EFFECT OF INTERCROPPING SHORT DURATION CROPS ON SUGARCANE PRODUCTION

By

IMDAD ALI SOHU, BASHIR AHMED ABRO AND ABDUL HAMID MEMON
Quaid-E-Awam Agriculture Research Institute, Larkana, Sindh, Pakistan

ABSTRACT
The study on intercropping of autumn planted sugarcane with onion, wheat, lentil, mustard and safflower was carried out at the experimental field of Sugarcane Research Station, QAARI Larkana during the year 2005-2006. The experiment was laid out in Randomized Complete Block with four replications with ultimate plot size of 8 x 8m (64m²). The results were statistically non-significant for germination %age, number of tiller per stool and plant height. Maximum germination (59.98%) was recorded when sugarcane was planted as sole crop followed by sugarcane + Lentil intercropping i.e. (58.00%). The same trend was noted for number of tillers stool⁻¹, cane girth and internodes/cane. The cane yield ha⁻¹ of sugarcane was highest (120.97 m.t ha⁻¹), when sugarcane was planted alone, whereas, all the intercrops reduced cane yield significantly. Competitive effect was observed for all intercrops when sown with sugarcane.

KEYWORDS: Sugarcane, Intercropping, Lentil, Mustard, Safflower, Wheat, Onion.

INTRODUCTION
Sustainable agriculture seeks, at least in principle, to use nature as the model for designing agricultural systems. Since nature consistently integrates her plants and animals in to a diverse landscape, a major tenet of sustainable agriculture is to create and maintain diversity. Intercropping offers farmers the opportunity to engage nature’s principle of diversity on their farms. Spatial arrangements of plants, planting rates, and maturity dates must be considered when planning intercrops. Intercrops can be more productive than growing pure stands. Many different intercrop systems are discussed, including mixed intercropping, strip cropping, and traditional intercropping arrangements (Preston, 2003).

Intercropping is the cultivation of two or more crops simultaneously on the same field. It also means the growing of two or more crops on the same field with the planting of the second crop after the first one has completed its development. The rationale behind intercropping is that the different crops planted are unlikely to share the same insect pests and disease-causing pathogens and to conserve the soil. There is a number of intercropping which include: (i) mixed or multiple cropping is the cultivation of two or more crops simultaneously on the same field without a row arrangement, (ii) relay cropping is the growing of two or more crops on the same field with the planting of the second crop after the first one has completed its development, (iii) row intercropping is the cultivation of two or more crops simultaneously on the same field with a row arrangement, (iv) strip cropping is the cultivation of different crops in alternate strips of uniform width and on the same field. It has two types; contour strip cropping and field strip cropping. Contour strip cropping follows a layout of a definite rotational sequence and the tillage is held closely to the exact contour of the field. Field strip cropping has strips with uniform width that follows across the general slope of the land (Boller et al. 2004).
Intercropping is not a new concept but centuries old technique of intensive farming that has been persisted in many areas of the world, which efficiently maximizes land and productivity per unit of area per season (Oad et al. 2001). The practice of intercropping of turnip with radish and carrot is gaining interest particularly among the farmers having smallholdings, who are unable to manage their diversified domestic needs from limited area. The day to day requirement of the growers be modified and re-examined in the light of newly suggested planting system which besides allowing easy and free inter cultivation and provides good chance for kitchen and marketable production (Oad et al. 2001). Frances et al. (1982) suggested that intercropping should be carefully practiced without damaging to the main crop. They were also of the view that intercropping must be practiced intensively and owner can obtain more added benefits with low added costs. Therefore, it is important to investigate the added benefits of intercropping through economic analysis.

Intercropping has a number of advantages, (i) it reduces the insect/mite pest populations because of the diversity of the crops grown. When other crops are present in the field, the insect/mite pests are confused and they need more time to look for their favorite plants; (ii) reduces the plant diseases, (iii) the distance between plants of the same species is increased because other crops (belonging to a different family group) are planted in between, (iv) reduces hillside erosion and protects topsoil, especially the contour strip cropping, (v) attracts more beneficial insects, especially when flowering crops are included the the cropping system, (vi) minimizes labor cost on the control of weeds, (vii) a mixture of various crops gives often a better coverage of the soil leaving less space for the development of weeds, (viii) utilizes the farm area more efficiently, (ix) Results in potential increase for total production and farm profitability than when the same crops are grown separately and (x) provides 2 or more different food crops for the farm family in one cropping season (Wolfe, 2000).

