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PROSPECTS OF INTERCROPPING RABI CROPS IN AUTUMN PLANTED SUGARCANE

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ABSTRACT

Sugarcane is a long duration crop and is suitable for intercropping with other short duration crops to maximize the farmer income from the unit area. Thus, this study was designed to find out the possibility of wheat, lentil and gram intercropping with autumn planted sugarcane crop. The study was carried out at National Agricultural Research Centre, Islamabad during 2004–05 cropping season. Sugarcane variety RB–72–454 was used as test crop and planted at 1.2 meter row distance in the first week of September, 2004. Two rows of each wheat, lentil and gram crop were seeded in the month of November in between cane rows. Sugarcane crop was harvested in the month of December, 2005. Lentil and gram were harvested in the month of April while, wheat in May. The results of the study indicted that sugarcane planted alone produced highest cane yield of 130.5 t ha^{-1}, while sugarcane intercropped with wheat produced lowest cane yield of 105.5 t ha^{-1}. The yields of wheat, lentil and gram were 1.18, 0.57 and 0.43 t ha^{-1}, respectively. However, it was observed that intercropping of wheat, lentil and gram with sugarcane decreased cane yield by 19.2, 18.6 and 14.3%, respectively. The maximum economic return of Rs. 156641 ha^{-1} was noticed when sugarcane was planted without intercropping, whereas, intercropping of sugarcane with wheat resulted in minimum return of Rs. 138889 ha^{-1}. Findings of the study revealed that autumn planting of sugarcane without any intercropping is more profitable than intercropping with cereal and leguminous crops.

INTRODUCTION

Sugarcane (*Saccharum officinarum*) is an important cash crop of Pakistan and ranks fourth in acreage after wheat, cotton and rice. Intercropping is a tool to promote autumn planting giving 15-20 percent higher cane yield and 0.5 units more sugar recovery than spring planted cane. It is usually planted in spring i.e. in the months of February and March but now there is an increasing trend of its plantation in autumn season i.e. in the months of September/October which appears to be more profitable than spring crop. Autumn planted sugarcane occupies the land for more than a year and competes with Rabi crops and, therefore, area under autumn planted sugarcane can only be increased at the cost of other Rabi crops. This problem can only be overcome by intercropping some suitable Rabi crops in autumn planted sugarcane. Emergence of autumn planted sugarcane completes within 5-6 weeks of planting. Sugarcane after emergence remains dormant for the period of 3-4 months due to low temperature in winter and makes little use of both soil and water resources. In order to drive benefits from its slow growth and make better use of resources, intercropping of some short duration crops can be explored. Hussain *et al*. (2004) studied the feasibility of sugarcane intercropping with potato, gram, lentil, mustard and coriander. In terms of agronomic performance, sugarcane + potato and sugarcane + gram were feasible, although both crop combinations produced lower values for the different sugarcane yield parameters (number of tillers, number of millable canes, unit stalk weight, height of cane, brix and yield of cane) than the sole crop. Sugarcane + gram were the most profitable crop combination with the highest net benefit and benefit cost ratio, followed by sugarcane + potato and sugarcane +coriander. The crop combinations sugarcane + mustard and sugarcane + lentil were not profitable because they produced less net benefit than sole sugarcane. Afzal *et al.* (2003) studied the intercropping of sunflower in sugarcane and results revealed that sugarcane alone produced more yield. Singh *et al.* (2002) found that Sugarcane + wheat, sugarcane + mustard in autumn and sugarcane + green gram in spring planted sugarcane are promising intercropping options for sustainability of sugarcane production and economic security of the sugarcane growers. Kuldeep *et al.* (2001) studied the possibility of growing chickpea as an intercrop in sugarcane. The results suggest that growing one row of chickpea as an intercrop in sugarcane can generate extra income without affecting the sugarcane yield, and that if recommended dose of fertilizer, is applied to sugarcane, there is no need to give any extra fertilizer to chickpea to get high productivity of both sugarcane and chickpea. Moreover, chickpea will also help in maintaining the soil fertility. Akhter *et al.* (2001) found that inter cropping of lentil in sugarcane gave more net income than cane alone. Gill *et al.* (1994) found that lentil intercropped in autumn planted sugarcane did not decrease number of millable canes and stripped cane yield considerably. The present study was conducted to explore the possibility of intercropping of different Rabi crops (wheat, lentil and gram) in autumn planted sugarcane.

Materials and Methods

The experiment was carried out at National Agricultural Research Center, Islamabad during 2004-05. The experiment was conducted in randomized complete block design (RCBD) with three replications. The treatments included in the study were: T1= cane alone, T2= cane + wheat, T3= cane + lentil, T4= cane + gram. Variety RB-72-454 was planted in 1st week of September using a seed rate of 55, 000 double budded setts ha-1... Fertilizer was applied @ 250-140-150 NPK kg ha-1. The plot size of each experimental unit was 8 m x 4.8 m consisting of four rows. The wheat variety Wafaq-2001, lentil variety Markaz and gram variety Dasht were used in the study. Two rows of each of wheat, lentil and gram were seeded in between cane rows in the month of October. Wheat, lentil and gram were harvested during the months of April-May and data for crop yield was recorded. Observations on number of millable canes, stripped cane yield, cane length, cane diameter and brix (%) of sugarcane were recorded at harvest during 2nd week of December, 2005. All other agronomic practices were kept uniform throughout the study period. Data collected were analyzed statistically using analysis of variance at 5% level of probability (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

Results presented in table-1 indicate the effect of different inter crops on yield and yield components of cane crop.

1.1 Number of millable canes

The number of canes was significantly affected by different intercrops. Cane alone produced significantly more number of canes (118, 000 ha^{-1}) than cane intercropped with wheat, lentil and gram. The intercrops adversely affected the cane formation. Similar results have been previously reported by Ahmed *et al.* (1991) and Hossain *et al* (2004).

1.2 Cane yield

Planting of sugarcane alone resulted in significantly higher cane yield (130.5 ha^{-1}) followed by cane inter cropped with gram (111.8 t ha^{-1}). Cane yields in case of cane intercropped with wheat, lentil and gram were statistically at par with each other. The decrease in cane yield by intercropping of wheat, lentil and gram was 19.2%, 18.6% and 14.3%, respectively. This decrease in yield was due to competition of intercrops with cane for growth resources, which affected cane formation and growth. These results are in line with Ahmed *et al.* (1991), Santanu *et al.* (2003), Singh *et al*. (2003), Nazir *et al*. (2002) and Imran *et al*. (2000).

1.3 Cane length

The results indicated that intercropping of wheat, lentil, and gram did not affect cane length. However, longer canes were observed when cane was planted alone (248 cm) and shorter canes were found when intercropping was done with lentil (222 cm). Gill *et al.* (1994) and Hossain *et al.* (2004) also reported similar results.

1.4 Cane diameter

Cane diameter was not affected by intercropping with wheat, lentil and gram. The cane diameter ranged between 25 to 27 mm. These results are in conformity with those of Nazir *et al*. (2002) and Gill *et al.* (1994).

1.5 Cane Brix

Intercropping of wheat, lentil and gram did not significantly affect cane brix. Apparently cane alone resulted in lower brix content as compared to intercrops. Similarly Nazir ***et al***. (2002) observed that sucrose content in cane juice was not affected significantly by different intercrops.

