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Dr. Shahid Afghan,
Shakarganj Sugar Research Institute
Toba Road, JHANG
Ph: 047-7629337-41
Contact: shahid.afghan@shakarganj.com.pk
URL:
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EFFECT OF SOME NEWLY INTRODUCED FERTILIZERS IN SUGARCANE

M. Aleem Sarwar*, Faqir Husain*, Abdul Ghaffar* and M. Ashfaq Nadeem*
* Sugarcane Research Institute, Ayub Agri. Res. Instt. Faisalabad, Pakistan

ABSTRACT

A field experiment was conducted at Sugarcane Research Institute, Faisalabad to study the effect of different fertilizer forms (solid and liquid) by different application methods (basal, top dressing, spray and fertigations) on yield and quality parameters of sugarcane variety HSF-240. Statistically significant results were obtained with respect to tillers per plant, number of millable canes (000/ha), cane yield (t/ha), sugar yield (t/ha) and juice% cane while non-significant results were obtained regarding germination%, brix% juice, pol% juice, purity%, CCS% and sugar recovery%. Similarly, those treatments received a combination of solid and liquid fertilizers produced results that were mostly statistically at par as compare to that treatment which received solid fertilizers only.

Keywords: Fertilizers, sugarcane, number of millable canes, cane yield, sugar yield

INTRODUCTION

Sugarcane is a major cash crop of Pakistan and it ranks second after textile industry with respect to employment, revenue generation and foreign exchange earning. Its importance can be judged from the facts that it was cultivated on an area of 907 thousand hectares giving an annual production of 44312 thousand tonnes and average cane yield of 48856 kg ha^{-1} during 2005-06 (Anonymous, 2006). But this yield is still low as compare to the potential yield of our varieties as well as average yield of the world. Several reasons may be assigned to this ominous fact like disease infestation, unfavorable arid climatic conditions, low rainfall etc. but poor soil fertility status and unbalanced use of fertilizers occupies the prime reason.

It is an evident fact that for sustainable agriculture, the importance of soil fertility and plant nutrition can never be neglected. A fertile and productive soil is the basic resource for good crop production and fertilizers plays a vital and leading role in this scenario. A healthy and useful combination of good management practices and balanced fertilization is a soul for bumper cane yield. Many researchers in past have investigated fertilizer requirement, time of application, its forms and methods of application in sugarcane crop. The work of some researchers is briefly discussed in coming lines. Bhatti and Khan (1972) reported that significantly higher yields of cane were obtained with the addition of 72, 76 and 54 kg/acre of N, P_2O_5 and K_2O respectively. They also reported that all NK combinations gave higher yields than NP combination. Tabayoyong (1958) studied the increased yield of sugarcane by the combined application of N, P_2O_5 and K_2O but response in terms of cane and sugar yields varied from soil to soil. He also reported the maximum cane yield with 120 Kg/ha each of N, P_2O_5 and K_2O and emphasized that both cane and sugar yields were increased by NP or NK combination but not by PK combination. De Gues (1967) stated the nutrient requirement of sugarcane crop by studying that a crop yielded 30 tonnes of cane per acre extracted on an average 67 Kg N, 28 Kg P_2O_5 and 135 Kg K_2O from soil. Jan (1957) observed an increase in cane yield and decrease in pol% juice by increasing the rate of 50-200 lbs/acre of nitrogen. He also noticed a decreased response when nitrogen application rate per acre exceeded 100 lbs. Kudachikar *et al.,* (1992) studied the role some micro nutrients in the form of liquid spray and observed a clear difference between treated treatments as compare to those treatments where these fertilizers were not used. They found cane yield was 41.22 t/ha in the untreated crop and highest (68.62 t/ha^{-1}) with 1% $MnSO_4$ spray, while sugar yields were 4.92 t/ha and 10.46 t/ha respectively. Yadav (1993) explored the role of NPKS and micro nutrients on sugarcane crop at eight different places in India. He reported that each Kg of applied N, P, K, NPK, S, Zn, Fe and Mn produced 0.72 to 3.50, 0.62 to 1.34, 0.08 to 2.92, 0.62 to 1.62, 3.48, 21.81, 20.83 and 25.08 to 68.09 quintals millable canes/ha while yield responses were 55.18, 58.00, 23.40 and 23.97 quintals millable canes for each Kg of foliar applied Zn, Fe, Mn, Ca respectively. Similarly in a three years experiment, Ali *et al.,* (1997) applied nitrogen in solid and foliar forms on two broad leaved and narrow leaved cane varieties. They noticed a higher pol% juice and CCS% in those treatments where nitrogen was split into solid and liquid form application.

