Effect of weed management practices on weed dynamics, growth, yield and economics spring sugarcane (Saccharum officinarum L.)

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Abstract

A field experiment was conducted to assess the performance of different weed management practices in spring sugarcane var. Co 86032 during year 2008-09 to 2010-11 at Central Sugarcane Research Station, Padegaon. In spring planted sugarcane application of Metribuzine @ 1 kg a.i. ha⁻¹ as PE + 2, 4-D @ 1 kg a.i. ha⁻¹ spray at 60 DAP + hoeing at 90 DAP found superior for control of weed in sugarcane with the highest weed control efficiency (80.80) at 120 DAP and also recorded significantly highest cane and CCS yield (115.52 and 17.33 t ha⁻¹ respectively), Net profit (₹ 54,628 ha⁻¹) and benefit cost ratio (1.72). Application of Atrazine @ 2 kg a.i. ha⁻¹ as PE + 2, 4-D @ 1 kg a.i. ha⁻¹ as PE at 60 DAP + hoeing at 90 DAP was found the next best treatment for weed control in sugarcane.

Keywords: Sugarcane, metribuzine, integrated weed management

Introduction

Adoption of improved technology based on seed nutrient and plant protection has enable the attainment of self sufficiency of food in India. However, there is a fear that it may short-lived, as a gap between food demand and supply is increasing due to high population growth rate. In this situation the urgency lies in increasing agricultural productivity with technologies that lead to remunerative, sustainable and eco-friendly agricultural system.

Sugarcane is the most important cash crop of Maharashtra. Sugar industry plays a pivotal role in the socio-economic and educational development in rural areas of Maharashtra. Many production factors are responsible for poor productivity of sugarcane viz., pure seed, nutrient and water management, aftercare operations in which weed management in a crucial one. Weeds are among the most under estimated pest, especially in India, where they cause average crop losses of 33 percent and more. Low productivity is mainly due to heavy weed infestation. (Srivastava et al., 2002) It is more appropriate that weeds, unlike insect and diseases often cause hidden symptoms of damage prior to harvest of sugarcane, and possibly also because of fatalistic attitude that weeds will always be present. Labour shortage is always there with sugarcane production (Ghosh et al., 2013). Therefore, the investigation was planned with objective to find out economical and effective weed management system in spring sugarcane.

Methodology

The field experiment was conducted to assess the performance of different weed management practices in spring sugarcane var. Co 86032 during year 2008-09 to 2010-11 at Central Sugarcane Research Station, Padegaon. The twelve treatments consisting of weedy check (T₁), Two HW at 30 and 60 DAP + 1 hoeing at 90 DAP (T₂), Atrazine @ 2 kg a.i. ha⁻¹ as PE + 2, 4-D @ 1 kg a.i. ha⁻¹ as PE at 60 DAP + hoeing at 90 DAP (T₃), Metribuzine @ 1 kg a.i. ha⁻¹ as PE + 2, 4-D @ 1 kg a.i. ha⁻¹ as PE at 60 DAP + hoeing at 90 DAP (T₄), Metribuzine @ 1 kg a.i. ha⁻¹ as PE at 15-18 DAP + hoeing at 90 DAP (T₅), Atrazine @ 2 kg a.i. ha⁻¹ as PE + Atrazine @ 2 kg a.i. ha⁻¹ as PE at 45 DAP (T₆), Metribuzine @ 1 kg a.i. ha⁻¹ as PE at 15-18 DAP + Metribuzine @ 1 kg a.i. ha⁻¹ as PE at 45 DAP (T₇), Atrazine @ 2 kg a.i. ha⁻¹ as PE + Tractor drowm cultivator at 60 DAP (T₈), Atrazine @ 2 kg a.i. ha⁻¹ as PE + Tractor drowm cultivator at 90 DAP (T₉), Atrazine @ 2 kg a.i. ha⁻¹ as PE + 2, 4-D @ 1 kg a.i. ha⁻¹ spray at 15-18 DAP as PoE + hoeing at 90 DAP (T₁₀), Atrazine @ 2 kg a.i. ha⁻¹ as PE + 2, 4-D @ 1 kg a.i. ha⁻¹ @ PoE at 15-18 DAP + Atrazine @ 2 kg a.i. ha⁻¹ as PE + 2, 4-D @ 1 kg a.i. ha⁻¹ as PoE at 45 DAP (T₁₁) and Metribuzine @ 1 kg a.i. ha⁻¹ PoE at 15-18 DAP + power tiller with rotavator at 90 DAP (T₁₂)
replicated thrie in randomised block design. The sugarcane var. Co 86032 was planted in spring season with 120 cm row spacing in gross and net plot size 10 m x 7.20 m and 8 m x 4.80 m, respectively. The crop was fertilized with 300:140:140 kg ha\(^{-1}\) N, P\(_2\)O\(_5\) and K\(_2\)O. The soil of experimental plot was medium black.

