PAKISTAN SUGAR JOURNAL

November-December 2006
VOLUME XXI, NUMBER 06

SUBSCRIPTION RATE

PAKISTAN

PSST Members
Sugar Companies/Others Rs.300/-

OVERSEAS US$25/-

Subscription rates include 6 issues for Pakistan Sugar Journal, airmail delivery

Recognized by Higher Education Commission (HEC)

ISSN 1028-1193

Subscription and Advertisement Service

Mohammad Awais Qureshi

Shakarganj Mills Ltd.,
Toba Tek Singh Road, JHANG
Tel: 047-7629337-41
Telex: 43471 CJP PK.
Fax: 047–7620272, 613050

E-mail: shahid@shakarganj.com.pk

Published by

Mohammad Asghar Qureshi

Under the patronage of
SHAKARGANJ
SUGAR RESEARCH INSTITUTE

COMPARATIVE GROWTH AND QUALITY ASSESSMENT OF DIVERSE SUGARCANE CLONES IN 3RD CYCLE UNDER THATTA AGRO-ECOLOGICAL CONDITIONS

By

Riaz Noor Panhwar, Dhani Bakhash Panhwar, *Manzoor Ali Memon, Ghulam Sarwar Unar, Muhammad Chohan, Ghulam Moheyuddin Kaloi, and Ali Hassan Mari

*National Sugar Crops Research Institute, PARC, Thatta, Pakistan

Technology Transfer Institute, PARC Tandojam, Pakistan

ABSTRACT

Fifty sugarcane clones obtained from second cycle were evaluated in third cycle at National Sugar Crops Research Institute, farm Thatta during the year 2003-04. The clones were screened against the standard sugarcane variety BL-4. All the clones in the trial behaved differently with estimation to their quantitative and qualitative traits. Out of the 50 clones tested, 12 clones were selected on the basis of relatively better cane thickness, larger cane height, higher weight per cane and CCS %. The selected clones were advanced to 4th cycle for further testing and evaluation.

INRODUCTION

Sugarcane (*Saccharum officinarum,* L.) is one of the major crops of Pakistan. It exerts a great impact on the economic uplift of the growers and provides raw material to the sugar industry for the manufacture of sugar and other by-products. Area under sugarcane cultivation in Pakistan has increased manifolds and now it is being grown on an area of 1,074,700 hectares with total annual production of 53,811,000 tones (Anonymous 2004). Although the domestic sugarcane production has steadily increased in the last four decades (Bashir and Saeed 2000), yet our national average cane yield is 50.07t/ha and average sugar recovery is 9.15% (Anonymous, 2004) which is much lower than the production potential of 256 t/ha in existing domestic cane varieties (Gill, 1995). The reasons for low cane and sugar yield in Pakistan may be attributed to poor soil fertility, conventional sowing methods, low seed rate, poor quality seed, poor agro management in addition to these low yielding varieties both in tonnage and quality limits production to a considerable extent (Ahmed, 1988). According to Keerio *et al.,* (2003) inherently low cane and sugar yielding varieties and fewer provisions for evolution and acclimatization of improved sugarcane varieties also play a distinct role. The average cane yield can be improved by adopting improved package of technology and developing high yielding varieties through different breeding techniques (Memon *et al.,* 2004).

In most of the cane-breeding programme around the world, large number of seedlings has to be planted in order to obtain the superior clones for release as new varieties (Tai *et al.,* 1992). Sugarcane clones are frequently evaluated in one or two row plots in early stages of selection. Selection in small plots should be based on sugar content, measuring cane yield in such trials may be inefficient, may necessarily delay progression of selected clones through to the next stages of selection (Jackson and Mc Rae, 2001). Selection in early stages must concentrates on easily recognized characters with good repeatability such as good growth, tillering, leaf development, desirable stalk characteristics and resistance and tolerance to diseases and pest (Skinner *et al.*, 1987). Zafar *et al.* (2005) stated that in good agronomic

practices the growth performance is a character that affects the yield of cane crop. Growth habits, erectness, inter-nodal length, girth of cane, length of cane and stooling depends upon genetic make up which may be detected by overall performance of the clones.

Breeding and selection strategies depend upon integrate group of the characters, usually determines the acceptance of released varieties at the farmers level. Selection of the clones made on simple genetic parameters such as good growth performance with thicker stalks, larger cane height, weight per cane and CCS% and discard of the clones having poor visual growth, grades and high insect pest attack would result in greater gains in early selection stages. Measuring cane yield in early selection stages not only is associated with some cost, but it may also add an extra year to selection if harvesting and weighing is practiced.

The efforts are needed to increase cane and sugar production per unit area to cope with the sugar requirements of the country's population, which is increasing at the rate of 3% per annum (Economics Survey, 1992). The situation demand new set of varieties, which is possible only through breeding efforts.

Keeping this objective in view the present study was undertaken to evaluate the performance of different sugarcane clones in 3rd cycle for some characters of agronomic importance.

MATERIALS AND METHOD

Study was conducted at National Sugar Crops Research Institute, PARC Thatta. Seedlings clones were raised in nursery from the exotic fuzz (True seed) of USA origin. These seedlings clones were transferred to the main field and grown as single plants. The selected sugarcane clones from the single plant trial were promoted and year wise tested in subsequent selection stages (first and second cycles). During October 2003 fifty sugarcane clones obtained from second cycle were planted in third cycle for further testing and selection. Two rows of each sugarcane clone were planted by over lapping method using two budded sets. The row length and row spacing were 5m and 1m respectively with two replications. Screening of the clones was made against standard variety BL-4. Crop was fertilized @ 275-112-175 Kg NPK/ha. All PK and 1/3 N was applied at sowing while remaining 2/3 N was applied in two equal splits first at the time of first ear thing up and the second at the time of ear thing up. Recommended agronomic and insect pest control practices were carried out uniformly. At the time of maturity six canes were randomly selected for the record of data on cane thickness, cane height, number of internodes per cane and weight per cane. Each month cane samples comprised of four canes per sample were randomly taken and analyzed for CCS% (Commercial Cane Sugar). The data so collected was averaged and subjected to statistical analysis using MSTAT-C statistical programme (Michigan State University, 1991).

RESULTS AND DISCUSION

Data presented in table-1 revealed that only three sugarcane clones HoTh-414, HoTh-409 and HoTh-432 produced maximum cane thickness of 30.04, 28.67 and 27.96 mm respectively which was higher than the cane thickness of 27.21 mm obtained from check variety BL-4. While cane thickness measured in 12 sugarcane clones was in the range of 25.01 to 26.95 mm, which was considered reasonable for the selection. By contrast, the rest thirty five clones in the trial showed lowest performance by producing canes of minimum thickness

ranged between 22.68 to 24.99 mm against the check. Thus under good growth performance the clones, showing cane thickness more than 25.0 mm were considered to promote towards the next selection cycle. According to Ramdoyal, (1999) use of large stalk diameter would enhance the acceptability of varieties from a commercial standpoint. Amaya *et al.* (1996) stated that canes that grow tall and thin may be more prone to lodging; the clones with thick stalked canes that resist lodging may have great potential to be the high yielding varieties in future.

Height of a cane contributes materially towards final cane yield. Data regarding cane height given in table-1 revealed that sugarcane clones HoTh-430, HoTh-409, HoTh-438, HoTh-434, HoTh-422 and HoTh-432 produced taller canes of 237.30, 230.61, 230.08, 225.30, 215.70 and 215.64 cm height respectively. Moreover, 19 clones exhibited next good performance by producing cane length ranged from 190.82 to 210.58 cm against the check variety BL-4, which gave 190.75 cm cane height. Contrary to this, 25 clones in the trial produced cane height ranged from 160.56 to 190.33 cm and failed to exceed check variety in respect of this quantitative trait. The variations in cane height may be attributed to the genetic constitution of the different clones. According to Jackson and Mc Rae (2001) under good growing conditions, individual seedling clones may produce up to about 2.0 m of cane that can be planted to the next selection stage.

The cane weight is the product of its length, girth and contributes substantially towards final cane yield. The data embodied in table-1 indicated that sugarcane clones HoTh-409, HoTh-432 and HoTh-438 produced heavier canes of 1.30, 1.15 and 1.12 kg weight/cane respectively against the check variety BL-4, which gave weight of 1.10 kg/cane. While, the clones like HoTh-406, HoTh-430, HoTh-404 and Hoth-434 showed almost matching results with check variety by producing weight of 1.08, 1.04, 1.03 and 1.0 kg/cane, respectively. The rest all the clones in the trial could not exceed the check variety in terms of this quantitative trait. However, the clones like HoTh-402, HoTh-408, HoTh-414, HoTh-419, HoTh-423 and HoTh-424 were placed in intermediate position for producing weight ranged from 0.89 to 0.96 kg/cane, which was considered reasonable for the selection. The results suggested that weight per cane was primarily under genetic control that varied with the clones.

The search of varieties that, besides having desirable characteristics, exhibit high sugar content is an important aspect in sugarcane breeding. Sugar recovery stands the factor of prime importance both from millers and breeding point of view. The data regarding month wise and mean CCS% is depicted in table-1, which revealed that sugarcane clones HoTh-404, HoTh-437, HoTh-433 and HoTh-415 produced maximum mean CCS of 13.16, 13.02, 12.96 and 12.92%, respectively. While, two clones like HoTh-406 and HoTh-419 remained at par with each other by producing next maximum mean CCS of 12.90%. Apart from this, the mean CCS value recorded from 8 clones was more than 12%, which was fairly higher than that of mean CCS value 11.33% recorded from check variety BL-4. However, later 27 clones showed more or less closer performance to the check by producing mean CCS values more than 11% and thus occupied intermediate position. In contrast, 10 clones showed relatively poor results by producing mean CCS values ranged between 10.72 to10.97% that was attributed to their late maturing behavior and continuous vegetative growth of the plants till late in the season.

CONCLUSION

Out of the 50 sugarcane clones tested only 12 were selected on the basis of relatively better cane thickness, larger cane height, higher weight per cane and CCS%. The selected sugarcane clones were promoted to 4th cycle for further testing and progression. The selected sugarcane clones have shown good performance in early selection stages and have great promise to be the good commercial varieties in future.