Therefore, keeping in view these findings and discussion this study was undertaken to evaluate the effect of some newly introduced liquid fertilizers in comparison with solid fertilizers on growth and yield of sugarcane under irrigated conditions of Faisalabad.

MATERIALS AND METHODS

A field study was conducted at Sugarcane Research Institute, Faisalabad in order to determine the response of growth characteristics of sugarcane crop to the application of solid, liquid and foliar fertilizers. Autumn planted promising commercial sugarcane variety HSF-240 was sown in tri replicated RCBD arrangement with net plot size 45 m^2 during September 2003 and harvested in February 2005. Soil sampling was done from 0-30 cm depth before seed bed preparation and its physical and chemical analysis was made in soil fertility laboratory that was as follows:

Physical properties of soil			**Chemical properties of soil**		
Sand	=	45%	Organic matter	=	0.95%
Silt	=	40%	Nitrogen	=	0.05%
Clay	=	15%	Phosphorus	=	5.8ppm
Texture	=	Loam soil	Potash	=	70ppm
Saturation			pH	=	7.8
Percentage	=	36	EC	=	0.50 dsm^{-1}

All the required agronomic operations and cultural practices were timely performed as and where necessary. While the fertilizers were applied according to different treatments which were as follows:

T_1= 0-0-0 NPK Kg/ha (control)
T_2= 168-112-112 NPK Kg/ha (standard)
T_3= 143-0-32 NPK Kg/ha +259 L/ha H_3PO_4+50kg Nutricalcium +4 sprays of NPK-C +2.50 bags of Nitro-20
T_4= 85-0-32 NPK Kg/ha + 259 L/ha H_3PO_4+ 50Kg Nutricalcium +2.5 bags of Nitro-20
T_5= 143-0-32 NPK Kg/ha + 259 L/ha H_3PO_4 +50Kg Nutricalcium + 2.50 bags of Nitro-20
T_6=143-0-32 NPK Kg/ha +259 L/ha H_3PO_4 +50Kg Nutricalcium+4 sprays of NPK-C
T_7= 168-112-32+50 Kg Nutricalcium+4 sprays of NPK-C +2.50 bags of Nitro-20

The data regarding germination and tillering were recorded after 45 and 90 days of sowing while the other parameters were determined and calculated at the time of harvest. Similarly, a composite sample of ten canes from one randomly selected stool of each replication was brought to laboratory for juice extraction and qualitative analysis as described by Spencer and Meade (1963). The data of physical and chemical characteristics, thus obtained, were analysed according to analysis of variance (ANOVA) and treatment means were compared with LSD test of significance at 5% probability levels according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

The results from experiment are packed in table. The brief discussion of studied characteristics is given in the coming lines one by one.

Germination

It is the most critical physiological stage in the life cycle of a plant as without germination there is no plant. It should be so sufficient to yield an optimum crop stand. A glance at the data given in the table revealed that the mean germination percentage was statistically non-significant. The highest germination percentage (51.98%) was found in T_1 (control) while the lowest (49.37%) in T_2 (standard). The other treatments revealed results between these two limits. The discussions are in harmony with those elucidated by Majeedano *et al.,* (2003) who also observed non-significant results of germination in their experiment.

Tillers per plant

It is the most important factor that determines the overall crop stand and ultimately affects the cane yield. The data pertaining to tillering are presented in table. The results showed that all treatments differed significantly among each other. The maximum number of tillers per plant ware rescored in T_2 where standard dose of solid fertilizers were applied and it was statistically at par with T_3 where a combination of solid and liquid fertilizers along the liquid fertilizer spray was used. Similarly, the minimum number of tillers per plant were noticed in T_1, having no fertilizer application and it was statistically at par with T_4 and T_6. The work conducted by Majeedano *et al.,* (2003) reveals similar results.

Number of millable canes

The magnitude of final cane yield is mainly determined by the millable cane count and it has the direct effect on cane yield as shown in the table. Statistically significant results were observed regarding the effect of different fertilizers on cane count. The highest value of cane count (154.50 000/ha) was observed in T_2 (standard) while the lowest one (119.70 000/ha) in T_1 (control). The treatments T_5, T_6 and T_7 were statistically at par. The explanation is in accordance with the findings of Korndoreer *et al.,* (1998) who highlighted the comparison of solid and fluid fertilizers for sugarcane.

Cane yield

It is the product of germination, tillering and cane count which attribute substantially towards final cane yield. A perusal of tabulated data indicated significantly variable cane yield produced due to different fertilizer inputs. The maximum cane yield (106.90 t/ha) was produced by T_2 while minimum cane yield (60.57 t/ha) by T_1. The treatments T_4, T_5 and T_6 were statistically at par with each other. A similar experiment with such confirmation was conducted by Subirose *et al.,* (1998).

