Weed management in spring-planted sugarcane (Saccharum officinarum)-based intercropping systems

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ABSTRACT

Field studies were conducted during spring seasons of 2000-01, 2001-02 and 2002-03 on a sandy loam soil to evaluate relative profitability of intercropping spring-planted sugarcane (Saccharum officinarum L.) with greengram [Phaseolus radiatus (L.) Wilczek], blackgram [Phaseolus mungo (L.) Hepper] and okra (Abelmoschus esculentus L.) in 1:1 ratio as compared to its sole cultivation and to assess the efficacy in these intercropping systems. Four weed-control treatments, viz. unweeded control, two hand-hoeings (30 days after sowing and after harvest of intercrops), pendimethalin @ 0.75 kg/ha as pre-emergence and trifluralin @ 1.0 kg/ha as pre-plant to intercrops. These were tested in randomized block design (RBD) with three replications. The data of 3 years showed that intercropping of okra reduced the cane yield by 8.1% compared with sole sugarcane. However, this intercropping system recorded the highest mean cane-equivalent yield (74.2 tonnes/ha) as well as net returns (Rs 37,461/ha) among the cropping systems. The net returns under sole sugarcane were Rs 24,950/ha. Uncontrolled growth of weeds reduced the yield of sole sugarcane by 26.7%. One pre-emergence application of pendimethalin @ 0.75 kg/ha or pre-plant incorporation of trifluralin @ 1.0 kg/ha recorded effective control of annual weeds and gave cane yield, intercrop yield and net returns comparable to two hand-hoeings. These herbicides, however, did not show their herbicidal effect on Cyperus rotundus.

Key words: Sugarcane, Intercropping, Okra, Greengram, Blackgram, Weed control

Ever-shrinking resources for cultivation make it important to maximize land use. Intercropping in wide-spaced spring-planted sugarcane (Saccharum officinarum) offers a good scope for increasing the productivity and income to the farmers. As one half of the total sugarcane area in Punjab is replanted each year in spring season, it provides an opportunity to adopt intercropping to obtain additional income to the farmers.

It was reported that intercropping does not affect sugarcane yield or quality (Misra, 1964). Mathur et al. (1968) reported improvement in juice quality due to intercropping. However, Yadav (1985) indicated that intercropping in spring-planted sugarcane would be more successful when limited to the first months of cane growth. In Punjab, intercropping of short-duration pulses, viz. greengram and blackgram, in spring-planted sugarcane has been recommended for almost last one decade (Anonymous, 2005). Okra is also an important short-duration crop and can fit well as intercrop in spring-planted sugarcane.

On the contrary, spring-planted sugarcane faces severe problem of weed infestation and the weed-control recommendations are available only for sole sugarcane. Moreover, scientific information on weed-management strategy in sugarcane-based intercropping systems is rather meagre. Manual or mechanical hoeing in these intercropping systems is very cumbersome. This discourages the farmers to adopt intercropping in sugarcane. Hence the present study was carried out to evaluate relative profitability of intercropping spring-planted cane with greengram, blackgram and okra, and to assess the efficacy of some commercially available selective herbicides for weed control in these spring-planted sugarcane-based intercropping systems.

MATERIALS AND METHODS

Field studies were conducted during 2000-01 at Sugarcane Research Station, Jalandhar and during 2001-02 and 2002-03 at Sugarcane Research Farm, Ladhowal of Punjab Agricultural University on a sandy loam soil. Treatments consisted of four cropping systems, viz. sole sugarcane, sugarcane + greengram [Phaseolus radiatus (L.) Wilczek] (1:1), sugarcane + blackgram [Phaseolus mungo (L.) Hepper] and sugarcane + okra (Abelmoschus esculentus L.).
esculentus L.) (1:1), and four weed-control treatments, viz. unweeded control, two hand-hoeings (with hand-hoe at 30 days after sowing and after harvest of intercrops), pendimethalin @ 0.75 kg/ha as pre-emergence and trifluralin @ kg/ha as pre-plant to intercrops. These treatments were tested in randomized block design with three replications. Early-maturing sugarcane (‘Col 83’) was planted in 75 cm rows in the first week of March, using a seed rate of 50,000 three-budded sets/ha. As per treatment, one row of greengram (‘SML 668’), blackgram (‘UG 414’) and okra (‘Punjab 7’) were sown between two rows of sugarcane after giving first irrigation to sugarcane crop, i.e. in the last week of March in the first two years and in the first week of April in the third year. A seeding rate of 10.0, 12.5 and 15.0 kg/ha was used for sowing greengram, blackgram and okra respectively. The sugarcane crop was supplied with recommended dose of N (i.e. 150 kg/ha). P and K were not applied, as the soil was sufficient in these two nutrients. No additional fertilizer was applied to greengram and blackgram, but 55 kg N/ha was supplied to okra, based on its population in comparison with its pure crop. Greengram and blackgram were harvested in the first fortnight of June and okra in the second fortnight of June. Pendimethalin was applied within 2 days of sowing, whereas trifluralin was incorporated before the sowing of intercrops. The data on dry matter of weeds were collected from an area of 0.5 m x 0.5 m at the time of harvest of intercrops. The data on tillering of sugarcane were recorded at grand-growth stage (120 days after sowing) whereas the population of millable canes, millable cane length and cane yield at the time of harvest of cane crop in January. The cane-equivalent yield was calculated based on the averaged selling price of the crops. Variances were subjected to Bartlett’s test for homogeneity of variances. As variances were found to be homogenous, pooled data are presented.