Economic benefits

The economics of different intercropping combinations was worked out, keeping in view the prevailing market prices of the produce (Table-2). The rates of sugarcane, wheat, lentil and gram were Rs. 1200/ton, Rs. 10375/ton, 40625/ton and 32000/ton, respectively. Results indicated that none of intercropping combination was economically superior to cane alone. Cane alone gave maximum gross income (Rs.156641), whereas, cane intercropped with wheat gave lowest gross income (Rs.138889). However, cane intercropped with lentil gave better return than other intercropping combinations. Similar results were obtained by Ahmed *et al.* (1994), Singh *et al.* (2003), and Santanu *et al*. (2003). However, these results do not agree with economic gains as reported by Nazir *et al.* (1991), Gill *et al*. (1994), Afzal *et al.* (2001)and Akhtar *et al.* (2001), Nazir *et al*. (2002), Shinde *et al.* (2009). Findings of the study showed that autumn planted cane as sole crop produced more yield and thus can generate more income for growers and intercropping of rabi crops in autumn planted sugarcane was found non profitable.

Table-1 Yield and yield components of sugarcane with intercrops combination

Treatments	**Cane No. (000 ha^{-1})**	**Cane yield (t ha^{-1})**	**Cane length (cm)**	**Cane diameter (mm)**	**Brix (%)**
T1= cane alone	118.00 a	130.5 a	248	25	18
T2= Cane + wheat	90.96 b	105.5 c	233	25	19
T3= Cane + lentil	93.04 b	106.2c	222	26	19
T4= Cane + gram	91.00 b	111.8 b	228	27	19
LSD (5%)	14.16	4.30	NS	NS	NS

Table-2 Economic analysis of various intercrops combination with autumn planted sugarcane

Treatments	Cane yield (t ha^{-1})	Yield of inter-crops (t ha^{-1})	Income of cane (Rs.)	Income of intercrops (Rs.)	Gross Income (Rs.)
T1= cane alone	130.5	__	156641	__	156641
T2= Cane + wheat	105.5	1.18	126646	12243	138889
T3= Cane + lentil	106.2	0.57	127480	23156	150636
T4= Cane + gram	111.8	0.43	134144	13760	147904

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VARIETAL SUITABILITY ASSESSMENT UNDER RAINFED CONDITION IN HIGH BARIND TRACT OF BANGLADESH

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ABSTRACT

A comparative study was under taken with six newly released sugarcane varieties viz. Isd 30, Isd 32, Isd 33, Isd 34, Isd 35 and Isd 36 were conducted at farmer's field in High Barind Tract under rainfed condition during 2004-05 and 2005-06 cropping season. The results revealed that Isd 32 produced significantly higher cane yield (72.39 and 64.70 t ha^{-1}) followed by Isd 35 (64.00 and 46.80 t ha^{-1}) and Isd 33 (57.40 and 49.80 t ha^{-1}) during the year 2005-06 and 2004-05 respectively. Thus, there is an ample scope to increase productivity of sugarcane by using varieties Isd 32, Isd 33 and Isd 35 in High Barind Tract of Bangladesh under rainfed condition.

Key words: Variety, Suitability, Assessment, Rainfed.

INTRODUCTION

In Bangladesh, major cultivated area of High Barind Tract (>85%) is still under rainfed condition. Sugarcane is a relatively drought tolerant crop and it may be grown at low rainfall zones but germination failure is the main limiting factor for sugarcane cultivation in rainfed condition. If germination can be ensured it is possible to grow sugarcane successfully in High Barind Tract under rainfed condition just after harvesting of T. Aman.

Bangladesh Sugarcane Research Institute developed some new varieties which do not perform equally well in all Agro-Ecological Zones (Miah *et al.,* 1994). The yield of a particular variety depends upon its heredity potential of the genotype and environment where it is exposed to during the course of its life cycle (Yadava, 1993). Although most of the recommended varieties of sugarcane now grown in the sugar mill zones of Bangladesh but that promising varieties may not show better performance in all the ecological zones due to variations of Agro-climatic factors (Anon. 1979). Moreover sugarcane varieties gradually degenerate over a considerable period of cultivation and show a tendency to decline in yield and vigor (Barnes, 1954 and Humbert, 1959). The highest number of millable cane, height and girth might have contributed to cane yield as reported by Singh and Sangwan, 1980. Miah *et al.,* 1986 also observed that the sugarcane clones having tall cane, maximum diameter and higher number of millable canes have produced higher cane yield per unit area. Most of the farmers of Bangladesh get low cane yield due to late plantation, adoptions of inadequate pests and diseases control measures and poor agronomic management. Introduction of suitable varieties with packages of recommended technologies may help to bring substantial improvement in cane and gur yield which interim will increase the farmer's income and upgrade their livelihoods. In view of the above factors this experiment was undertaken to evaluate cane varieties for suitable High Barind Tract region under rainfed condition.

MATERIALS AND METHODS

The experiment was conducted at farmer's field in High Barind Tract of Rajsashi area under rainfed condition during the cropping season 2004-2005 and 2005-06 with six treatments as varieties viz. Isd 30, Isd 32, Isd 33, Isd 34, Isd 35 and Isd 36. The experiment was laid out in a Randomized

Complete Block (RCB) design with four replications. Plantation was done with two budded setts in the last week of October 2004 and 2005 after good shower when the field was at a moisture of field capacity i.e. Zoe condition. Before plantation setts were pre-germinated by heap method covered with rice straw for ensured germination. Plot size of each treatment was 8m x 8m where row-to-row distance was maintained a one meter. Necessary intercultural operations were done as and when required. Data were recorded at different growth stage of crop. Brix reading was recorded by hand Referactometer from standing cane in field. Can yield data was recorded at harvest in December 2005 and 2006. Means of treatments were compared by LSD test statistically using "Analysis of Variance" technique (Steel and Torrie, 1960).

RESULTS AND DISCUSSION

Table 1 shows that no significant difference was found in germination, tiller production among the tested varieties but differences were observed in millable cane where Isd 33 produced the highest number of millable cane (81.71 x10^3 ha^{-1}) followed by Isd 34 (81.09 x10^3 ha^{-1}) but it was at per statistically. The lowest number of millable cane was recorded in Isd 30 (51.29 x 10^3 ha^{-1}), which differed significantly over all other varieties. . In case of yield, the highest cane yield was recorded in Isd 32 (64.70 t ha^{-1}) followed by Isd 33 (57.40 t ha^{-1}) and that differed significantly. But no significant yield difference was observed among Isd 34, Isd 35 and Isd 36. The highest Brix of 21.85% was recorded in Isd 35 which significantly differed among all other varieties. However lowest Brix of 17.87% was recorded in Isd 32.