**Results**

**Weed studies: Weed flora**

The major monocot weed flora observed in experimental plot was viz., Cynodon dactylon, Panicum isachamii, Commelina abenghalensis, Brachyema spp, Convul varfulvaris, and dicot viz., Parthenium hysterothorus, Portulaca oleracea, Ameranthu sviridis, Digeria arvensis, Ipomea aquatica, Eclipta spp., Xanthium strumarium and Euphorbia spp. Cyperus rotundus was observed under sedges.

**Weed Dynamics**

The data on effect of different weed management treatments on weed intensity, dry weight of weeds and weed control efficiency (WCE) are presented in Table 1. At 30 DAP application of Atrazine @ 2 kg a.i. ha\(^{-1}\) as PE + 2,4-D @ 1 kg a.i. ha\(^{-1}\) as PoE at 15-18 DAP + hoeing at 90 DAP (T\(_{10}\)) significantly reduced the weed intensity which was found at par with Metribuzine @ 1 kg a.i. ha\(^{-1}\) as PoE at 15-18 DAP + power tiller with rotator at 90 DAP (T\(_{12}\)), Atrazine @ 2 kg a.i. ha\(^{-1}\) as PE + 2,4-D @ 1 kg a.i. ha\(^{-1}\) as PoE at 15-18 DAP+ Atrazine @ 2 kg a.i. ha\(^{-1}\), +2,4-D @ 1 kg a.i. ha\(^{-1}\) as PoE at 45 DAP (T\(_{11}\)), Metribuzine @ 1 kg a.i. ha\(^{-1}\) spray at 15-18 DAP + Metribuzine @ 1 kg a.i. ha\(^{-1}\) as PoE at 45 DAP (T\(_{1}\)) and Metribuzine @ 1 kg a.i. ha\(^{-1}\) as PoE spray at 15-18 DAP + hoeing at 90 DAP (T\(_{1}\)). The dry weight of weeds at 30 DAP was significantly lower in application of Atrazine @ 2 kg a.i. ha\(^{-1}\) as PE + 2,4-D @ 1 kg a.i. ha\(^{-1}\)as PoE at 15-18 DAP+ Atrazine @ 2 kg a.i. ha\(^{-1}\), + 2,4-D @ 1 kg a.i. ha\(^{-1}\) as PoE at 45 DAP (T\(_{11}\)) which was found at par with T\(_{12}, T_{10}, T_9, T_7, T_5, T_3, T_2, T_1\) and T\(_{11}\). While weed control efficiency was higher in T\(_{11}\) and T\(_{12}\) (Table 1). At 60 DAP, application of Metribuzine @ 1 kg a.i. ha\(^{-1}\) spray at 15-18 DAP + Metribuzine @ 1 kg a.i. ha\(^{-1}\) as PoE at 45 DAP (T\(_{1}\)) was found most significant in reduction of weed intensity and dry weight of weed, which is followed by T\(_{11}\) with respect to weed intensity and T\(_{6}, T_{11}, T_7, T_5, T_3, T_1\) and T\(_{1}\) were found at par with T\(_{7}\) with respect to dry weight of weed. Application of Metribuzine @ 1 kg a.i. ha\(^{-1}\) spray at 15-18 DAP + Metribuzine @ 1 kg a.i. ha\(^{-1}\) as PoE at 45 DAP (T\(_{1}\)) recorded higher WCE at 60 DAP. The results are confirmative to Ghosh et al., 2012\(^{[2]}\).

