt and atrazine followed by intercultivation can also be attributed to low cost of weed control in these treatments these results are in agreement with Sreenivas and Satyanarayana (1994) and Deshmukh *et al*. (2014).

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