EFFECT OF INTERCROPPING SHORT DURATION CROPS ON THE PRODUCTION OF SUGARCANE CROP

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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 ($64m^2$). The results obtained were analysed and reported briefly. 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 sole 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 maximum (120.97 m.t ha^{-1}), when sugarcane planted alone, whereas all the intercrops reduced cane yield significantly. Smoothly and competitive effect was observed for all intercrops when sown with sugarcane.

Keyword: 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 into 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 diseased-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 in 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 small holdings, who are unable to manage their diversified domestic needs from limited area. The day to day requirement of the growers be modified and reexamined 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 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 planted 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. Cropping, where as Alam *et al*. (2001) conducted that among inter crops highest mungbean yield were 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 would be economical and have minimum smothering and competitive effect on sugarcane.

MATERIALS AND METHODS

Experiment was conducted designed to evaluate the effects of intercrops on cane yield of sugarcane variety Larkana-2001, experimental Field of Sugarcane Research Station, 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 64m^2. The cane was cut in to two budded set and treated with fungicide. The recommended fertilizer dose i.e. 268+134+268 kg NPK were 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 in the month of August 26, 2004. The onion was transplanted in October, wheat during 3rd week of November, mustard and safflower was planted in early November. The first dose of recommended fertilizer was applied before its sowing. Other cultural operations were performed as recommended by Agronomist. 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 analysed statistically following Gomez and Gomez (1984).

RESULTS AND DISCUSSION

1. Germination percentage

It is explicit from the data that germination percentage ranged from 53-60 percent. The maximum 59.98 per cent 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 confirmed by Sain, *et al*. (2003) who reported that sugarcane planted alone recorded maximum germination.

2. 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. The results 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}.

3. Cane height (cm)

Cane height indicated that cane attained more height in sugarcane alone 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), respectively. It is clear from the data presented in Table-3, that all the tested intercrops affected the plants 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 confirmed by Singh, *et al*. (2001) who reported that sole sugarcane stand recorded greater cane length as compared to sole sugarcane.

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. The differences in cane girth 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 much (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 maximum 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 contribute significant part in the yield of sugarcane. On the basis of these result, it is concluded that wheat, mustard and safflower, intercrops reduced the number of internodes of cane which ultimately reduced the cane yield. Supporting the present findings, Vashist *et al*. (2003) reported that cane more number of internodes in pure stands than in intercrops.

6. 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 difference in yield of sugarcane when intercropped by 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 confirmed by 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 germination percentage of sugarcane as influenced by different varieties

Intercrops	Germi-nation %	Number of tillers/ stool	Cane Height (cm)	Cane girth (cm)	Number of Internodes /cane	Cane yield (M. tons) ha-1
T1=Sugarcane alone	59.98	6.45	216.75	2.59 a	19.65 a	120.97 a
T2=Sugarcane-Onion	54.74	5.46	223.00	2.07 b	18.05 b	106.66 b
T3=Sugarcane-Wheat	53.33	5.52	190.50	1.99 c	17.15 bc	98.12 c
T4= Sugarcane-Lentil	58.00	5.32`	214.50	2.12 b	18.32 b	94.23 c
T5=Sugarcane-Canola	54.46	5.11	202.75	2.06 b	16.15 c	81.81 d
T6=Sugarcane-Safflower	58.27	4.30	207.25	1.74 c	15.55 d	77.77 de
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.

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