At 90 DAP the weed intensity was significantly reduced due to application of Atrazine @ 2 kg a.i. ha\(^{-1}\) as PE + Tractor drawn cultivator at 60 DAP (T\(_{9}\)) which was found at par with treatment T\(_{3}, T_7, T_3, T_2, T_7, T_{11}\) with respect to dry weight of weeds. Significant dry weight of weeds was observed in two weeding at 30 and 60 DAP + 1 hoeing at 90 DAP (T\(_{1}\)) and application of Atrazine @ 2 kg a.i. ha\(^{-1}\) as PE + Tractor drawn cultivator at 60 DAP (T\(_{8}\)) which was found at par with all the treatment except T\(_{7}\) and control. The highest weed control efficiency at 90 DAP was observed in application of Atrazine @ 2 kg a.i. ha\(^{-1}\)as PE + Tractor drawn cultivator at 60 DAP (T\(_{9}\)). At 120 DAP, significantly the lowest weed intensity and dry weight of weeds was recorded due to application of Metribuzine @ 1 kg a.i. ha\(^{-1}\) as PE + 2,4-D @ 1 kg a.i. ha\(^{-1}\) as PoE at 60 DAP + hoeing at 90 DAP (T\(_{6}\)) which was found at par with treatment T\(_{12}, T_2, T_9, T_7, T_5, T_3, T_2, T_1\) and T\(_{11}\) with respect to dry weight of weeds. Also the highest weed control efficiency was observed with the application of Metribuzine @ 1 kg a.i. ha\(^{-1}\) as PE + 2,4-D @ 1 kg a.i. ha\(^{-1}\) as PoE at 60 DAP + hoeing at 90 DAP (T\(_{9}\)) at 120 DAP. The results are inconformity with Raskar (2004)\(^{[3]}\) and Tej Pratap et al. (2013)\(^{[7]}\).

**Growth, cane and CCS yield**

The data presented in Table 1 revealed that, application of Metribuzine @ 1 kg a.i. ha\(^{-1}\) as PE spray + 2, 4-D @ 1 kg a.i. ha\(^{-1}\) as PoE at 60 DAP + hoeing at 90 DAP observed significantly the highest millable height (239 cm) and millable canes (98093 ha\(^{-1}\)) and cane yield (115.52 t ha\(^{-1}\)) and CCS yield (17.23 t ha\(^{-1}\)) than other treatments. While the cane yield was found at par with application of Atrazine @ 2 kg a.i. ha\(^{-1}\) as PE + 2,4-D @ 1 kg a.i. ha\(^{-1}\) as PoE at 60 DAP + hoeing at 90 DAP (111.80 t ha\(^{-1}\)). Similar results have been reported by Sokolova (2010)\(^{[4]}\), Srivastava (2005)\(^{[5]}\) and Tomar (2003)\(^{[8]}\).