REFERENCES

1. Anonymous, 2004. Annual Report Pakistan Sugar Mills Association, Sindh Zone. pp 6-9.
2. Ahmed, N. 1988. Studies on comparative decline in yield potential and quality of some old sugarcane varieties. M. Sc. (Hons.) Agri. Thesis, Deptt. Agron., University of Agri. Faisalabad.
3. Amaya, A., A. L. Gomez., J. T. Buitrago., C. A. Moreno, and C. Cassalett., 1996. Characterization of lodging in sugarcane. Vol.2. p. 321-328. In Proceedings of the International Society of Sugarcane Technologists XXII Congress, Cartagena Colombia. 11-15 Sept. 1996. Tecnicana.
4. Bashir, S. and M. Saeed, 2000. Effect of planting pattern and seedling density on yield, weed mass production and crop lodging in sugarcane cultivar SPSG-26. Pakistan Sugar J. 15 (4): 22-25.
5. Economic Survey, 1992-93. Government of Pakistan, Finance Division, Economic Advisor Wing, Islamabad.
6. Gill, M.B. 1995. Physio agronomic studies on flat versus pit plantation of autumn and spring sugarcane (*Saccharum officinarum,* L.). Ph.D. Agri. Thesis, Department of Agronomy, University of Agri. Faisalabad (Pakistan). 49-89.
7. Jackson, P. and T.A. Mc Rae, 2001. Selection of sugarcane clones in small plots. Effects of plot size and selection criteria. Crop Science 41: 315-322.
8. Keerio, H. K., R. N. Panhwar, Y. M. Memon, M. Y. Araien, M. Chohan and B. R. Qazi, 2003.Qualitative and quantitative performance of some promising and commercial sugarcane varieties under agro-climatic conditions of Thatta. Pak. J. of Applied Sciences, 3 (10-12): 670-673
9. Memon, Y. M., H. K. Keerio, R. N. Panhwar, B. R. Qazi, M. A. Rajput and G. S. Unar, 2004. Yield response of different sugarcane genotypes under agro-climatic conditions of Thatta. Journal of Applied Sciences 4(1): 90-92.
10. Michigan State University, 1991. MSTAT-C, Micro computer statistical programme.
11. Ramdoyal, K. 1999. Genetic correlation and repeatability of agronomic characters in sugarcane population in contrasting environments and different crop years. Sugarcane. No.4. 6-12.
12. Skinner, J.C., D.M. Hogarth, and K.K. Wu. 1987. Selection methods, criteria and indices. *In* D.J. Heinz (ed.) Sugarcane improvement through breeding. Elsevier, Amsterdam.
13. Tai, P.Y.P., J.M. Shine and J. D. Miller. 1992. Cross evaluation using a small progeny test. J. Amer. Soc. Sugarcane Tech., 12, 110-111.
14. Zafar, M., A. A. Chattha, M. A. Grawal and Z. Ali, 2005. Comparative performance of sugarcane clones at nursery stage for growth, quality and disease response. Pak. Sugar J. 20 (3):2-6.

Table-1 Performance of sugarcane clones for quality and quantitative traits in 3rd cycle at NSCRI farm Thatta during 2003-04

Genotypes	Cane thickness (mm)	Cane height (cm)	Internodes/ plant	Weight/ cane (Kg)	Month wise CCS%			Mean CCS%
					Oct.	Nov.	Dec.	
HoTh-401	25.01	190.00	22.03	0.83	11.01	11.32	11.41	11.24
HoTh-402	25.92	198.64	22.80	0.91	12.67	12.71	12.80	12.72
HoTh-403	24.67	180.33	19.60	0.81	10.85	10.96	11.24	11.01
HoTh-404	25.40	202.00	21.60	1.03	12.92	13.16	13.40	13.16
HoTh-405	23.89	175.38	18.20	0.75	10.78	11.02	11.34	11.04
HoTh-406	26.01	200.00	23.82	1.08	12.74	12.92	13.05	12.90
HoTh-407	24.89	185.24	22.47	0.78	10.61	10.82	10.97	10.80
HoTh-408	25.99	210.33	21.36	0.96	12.33	12.51	12.83	12.55
HoTh-409	28.67	230.61	25.04	1.30	12.61	12.94	12.90	12.81
HoTh-410	23.68	160.56	18.90	0.71	10.59	10.66	10.91	10.72
HoTh-411	24.50	185.00	20.67	0.75	10.98	11.04	11.32	11.11
HoTh-412	23.01	188.00	24.68	0.70	10.85	11.00	11.08	10.97
HoTh-413	24.86	190.18	18.36	0.71	12.53	12.87	12.81	12.73
HoTh-414	30.04	185.34	20.33	0.96	10.81	10.86	11.22	10.96
HoTh-415	24.56	205.02	19.33	0.74	12.62	13.06	13.10	12.92
HoTh-416	25.36	190.27	20.18	0.73	10.72	10.94	11.14	10.93
HoTh-417	24.64	200.37	18.26	0.71	11.32	11.58	11.66	11.52
HoTh-418	23.34	180.31	19.37	0.67	11.11	11.04	11.41	11.18
HoTh-419	25.96	195.33	23.04	0.91	12.60	12.97	13.14	12.90
HoTh-420	22.68	190.82	22.50	0.61	10.69	10.83	11.00	10.84
HoTh-421	25.43	205.62	24.60	0.81	10.72	10.95	11.26	10.97
HoTh-422	23.01	215.70	23.20	0.73	10.65	10.86	11.18	10.89
HoTh-423	24.46	199.20	20.90	0.89	10.70	10.98	11.15	10.94
HoTh-424	25.44	200.58	19.70	0.90	12.56	12.79	12.99	12.78
HoTh-425	24.01	185.35	25.00	0.71	11.03	11.13	11.54	11.23
HoTh-426	24.61	190.20	22.48	0.75	11.12	11.41	11.60	11.37
HoTh-427	24.64	210.58	20.22	0.82	10.78	11.00	11.34	11.04
HoTh-428	23.64	205.07	20.90	0.80	11.16	11.25	11.49	11.30
HoTh-429	23.40	180.25	19.76	0.71	11.28	11.51	11.73	11.50
HoTh-430	26.95	237.30	21.25	1.04	12.64	12.89	13.12	12.88
HoTh-431	23.67	185.04	20.63	0.69	10.76	11.04	11.39	11.06
HoTh-432	27.96	215.64	23.45	1.15	12.50	12.92	12.95	12.79
HoTh-433	24.10	180.22	21.27	0.69	12.74	12.96	13.19	12.96
HoTh-434	26.78	225.30	22.33	1.00	11.26	11.43	11.69	11.46
HoTh-435	24.00	195.65	22.00	0.79	10.75	11.09	11.38	11.07
HoTh-436	23.67	175.00	19.34	0.60	11.13	11.24	11.72	11.36
HoTh-437	23.45	180.67	20.44	0.65	12.79	13.07	13.21	13.02
HoTh-438	25.91	230.08	22.66	1.12	12.65	12.74	12.90	12.76
HoTh-439	24.67	200.00	21.60	0.81	11.10	11.37	11.85	11.44
HoTh-440	24.96	205.67	22.20	0.79	11.20	11.53	11.81	11.51
HoTh-441	23.46	190.18	18.96	0.69	11.15	11.38	11.73	11.42
HoTh-442	23.69	185.44	18.33	0.70	11.32	11.64	11.79	11.58
HoTh-443	24.56	190.80	19.34	0.78	11.20	11.49	11.68	11.45
HoTh-444	24.99	170.03	18.18	0.69	11.08	11.06	11.28	11.14
HoTh-445	23.45	195.29	20.69	0.61	10.80	10.92	11.12	10.94
HoTh-446	23.01	200.78	20.37	0.62	11.09	11.22	11.58	11.29
HoTh-447	23.56	210.15	23.22	0.65	11.30	11.62	11.86	11.59
HoTh-448	24.40	195.00	22.00	0.71	11.34	11.58	11.90	11.60
HoTh-449	23.46	180.00	18.47	0.70	11.02	10.93	11.39	11.11
HoTh-450	23.68	190.33	19.56	0.69	11.32	11.56	11.88	11.58
BL-4	27.21	190.75	23.22	1.10	11.11	11.34	11.54	11.33
C V%	2.95	1.63	4.20	3.66	-	-	-	-
LSD 0.5%	1.46	6.39	1.78	0.06				
LSD 0.1%	1.97	8.52	2.37	0.08				

CORRELATION STUDIES BETWEEN STEM BORER INFESTATION AND OTHER PARAMETERS OF SUGARCANE VARIETIES

By
*Samiullah Khan, Said Mir Khan, **Khalid Abdullah and ***Abdul Latif
*Gomal University, Dera Ismail Khan **University of Reading, United Kingdom
***Agriculture Research Institute, Dera Ismail Khan

ABSTRACT

Twelve sugarcane varieties were evaluated for stem borer reaction. The stem borer incidence at farmer's field was evaluated by conducting a survey for the active pest season (Aug.-Nov.). Results of screening trial showed varieties S97-US-102, S96-SP-228 and S96-SP-571 had least percent stem borer infestation (2.04, 2.267 and 2.353 respectively). The interaction between plant height and stem borer's infestation was positive with a r^2=0.984, plant girth had negative relation while no relation could be estimated between brix and stem borer infestation. In a separate trial on (ratoon crop) variety S-97-US-128 had significantly more stem borer infestation than all other tested varieties.

Key words: sugarcane pests, survey, varietal resistance, stem borer

INTRODUCTION

Borers enjoy pivotal role in insect pests attacking sugarcane in Pakistan. Kumarasinghe (2003) considered borers as a serious pest among 103 pests species associated with sugarcane in Sri Lanka (Kuniata, 1998). Among control tactics recommended for the bores management, farmers in Pakistan, widely rely on synthetic pesticide, mostly applied indiscriminately with out the assessment of pest and beneficial fauna. This situation rune the efforts of various agencies encouraging demonstrating farmers to opt biological control.