Result presented in Table 2 reveals that, the tested varieties showed significant differences in percent germination, number of tiller production, number of millable cane, yield and percent Brix in cane . Among the test varieties Isd 34 showed the highest germination of 41.37 % followed by 40.96 % in Isd 36 and 40.47 % in Isd 35 which were statistically at per but differed statistically over Isd 33, Isd 32 and Isd 30. The highest number of tillers (224.80 ×10^3 ha^{-1}) was recorded in Isd 35 followed (212.10 ×10^3 ha^{-1}) in Isd 36 which were statistically identical but significantly differed over Isd 30, Isd 32, Isd 34 and Isd 36. However cane variety Isd 32 produced highest number of millable cane (110.68×10^3 ha^{-1}) followed by Isd 34 (92.70 x10^3 ha^{-1}) and Isd 35 (91.71 x10^3 ha^{-1}). The lowest number of millable cane was recorded in Isd 30 (76.35 x$10^3$$ha^{-1}$) whose effect statistically significant over all other varieties. Again highest yield of 72.39 t ha^{-1} was obtained in Isd 32 followed by 64.00 t ha^{-1} in Isd 35. The yields of Isd 33, Isd 34 and Isd 35 were 63.38, 62.57 and 64.00 t ha^{-1} respectively and showed statistically similar. The lowest yield was found in Isd 36 (57.37 t ha^{-1}). In case of percentage of Brix , Isd 35 was superior (20.20%) followed by Isd 36 (19.95%), which was statistically identical but they significantly differed over Isd 30, Isd 32, Isd 33 and Isd 34.

Chowdhury *et al.*, 1999 supported our results where they reported that different varieties with Isd 16, Isd 18, Isd 20, Isd 22 and Isd 28 produced different yield of 71.80, 58.50, 77.27, 72.63 and 42.09 t ha^{-1} respectively at different level of field trial. Rashid *et al.,* 1999 also reported that sugarcane varieties Isd 2/54 and L.J.C showed yields of 69.20 and 71.26 t ha^{-1} respectively. It was revealed that newly released varieties had higher cane yields than that variety earlier.

The varieties tested in the present experiment produced much higher yield compared to national average of 41.60 t ha^{-1} (BBS, 1995) and there is a great scope to improve cane productivity by using newly released BSRI varieties in the High Bariand Tract under rainfed condition. From the present findings Isd 32 and Isd 33 may be recommended for commercial cultivation in Tigh Barind Tract under rainfed condition to ensure higher momentary income for the cane growers and also benefited to our country.

It may be concluded that the variety Isd 32 and Isd 33 produced significantly higher yield sugarcane yield and Isd 35 shown higher percent of Brix in cane among all other tested varieties both the crop seasons. However, it is being found that all the newly released sugarcane varieties showed superiority in yield over national average. Thus, it can be suggested to cultivate these sugarcane varieties for sustainable production in High Barin Tract under rainfed condition.

Table-1 Performance of BSRI bred sugarcane varieties in respect of yield and yield attributes at High Barind Tract of Rajshahi area under rainfed condition, 2004-2005

Varieties	Germination (%)	No. of Tillers (10^3 ha^{-1})	No.of millable cane (10^3 ha^{-1})	Yield (t ha^{-1})	Brix (%)
Isd 30	35.24	209.41	51.29c	55.50b	18.60c
Isd 32	37.15	210.00	68.64b	64.70a	17.87d
Isd 33	34.54	196.37	81.71a	57.40b	18.72c
Isd 34	35.41	204.53	81.09a	48.40c	18.60c
Isd 35	34.20	202.09	68.22b	46.80c	21.85a
Isd 36	35.76	192.62	68.58b	49.80c	20.68b
Lsd (5%)	NS	NS	6.75	5.26	0.60

* In a column figures having similar letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT at 5% level of probability.

Table-2 Performance of BSRI bred sugarcane varieties in respect of yield and yield attributes at High Barind Tract of Rajshahi area under rainfed condition , 2005-2006

Varieties	Germination (%)	No. of Tillers (10^3 ha^{-1})	No.of millable cane (10^3 ha^{-1})	Yield (t ha^{-1})	Brix (%)
Isd 30	32.47c	166.20bc	76.35c	61.93bc	18.50b
Isd 32	37.83b	153.10c	110.68a	72.39a	17.25c
Isd 33	36.37b	126.50c	85.15bc	63.38b	18.75b
Isd 34	41.37a	160.40c	92.70b	62.57b	18.39b
Isd 35	40.47a	224.80a	91.71b	64.00b	20.20a
Isd 36	40.96a	212.10ab	108.47bc	57.37c	19.95a
Lsd (5 %)	2.53	46.26	11.93	4.56	1.00

* In a column figures having similar letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT at 5% level of probability..

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DETERMINATION OF POST HARVEST DETERIORATION IN UPCOMING UGARCANE VARIETIES

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ABSTRACT

Two promising sugarcane varieties Q-88 and GT-7 were evaluated during the year 2006-2007 for post harvest deterioration. The weight of 10 canes 15.91, 15.42, 14.82, 13.85 and 12.97 kg, Brix content 21.02, 20.79, 20.42, 20.07 and 19.47%, fiber content 12.93, 13.06, 13.18, 13.33 and 13.50%, sugar recovery 10.48, 10.35, 10.11, 9.78 and 9,50%, and purity 84.06, 83.90, 83.78, 83.59 and 83.34% when harvested cane was left unprocessed for 1, 2, 4, 6 and 8 days, respectively. Similarly, in varieties Q-88 and GT-7, weight of 10 canes was 13.90 and 15.29 kg, Brix 20.28 and 20.43%, fiber content 13.47 and 12.94%, sugar recovery 10.03 and 10.05% and purity 82.58 and 84.88%, respectively. The accumulated losses in Q-88 were 3.39, 6.84, 10.43 and 15.88% and in GT-7 3.08, 6.85, 12.94 and 18.47%; accumulated losses in sugar recoveries in Q-88 were 1.15, 2.97, 6.03 and 9.76% and in GT-7 1.24, 3.53, 6.68 and 9.35%, when harvested cane was left unprocessed for 2, 4, 6 and 8 days, respectively. Per day weight loss in Q-88 was 3.39, 3.45, 3.59 and 5.45% (avg. 3.97%) and in GT-7 per day weight loss was 3.08, 3.77, 6.08 and 5.53%, when harvested cane was left unprocessed for 2, 4, 6 and 8 days, respectively (avg. 4.61%). The daily loss in sugar recovery of Q-88 was 1.15, 2.97, 6.03 and 9.76% (avg. 2.44%) and in GT-7 daily loss was 1.24, 2.29, 3.15 and 2.67%, when harvested cane was left unprocessed for 2, 4, 6 and 8 days, respectively (avg. 2.34%). It was concluded that with each day delayed milling of harvested cane, the quantity and quality of cane and juice was adversely affected and delay in processing of cane upto 8th day resulted 15.88 and 18.47% loss in cane weight and 9.76 and 9.35% loss in sugar recovery in varieties Q-88 and GT-7, respectively. Variety GT-7 experienced greater weight loss with average daily weight loss of 4.61% than variety Q-88 (3.97%), while per day sugar recovery losses were not notably different in both the varieties i.e. 2.44% in Q-88 and 2.34% in GT-7.