Singh (2002) suggested that inter cropping reduced the cane yield. However, additional harvest of inter crops, increased the net income. The fertilizer and irrigation water both are consumed efficiently by the plants, the inter space in crop, is better utilized and cost of interculture is reduced. Wheat, onion, sunflower, canola and mustard are successfully grown in upper and lower Sindh. Siddiqui et al. (2004) reported that highest cane yield was obtained when onion was used as the first intercrop. In this experiment sugarcane was intercropped with each of the above four crops. The effect of the intercrops on sugarcane yield was studied and the economics were also worked out. They further reported that yield obtained under sole cropping was statistically at par with sugarcane + rape seed intercropping. Highest net returns were obtained from cane + rape and cane + mustard inter crops, which is higher than that obtained under sole sugarcane. Alam et al. (2001) reported that among inter crops; highest mungbean yield was obtained with Lentil and Onion. Keeping in view the above facts, the present study was designed to evaluate the effect of intercrops on quantitative and qualitative characters of sugarcane. The main objective of this study is to select the crops for intercropping in sugarcane, which could be economical and have minimum smothering and competitive effect on sugarcane.

MATERIALS AND METHODS
Experiment was conducted to evaluate the effects of intercrops on cane yield of sugarcane promising variety Chandka at the experimental Field of QAARI Larkana during the year 2005-2006. Six intercropping treatments such as sugarcane alone, sugarcane + onion, sugarcane + wheat, sugarcane + lentil, sugarcane + mustard and sugarcane + safflower were examined in a four replicated Randomized Complete Block Design having net plot size of 64m². The cane was cut in to two-budded set and treated with fungicide. The recommended fertilizer dose for upper Sindh 275N+150P+160K kgs / hectare was applied. After one month of sugarcane planting, onion, wheat, safflower, lentil and mustard were intercropped in between the rows of sugarcane. The sugarcane crop was planted on September 26, 2005. The onion was transplanted in October; wheat was planted during 3rd week of November, mustard and safflower was planted in early November. Irrigation and fertilizer was applied in all the sugarcane planted plots. Observations were recorded on all the growth and yield contributing characters for principal as well as intercrops. The data thus collected were analyzed statistically following Gomez and Gomez (1984).
RESULTS AND DISCUSSION

Germination percentage
It is explicit from the data that germination percentage ranged from 53-60 percent. The maximum germination percentage 59.98 of sugarcane was recorded when planted alone followed by Mustard (58.27 percent), Lentil (58.00), onion (54.74), mustard (54.46) and wheat (53.33 per cent) respectively when intercropped with sugarcane. Wheat intercropped with sugarcane recorded the minimum germination percentage and other crops increased germination percentage. Sugarcane also increased germination percentage over the intercrop (sugarcane + wheat). The results are in line with those of Sain, et al. (2003) who reported that sugarcane planted alone recorded maximum germination.

Number of tillers stool\(^{-1}\)
The summarized observations regarding average number of tillers per stool, recorded at the time of harvesting revealed that significantly more number of tillers per stool were produced in the plots having sugarcane alone (6.45) followed by sugarcane with wheat (5.52), sugarcane with lentil (5.32), sugarcane with onion (5.46), sugarcane with mustard (5.11) and sugarcane with safflower (4.30). The analysis of variance showed that number of tillers per stool was significantly higher in sugarcane alone. The difference in number of tillers stool\(^{-1}\) of sugarcane with intercrops showed statistically non-significant results. The data clearly manifest that all the test intercrops had smothering and competitive effect on sugarcane, but is much pronounced in case of safflower. Therefore, it could be inferred on the basis of these results that intercropping of mustard and safflower with sugarcane had significant smothering and competitive effect on cane plant. Similar results have also been reported by Sain, et al. (2003) who reported that sugarcane planted alone recorded highest number of shoots and cane yield t ha\(^{-1}\).

Cane height (cm)
Regarding the cane height, it was observed that cane attained more height in sugarcane and onion intercropping (223.00). The differences among all the other intercrop combinations regarding cane height were non-significant. The best was sugarcane alone (216.75 cm) followed by sugarcane + lentil (214.50), sugarcane + safflower (207.25 cm), sugarcane + mustard (202.75 cm) and sugarcane + wheat (190.58 cm). It is clear from the data presented in Table-3, that all the tested intercrops affected the plant height. This effect was more pronounced in case of sugarcane + wheat (190.58 cm), on the basis of these results, it could, therefore be inferred that wheat, mustard and safflower with planted crops had more smothering and competitive effect on cane plants, reducing the plant height and ultimately reducing the yield. The results are in accordance with those of Singh, et al. (2001) who reported that sole sugarcane stand recorded greater cane length as compared to sugarcane intercrops.