The biology of the sugarcane borer is well synchronized to that of sugarcane ecology. The favorable weather conditions favorable to rapid growth of sugarcane plant (warm temperature and abundant of rainfall) invariably result in rapid increase in populations of the sugarcane borer. (Hensley, 1971) The pest behavior, estimated losses and farmers attitude of less likely to adopt only biological control may be because of it delayed action, it is imperative to evaluate other possible control tactics to be incorporated in the IPM program for sugarcane borers. Host plant resistance and knowledge of population build up are some of the areas which give good standby understanding the developing-population of the pest and knowledge of prediction could result in prompt action and minimizing the losses at initial stage. Many scientists evaluated different gene pool for the borers reaction and recorded the population build up peaks in their agro-ecological areas like Atwal (1976), Rossi and Flower (2000), Allsopp *et al.* (2000), Ricaud and Arceaneaux (2000), Schexnayde *et al.* (2001), Kumarasinghe *et al*. (2001), Keeping and Mayer (2002), Samson (2002), Khaliq *et al.,* (2003), Chattha *et al.* (2003), Baloch *et al.* (2003), Kumarasinghe (2003), Zafar *et al.* (2003) and Lohar *et al.* (2004). The study in hand was designed with objectives to evaluate any relation between borer infestation and yield components and estimate the population buildup in farmers field during the active-season of borers.

MATERIALS AND METHODS

The experiments were conducted in Research Block of Agriculture Research Institute, Dera Ismail Khan (NWFP) during the year 2003-04. The experiments were kept pesticide free through out the crop season.

A. Testing of sugarcane varieties against stem borer:
The experiment was conducted in randomized block design, and replicated three times. Sugarcane crop was planted on five-row-plots of five-meter long. All the cultural practices were applied uniformly to all plots. Twelve promising sugarcane varieties, selected from the previous year's performance trials, were used in this experiment. Sugarcane sets of two to three buds were planted in rows 75-cm apart. Double sets were arranged in end-to-end position. Varieties evaluated were:

1. S-97-US-183	2. S-96-SP-574	3. S-97-US-128	4. S-97-US-173
5. S-96-SP-228	6. S-97-US-102	7. S-96-SP-680	8. S-96-SP-571
9. 3210	10.S-85-NSG-6	11.S-95-NSG-15	12.NIA-98

For data collection five plants in each plot were assessed for stem borer's infestation, dead hearts and the data generated were converted into percent infestation using following formula.

$$\text{Percent infestation} = \frac{\text{No. infested Canes}}{\text{Total No. of Canes}} \times 100$$

Other parameters like plant height, girth, brix were also recorded, employing the standard procedures. Brix was measured using refrectometer (OGAWA SEIKI Co, LTD Tokyo).

The data were subjected to statistical analysis using MSTAT-C and correlation was also studied between stem borer infestation and other morphological parameters.

Survey
Major sugarcane growing areas of Dera Ismail Khan were surveyed for the insect pest attacking sugarcane crop from August till November. Stem borer attack was recorded in percent infestation by observing five plants and presence of exit hole of stem borer was considered as infested. At each location 3 farmers field were selected and at each field three plots were considered for data collection.

RESULTS AND DISCUSSIONS

A- Testing of sugarcane varieties against stem borer:
The data for various traits (parameters) of the twelve sugarcane varieties were analyzed statistically and presented in table-1. The table revealed that varieties performed for the stem borer infestation was significantly different. Varieties S96-US-102 (2.043), S96-SP-228 (2.267) and S96-SP-571 (2.353%) had significantly least stem borer infestation and were non-significant from each other. While variety S95-NSG-15 (7.767 %) has high stem borer infestation. On the basis of level of infestation the varieties ranked in descending order were 3210> NIA-98> S97-US183> S96-SP-6807> S97-US-173> S96-SP-574> S85-NSG-6> S97-US-128.

Variety S97-US-183 with an average plant height of 205cm was ranked tallest among the tested varieties. On the other hand variety S96-SP-574 proved the short-stature one with an average height of 100.2cm. Plant height also play important role in other phenomena like yield, lodging, and pest attack. The tested varieties had varying degree of brix and ranged from 23.33 to 14.43. Varieties S96-SP-228, 3210, NIA-98 and S97-US-173 were found the non-significantly different from each others from highest brix point of view while variety S96-SP-574 exhibited the least in brix. Plant girth or cane thickness of all varieties were measured and found that it ranged from 1.80 to 1.017cm. Varieties S97-US-128, S85-NSG-6, and S97-US-102 had the highest cane thickness while variety S95-NSG-15 had the minimum girth.

The resistant phenomena of varieties are explained by naturally presence of toxin, tolerance and pest preference (for landing, egg laying etc.) characteristics. Studies of all these factors of resistant varieties were not in the domain of present studies. However some efforts were made to explain theses phenomena in the available resources were considered. It also opens new horizons for future researchers to design their studies on these lines. Lohar (2004) studied varietal susceptibility of sugarcane borers and reported that some varieties are resistant to stem borer but less resistant to root borer and vise-versa. Allsopp *et al.,* (2000) tested 11 varieties and found variation in resistance level, sugar percentage and yield. Khaliq *et al*., (2003) also obtained similar trend as recorded in the present studies though the scientists used different cultivars and tested their varieties in different ecological conditions.

Diversity in the varietal behavior was the hypothesis of the present studies. Basically diversity is a function of genetic make up of the variety, however, gene expression again rely on the environmental factors. So it is very important to test even similar gene pool in varying agro ecological conditions to find the best or variety with desired exhibited characteristics.

Correlation Studies

The interaction between plant height and stem borer's infestation proved to be a positive with a r2=0.984 (Fig-1). The stem borer infestation increased with increase in plant height. Short nod-length varieties were resistant than long nodal varieties. The stem borer's such trend is also verified in other crops like maize and rice where taller varieties are more likely to be infested then the short stature varieties. The phenomena could be explained by the fact that taller varieties had advantage for the moths to recognize and rest for egg laying then shorter plants or varieties, resulted in comparatively higher damage.

Table-1 Performance of different sugarcane varieties against stem borer at ARI D. I. Khan

Varieties	% Stem borer infestation	Plant Height (cm)	Plant Girth (cm)	TSS (°Brix)
S97-US-183	5.233 c	205.000 a	1.577 cd	21.833 bc
S96-SP-574	3.043 f	100.167 i	1.473 e	14.433 g
S97-US-128	2.553 g	160.433 c	1.800 a	21.167 c
S97-US-173	3.500 e	128.600 f	1.627 c	22.233 abc
S96-SP-228	2.267 gh	138.733 e	1.503 de	23.333 a
S97-US-102	2.043 h	107.967 h	1.730 ab	17.867 ef
S96-SP-680	4.243 d	110.600 h	1.257 f	19.400 d
S96-SP-571	2.353 gh	148.633 d	1.707 b	21.233 c
TCP83-3210	7.100 b	148.633 d	1.627 c	23.173 ab
S85-NSG-6	2.687 fg	190.600 b	1.773 ab	17.000 f
S95-NSG-15	7.767 a	121.967 g	1.017 g	18.833 de
NIA-98	6.783 b	111.600 h	1.513 de	23.133 ab
LSD	0.4317	3.887	1.37	0.075

Means followed by similar letters in a column are non-significant different at 5% of probability level.

The Relationship between stem borer's infestation and brix percentage was not very much effective and showed 6.7 percent (Fig-2). The Fig-3 shows correlation between stem borer's infestation and plant girth. The 60.7 percent negative relations depict the decreasing borers infestation trend in thicker cane. The negative relationship with plant girth also gives a message for the sugarcane breeder to consider it with short stature varieties for a better impact of natural resistance. The thick canes had lesser stem borer infestation probably due to the reason that thicker cane would require harder peal to withstand against lodging and could be mechanical barrier for the boring larvae resulted in lesser infestation. However further investigation before making conclusion is required on more detailed morphological and chemical parameters. Similar observation was recorded by the Kumarasinghe *et al.* (2001) though they used different morphological parameters and insects, but of the opinion that morphological traits resulted in over 82% of growth of insects.

Germination:
The results (Table-2) indicated that variety BF-138 had greater germination percent (64%) as compared to the rest of varieties, followed by the varieties CPF-237 and S96-SP-302 with average germination percent 58 and 51 respectively, while variety NSG311 had minimum germination 13%. Chattha *et al.* (2003) evaluated different sugarcane varieties for germination, tillering, millable canes, cane yield and commercial cane sugar/brix %. The results thus obtained revealed that different varieties behaved differently at different locations.

Yield:
The results presented in table-2 exhibited that all the tested varieties were significantly different from each other from cane yield point of view. Variety S96-SP-302 had maximum cane yield, which was 137.78 t/ha. Closely followed by S95-HS-185 with 134.67 t/ha. Malakand-17 showed poorest performance in cane yield. Variety CPF-237 provided cane yield 75 t/ha. Chattha *et al. (*2003) reported approximately similar results. Yield losses occur due to stalk mortality, reduced crop growth due to lack of nutrition and water uptake, lodging, cane breakage, etc. Yield losses cannot be precisely assessed.

Height:
The results (Table-2) revealed that variety LRK-2001 was obtained in maximum plant height (291cm) followed by S96-SP-302 and Q-88 with mean plant height 260 and 246cm, respectively. Except Malakand-17 in which minimum plant height (176cm) was recorded. All varieties produced plant height more than 200cm.