Keywords: Sugarcane, varieties, post harvest losses

INTRODUCTION

Sugarcane, *Saccharum officinarum* L., is a giant perennial grass belonging to the family graminae and the tribe *Andropogonae* (Nazir *et al.* 2000). It is highly water-intensive and an important crop. Sugar production in the country mostly depends on this crop, though a small quantity of sugar is also produced from sugar beet. Its share in value added of agriculture and GDP are 3.5 and 0.7 percent, respectively. The sugarcane production in Pakistan followed a declining trend and the cane production of 53413 thousand tons in the year 2003-04 came down to 47244 thousand tons in 2004-05, while in 2005-06 it further decreased to 44666 thousand tons. The reduction in cane production was 11.6% (2004-05) and 5.5 % (2005-06) over the preceding year. However, in the year 2006-07 the total cane production showed promising trend 54752 thousand tons cane, with an increase of 22.6 percent over the preceding year (GOP, 2007).

Generally, the studies on sugarcane production are being carried out, but relatively less attention has been paid to post harvest losses. There are two areas of post harvest quality decline in sugarcane (i) inversion process accompanying harvest operations and subsequent delay in delivering of cane to factory and (ii) factory losses incidence to inefficient processing which may be heightened by sugar inversion and conversion reactions within the milled juice. Field losses in sugarcane quality may considerably exceed the factory losses borne by the processor. A well ripened sugarcane crop, the culmination of many months or years of culturing programming, may thus lose its sugar within a few days after harvest operations begin (Salassi *et al.* 2003). Post harvest deterioration in sugarcane have not always been viewed in terms of sucrose losses. In fact, the harvested cane kept in the field for one week or more had a higher sugar content than it did at the time of cutting. The magnitude of this so called "after ripening" appears to be far less pronounced when a full account is given to moisture or weight losses and purity changes relative to recoverable sucrose. It is generally agreed that the second week after harvest be accumulated sugar experiences unfavorable changes such that the sucrose is not already inverted will be exceedingly difficult to recover from the low quality juice (Salassi *et al.* 2003). Post harvest deterioration is more nearly related to moisture and original condition of cane than to storage methods, i.e. piles vs open storage. The sound, clean, dry cane deteriorated much slower than cane which was damaged, dirty and wet. Burning, freezing and mechanical harvesting can also cause significant post harvest losses in sugarcane. Moreover, fire causes major physiological changes in the sugarcane plant, the magnitude of these changes depending upon the severity of the fire. Temperatures measured within the cane stalk and visual operations in laboratory and field tests indicated that significant loss of fluid took place by (1) physical ejection and (2) exudation from the stalk. A substantial thermal degradation of the outer tissue occurred most probably. It is suggested that water flow within the stalk might have accelerated towards the leaf at the peak of the fire, but immediately thereafter, juice might have flown towards the root system if it had become sufficiently water deficient to provide the pressure potential. Finally, it is ultimate to say that the harvested cane should necessarily be transported to mill within the period of 24 hours; otherwise there will be loss in cane weight and sugar content. The magnitude of loss in cane weight and sugar content increases even upto 50 percent. The present investigation thus, has been performed to examine the post harvest deterioration in two promising sugarcane varieties when harvested cane is left unprocessed for various time periods.

MATERIALS AND METHODS

The laboratory experiment was conducted at Quaid-e-Awam Agriculture Research Institute, Larkana. The sugarcane crop was sown in the month of October 2005. At maturity, the laboratory analyses were carried out in the month of December, 2006 and completed in the month of January 2007. The main objective of the investigation was to estimate the losses in the quantity and quality of cane and its juice, if harvested cane crop is left unprocessed for different periods. The accumulated losses for a week long storage were also examined and quantified the quantitative and qualitative deterioration per day. During analysis of quantity and quality characters of cane and juice, the study focused the following parameters: weight of 10 canes (kg), fibre percentage, Brix percentage, CCS percentage, purity percentage and accumulated and per day losses in cane weight and sugar content (%). The data collected

were subjected to statistical analysis. Analysis of variance was applied to ascertain the level of significance of the differences among various treatments, while L.S.D. (Least Significant Difference) test was applied to observe the statistical difference within treatments following Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Weight of 10 canes (kg)

There was a consecutive decrease in weight of 10 canes after each day delay in processing of harvested cane. The average weight of 10 canes in control (cane lifted for milling within 24 hours of harvesting) was 15.91 kg, which was reduced to 15.42 kg and 14.82 kg when harvested cane was left unprocessed for 2 and 4 days, respectively. The weight of 10 canes was further decreased to 13.85 kg when harvested cane was left unprocessed for 6 days, while the lowest weight of 10 canes (12.97 kg) was noted when harvested cane was left unprocessed for 8 days. Among varieties, GT-7 lost relatively less weight, which was 16.77 kg in control and decreased to 13.53 kg when harvested cane left unprocessed for 8 days with an average 10 canes weight of 15.29 kg. In variety Q-88, 10 canes weight in control was 15.05 kg, which was reduced to 12.40 kg after 8 days delay in processing of harvested cane, averaging 13.90 kg. These results are partially supported by Abbasi *et al.* (2000) and Archna Suman *et al.* (2000) who reported significant deterioration if harvested cane is left in the field unprocessed.

Brix (%)

Results presented in Table-2 indicated that there was a consecutive deterioration of Brix content in juice after each day delay in processing of harvested cane. The average Brix content in control (cane lifted for milling within 24 hours of harvesting) was 21.02%, which was reduced to 20.79% and 20.42% when harvested cane was left unprocessed for 2 and 4 days, respectively. The Brix content was further deteriorated to 20.07% when harvested cane was left unprocessed for 6 days, while the lowest Brix content (19.47%) was recorded when harvested cane was left unprocessed for 8 days. In case of varieties, GT-7 suffered comparatively less deterioration of Brix content, which was 21.04% when its cane was processed within 24 hours after harvest (control) and decreased to 19.82% when harvested cane left unprocessed for 8 days with an average Brix content of 20.43%. In variety Q-88, Brix content in control was 21.00% at day-1, which was reduced to 19.12% after 8 days delay in processing of harvested cane, averaging 20.28%. The results are in concurrence to those of Birkett and Stein (2004), Eggleston and Legendre (2000) and Larrahondo *et al.* (2002), who were of the view that brix content is adversely affected by delay in processing of cut cane.

Fiber (%)

There was an inverse effect on fibre content in juice and it was consecutively increased with each day delay in processing of harvested cane. The average fiber content in control (cane lifted for milling within 24 hours of harvesting) was 12.93%, which was increased to 13.06% and 13.18% when harvested cane was left unprocessed for 2 and 4 days, respectively. The fiber content was further increased to 13.33% when harvested cane was left unprocessed for 6 days, and reached to maximum percentage (13.50%) when harvested cane was left unprocessed for 8 days. The varietal effect indicated that average fiber content was significantly higher (13.47%) in variety Q-88 than GT-7 (12.94%). In GT-7, the fiber content was 12.63% when its cane was processed within 24 hours after harvest (control) and increased to 13.29% when harvested cane left unprocessed for 8 days. In variety Q-88, the fiber content in control was 13.24% at day-1, which was increased to 13.71% after 8 days delay in processing of harvested cane (Table-3). These results are in line with those of Maeda et al. (1999), Mohamed (2001) and Nazir et al. (2000) who were of the experience that fiber content reduced when harvested cane was not milled in time.