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Weed density (no./m(^2))</th>
<th>Weed dry wt. (g/m(^2))</th>
<th>WCE (%)</th>
<th>Millable height (cm)</th>
<th>Millable Canes /ha</th>
<th>Cane yield (t/ha)</th>
<th>CCS yield (t/ha)</th>
<th>Net profit (rupee/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(_{1}): Weed check</td>
<td>35.00</td>
<td>46.00</td>
<td>90.00</td>
<td>64.00</td>
<td>3.00</td>
<td>95910</td>
<td>94205</td>
<td>93090</td>
</tr>
<tr>
<td>T(_{2}): Two weeding at 30 and 60 DAP + 1</td>
<td>33.00</td>
<td>21.00</td>
<td>18.00</td>
<td>33.00</td>
<td>14.00</td>
<td>230</td>
<td>93866</td>
<td>36291</td>
</tr>
<tr>
<td>T(_{3}): Atrazine @ 2 kg a.i. ha(^{-1})</td>
<td>17.00</td>
<td>5.56</td>
<td>3.91</td>
<td>30.00</td>
<td>13.20</td>
<td>230</td>
<td>93866</td>
<td>36291</td>
</tr>
<tr>
<td>T(_{4}): Metribuzine @ 1 kg a.i. ha(^{-1})</td>
<td>11.00</td>
<td>19.00</td>
<td>14.00</td>
<td>9.00</td>
<td>12.00</td>
<td>230</td>
<td>93866</td>
<td>36291</td>
</tr>
<tr>
<td>T(_{5}): Metribuzine @ 1 kg a.i. ha(^{-1})</td>
<td>8.00</td>
<td>16.00</td>
<td>12.00</td>
<td>15.00</td>
<td>11.00</td>
<td>230</td>
<td>93866</td>
<td>36291</td>
</tr>
<tr>
<td>T(_{6}): Atrazine @ 2 kg a.i. ha(^{-1}) as PE + Atrazine @ 2 kg a.i. ha(^{-1}) as PoE at 45 DAP</td>
<td>17.00</td>
<td>17.00</td>
<td>12.00</td>
<td>9.00</td>
<td>10.00</td>
<td>230</td>
<td>93866</td>
<td>36291</td>
</tr>
<tr>
<td>T(_{7}): Metribuzine @ 1 kg a.i. ha(^{-1}) as PE as PoE at 15-18 DAP + hoeing at 90 DAP</td>
<td>17.00</td>
<td>17.00</td>
<td>12.00</td>
<td>9.00</td>
<td>10.00</td>
<td>230</td>
<td>93866</td>
<td>36291</td>
</tr>
</tbody>
</table>

\[:\]
Atrazine @ 2 kg a.i. ha⁻¹ as PoE at 45 DAP. Application of Metribuzine @ 1 kg a.i. ha⁻¹ as PoE at 45 DAP + hoeing at 90 DAP. 

<table>
<thead>
<tr>
<th>Treatment</th>
<th>CCS yield (t ha⁻¹)</th>
<th>DAP</th>
<th>PoE</th>
<th>SE</th>
<th>CD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrazine @ 2 kg a.i. ha⁻¹ as PoE + Tractor drawn cultivator at 60 DAP.</td>
<td>54.628</td>
<td>41.8</td>
<td>20.0</td>
<td>0.50</td>
<td>1.39</td>
</tr>
<tr>
<td>Metribuzine @ 1 kg a.i. ha⁻¹ as PoE at 45 DAP + power tiller with rotator at 90 DAP.</td>
<td>25.723</td>
<td>41.2</td>
<td>20.0</td>
<td>0.50</td>
<td>1.39</td>
</tr>
</tbody>
</table>

Economics

The data presented in Table 1 showed that, the Metribuzine @ 1 kg a.i. ha⁻¹ as PE + 2, 4-D @ 1 kg a.i. ha⁻¹ as PoE at 60 DAP + hoeing at 90 DAP realized the higher net profit (₹ 54628 ha⁻¹) and benefit: cost ratio (1.72) followed by Atrazine @ 2 kg a.i. ha⁻¹ as PE + 2, 4-D @ 1 kg a.i. ha⁻¹ as PoE at 60 DAP + hoeing at 90 DAP.

Conclusion

In spring planted sugarcane application of Metribuzine @ 1 kg a.i. ha⁻¹ as PE + 2, 4-D @ 1 kg a.i. ha⁻¹ spray at 60 DAP + hoeing at 90 DAP found superior for control of weed in sugarcane with the highest weed control efficiency (80.80) at 120 DAP and also recorded significantly highest can and CCS yield (115.52 and 17.33 t ha⁻¹ respectively), Net profit (₹ 54628 ha⁻¹) and benefit cost ratio (1.72). Application of Atrazine @ 2 kg a.i. ha⁻¹ as PE + 2, 4-D @ 1 kg a.i. ha⁻¹ as PoE at 60 DAP + hoeing at 90 DAP was found the next best treatment for weed control in sugarcane.

References