Table-2 Data of Various Parameters of different sugarcane varieties at ARI D. I., Khan

Varieties	Varieties	Beneficial insects/ plant	Stem borer Infestation (DH)	Yield (t/ha)	Germi-nation %	Height (cm)	Girth (cm)	Recovery (%)	TSS at harvesting (Brix)
S97US-183	S86US-340	1.333 d	6.571 b	51.33 g	25f	205 g	2.38 cd	9.15 cdef	21.73bcd
S96SP-574	S842-1-282	2.667 ab	7.247 b	66.76 ef	36e	215 efg	2.58 bc	9.02 cdef	21.07bcde
S97US-128	NSG 311	3.333 a	11.337a	63.83 f	13g	233 cdef	2.35 cd	9.48 bcde	21.81bc
S97US-173	S95HS-185	1.667 cd	5.963 b	134.67 a	49bc	243 bcd	2.56 bc	10.63 a	22.40b
S96SP-228	LPHS-35	1.333 d	8.077 b	52.75 g	37de	220 defg	2.35 cd	10.32 ab	20.97bcde
S97US-102	S96SP-302	1.000 d	8.316 b	137.78 a	51b	260 b	3.31 a	9.88 abc	24.97a
S96SP-680	BF-138	1.000 d	7.227 b	83.33 c	64a	220 defg	2.21 d	8.25 fg	19.82e
S96SP-571	Q-88	2.333 bc	6.413 b	106.92 b	42de	246 bc	2.16 d	8.48 efg	20.02de
TCP83-3210	LRK 2001	1.667 cd	6.670 b	70.83 de	43cd	291 a	2.81 b	8.52 defg	21.08bcde
S95NSG-6	Malakand-16	1.000 d	7.317 b	81.92c	37de	235c de	2.26 d	7.63 g	21.10bcde
S95NSG-15	Malakand-17	1.667 cd	6.480 b	51.33 g	36e	176 h	2.40 cd	8.57 defg	20.63cde
NIA-98	CPF-237	2.667 ab	7.370 b	75.00 d	58a	210 fg	2.20 d	9.55 bcd	20.17cde
LSD	LSD	0.8295	2.454	4.980	6.098	24.96	0.2884	1.040	1.714

Means followed by similar letters in a column are significant different at 5% of probability level.

Girth:
Plant girth or cane thickness of all varieties (Table-2) were measured and found that it ranged from 3.31cm to 2.16cm. Varieties S96-SP-302, LRK-2001 and S84-1-282 had girth 3.31, 2.81 and 2.58cm respectively, while variety Q-88 had minimum girth (2.16cm).

Recovery:
The results (Table-2) revealed that variety S95-HS-185 had maximum recovery (10.63%), closely followed by variety LPHS-35 (10.32%), while variety Malakand-16 had minimum recovery (7.63%).

CSS at Harvest (Brix):
The results (Table-2) revealed that the tested varieties were found non-significantly different from brix percentage point of view. The percentage of tested varieties S96SP-302, S95HS-185 proved i.e. highest brix 24.97 and 22.40% respectively, while variety BF-138 had lowest degree of brix percent (19.82%).

Population Dynamics Studies:
The survey was conducted on farmer's field representing all sugarcane growing zones of Dera Ismail Khan. The overall data show that the *Pyrilla perpusilla* walker population remains negligible during survey period. Pyrilla is occasional pest and mainly relate with the fluctuation of beneficial population and the cultural practices performed by the growers. The beneficial (parasitoids) hide in the sugarcane trash in winter at the time of harvesting. It is a common observation that farmers burn sugarcane field trash after harvesting happened to have more pyrilla infestation then others. More over the environmental factors also play a pivotal role in population build up of pyrilla. Observations of few fields showed gurdaspur borers infestation but it was not common in all the areas served. Black bug is insect attacking sugarcane, but its damage is indirect and sooty mould etc. can be seen on plants besides the yellowing coloration.

However, during the survey black bug prevailed (though in considerable low population) through out the period of survey, and its population remained less than one adult per leaf. In November at some locations like Lang Khair Shah and Qazi Khokar it was totally disappeared. Probably due to low temperature, other locations also showed more or less similar trend of low black bug population over the period as well. The figure 4 shows a declining population trend in the month of September to November at all the location which clearly advocate the environmental factor especially temperature dependent pest of sugarcane. This information could be effectively utilized towards management decisions for the pest and pest incidence forecast as well.

Table-3 Percent infestation of Stem Borer and Black Bug Population (adult/ leaf) on sugarcane fields during the moths of August to November at various sugarcane areas of Dera Ismail Khan

Area	Stem Borer Infestation %			
	August	September	October	November
Parova	05.76	24.32	26.56	29.09
Lunda Sharif	26.05	53.75	53.84	72.22
Pusha Pull	13.04	35.50	28.30	43.39
Himmat	04.70	20.00	16.36	44.23
Lang Khair shah	12.35	18.75	22.85	46.77
Qazi kho Khar	11.68	21.80	37.70	36.50
Zafar abad	16.60	14.28	18.75	36.66
Korai	00.00	00.80	15.38	00.50
Shore Kot	22.22	25.00	49.05	38.77

Averaged over three fields and three samples from each field at each location

By the survey it was learned that sugarcane stem borer is the most prominent insect attacking sugarcane in D. I. Khan and farmers practices of management, fails to keep the pest below threshold level. Right from August till November its record confirms that this pest has established in the sugarcane growing area. This is probably due to the reason that most of the sugarcane stem borer are polyphagous in nature and their wild or cultivated host plant remain available year round and the sugarcane is it self a long duration crop with two sowing season allow the insect to develop on variety of alternatives and choices. The figures 4-12 also show a increasing trend right from August till November that trend could be a good tool for pest forecast. The increasing trend could be explained by the fact that the stem borer infestation and damage is irreversible and every time it gives a cumulative damage. Though the insect being cold-blooded organisms, hibernate in winter but the damage exists unlike to other pests' damage like pyrilla and black bug. Henseley (1971) studied the insect population infesting sugarcane and reported varying trend over the months and stated that environmental factors affect the population buildup or otherwise.

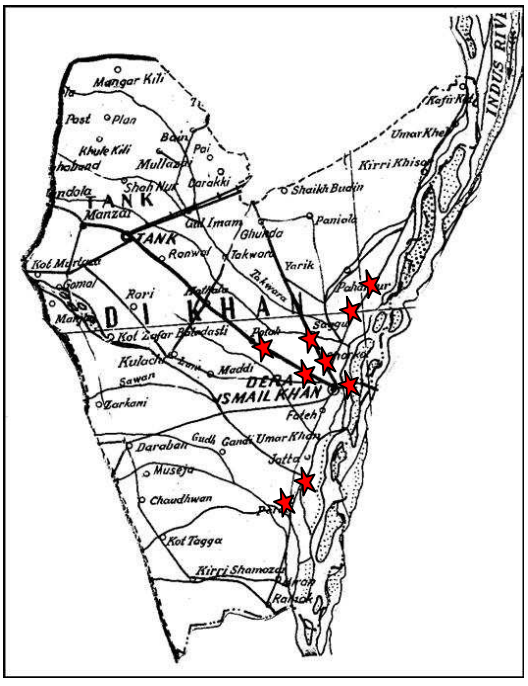

Table-4 Average Weather data of Dera Ismail Khan

Factors	Year 2004			
	August	September	October	November
Max Temp	36ºC	36 ºC	30ºC	27ºC
Min Temp	25ºC	24ºC	19ºC	10ºC
Humidity	72	70	70.5	67
Pan Evaporation	5.14mm/day	6.08mm/day	4.06mm/day	12.85mm/day
Rainfall	42.5mm	50mm	0	0
Rainy days	3,9,18,25,27	16	0	0

REFERENCES

1. Allsopp P. G, N. G. M. Gill and J. K. Stringer, 2000. Host- plant resistance in sugarcane to pink ground pearls, *Eumargarodes laingi* jakubski (Hemiptera: Margarodidae): Confirmation and further screening of clones. Black Well Synergy. Australian Journal of Entomology, 39.316.

2. Atwal, A. S, 1976. Agri. Pest of India and Southeast Asia. Kalyani Publisher, Ludhiana, India.pp.332-333.

3. Baloch. F. M., N. A. Soomro and I. Majeedano, 2003. Quantitative and qualitative performance of different promising sugarcane cultivars for their adaptability. Indus Journal of Plant Science. 3. 228-231.

4. Chattha A. A., M. Afzal, M. Sarwar., A. Jabbar and M. A. Iqbal, 2003. Evaluation of promising cane varieties during spring in central Punjab. Shakarganj Sugar Research Institute. Pak. Sugar Journal November-December, 80-84.

5. Hensley, S. DS, 1971. Management of sugarcane borer populations in Louisiana, a decade of change. Entomophaga 16: 133-146.

6. Keeping M.G. and J.H. Meyer, 2002. Calcium silicate enhances resistance of sugarcane to the African stalk borer *Eldana saccharina* walker (Lepidotera: pyralidae). Black Well Synergy. Agriculture and Forest Entomology.4. 265.

7. Khaliq, A., M. Ashfaq, M. A. Khan and A. Ali, 2003. Varietal resistance in sugarcane against top borer, *Scirpophaga nivella* F. Pakistan entomologists, 25.41-44.

8. Kumarasinghe, N. C., S. D. Wratten, P. C. Jepson, 2001. Morphological basis for resistance in sugarcane to Pyrilla perpusilla Walker (Homoptera: Lophopidae). Intern. J. Pest Manag. Taylor & Francis. 47.127 - 134.

9. Kumarasinghe, N.C, 2003. Insect fauna associated with sugarcane plantations in Sri Lanka. J. Env. Bio. 24 (4): 359-368.

10. Kuniata, L. S, 1998. Borer damage and estimation of losses caused by *Sesamia grisescens Walker* (Lepidoptera: Noctuidae) in sugarcane in Papua New Guinea. Intern. J. Pest Manag. Taylor & Francis. 44. 93 – 98

11. Lohar, M. K., J. I. Shaikh, A. G. Lanjar and R. D. Khuhro, 2004. Varietal susceptibility and natural enemies associated with sugarcane borers. Sindh Agriculture University Tandojam. National Conference on Agriculture and Animal Sciences 23-25 Nov., 71.

12. Majeedano, H. I., F. M. Baloch, N. A. Soomro, G. S. Tunio and M.U. Usmanikhail, 2004. Effect of planting geometry and seeding rates on the yield quality of up coming sugarcane variety (triton) in Sindh. Sindh Agriculture University Tandojam. National Conference on Agriculture and Animal Sciences, November 9. 23-25.

13. Ricaud, R. and A. Arceaneaux, 2000. Cultural and land management practice research in sugarcane in 1999. Louisiana State University Agricultural Center 2000 Annual Sugarcane Report. 124-135.

14. Rossi, M. N. and H.G. Flower. 2000. Ant predation of larval *Diatraea saccharalis* Fab.(Lep., crambidae) in new sugarcane in Brazil. Black Well Synergy. Journal of Applied Entomology, 124. 245.

15. Samson, P. R, 2002. Field response of sugarcane cultivars to sugarcane soldier fly, *Inopus rubriceps* (Macquart) (Diptera:Stratiomyidae).Black Well Synergy. Australian Journal of Entomology, 41. 262.