Sugar recovery (%)
The average sugar recovery in control (cane lifted for milling within 24 hours of harvesting) was 10.48%, which was reduced to 10.35% and 10.11% when harvested cane was left unprocessed for 2 and 4 days, respectively. The sugar recovery was further reduced to 9.78% when harvested cane was left unprocessed for 6 days, and the lowest sugar recovery (9.50%) was noted when harvested cane was left unprocessed for 8 days. The comparison of varieties for sugar recovery indicated that both the varieties i.e. Q-88 and GT-7 had no notable difference in sugar content and it was 10.45 and "p.51% in Q-88 and GT-7 when their cane was processed within 24 hours after harvest (control) and decreased to 9.43 and 9.56%, respectively when their harvested cane left unprocessed for 8 days with an average recoveries of 10.03 and 10.05% (Table-4). Similar results have also been reported by Salassi et al. (2003), Saska (2002), Sens (2002), Sharma et al. (2004), Singh et al. (2002),Singh and Solomon (2003), Singh (2004), Solomon et al. (1999), Uppal et al. (2000), Uppal and Sharma (2003), Uppal and Sharma (2004), who's consolidated experience revealed that each delay in milling of harvesting cane would result substantial loss of recovery.

Purity (%)
There was adverse effect on purity percent in juice with each day delay in processing of harvested cane. The average purity percent in control (cane lifted for milling within 24 hours of harvesting) was 84.06%, which was decreased to 83.90% and 83.78% when harvested cane was left unprocessed for 2 and 4 days, respectively. The purity percent in juice was further decreased to 83.59% when harvested cane was left unprocessed for 6 days, and it reached to a minimum level of 83.34% when harvested cane was left unprocessed for 8 days. The varietal effect indicated that average purity percent was significantly higher (84.88%) in variety GT-7 as compared to variety Q-88 (82.58%). In GT-7, the purity percent was 85.17% when its cane was processed within 24 hours after harvest (control) and decreased to 84.52% when harvested cane left unprocessed for 8 days. In variety Q-88, the purity percent in control was 82.94% at day-1, which was decreased to 82.16% after 8 days delay in processing of harvested cane (Table-5). Sharma et al. (2004) and Singh et al. (2002) found that delayed processing of harvested deteriorates purity of juice in cane.

Accumulated losses in cane weight and sugar recovery
The losses in cane weight and sugar recoveries were accumulated for both the varieties (Q-88 and GT-7) as affected by delay in processing for certain periods (Table-6). The results indicated that variety GT-7 suffered greater accumulated losses in 10 canes weight as compared to Q-88. The accumulated losses in weight of 10 canes in Q-88 were 3.39, 6.84, 10.43 and 15.88 percent, while in GT-7, the losses were 3.08, 6.85, 12.94 and 18.47 percent when harvested cane was left unprocessed for 2, 4, 6 and 8 days, respectively. The results on accumulated losses in sugar recoveries (Table-6) indicated that in sugarcane variety Q-88, the losses were 1.15, 2.97, 6.03 and 9.76 percent, while in variety GT-7, the losses were 1.24, 3.53, 6.68 and 9.35 percent, when harvested cane was left unprocessed for 2, 4, 6 and 8 days, respectively (Table-6).

Per day losses in cane weight and sugar recovery
Per day losses in cane weight and sugar recoveries were worked out for both the varieties (Q-88 and GT-7) as affected by delay in processing for certain periods (Table-7). The results suggested that variety GT-7 suffered greater per day losses in 10 canes weight as compared to Q-88. The per day losses in weight of 10 canes in Q-88 were 3.39, 3.45, 3.59 and 5.45 percent, averaging 3.97 percent, while in GT-7, the losses were more i.e. 3.08, 3.77, 6.08 and 5.53 percent, when harvested cane was left unprocessed for 2, 4, 6 and 8 days, respectively, averaging losses of 4.61 percent per day.

The results on per day losses in sugar recoveries (Table-7) indicated that in sugarcane variety Q-88, the losses were 1.15, 2.97, 6.03 and 9.76 percent (averaging 2.44 percent), while in variety GT-7, the losses in recovery were 1.24, 2.29, 3.15 and 2.67 percent, when harvested cane was left unprocessed for 2, 4, 6 and 8 days, respectively, with average per day losses of 2.34 percent.

CONCLUSION

It was concluded that with each day delayed milling of harvested cane, the quantity and quality of cane and juice was adversely affected and delay in processing of cane up to 8th day resulted 15.88 and 18.47% loss in cane weight and 9.76 and 9.35% loss in sugar recovery in varieties Q-88 and GT-7, respectively. Variety GT-7 experienced greater weight loss with average daily weight loss of 4.61% than variety Q-88 (3.97%), while per day sugar recovery losses were not notably different in both the varieties i.e. 2.44% in Q-88 and 2.34 in GT-7.

Table-1 Average weight of 10 canes (kg) of sugarcane varieties as affected by post-harvest storage periods

Cane storage periods	Varieties		Mean
	V1=Q-88	**V2=GT-7**	
S1=Control	15.05	16.77	15.91 a
S2= 2 days after harvest	14.54	16.30	15.42 ab
S3= 4 days after harvest	14.02	15.61	14.82 b
S4= 6 days after harvest	13.48	14.22	13.85 c
S5= 8 days after harvest	12.40	13.53	12.97 c
Mean for varieties	13.90 b	15.29 a	-

	Storage periods(S)	Varieties(V)	S x V
S.E. ±	0.1165	0.1504	0.0951
LSD 0.05	0.6418	0.4971	0.4763
LSD 0.01	0.8873	0.6873	0.6414

Table-2 Mean Brix (%) of sugarcane varieties as affected by post-harvest storage periods

Cane storage periods	Varieties		Mean
	V1=Q-88	**V2=GT-7**	
S1=Control	21.00	21.04	21.02 a
S2= 2 days after harvest	20.89	20.68	20.79 a
S3= 4 days after harvest	20.45	20.40	20.42 ab
S4= 6 days after harvest	19.92	20.21	20.07 ab
S5= 8 days after harvest	19.12	19.82	19.47 b
Mean for varieties	20.28	20.43	-

	Storage periods(S)	Varieties(V)	S x V
S.E. ±	0.1612	0.2081	0.1316
LSD 0.05	0.8874	-	-
LSD 0.01	1.2270	-	-

Table-3 Mean fibre content (%) in juice of sugarcane varieties as affected by post-harvest storage periods

Cane storage periods	Varieties		Mean
	V1=Q-88	V2=GT-7	
S1=Control	13.44	12.63	12.93 a
S2= 2 days after harvest	13.34	12.77	13.06 d
S3= 4 days after harvest	13.45	12.91	13.18 c
S4= 6 days after harvest	13.59	13.08	13.33 b
S5= 8 days after harvest	13.71	13.29	13.50 a
Mean for varieties	13.47 a	12.94 b	-
	Storage periods(S)	Varieties(V)	S x V
S.E. ±	0.0096	0.0126	0.0098
LSD 0.05	0.0550	0.0426	0.0408
LSD 0.01	0.0760	0.0589	0.0550

Table-4 Mean sugar recovery (%) in juice of sugarcane varieties as affected by post-harvest storage periods

Cane storage periods	Varieties		Mean
	V1=Q-88	V2=GT-7	
S1=Control	10.45	10.51	10.48 a
S2= 2 days after harvest	10.33	10.37	10.35 a
S3= 4 days after harvest	10.14	10.08	10.11 ab
S4= 6 days after harvest	9.82	9.74	9.78 bc
S5= 8 days after harvest	9.43	9.56	9.50 c
Mean for varieties	10.03	10.05	-
	Storage periods(S)	Varieties(V)	S x V
S.E. ±	0.0737	0.0951	0.0602
LSD 0.05	0.4044	-	-
LSD 0.01	0.5591	-	-