RESULTS AND DISCUSSION

Weed flora

Cyperus rotundus was dominant weed species at both the locations. Other weeds present in the field included Digitaria sanguinalis, Brachiaria reptans, Eleusine aegypticum, Trianthema portulacastrum, Chenopodium album, Digitaea arvensis, Anagallis arvensis, Tribulus terrestris, Melilotus alba and Amaranthus viridis.

Cropping systems

The dry matter of weeds remained statistically uninfluenced by the cropping systems, indicating that none of the intercrops did exert any suppressing effect on weeds (Table 1). However, they influenced the number of tillers and millable canes though not to a significant level. Av-

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Effect on sugarcane weed</th>
<th>Dry matter of weeds (g/ha)</th>
<th>Annual Total sugars</th>
<th>Weed control</th>
<th>yield (t/ha)</th>
<th>yield (t/ha)</th>
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<td>14.4</td>
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<td>12.7</td>
<td>11.5</td>
<td>10.5</td>
<td>9.5</td>
</tr>
<tr>
<td>Intercrop</td>
<td>14.4</td>
<td>13.5</td>
<td>12.7</td>
<td>11.5</td>
<td>10.5</td>
<td>9.5</td>
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<tr>
<td>Pd @ 0.75</td>
<td>14.4</td>
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<tr>
<td>Tfl @ 0.75</td>
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Table 1. Effect of cropping systems on weed-control treatments on weeds of sugarcane and intercrops, cane-equivalent yield and net returns (pooled data of 3 years).
age data of 3 years showed that intercropping of greengram, blackgram and okra lowered the tillering of sugarcane by 6.3, 5.2 and 10.4%, respectively, compared with sole sugarcane. There were no significant differences between sole and intercropped sugarcane with regard to the number of millable canes and cane length. The cane yield decreased by 8.1% with intercropping of okra compared with sole sugarcane. This reveals that growth of sugarcane plants was affected by competition with okra plants. This may be due to late harvesting of okra in the second fortnight of June and influence on the growth of sugarcane due to late vacation of land. But the yield of sugarcane intercropped with greengram and blackgram was higher than of sole sugarcane, perhaps owing to low competition and nitrogen-fixing capacity of these pulses. The grain yield of greengram and blackgram and fruit yield of okra were 4.2, 4.2 and 56.2 q/ha respectively. Though intercropping of okra reduced the cane yield, it recorded the highest cane-equivalent yield (74.2 tonnes/ha), which was 32.0% more than of sole sugarcane and 18.1 and 21.0% more than of cane + greengram and cane + blackgram respectively. This was due to higher value of okra produce.

The net returns were found higher in all the intercropping systems over sole cane. The intercropping of okra in sugarcane gave the highest net returns (Rs 37,461/ha), of which sole cane accounted for only Rs 24,950/ha. Hence an additional income of Rs 12,511/ha was obtained with okra intercropping. This reveals that though there was a slight decrease in cane yield intercropped with okra, the lost income was offset by the income generated from okra.

Weed-control treatments
Pre-emergence application of pendimethalin @ 0.75 kg/ha as well as pre-plant incorporation of trifluralin @ 1.0 kg/ha gave effective control of annual weeds and recorded dry matter of weeds on a par with that of two hand-hoeings (Table 1). The highest weed-control efficacy was recorded with two hand-hoeings, i.e. 74.1%, compared with pendimethalin (45.3%) and trifluralin (35.6%). Lower weed-control efficacy in herbicide-treated plots was due to their failure to control *Cyperus rotundus* that flourished in the absence of competition form other weeds. Thus the dry matter of *Cyperus rotundus* under herbicide-treated plots increased and was comparable to that of the unweeded control. The re-emergence of *Cyperus rotundus* after each hoeing increased its dry matter under two hand-hoeings. Singh and Yadav (2002) also reported effective control of annual weeds in cane + greengram or blackgram with pre-emergence application of pendimethalin @ 1.5 kg/ha in clay-loam soils at Lucknow. Pendimethalin @ 0.75 kg/ha has been recommended for the control of weeds in greengram under Punjab conditions (Anonymous, 2005).

All the weed-control treatments recorded significantly higher cane yield compared with the unweeded control (Table 1). The uncontrolled growth of weeds reduced the yield of sugarcane by 26.7%. Two hand-hoeings recorded the highest cane yield (61.0 t/ha). Pendimethalin and trifluralin produced cane yield at par with two hand-hoeings. Effective control of weeds in herbicide-treated and hand-hoed plots resulted in higher tiller production, which increased the population of millable canes and ultimately the cane yield. The yield of greengram, blackgram and okra and cane-equivalent yield followed the same trend as that of cane yield. Two hand-hoeings recorded the highest net return (Rs 34,780/ha), which was on a par with that of pendimethalin (Rs 32,334/ha) and trifluralin (Rs 31,496/ha) treatments. The net returns in unweeded control (Rs 18,436/ha) decreased significantly compared with those of all the weed-control treatments. All the interactions were found non-significant.

It was concluded that intercropping of one row of okra between two rows of spring-planted sugarcane would be more effective than greengram or blackgram to increase the cash returns of the farmers in northern India. Keeping in view the scarcity of labour and difficulty in manual or mechanical hoeing in these intercropping systems, pre-emergence application of pendimethalin @ 0.75 kg/ha or pre-plant incorporation of trifluralin @ 1.0 kg/ha could be used for effective control of weeds.

**REFERENCES**