16. Schexnayde, H. P., T. E. Reagan and D.R. Ring, 2001. Sampling for the sugarcane borer (Lepidoptera: Crambidae) on sugarcane in Louisiana. Louisiana State University Agricultural Centre, Baton Rouge, LA70803-1710.

17. Zafar, M., M. Akram, M. S. Anwar, M. Afzal, M. Sarwar and A. A. Chatta, 2003. Acclimatization of Brazilian origin sugarcane clones in advance nursery stage under Faisalabad agro climatic conditions. Shakarganj Sugar Research Institute. Pak. Sugar Journal November-December, 91-98.

SUGARBEET (*Beta vulgaris* L.) RESPONSE TO DIFFERENT NITROGEN DOSES

By

*Umed Ali Buriro, Fateh Chand Oad, **M. Usman Usmanikhail and ***Muzzamil H. Siddiqui

*Sindh Agriculture University, Tandojam, Pakistan ** Sugarcane Section, A.R.I, Tandojam

***University College of Agriculture, Rawalakot, Azad J. and Kashmir

ABSTRACT

The research was conducted to assess the growth and beet yield of Kawaterma sugar beet variety in response to different nitrogen levels at Sindh Agriculture University, Tandojam, Pakistan. Nitrogen levels tested were: 0, 50, 80, 100, 120 and 150 kg ha^{-1}. The growth and yield characters of sugar beet were significantly affected due to increased nitrogen levels. The nitrogen level of 100 kg ha^{-1} produced significantly ($P<0.01$) more germination greater biomass weight, higher single beet weight and beet yield ha^{-1}. Nitrogen levels at the rate of 120 and 150 kg ha^{-1} were ranked at the second and third places for all observed crop parameters. Thus, 100 kg Nha^{-1} was assessed as the optimum level for getting maximum beet root yield in variety Kawaterma and further increase in N levels remained uneconomical by producing adverse effects on all the crop parameters.

Keywords: Sugarbeet, Beta vulgaris, Nitrogen, Growth, Beet, Yield.

INTRODUCTION

Sugar beet are believed to the native to the Mediterranean area of Europe, Egypt and North Africa and secondary area of development located near East. Many members of the beet family are found in areas with elevated salt leaves. Beets have been grown as a pet-herb throughout the recorded history. The root of wild beets, however, was used by ancient civilizations only for medicine. These wild forms did not resemble the modern enlarged beet (Pierce, 1987). Beet root can be grown on a variety of deep arable soils, including muck, sand and sandy or silty loams free from stones seems to be the most suitable. Beets tolerate alkaline soils but, are sensitive to excessive acidity. The plants should be spaced at 23 cm apart, while the row spacing should be maintained at 38-45 cm (Martin, 1978).

The yield obtained locally is much lower as compared to other agricultural countries of the world and there may be a number of causes for this low yield. Among those, the under doses of chemical fertilizer is the major yield limiting factor. It was reported that although nitrogen deficiencies lowers yield but excessive nitrogen application also affects the quality of tubers and cropping systems (Hills and Ulrich, 1971). Further, Cole et al., (1976) reported that beet tubers affected significantly with excess N application. The sugar beet cultivation at Sindh is feasible and promising and even better results could be obtained if proper production technology and infrastructure in the processing sector are established well in time. Looking the economic importance of sugar and sugar industry, this experiment is step to explore nitrogen requirement for sugar beet crop in Tandojam conditions.

MATERIALS AND METHODS

The study was conducted to determine the influence of varying nitrogen fertilizers level on the growth and beet yield at Student Farm Department of Agronomy, Sindh Agriculture

University, Tandojam, Pakistan. The different nitrogen levels (0, 50, 80, 100, 120 and 150 Kg N ha^{-1}) were applied to sugar beet variety Kawaterma in randomized complete block design, replicated three times.

The field operations for land preparation and experiment maintenance like irrigation, weed control, thinning and earthing were adopted according to the requirement of crop. The 100 kg P ha^{-1} fertilizer was incorporated in the form of SSP during furrow preparation. The nitrogen doses were applied in three splits i.e. during first, third and fourth irrigations. The dozes applied are integrated in the treatments.

The fifteen plants of sugar beet were selected randomly from each treatment for the data collection. The beet yield ha^{-1} was computed by harvesting $3m^{-2}$ area from middle of plot. All the data collected were analyzed following the procedure of Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Germination percentage:
The maximum germination (81-84%) was observed in the plots receiving 100-120 kg Nha^{-1}. The minimum germination (58.33%) was exhibited in the control plots where no fertilizer was incorporated. The results clearly indicated that germination percentage increased as the N fertilizer level increased, but decreased linearly after the application of 120 kg Nha^{-1}.

Biomass $plant^{-1}$
The highest biomass $plant^{-1}$ (1411.23g) was obtained under 100 kg Nha^{-1}, followed by 120 kg Nha^{-1} (1213.77g) and 150 kg Nha^{-1} (1154.96g). The lowest values (705.67g) for this parameter were noted under control plots. Faber *et al*., (1991) reported that leaf yields increased as the nitrogen levels increased. Further, Shepherd (1991) also observed that sugar beet response was better at 120 N kg ha^{-1}.

Beet root weight $plant^{-1}$
The beet root weight $plant^{-1}$ showed the superiority of 100 kg Nha^{-1} where 1257.35g of beets were recorded. The application of 120 and 150 kg Nha^{-1} were at the second and third ranks where 1045.40 and 900.77g beet root weights per plant were exhibited. The minimum (443.12g) beet root weight was observed in the un-fertilized plots. Halvorson and Hartman (1988) also reported that application of N significantly increased beet weight.

Beet root weight (kg ha^{-1}):
The production of beet weight was maximum under 100kg Nha^{-1}(71666.67 kg ha^{-1}), fallowed by 120 kg Nha^{-1} (66666.67kg ha^{-1}). The minimum values (38333.33 kg ha^{-1}) for this parameter were noted under control plots.

The results for beet root weight clearly indicated that values increased at each incremental level of nitrogen upto 100 kg Nha^{-1}, beyond that, the values declined. These findings are fully supported with the earlier research of Shepherd (1991) who recommended 120 kg Nha^{-1} as optimum; Ladewig and Marlander, (1997) suggested 70-80 kg Nha^{-1}, for achieving maximum beet root weight.

Relationship of crop parameters with beet yield: The correlation coefficient (r) indicated beet yield ha^{-1} was significantly and positively associated with germination (r=0.93), biomass per plant (r=0.98) and beet root weight per plant. Beiss (1997) also reported that N uptake by plants during vegetative growth were closely correlated.

CONCLUSIONS AND RECOMMENDATION

High yield of sugar beets require better nitrogen fertilizer management. It is prime important to determine the amount of N to be applied, account must be taken of the uptake of N by the growing crop and the available N in the soil. The study proved the superiority of 100 kg N ha^{-1} for the growth and beet yield, beyond that the crop parameters decreased gradually. Hence, 100 kg Nha^{-1} is recommended as farmers guide line to obtain satisfactory beet yield.

Table-1 Sugar beet crop characters as affected by different N levels

Treatment (N kg ha^{-1})	Germination (%)	Biomass $Plant^{-1}$ (g)	Beet root weight $Plant^{-1}$ (g)	Beet root weight (kg ha^{-1})
0	58.33 d	505.67 f	443.12 f	38333.33 f
50	62.67c	668.93 e	178.93 e	46666.67 e
80	65.67c	825.57 d	804.42 d	56666.67 d
100	84.00a	1211.23a	1251.39a	71666.67 a
120	81.670a	1013.77b	1045.40b	66666.67 b
150	71.67b	954.96 c	900.77 c	61666.67 c
LSD 5%	3.78	6.22	3.62	15.67
LSD 1%	5.19	8.55	4.97	21.53
SE	1.26	2.08	1.21	525.3

Mean fallowed by common letters are not significantly different at 5% probability level.

REFERENCES

Pierce, L.C., 1987. "Vegetables", Characteristics, Production and Marketing, John Willey and Sons, Toronto, Singapore, Brishane, New York, 399-401.

Martin, T. H., 1978. Successful fruit and vegetable growing, Orbis Publishing, London, 110.

Hills, F. T. and A. Ulrich, 1971. Nitrogen nutrition. *In*: R. T. Johnson *et al*. (eds.) advances in sugar beet production: Principles and practices. Lowa State Univ. Press, Msames, I. A. 111-115.

Cole, D. F., A. D. Halvorson, G. P. Hartman, J. E. Etchevers and J.T. Morgan, 1976. Effect of nitrogen and phosphorus on percentage of crown tissue and quality of sugar beet. N. D. Farm Res., 33: 26-28.

Gomez, K. A. and A. A. Gomez, 1984. Statistics for Agricultural Research (Second Edition). John Willey and Sons, New York.

Faber, A., A. Chojnacki and T. Kryszkowska, 1991. Assessment of sugarbeet nitrogen nutritional status on the basis of chemical analysis of plants. Pamietnik Pulawski., 29-40.

Shepherd, M. A., 1991. Leaching of spring applied fertilizers and nitrogen requirements of sugar beet. Committee Paper - Sugar Beet Research and Education Committee. (2527):20.

Halvorson, A. D. and G. P. Hartman, 1988. Nitrogen needs of sugarbeet produced with reduced-tillage systems. Agronomy Journal, 80:719-722.

Ladewig, E. and B. Marlander, 1997. Determination of optimum N-supply in sugar beet by different mathematical methods. J. Zeitschrift fur Pflanzenernahrung und Bodenkunde, 160:85-88.

Beiss, U., 1977. Calculation of the nitrogen requirement of sugar beet. J. Zucker. 30:643-649.