Table-5 Mean purity (%) in juice of sugarcane varieties as affected by post-harvest storage periods

Cane storage periods	Varieties		Mean
	V1=Q-88	V2=GT-7	
S1=Control	82.94	85.17	84.06 a
S2= 2 days after harvest	82.77	85.02	83.90 a
S3= 4 days after harvest	82.63	84.92	83.78 ab
S4= 6 days after harvest	82.41	84.78	83.59 ab
S5= 8 days after harvest	82.16	84.52	83.34 b
Mean for varieties	82.58 b	84.88 a	-
	Storage periods(S)	Varieties(V)	S x V
S.E. ±	0.0671	0.0866	0.0548
LSD 0.05	0.3692	0.2860	0.2740
LSD 0.01	0.8104	0.3953	0.3690

Table-6 Accumulated losses in cane weight and sugar recovery due to delay in processing of harvested cane

Cane storage periods	**V1=Q-88**		**V2=GT-7**	
	10 Cane weight (%)	**Sugar recovery (%)**	**10 Cane weight (%)**	**Sugar recovery (%)**
S1=Control	0	0	0	0
S2=2 days after harvest	3.39	1.15	3.08	1.24
S3=4 days after harvest	6.84	2.97	6.85	3.53
S4=6 days after harvest	10.43	6.03	12.94	6.68
S5=8 days after harvest	15.88	9.76	18.47	9.35

Note: The accumulated losses were quantified on the basis of increase/decrease in related characters in the preceding tables.

Table-7 Per day losses in cane weight and sugar recovery due to delay in processing of harvested cane

Cane storage periods	V1=Q-88		V2=GT-7	
	10 Cane weight (%)	Sugar recovery (%)	10 Cane weight (%)	Sugar recovery (%)
S1=Control	0	0	0	0
S2=2 days after harvest	3.39	1.15	3.08	1.24
S3=4 days after harvest	3.45	1.82	3.77	2.29
S4=6 days after harvest	3.59	3.06	6.08	3.15
S5=8 days after harvest	5.45	3.73	5.53	2.67
Average day^{-1} losses	3.97	2.44	4.61	2.34

Note: The per day losses were quantified on the basis of accumulated losses by subtracting the benchmark or preceding values from progressing values.

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SUGAR INDUSTRY ABSTRACTS

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Efficiency of mechanical cane loading in Egypt l'efficience du chargement mecanique de la canne en egypte eficiencia del cargue mecanico de cana en egipto
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Agricultural Engineering Proc. Int. Soc. Sugar Cane Technol., Vol. 27, 2010. pp. 11.

The cane growing area along the Nile valley in Upper Egypt has expanded. Most farmer holdings are small, typically ranging from 0.5 to 1 hectare. Cane delivery schedules and consequently harvesting dates mainly depend on the delivery allocation and the date of harvest last season. The mill administration assigns a transport vehicle (main vehicle) for each farmer according to the schedule. Farmer/s harvest and transport cane from inside field/s (using tractor-pulled-trailers) to temporary storage sites at which the main vehicle/s are loaded. Loader efficiency can be low due to time losses associated with travel from one storage site to another. To achieve reasonable efficiency of the loader, storage sites may be amalgamated allowing greater utilization of loaders. This procedure may increase the infield transport distance which may reduce the rate of cane supply from fields, thus contributing to increased cane delivery delay. Farmers may have to transport a part of the main vehicle load to the storage site the previous day to secure continuous operation of the loader. In this study, loader efficiency, loading rate, the percentage of main vehicle/s load/s delayed more than 24 h and cane collection efficiency were studied. In most cases, one main vehicle is assigned to each farmer, where a trailer pulled by tractor is used to transfer cane from inside the field to the storage area. Results show that total efficiency of the loader was 75% in the case of loading lorries in a large storage area and 81% in the case of railway wagons loaded at a station. Average total efficiency of the loader was 61% when loading decauvelle wagons distributed in several storage areas within the same production region. Efficiency of loading tractor trailers in the field was 54%. Maximum efficiency was observed to be achieved if the loader works for the full operational day in one storage area. Cane collection efficiency was variable for the variable operating conditions. The percent of cane delayed more than 24 h was also estimated. Large temporary storage areas at which lorries are loaded with cane, and cane loading stations for railway wagons may represent more optimal conditions for loader operation. The paper discusses the efficiency of loader operation under a range of variable conditions, and related cane delivery delay. The results highlight the role of loader operation efficiency as a factor determining the adoption of mechanical loading of sugarcane. Recommendations for the proper operation of a cane loader are suggested.

Optimal use of biomass in an isolated environment: case study at miyako island, japan utilisation optimale de la biomasse dans un environement isole: etude de cas dans l'lle de miyako, japon el uso optimo de la biomasa en un **entorno aislado: estudio de caso en la isla de miyako, japon**
Yoshiyuki Shinogi, Teruhito Miyamoto, Koji Kameyama and Chen Yan
Agricultural Engineering Proc. Int. Soc. Sugar Cane Technol., Vol. 27, 2010. pp. 12.

This paper briefly outlines an ongoing research project and some research outcomes focusing on sugarcane. Five research topics were identified, namely: 1) development of technologies for farmland application of converted biomass from sugarcane molasses such as compost, char, digestive slurry and vinasse; 2) clarification of optimal allocation of biomass and optimal operational conditions for conversion plants; 3) development of groundwater conservation technologies with biomass, mainly focusing on nitrogen; 4) development of technologies for introduction of energy crops and optimal CO_2 gas application to crops; and 5) clarification of favourable conditions for sugar-ethanol by-production systems using greater-biomass sugarcane. Our target biomasses are bagasse and cattle wastes. Five conversion plants, including two pyrolysis, one composting, one bio-gas and one gasification, have already been installed to properly and effectively convert biomass. Farmland application technologies for char and digestive slurry with bagasse have mainly been studied. Also, vinasse (bio-ethanol by-product; distilled residue) is another biomass target. We analysed vinasse for return of by-products to the farmland as a way to achieve sustainability and devote efforts to the application of vinasse to farmland. Of course, safety to crops, the soil and water environment should be confirmed first. Previous experiments revealed vinasse does not have bad impacts on crop growth. Also, we conducted studies to clarify the favourable conditions for introduction of greater biomass sugarcane to develop sugar-ethanol by-production systems. A favourable new variety of sugarcane was previously selected. In addition, a sugar-yield equation for great-biomass sugarcane was developed from observed data.

Diversification of sugarcane varieties for cattle feed and sustainability diversification des varietes de canne **a sucre pour l'alimentation animale et la durabilite diversificacion de las variedades de cana de azucar para el ganado, alimentacion y la sostenibilidad**

H. Jorge, O. Suarez, H. Garcia, I. Jorge and L. Benitez

Agricultural Engineering Proc. Int. Soc. Sugar Cane Technol., Vol. 27, 2010. pp. 21.