Cane girth
The cane girth was affected significantly (P<0.01) by the intercrops. A perusal of the data showed that average cane girth was significantly affected by different intercrops. The maximum cane girth (2.59 cm) was recorded in the plots of sugarcane alone while in other plots, with different intercrops, the cane girth was variable with lentil (2.12cm), onion (2.07cm), wheat (1.99 cm) and mustard (2.07 cm), intercrops were statistically not significant. It was observed that safflower affected the cane girth more (1.74 cm) and their effect was statistically highly significant. Wheat and safflower reduced the cane girth which ultimately reduced the yield of sugarcane. Nazir, et al. (2002) conducted experiment on agronomic benefits of some autumn sugarcane intercropping system and reported that cane yield reduced with intercropping of respective crops and obtained more cane thickness in sole sugarcane crop than intercrops.

Number of internodes
The data revealed that number of internodes varied significantly with the intercrops in sugarcane. The maximum average number of internodes (19.65) was found in sugarcane planted alone. The analysis of variance showed that the differences in number of internodes of sugarcane having onion and lentil as intercrops were (15.05 and 18.32). The number of internodes was significantly the least (15.55) when planted with safflower as intercrop.
The internodes were highest in sugarcane when planted alone followed by sugarcane with lentil (18.32), onion (18.02), wheat (17.15), mustard (16.15) and safflower (15.55) intercrops respectively. The number of internodes contributes significant part in the yield of sugarcane. On the basis of these results, it is concluded that wheat, mustard and safflower, intercrops reduced the number of internodes of cane which ultimately reduced the cane yield. The present findings are in line with the results of Vashist et al. (2003) who reported that cane produced more number of internodes in pure stands than in intercrops.

Cane yield m. tons ha$^{-1}$

It is clear from the data that the maximum yield ha$^{-1}$ (120.97 m. tons) was obtained when sugarcane was planted alone followed by sugarcane with onion (106.66), wheat (98.12), Lentil (94.23), mustard (81.81) and safflower (77.77) intercrops respectively. The differences in yield were non-significant, when wheat and lentil were intercropped with sugarcane. Similarly, the differences in yield of sugarcane when intercropped with mustard and safflower were non-significant. As intercropping of wheat, mustard, onion, lentil and safflower with sugarcane reduced the yield, therefore, on the basis of these results, it may be inferred that the intercropping of these crops with sugarcane is un-economical under local conditions. The results are similar to Sain et al. (2003) who reported that sugarcane planted alone recorded maximum cane yield ha$^{-1}$. Vashist et al. (2003) reported that cane yield was highest in pure cane stand and Singh et al. (2001) confirmed that sole sugarcane stand recorded highest yield and millable canes.

**Table-1: Mean performance of sugarcane crop planted alone and with other intercrops**

<table>
<thead>
<tr>
<th>Intercrops</th>
<th>Gernination %</th>
<th>Number of tillers/stool</th>
<th>Cane Height (cm)</th>
<th>Cane girth (cm)</th>
<th>Number of Internodes/cane</th>
<th>Cane yield (M. tons) ha$^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_1 =$Sugarcane alone</td>
<td>59.98</td>
<td>6.45</td>
<td>216.75</td>
<td>2.59 a</td>
<td>19.65 a</td>
<td>120.97 a</td>
</tr>
<tr>
<td>$T_2 =$Sugarcane-Onion</td>
<td>54.74</td>
<td>5.46</td>
<td>223.00</td>
<td>2.07 b</td>
<td>18.05 b</td>
<td>106.66 b</td>
</tr>
<tr>
<td>$T_3 =$Sugarcane-Wheat</td>
<td>53.33</td>
<td>5.52</td>
<td>190.50</td>
<td>1.99 c</td>
<td>17.15 bc</td>
<td>98.12 c</td>
</tr>
<tr>
<td>$T_4 =$Sugarcane-Lentil</td>
<td>58.00</td>
<td>5.32 `</td>
<td>214.50</td>
<td>2.12 b</td>
<td>18.32 b</td>
<td>94.23 c</td>
</tr>
<tr>
<td>$T_5 =$Sugarcane-Canola</td>
<td>54.46</td>
<td>5.11</td>
<td>202.75</td>
<td>2.06 b</td>
<td>16.15 c</td>
<td>81.81 d</td>
</tr>
<tr>
<td>$T_6 =$Sugarcane-Safflower</td>
<td>58.27</td>
<td>4.30</td>
<td>207.25</td>
<td>1.74 c</td>
<td>15.55 d</td>
<td>77.77 de</td>
</tr>
</tbody>
</table>

S.E± 2.120 0.025 10.57 0.0600 0.3600 2.345
LSD1 0.05 - - - 0.1807 1.0844 4.989
LSD2 0.01 - - - 0.2503 1.5019 6.087

Mean values followed by same letters do not differ significantly at 0.05 probability level according to DMR Test.
REFERENCES