PERFORMANCE OF SUGARCANE VARIETIES FOR GUR PRODUCTION UNDER HIGH BARIND TRACT (AEZ-26) OF BANGLADESH

By
M. S. Rahman, G. M. A. Hossain, A. K. Al-Azad, M. I. Ara and M. Kuasha*
*Bangladesh Sugarcane Research Institute, Ishurdi-6620, Pabna

ABSTRACT

An experiment was conducted during 2001-2002 cropping season at farmer's field in Chapai Nawabgonj district under High Barind Tract (AEZ-26) soil to evaluate performance of three newly released varieties (Isd 29, Isd 30 and Isd 31) of sugarcane against two standard varieties viz., Co-1158 and Isd 16. Tillering, millable canes, cane and gur yield except brix percent of all varieties showed significant difference compared to standard varieties. Varieties Isd-31 produced considerable higher cane and gur yield than standard and rest varieties. On the other hand variety Isd 29 and Isd 30 showed progressive increase of cane and gur yield over standard variety Co-1158, while decreased cane and gur yield than another standard variety Isd 16. Hence, variety Isd 31 may be recommended for commercial cultivation at High Barind Tract (AEZ-26) soils.

Key words: Performance, Sugarcane, Varieties, Gur, Barind Tract

INTRODUCTION

Sugarcane is one of the most important cash cum industrial crop of Bangladesh and plays a vital role in national economy. In Bangladesh Gur making is one of the most important cottage industries. In fact, more than 50 per cent of the total sugarcane production in our country is utilized for gur manufacture (Anon., 1981). Sugarcane varieties useful for white sugar manufacture is normally well suited for gur manufacture as well (Rao, 1983). Sugarcane varieties after a considerable period of cultivation show a tendency to decline in yield and vigour (Barnes, 1954 and Hambert, 1959). To maintain high yield it is necessary to replace varieties every few years with new clones (Poehlman and Brathakur, 1969). Sugarcane varieties released by Bangladesh Sugarcane Research Institute (BSRI) do not perform equally well in all ecological zones. Therefore, it is important to evaluate newly released sugarcane varieties suitable for commercial sugarcane production in the area and to ensure sugarcane supply to the gur makers. Gur quality differs from variety to variety. The chemical composition of gur and its quality are dependent on the composition of the juice. Gur quality depends on the number of factors i.e. Variety, soil, climate, nature of cultivation, the stage of maturity at harvest and the method of gur preparation. The quality of gur is considered by its sucrose content, reducing sugars, colour etc (Gopal et al., 1959) though the quality may be further modified by method of boiling and clarificants used for gur making.

In Bangladesh gur making has a significant bearing on the rural economy, so it has paramount importance to take a step to conduct varietal trails for the assessment of economic attributes like yield of cane, gur and their quality. The present investigation was aimed for evaluation of suitable varieties for higher cane and gur yield.

MATERIALS AND METHODS

An experiment was conducted during 2001-2002 cropping season in the non-mill zone area at Ranihati, Shibgonj of Chapai Nawabgonj district under High Barind Tract (AEZ-26) soil. The study was conducted in a farmer's field. Three newly released varieties of BSRI i.e. Isd 29, Isd 30 and Isd 31 were tested against two standard varieties viz., Co-1158 and Isd 16. The experiment was laid out in a randomized complete block design with three replications. The plot size was 6 m x 8 m where row-to-row and plant-to-plant distance was 1m and 0.45 m respectively. Forty-five days old soil bed settlings of each variety were planted on first week of December 2001. Recommended doses of fertilizers were applied in the plots. Normal cultural practices were done as and when needed. The canes were harvested on following December 2002. Data were recorded on tillering, millable canes, brix per cent, yield of cane and gur production. The average values of all parameters were statistically analyzed to compare different varieties under observation.

RESULTS AND DISCUSSION

Analysis of variance showed significant difference for tillers, millable canes, cane yield and gur yield whereas non-significant difference for brix % (Table 1). Such significant difference of different characters among varieties also reported by Mian and Awal (1979). It might be due to differences of the genotypes.

It is seen from the table-2 that there was significant difference in tiller production among the varieties. The highest number of tiller was obtained from Isd 31 (249.7 x 10^3 ha^{-1}) and the lowest from Co-1158 (214.9 x 10^3 ha^{-1}). Variety Isd 16, Isd 29 and Isd 30 produced statistically similar number of tiller. The results supported the findings of Miah *et al.,* (1994) and Rasid *et al.,* (2001) found variation in tiller production among different varieties. Regarding millable cane production all the varieties showed significant difference with the standard variety Co-1158. The highest number of millable canes was obtained from Isd 29 (120.7 x 10^3 ha^{-1}) followed by Isd 16 (116.9 x 10^3 ha^{-1}) and the lowest from Co-1158 (90.0 x 10^3 ha^{-1}). Variety Isd 16 produced statistically similar number of millable canes with Isd 31(110.0 x 10^3 ha^{-1}) and Isd 31 produced statistically similar number of millable canes with Isd 30 (105.0 x 10^3 ha^{-1}). The results corroborated with the findings of Miah *et al.,* (1986) and Miah *et al.,* (1994) observed variation in number of millable canes production while studied the performance of some promising clones/ variety. In case of cane yield, variety Isd 31 produced significantly the highest (101.8 t ha^{-1}) yield and differed with all other varieties. The findings supported the results of Singh *et al.,* (1999) and Arvind *et al.,* (1997) where they found variation in cane yield among different varieties. The lowest cane yield was obtained from Co-1158 (70.41 t ha^{-1}) and it was differed significantly with rest varieties. Variety Isd 16 (92.13 t ha^{-1}) showed statistically similar yield with Isd 30 (86.10 t ha^{-1}) and Isd 30 exhibited statistically similar yield with Isd 29 (84.47 t ha^{-1}). Brix per cent of different varieties showed statistically non-significant effect which corroborates the findings of Matin *et al.,* (1989) and Anon.(2001) observed non-significant difference in brix % among some sugarcane varieties. Highest gur yield was obtained from Isd 31 (10.43 t ha^{-1}) followed by Isd 16 (9.90 t ha^{-1}) and the lowest from Co-1158 (7.04 t ha^{-1}). Varity Isd 30 and Isd 29 exhibited non-significant difference among them while significant difference with rest varieties. The highest cane yield of Isd 31 variety was associated with the highest tiller production. Results supported finally of Rashid *et al.,* (2001).

From the table 3 it is found that highest percentage of cane yield (44.58 % and 10.50 % over Co-1158 and Isd 16, respectively) was obtained from Isd 31 and highest gur yield (48.15 %

and 5.35 % over Co-1158 and Isd 16, respectively) also from same variety. Variety Isd 29 increased 19.97 % cane yield and 22.30 % gur yield over standard variety Co-1158, rather produced -8.31% and -13.03 % decreased cane and gur yield, respectively, than variety Isd 16. On the other hand Variety Isd 30 increased 22.28 % cane yield and 23.30 % gur yield over standard variety Co-1158, on the contrary produced -6.55 % and -12.32 % decreased cane and gur yield, respectively, than variety Isd 16.

From the above discussion it may be concluded that regarding yield contributing parameters (tillers, millable canes and brix per cent), cane and gur yield, all the varieties performed better than that of standard variety Co-1158. Another standard variety Isd 16 showed superior performance over rest variety except Isd 31. Highest increase percentage of cane and gur yield over two standard varieties was obtained from variety Isd 31. On the contrary variety Isd 29 and Isd 30 produced increased percentage of cane and gur yield over Co-1158 rather decreased percentage of cane and gur yield than standard variety Isd 16. Hence Isd 31 may be suggested for commercial cultivation in High Barind Tract (AEZ-26) soils of Bangladesh.

REFERENCES

1. Anonymous, 1981. Statistical year book of Bangladesh. Bangladesh Bureau of Statistics, Statistical Division, Ministry of Finance and Planning, Govt. of the People's Republic of Bangladesh. 548-550.
2. Anonymous, 2001. Annual Report-1999-2000. Bangladesh Sugarcane Research Institute. 131-132.
3. Arvind, M., K. M. Naidu, and A. Mishra, 1997. Performance of promising mid late and late maturing sugarcane varieties under sub-tropical conditions. Agricultural-Science-Digest-Karnal, 17 (2): 79-82.
4. Barnes, A.C. 1954. Agriculture of Sugarcane, Leonard ltd. 1, Eden street, London. 98-102.
5. Hambert, R. P. 1959. The growing of sugarcane, Amsterdam, Elsevier Publishing Company. 2-6.
6. Gopal Aiyar, K. V. and K. Chiranjivi Rao, 1959. Studies on the relation of the chemical composition of cane juice and the quality of jaggery with special reference to the new Co. Canes. *Proc. ISSCT*, 10: 825-828.
7. Mian, M. A. K. and A. Awal, 1979. Estimates of genotypic and phenotypic variation, heritability and genetic advance under selection of some characters of sugarcane. Bangladesh J. Sugarcane, 1: 40-44.
8. Miah, M. A., A. Awal, S. M. N.Nahar, A. Sk. Mannan, and M. Y. Ali, 1994. Performance of some promising clones and varieties of sugarcane in Himalayan Piedmont Plain Soils. Bangladesh J. Sugarcane, 16: 116-119.
9. Miah, M. A., A. Awal, M. A. Karim, and A. K. M. Azad, 1986. Performance of some varieties/promising clones in the sandy soil of Setabganj-sugar mills. Bangladesh J. Sugarcane, 8: 61-63.
10. Poehlman, R. P. and D. Barthakur, 1969. Breeding Asian Field Crops. Mohan. primiani, Oxford and IBH Publishing Co., 66-janapath, New Delhi, 110001. 238-55.
11. Rao, T. J., B. V. Natarayan, and K. V. Bhacyalakshmi, 1983. Sugarcane. 141.
12. Rashid, M. H., M. A. Quddus, M. A. Rashid,. and N. E. Elahi, 2001. Performance of modern sugarcane varieties for gur production in Modhupur Tract Soils. Bangladesh J. Sugarcane, 23: 57-60.
13. Singh, J. P. R., U. P. Sinha, and S. Kumar, 1999. Performance of mid late sugarcane varieties of north central zone in calciorthents soil of Bihar. Indian Sugar, 49 (6): 411-413.

14. Matin, M. A., A. B. M. M. Rahman, and M. Y. Ali, 1989. Performance of three sugarcane varieties as transplant and ratoon cane under rainfed condition. Bangladesh J. Sugarcane, 11: 32-36.