The paper reports results of a study of 44 sugarcane genotypes, evaluated as cattle feed, at 13 months of age, in the first ratoon crop, at Villa Clara-Cienfuegos Territorial Sugar Cane Research Station and the Sancti Spiritus National Breeding Center in Cuba. Fourteen traits were evaluated by means of multivariate analyses (Principal Components and Discriminant Function), and also a simulation was conducted of agro-ecological regionalisation for the allocation of the sugarcane varieties according to the main limiting factors (drought and poor drainage) on a cattle producing farm. Results showed that the variables, percentage of stalk fresh weight (% of stalks) and of tops (% of tops), had high influence in the first principal component, whereas the genetic disease (smut and rust) resistance had high influence in the second component. It should be pointed out that the percentage of digestibility of the dry matter showed very little variability, which indicates a high stability of this trait. The Discriminant Function Analysis allowed classification of cultivars into three groups: varieties of low forage value (below 40% digestibility of the dry matter), varieties of intermediate forage value (between 40-50%) and varieties of high forage value (above 50% digestibility). Results allowed the recommendation of 21 new genotypes, characterized by their resistance to main diseases and their high forage value, and nine were superior to the control My5514, four suitable for water logging stress and three for drought stress. The simulation of the agro-ecological regionalisation enabled spatial location and modeling for the appropriate establishment of individuals, in agreement to their digestibility, tolerance to the two environmental stresses (water logging and drought) and their disease resistance.

Strategies for the optimal use of nitrogen fertilisers in the sugarcane crop in guatemala strategies pour une utilisation optimale dbs engrais azotes en culture de canne **a sucre au guatemala estrategias para el uso optimo de fertilizantes nitrogenados en el cultivo de la cana de azucar en guatemala**

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The objective of this work is to present practical criteria that will help sugarcane growers to optimise their investment in nitrogen fertilisers in the sugarcane crop in Guatemala. The importance of this objective is in relation to the general increase of fertiliser price and particularly of nitrogen fertiliser. The criteria are based on knowledge of crop response to N application in the region after 14 years of experience in research on the topic. Crop N response is a function of cane yield, soil fertility, crop age or crop cycle and other variables associated with agronomical practices and soil condition. As a result, N rate used in sugar mills' fertilisation programs can be adjusted by comparing the current relation of kg of nitrogen per tonne of cane (N:TC), with reference ratios recommended for different soils according to organic matter content (OM) and other factors. Besides, N rates must be adjusted to fertiliser and sugar price for different production groups. As an alternative to reduce dependence on nitrogen fertilisers, there are practices that must be taken into account and be optimised in the short term. These practices consist of usage of species of green manure adapted to the intercropping system, the use of co-products and, in the mid and long term, there is potential for N biological fixation in the sugarcilhe crop.

Gge biplot analysis used to evaluate cane yield of sugarcane *(saccharum* spp.) cultivars across sites and crop cycles l'utilisation de l'analyse biplot gge pour l'evaluation du rendement des cultivars de la canne a sucre *(saccharum* spp.) a travers les sites et les cycles de culture analisis gga biplot utilizado para evaluar el rendimiento de cana en cultivares de cana de azucar *(saccharum* spp.) a traves de sitios y ciclos del cultivo

J.L. Queme, H. Orozco and M. Melgar

Agricultural Engineering Proc. Int. Soc. Sugar Cane Technol., Vol. 27, 2010. pp. 65.

Multi-environment yield trials (MET) are a series of experiments in which a set of genotypes (G) are evaluated in multiple environments (E). The presence of genotype x environment (GE) interaction observed in MET complicates the selection and/or recommendation of cultivars. Several statistical methodologies have been developed for the analysis of GE interaction. GGE biplot of the SREG model is a recent methodology based on a graph formed with the first two principal components (PCI and PC2). GGE represents the G main effect plus the GE interaction effects. Thus, GGE biplot provides an adequate graphical tool for visual analysis of MET data. The objectives of this research were to evaluate sugarcane cultivar responses across environments in order to identify high-yielding cultivars with broad or specific adaptation by applying the GGE biplot analysis. Fourteen sugarcane cultivars were evaluated at three sites in the plant, first and second ratoon crops across the middle land zone of the sugarcane growing area of Guatemala, forming nine environments (three sites x three crop cycles). Data on tonnes of cane per hectare (TCH) were recorded. The first two principal components (PCI and PC2) were highly significant ($P<0.01$) and explained 73% of the GGE. GGE biplot analysis allowed selection of the sugarcane cultivar PR75-2002 as second Sn average cane yield and had broad adaptation (stable). Two groups of environments (mega-environments) were defined; the first had seven environments and the second one had two environments The winning cultivars with the highest cane yield were CGOO-120 and CGOO-092 for each of those groups (specific adaptation), respectively. The G main effect and GE interaction can be exploited by selection of highest cane yield cultivars for each mega-environment.

Tolerance of sugarcane parents to herbicides and its transmission in progeny tolerance des geniteurs de la canne a sucre aux herbicides et sa transmission a la descendance tolerancia de parentales a herbicidas y su transmision a las progenies en cana de Azucar

K. Ramdoyal, S. Seeruttun, M.G.H. Badaloo and C. Barbe

Agricultural Engineering Proc. Int. Soc. Sugar Cane Technol., Vol. 27, 2010. pp. 66.

Sugarcane varieties with one or both parents in common have been observed to show a similar tolerance level to the tank-mix of diuron and Actril-DS®. This study was initiated to evaluate parent varieties frequently used in the breeding program of the Institute, for transmission of their tolerance to herbicide in crosses. Sixty parents established in pots and later transplanted in replicated field trials were evaluated for their tolerance to the test herbicide tank-mix. Crosses were made with some selected parents with known tolerance and 15 families, comprising 40 seedlings each, were subsequently evaluated for their response to the same tank-mix. Parents differed significantly in their tolerance to herbicide and were classified as: tolerant (T) 10%; slightly susceptible (SS) 34%; moderately susceptible (MS) 25%; susceptible (S) 25%; highly susceptible (HS) 7%. The phenotypic correlation between the degree of tolerance to the herbicide tank-mix evaluated in pots and in the field was moderately high, indicating that assessment of response of genotypes in pots can provide a useful indication of expression of tolerance at field level. The families also differed significantly in their tolerance to herbicide. Generally, crosses between T/SS x MS parents produced about 40% and 46% of progenies in the T/SS and MS classes, respectively. Conversely, S x HS crosses produced a very high proportion (75%) of progenies in the S/HS. The degree of susceptibility to herbicide increases with the degree of susceptibility of the parental combination. A clear-cut segregation towards either T/SS or S/HS groups was not evident that could indicate the action of a major gene. Partitioning of variance indicated a high component of additive genetic variance, high narrow-sense heritability, and the possibility of breeding for the character through a judicious choice of parent varieties.

The effect of bagasse furnace ash application on sugarcane resistance to top borer *scirpophaga nivella intacta* snellen (lepidoptera: pyralidae) effet de cendre de bagasse sur la resistance de la canne a sucre contre le foreur apical de la canne *scirpophaga nivella intacta* snellen (lepidoptera: pyralidae) el efecto de la aplicacion de cenizas de bagazo en la resistencia de la cana al barrenador del cogollo *scirpophaga nivela intacta* snellen (lepidoptera: pyralidae

Saefudin Saeroji, Sunaryo and Heru Gunito

Agricultural Engineering Proc. Int. Soc. Sugar Cane Technol., Vol. 27, 2010. pp. 92.