Table-1 Analysis of variance with mean sum square of different growth parameters of sugarcane

Source of variation	d f	Values of mean sum of square with level of significance				
		Tillers (x 10^3 ha^{-1})	Millable canes (x 10^3 ha^{-1})	Yield of cane (t ha^{-1})	Brix (%)	Gur Yield (t ha^{-1})
Replication	2	35.199	14.099	7.841	1.117	0.077
Variety	4	454.522**	1724.503**	395.858**	1.142 ^{NS}	5.196 **
Error	8	17.095	164.387	11.854	0.304	0.137

Table-2 Comparative performance of sugarcane varieties in farmers field

Varieties	No. of Tillers (x 10^3 ha^{-1})	No. of Millable canes (x 10^3 ha^{-1})	Yield of Cane (t ha^{-1})	Brix (%)	Gur yield (t ha^{-1})
CO-1158	214.9 c	90.0 d	70.41 d	18.0	7.04 c
Isd 16	231.5 b	116.9 ab	92.13 b	19.5	9.90 a
Isd 29	232.9 b	120.7 a	84.47 c	18.5	8.61 b
Isd 30	230.6 b	105.0 c	86.10 bc	18.0	8.68 b
Isd 31	249.7 a	110.0 bc	101.8 a	18.3	10.43 a
LSD (0.05)	7.785	8.535	6.483	NS	0.697

Values followed by the same letter in a column do not differ significantly at 0.05 P

Table-3 Increase/ decrease percentage of cane and gur yield of sugarcane varieties over two standard varieties

Standard varieties	Sugarcane Varieties					
	Isd 29		Isd 30		Isd 31	
	Cane yield (%)	Gur yield (%)	Cane yield (%)	Gur yield (%)	Cane yield (%)	Gur yield (%)
CO-1158	19.97	22.30	22.28	23.30	44.58	48.15
Isd 16	-8.31	-13.03	-6.55	-12.32	10.50	5.35

SUGAR INDUSTRY ABSTRACTS

By
Mohammad Awais Qureshi and Shahid Afghan*
*Shakarganj Sugar Research Institute, Jhang

FACTORY PROCESSING

Improving the process steam economy in a cane sugar factory: a case history of a successful cogeneration project

P.G. Wright, T.A. Silva and K. Amador
Proc. Int. Soc. Sugar Cane Technol., 25: 142-149

The classic procedure to increase cogeneration export from a sugar factory is to maximise the production of high-pressure steam and to minimise the factory requirements of low pressure process steam, in order to take more advantage of efficient fully condensing turbo alternator systems. Factory configurations that reduce process steam requirements need to be closely examined. This paper reviews the factory configurations that reduce process steam at Ingenio San Antonio, Nicaragua, over recent years, starting from conditions of low steam economy and moving to an operation with high steam economy, appropriate to a full cogeneration factory. The major achievements in this project include the exclusive use of #3 stage evaporator vapour for all raw pan stage operations, using new technology Roberts evaporators, using continuous vacuum pans for all three massecuites, and having the annex refinery operations on #2 stage vapour. Very low process steam consumptions have been consistently achieved. Ideas for further improvements are discussed, and the factors limiting further economies are outlined.

Estimation of the heating value of bagasse blended with different quantities of trash as a biomass fuel

Arbey Carvajal, Adolfo L. Gomez and Carlos O. Briceno
Proc. Int. Soc. Sugar Cane Technol., 25: 150-156

The introduction of legislation and requirements of environmental agencies will prohibit the burning of crops and associated harvest residues in the Colombian cane sugar industry by 2005. This has led to an increase not only in the use of mechanical harvesters within the industry but also manual harvesting and therefore rising levels of trash in cane. Opinions are split as to whether extraneous matter should be reduced in the field during the harvesting stage, separated at the factory, or processed jointly with the cane. In addition to these issues, the use of bagasse containing significant quantities of trash as a biomass fuel needs to be addressed. In 2003, Incauca mill and Cenicana undertook the first steps in a study that will cover the 13 Colombian sugar factories. This study is aimed at determining the effects of moisture content, ash and sucrose in samples of bagasse mixed with extraneous matter and their effects on the heating value of this biomass fuel. The results obtained showed that moisture had the greatest and sucrose the least effect on the heating value of this biomass fuel.

AGRICULTURE

Agronomy

Cane Fert 1.0: a chemical fertiliser recommendation software for sugarcane production in Thailand
P. Prammanee, A. Jintrawet, C. Lairungreung and S. Kongton
Proc. Int. Soc. Sugar Cane Technol., 25: 198-203

Chemical fertilizer accounts for a substantial part of sugarcane production costs in Thailand, where most cane growers lack basic knowledge regarding the use of fertilizers. A computer program, Cane Fert is being developed to accurately determine recommendations for the application of N, P and K using the properties of the soils under sugarcane production throughout Thailand. The project includes: sugarcane soil identification using soil series maps; field surveys to confirm the identification; determination of nutrient requirements; cane growth simulation using CANEGRO 3.5 to determine the effect of water and nitrogen; economic analyses of chemical fertiliser recommendations and validation trials to confirm the recommendations generated by Cane Fert 1.0. The resulting software allows users to identify the site by pointing an arrow on a map displayed on the computer screen. The farm's location, soil series, soil chemical properties, N-P-K requirements, and the amount and method of chemical fertilizer application are also generated. It is anticipated that sugar mills, sugarcane grower associations, government agencies, agronomists, and extension workers will use this software.

Combined applications of NIR, RS, and GIS for sustainable sugarcane production
Masami Uena, Yoshinobu Kawamitsu, Liya Sun, Eizo Taira and Kenjiro Maeda
Proc. Int. Soc. Sugar Cane Technol., 25: 204-209

Near Infrared Reflectance (NIR) and Remote Sensing (RS) were used to gather detailed information on soil and crop conditions that play an important role in sustainable sugarcane production. The NIR system was also used to measure not only sucrose but also P, K, and Mg simultaneously. Large quantities of data collected using the NIR system were combined in a Geographic Information System (GIS) in order to execute spatial analyses. Mapping of the information on cane quality and minerals in the juice and soils was carried out for all cane fields in Minami-Daito and Kita-Daito Islands. The results of analyses showed the presence of high levels of K in the cane juice and that fields needed adjustments in the application rates of K to insure optimum sugar yields. As a complement to NIR, high-resolution satellite images, such as those developed by the IKONOS system, were used to evaluate the cane growth conditions and to prepare field maps. The combined applications of NIR, RS and GIS are proving effective in improving management practices on individual farms.

AGRICULTURE ENGINEERING

Evaluation of sugarcane varieties for sugar and alcohol production
Jesus E. Larrahondo, Jorge I., Victoria, Diego F. Arcila and Cesar A. Gamez
Proc. Int. Soc. Sugar Cane Technol., 25: 437-441

Pilot ethanol production tests were performed to evaluate optimum chemical age and

characteristics of different sugarcane varieties for sugar and alcohol production. In addition, promising varieties of the series CC (CENICANA-Colombia) were studied in order to determine recoverable yields of sucrose, fermentable total sugars, and quality characteristics between 10 and 15 months of harvesting age. The potential ethanol production increased with age of cutting and, under pilot test conditions, higher ethanol yields were observed at 12 months of age for the commercial varieties MZC74-275, CC84-75 and RD75-11. The results indicated that potential alcohol production for the CC varieties fluctuated between 80 and 90 L/t of cane. Combining data on the practical yields of ethanol and those reported for analyses of sugarcane quality, there was a high correlation between pol % cane and ethanol yields in this study.

Development of a cattle food from excess bagasse using solid fermentation
Emilio M. Aranda-Ibanej, Lazenka Alvarez-Aguirre, German Mendoza-Martinez, Sergio Salgado-Garcia, Jesus A. Ramos-Juarez, Hilario Becerril-Hernandez
Proc. Int. Soc. Sugar Cane Technol., 25: 442-446

In order to contribute to the sustainability of the cattle and sugar industries, a feed from excess bagasse was developed. We used two sources of nitrogen: urea and molasses sugar concentrate (CMS), in three proportions (100:0, 50:50, 0: 100) with three levels of grain (0%, 10%, 15%) using 5 replicates, in a completely randomised design with a factorial arrangement (3 x 3). All ingredients were mixed and added with 15% of inoculum from fermented sugarcane. The mixtures were left on the floor (10 cm height), in order to promote aerobic fermentation (24 h). Then, the mixtures were ensiled for 0, 1, 3, 5, 10, 15, 30, 45 days. At each time, samples were analysed for dry matter, pH, temperature, protein, and lactic acid. Results showed increases in true protein, lactic acid and a pH between 3.8 and 5.0. On days 30 and 45, the temperature was raised, which caused protein degradation and an increase in pH. Dry matter of the silage was between 30 and 40%. It was concluded that the excess bagasse is a by-product that can be incorporated in the manufacture of feed for cattle.

Development of a multi purpose cultivator for use in sugarcane
T. Akachi, M. Miyahira, K. Kuramoto, M. Syoda and T. Morita
Proc. Int. Soc. Sugar Cane Technol., 25: 378-382

Since the introduction of highly efficient mechanical harvesters into the Japanese sugar industry, there has been an increased *focus* on mechanizing other operations such as planting and other crop husbandry operations. The cost of purchasing and operating the machinery to undertake these mechanized operations has become a significant problem. To reduce the machinery costs, a multipurpose cultivator was developed, which can be used for the tasks of planting, hilling up, and ratoon management. The planting operation can be undertaken using one auxiliary worker *on* the machine. When operating in ratoon crops, the machine can simultaneously undertake five operations, namely root cutting, inter row-tillage, subsoil breaking, fertilization, and the incorporation of pesticides into the soil on two rows of cane. In addition, the multipurpose cultivator should be adaptable to operate under a minimum tillage farming system. The multipurpose cultivator has been demonstrated to work effectively and has reduced both labour and machinery costs in the production of sugarcane in the Japanese industry.