Sugarcane top borer, *Scirpophaga nivella intacta* Snellen, is a major pest of sugarcane at PT Gunung Madu Plantations, Lampung, Indonesia. Infestation on several commercial varieties is alarming despite an integrated control program. Many studies have been done in South Africa, Hawaii, Florida, India, and Taiwan on use of the element silicon to improve plant resistance to pest and disease. Bagasse furnace ash, plentiful at a cane sugar factory, is known as an important silicon source. A field trial was conducted in the plantation to study the effect of bagasse furnace ash application on sugarcane resistance to top borer infestation. A susceptible variety TC4 was used. Treatments comprised a control and 40, 80, and 120 t/ha of pre-plant broadcast application. In the 120 t/ha treatment, the number of top borer larvae successfully boring into the leaf spindle was 20.7% less than the control. Also 19.2% fewer larvae bored into the growing point and the internodes. Similarly, the length of boring tunnels (measured from the growing point) in this treatment was shorter than in the control. In addition, stalk population, height, and diameter increased with the rate of ash application. Application of 120 t/ha bagasse furnace ash of approximately 7.97 ± 0.58% silicon content increased the resistance of susceptible variety TC4 to top borer infestation and increased the cane yield by 39.89%.

Advances and challenges in sugarcane biotechnoloy and plant pathology: a review of the ix plant pathology workshop and vi molecular biology workshop les avancees et les defis en biotechnologie et pathologie de la canne **a sucre: une revue du ix atelier de pathologie et du vi atelier de biologie moleculaire avances y retos en la biotecnologia y patologia de la cana de azucar: una revision del taller ix de patologia y vi de biologia molecular**

J.C. Comstock, A. Dookun-Saumtally, B. Croft, A. D'hont, F.F. Garces Obando, E. Mirkov, G.P. Rao, S. Saumtally, G.M. Souza and D. Watt

Agricultural Engineering Proc. Int. Soc. Sugar Cane Technol., Vol. 27, 2010. pp. 124.

FOR THE second time, the International Society of Sugar Cane Technologists (ISSCT) Pathology and Molecular Biology Workshops were jointly held, from 23-27 June 2008 in Cali, Colombia. The meeting was hosted by CENICANA and organized by Jorge I. Victoria and Jershon Lopez-Gerena. The response of participants was positive with 44 delegates representing 15 countries attending. Thirty seven oral presentations and ten posters covering a wide range of topics including molecular characterization of yeasts, insect pests and pathogens, genetic transformation of Sugarcane, molecular markers, genetic mapping, pathogen variability, disease diagnosis, plant resistance and disease epidemiology among others were presented. The workshop also provided the opportunity to listen to three plenary talks on biofuel production, transgenics and nutritional improvements in food crops through genomics. A special session was devoted to orange rust, a newly introduced disease in Florida and in Central America. Following the technical sessions, site visits were organised during two days to sugar mills, commercial fields, plots with transgenic sugarcane, and laboratories at CENICANA. The experience of having joint-section meetings proved very useful with excellent interaction among participants.

Sugarcane rusts in florida les differentes rouilles de la canne a **sucre en floride royas de la cana de azucar en la Florida**

Jack C. Comstock, Neil C. Glynn and R. Wayne

Agricultural Engineering Proc. Int. Soc. Sugar Cane Technol., Vol. 27, 2010. pp. 125.

Sugarcane orange rust symptoms were first observed in Florida in June 2007 on cultivar CP 80-1743. The causal agent, *Puccinia kuehnii,* was subsequently verified morphologically and molecularly constituting the first confirmed report of sugarcane orange rust in the Western Hemisphere. Orange rust was distributed throughout the entire Florida sugarcane industry, primarily on cultivars CP 80-1743 and CP 72-2086. The objective of this research was to evaluate the reaction of the commercial cultivars to both sugarcane brown and orange rusts and to assess their effect on the CP cultivar development program in Florida. The rust reactions of several widely grown commercial cultivars, newly released cultivars and clones in the selection program, parental clones and CP historical clones were determined in order to develop a suitable resistance strategy to address the new incursion of orange rust. Changes in the program to increase the level of rust-resistant progeny are detailed.

Potassium removal from distillery slops by *candida utilis* propagation elimination du potassium des vinasses de distillerie au moyen de *candida utilis* remocion del potasio de los residuales de la destilacion mediante la propagacion de *candida utilis*

M. A. Otero-Rambla, O.A. Almazan-Del Olmo, Daniel Bello-Gil, Gustavo Saura-Laria and Julio A. Martinez-Valdivieso

Agricultural Engineering Proc. Int. Soc. Sugar Cane Technol., Vol. 27, 2010. pp. 138.

Yeasts accumulate varied amounts of most of the minerals present in their growth media. Much of the 7.5-8.1% ash found in the yeast grown for baking or harvested from beer is potassium phosphate, but yeast has the ability to accumulate other ions provided (but not necessarily needed) in high concentration. Distillery slops still contain about 70% of all potassium contributed to the soil in cane fields as chemical fertilizer, thus fertigation with these wastewaters has to be carefully calculated since otherwise soil Stalinization can occur. When grown in a medium composed of distillery slops, nutrient salts (ammonium phosphate and sulfates) and a microbial growth enhancer *Candida utilis* shows a great resistance to potassium concentration in continuous culture. Yeast cells were propagated under the above conditions with increasing amounts of K_2O from 2.5 g/L concentration (distillery slops from molasses fermentation) up to 25 g/L in propagation medium. Specific growth rate (umax) ranged from 0.32 to 0.28 IT^1 for the extreme values mentioned above, while biomass- substrate yield coefficients were 0.23 to 0.18. These results suggest that yeast propagated on supplemented distillery slops could significantly reduce the potassium content of these wastes making them more suitable for irrigation purposes. According to the nutritional assessment reported, the potassium accumulated has no deleterious effect on animal health.

Communities auto sufficient in fuels for humans, transport and electric needs communautes autosuffisant en carburant pour les besoins de l'homme, le transport et l'energie electrique comunidades auto suficientes en combustibles para las necesidades humanas, de transporte y electricas

Peter Charles Jais

Agricultural Engineering Proc. Int. Soc. Sugar Cane Technol., Vol. 27, 2010. pp. 139.

IN VIEW OF the present problems facing the world with respect to fossil fuels (pollution and global warming, availability and price), we studied the possibility of a small community becoming auto sufficient in sugar, automotive fuel (ethanol) and electricity, all from renewable biomass (sugarcane). The study was done, based on a real project that we are presently installing under similar lines. The fuel needs of a community of 100 000 people were quantified in terms of sugar, ethanol, and electricity. A mass and energy balance was calculated to determine the amounts of cane and trash needed to produce the sugar, ethanol and electricity by generation and co-generation. The results showed us that 100 tonnes of cane per hour can supply sufficient sugar and electric energy for a community of 100 000 people and run their cars on 96°GL ethanol (no mix with gasoline) and still be able to export surplus ethanol. The auto sufficiency is for the whole year and not only the crop period. The overall results showed us that, when compared to the importation of 'fuels', the project was positive.

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