Real-time sugarcane harvest monitoring using spot 4&5 satellite data
E. Bappel A. Hegue, P. Degenne, V. Lebourgeois and B. Siegmund
Proc. Int. Soc. Sugar Cane Technol., 25: 383-386

In the context of the SUCRETTE project, (Systeme de sUivi de la Canne Ii sucRE par Telede TEction) the Centre International de Recherche Agronomique pour Ie Development (ClRAD) has set up a sugarcane harvest monitoring program using satellite data on Reunion Island. The methodology was based on the study of the time series SPOT 4&5 reflectance images during the 2003 harvest season from June to December. By analyzing SPOT 4&5 satellite images, harvested fields and standing cane were easily identified. A multi spectral classification of the scene was used to produce a harvest map. It was possible to generate a sugarcane harvest map and statistics ten days after image acquisition. The methodology allowed for the determination of the harvest advance rate during the six months of the harvesting campaign. In the study, this was obtained by producing sugarcane harvest maps at four times (03-07-21, 03-08-21, 03-10-14 and 03-11-20). The overall classification accuracy of the harvested fields reached 98.8% using 82 ground control fields. The harvest advance rate estimated by remote sensing was close to the mill observation, with a maximum error of 8%. Furthermore, the mill records and the harvested area can be used to estimate sugarcane yield. These results indicated that remote sensing technology could be adapted to monitor harvest schedules in real-time, using SPOT 4&5 data. Information extracted from satellite images could be a decision support tool for mill opening and closing dates as well as for crushing rates, which could have a significant economic impact.

PLANT BREEDING

Poor and variable flowering in tropical sugarcane improvement programs: diagnosis and resolution of a major breeding impediment
N. Berding
Proc. Int. Soc. Sugar Cane Technol., 25: 493-503

Flowering of sugarcane *(Saccharum* spp. hybrids) is poor and variable at many tropical locations where cross pollination is undertaken. Often, combinations made are restricted to the best possible among the parents flowering on a day rather than to combinations among the best parents. This paper draws on experience gained with sugarcane initiation in controlled photoperiod facilities in a tropical environment at BSES Meringa (17.loS Lat.). Natural photoperiodic regimes received at five equal1y spaced latitudes from the Equator to the Tropic of Capricorn were considered for their impact on initiation. Data are presented for flowering of 18 clones in six moisture regimes at BSES Meringa to show the impact of grossly excessive maximum temperatures. Temperature data for a minimum of 10 years for three locations-the Cenicana Experiment Station, Colombia (3.35°N Lat.), Ramu Sugar Limited, Papua New Guinea (6.05°S Lat.), and the Sugarcane Breeding Institute, India (1 I.28°N Lat.)--also were considered for their impact. High levels of flowering are achievable on the tropical lowland coast at BSES Meringa using controlled photoperiod facilities to avoid ambient maximum temperatures >32°C. Conducive year-round temperatures make the Cenicana site perfect but the benign photoperiod suggests controlled photoperiod facilities, as used at Cenicana, are essential. The Ramu site can suffer from initiation temperatures >32°C, and has a benign photoperiod. Use of a higher-elevation facility would resolve this. Initiation temperatures >32°C at Coimbatore is avoidable with an offset initiation at lower maxima, using a controlled photoperiod facility. The efficacy of controlled photoperiod facilities is well proven at BSES Meringa, and has been validated at CSlNCAE, Ecuador. Many tropical locations could benefit from such infrastructure to improve flowering by imposing stronger

photoperiodic stimuli for initiation, by avoiding high initiation temperatures, or both. The ability to make crosses among the best parents available will ensure a handsome return on investment of R & D capital into such facilities.

Sugarcane cultivar identification using remote sensing data
M. S. Simoes, H. M. Machado, J. C. N. Epiphanio, A.Rformaggio and Rc. Campos
Proc. Int. Soc. Sugar Cane Technol., 25: 504-509

Remote sensing images are the best tool for surveying large areas of sugarcane, being cheaper and faster than other techniques. This kind of survey would enable breeding programs to follow the increase in area of cultivars and so charge users royalties to support their programs. The spectral behaviour of 10 cultivars was studied in a plot experiment conducted at the Copersucar Technology Center, Piracicaba/SP, using a Field Spec spectral radiometer. Spectral curves were measured 9 times during the season 2002-2003. Yield and green leaf area index were measured simultaneously with spectral data, and biophysical and biochemical variables were determined in the laboratory. Results showed more differences in the spectral curves starting in the 8th month of growth. Yield was not a factor contributing to spectral differences among cultivars, and the spectral characteristics were more correlated with canopy structure and biomass. Differences in the spectral response were highlighted around 220 days after planting. Spectral response during later growth stages appears to be a good tool to identify and monitor cultivars of sugarcane.

SUGARCANE PATHOLOGY

Diagnosis of leaf fleck, leaf scald, mosaic, ratoon stunting disease and yellow leaf of sugarcane in commercial fields and quarantine in ecuador
F. F. Garces, C. Balladarez, G. Quiridumba Y and C. Munoz
Proc. Int. Soc. Sugar Cane Technol., 25: 695-700

A survey was conducted from 2001 to 2003 to determine the presence and distribution of leaf fleck caused by *Sugarcane bacilliform virus* (SCBV), leaf scald caused by *Xanthomonas albilineans,* mosaic caused by *Sugarcane mosaic virus* (SCMV), ratoon stunting disease (RSD) caused by *Leiftonia xyli* subsp. *xyli* and yellow leaf caused by *Sugarcane yellow leafvirus* (SCYL V), in commercial fields and in quarantine in Ecuador. Diagnostic tests were carried out using Tissue-blot immunoassay (TBIA), Dot-blot immunoassay (DBIA) and Polymerase chain reaction (PCR) assays. In commercial fields, leaf scald, RSD and yellow leaf showed incidence levels of 1.5%, 17.2% and 26.3%, respectively. Leaf scald occurred in 32.0%, RSD in 79.1 % and yellow leaf in 73.8% of the evaluated cane fields. In quarantine, 39.8% of varieties were infected with SCYL V, 0.9% were infected with *X albilineans,* 0.9% with *L. xyli* subsp. *xyli* and 18.5% with SCBV. No SCMV was detected in quarantine. According to these results, RSD and yellow leaf are the most important diseases in Ecuador because of the high levels of infection and distribution in commercial fields. High levels of plants infected by SCYL V were found in varieties recently introduced for commercial production at San Carlos and Valdez mills. This is the first report of the widespread occurrence of *X albilineans,1. xyli* subsp. *xyli* and SCYL V, as well as the presence of SCBV, in Ecuador.

The current disease situation in commercial sugarcane at Ramu, Papua New Guinea

G. Rauka, Rc. Magarey and Ls. Kuniata
Proc. Int. Soc. Sugar Cane Technol., 25: 701-704

Papua New Guinea (PNG) is a centre of origin for several *Saccharum species,* including S. *officinarum,* the original species used in commercial production. A number of endemic diseases affect commercial sugar production in PNG on the commercial estate of Ramu Sugar Limited at Gusap, Madang Province. These include downy mildew, Ramu stunt and the leaf diseases brown rust and yellow spot. Of these, downy mildew is of greatest significance. Ramu stunt has also had a very serious effect on crop production. Resistance screening trials are undertaken routinely for both downy mildew and Ramu stunt. In recent years, two previously exotic major diseases, leaf scald and ratoon stunting disease (RSD), have been identified on the estate. RSD is now a serious problem for Ramu Sugar and control programs are being established. Diseases will be of on-going importance for commercial sugar production in PNG.

SUGARCANE ENTOMOLOGY

Monitoring populations of adult fall armyworm, *Spodoptera fruigiperda* smith (Lepidoptera: noctuidae), in Florida sugarcane using pheromone traps, with special reference to genetic strains of the pest

D.G. Hall, R. Meagher, R. Nagoshrz and M. Lrey
Proc. Int. Soc. Sugar Cane Technol., 25: 784-787

Fall Army Worm (FAW) is a pest of occasional importance in Florida sugarcane and sporadic outbreaks of FA W often develop rapidly in young cane and can result in severe defoliation. Traps baited with pheromones hold potential for predicting where and when infestations develop. Two genetic strains of FA W occur in Florida, the 'corn' and 'rice' strains, but whether both strains are associated with sugarcane was not known. Commercial pheromone lures for monitoring FA W in sugarcane were compared by obtaining data on numbers of FA W collected at pheromone traps, and investigating the genetic strain(s) of FA W associated with sugarcane. Five synthetic F AW pheromones available for purchase (Hereon, Trece, Scentry 2-component, Scentry 4-component, and Scenturion) were evaluated using universal moth traps (yellow, white and green combination) at multiple locations in Florida during 2003 and 2004. Polymerase chain reaction (PCR) analyses were used to identify FA W strains. The Scenturion lure attracted significantly more FA W than the other lures. The Trece and Scentry 2 lures ranked second in numbers of moths captured. For traps baited with Scenturion lures, numbers of moths collected at traps peaked during 2003 and 2004 at maximums of 125 and 356 moths per trap per night, respectively. PCR analyses indicated 99% FA W collected during 2003 were 'rice strain' individuals. In 2004, 96% moths collected in areas where no com was grown were 'rice strain' individuals and 85% were 'rice strain' over all trapping locations. Only a few FA W larvae were found in cane, and these were 'rice' strain. Larvae of each strain were found in com. The study provided base information on pheromone trapping for FA Wand indicated that FA W infestations in Florida sugarcane may be predominantly by 'rice strain' individuals.

INSTRUCTIONS FOR AUTHORS

Dear Authors,

Please follow these instructions for review/publication of your research papers in PAKISTAN SUGAR JOURNAL (PSJ). It will help editorial board to review your articles immediately. Otherwise, it will be delay in review process:

- Write the title of your article in CAPITAL LETTERS in the center of the page
- Write the complete name of all authors with their addresses, its compulsory
- In the text, references should be cited by author and years as, for one, two or more authors (Hammer, 1994, Hammer and Rouf, 1995; Hammer etal., 1993), respectively.
- Write HEADINGS in bold letters and in the center of the page.
- Type your article only in TIMES NEW ROMAN format.
- Send TABLES or FIGURES on separate page with bold title and mark its numbers correctly.
- Follow the following rule for Reference, for one author: Hussain, K. 1991 for two authors; Khan, M. and A. Habib 1995, for more than two; Ali, K., A. Hussain and S. Nasir. 1990
- Don't write the 3 name of journals in ITELICS In Reference.
- Always send tow soft copies and one hard copy of CD. Please don't use FLOPPY for this purpose
- Send copies on A-4 size page preferable LASER PRINT in word document
- PSJ publishes paper free of charges from authors