Sugar yield

It is the product of stripped cane yield and its respective commercial cane sugar. A speculative view to the results obtained in table, it could be observed that the treatments varied significantly with respect to sugar yield. The maximum amount of sugar (14.34 t/ha) was observed in T_2 while the lowest amount (8.44 t/ha) in T_1. Similarly the treatments T_4, T_5, and T_6 were statistically at par. These studies are in confirmation with Subirose *et al.,* (1998) and El-Latif *et al.,* (2000).

Juice % cane

It is a valuable parameter for millers as well as farmers because it increases cane weight on one hand and sugar yield on the other hand. The data given in table indicated the differences among treatments were significant for juice% cane. The maximum (61.18%) juice% cane was extracted from T_2 and minimum (53.59%) from T_1 while all treatments, except T_2 and T_3, were statistically at par with T_1 by producing 55.01, 54.26, 53.93 and 55.76 percent juice extraction respectively.

Brix% juice

It is one of those qualitative parameters used for maturity judgment. The perusal of data embodied in table showed that treatments' differences regarding brix were non-significant. However, the lowest reading of brix was recorded in T_2 where solid fertilizers were applied. It was followed by T_4 (20.68), T_5 (20.76), T_6 (20.99), T_7 (21.04) and T_1 (21.17) in ascending order. These studies are in close confirmation with the findings of Abd-El-Gawad *et al.,* (1992).

Pol% juice

The second important qualitative parameters after brix are pol% juice. It is evident from data table that there was non-significant variation for pol% juice among the seven treatments. However, the highest value (18.49%) for pol% juice was found in T_1 and the lowest (17.87%) in T_2. The remaining five treatments produced intermediate results. These results are identical with the results obtained by Mohammed (1989) who described an inverse relation between the increasing solid fertilizer and decreasing pol% in juice.

Purity

Juice purity is the main factor that is used in maturity and quality judgment. The data pertaining to juice quality are presented in table. The results revealed that all the treatment means varied non-significantly with respect to purity. The lowest purity (86.85) was recorded in T_2 where solid fertilizers were applied while the highest purity (87.34) was observed in control (T_1). The other treatments produced intermediate results. The lower purity value may be due to high level of nitrogen fertilization that accumulated nitrogenous bodies in juice and decreased juice purity. The results are in accordance with the findings of Hussain and Atta (1991) who also reported an inverse relation between purity and nitrogen fertilization.

CCS

It is the major and final qualitative trait that is equally important for miller, farmer and breeder. The tabulated data showed variable effect of different fertilizers and combinations on CCS%. The lowest CCS% (13.42) was observed in T_2 that was followed by T_4 (13.51), T_5 (13.58), T_6 (13.77) T_7 (13.82), T_3 (13.85) and T_1 (13.93) in ascending order.

Sugar recovery

It is obtained from CCS% by multiplying it with a constant factor. The same trend as that of CCS% was observed in sugar recovery. The maximum sugar recovery (13.09) was noted in T_1 while T_3, T_7, T_6, T_5, T_4, and T_2 followed it in descending order by producing 13.02%, 13.00%, 12.94%, 12.77%, 12.70% and 12.61% sugar recovery. These results are similar to the findings of Abd-El-Gawad *et al.,* (1992).

Table-1 Effect of different fertilizer treatments on various physical and chemical characteristic of cane crop

Treatments	Germination (%)	Tillers/ Plant	Millable canes (000/ha)	Cane yield (t/ha)	Sugar yield (t/ha)	Juice % cane	Brix% juice	Pol% juice	Purity (%)	CCS (%)	Sugar Rec. (%)
T_1	51.98	1.76d	119.70e	60.57e	8.44e	53.59c	21.17	18.49	87.34	13.93	13.09
T_2	49.37	2.38a	154.50a	106.90 a	14.34a	61.18a	20.58	17.87	86.85	13.42	12.61
T_3	49.62	2.25ab	146.80b	95.06b	13.17b	57.76b	21.08	18.39	87.24	13.85	13.02
T_4	51.32	1.94cd	130.29d	79.96d	10.26d	55.01c	20.68	17.98	86.95	13.51	12.70
T_5	50.73	2.03bc	135.40c	76.42d	10.38d	54.26c	20.76	18.06	87.00	13.58	12.77
T_6	50.99	2.01bcd	135.10c	74.83d	10.30d	53.93c	20.99	18.30	87.20	13.77	12.94
T_7	50.61	2.09bc	137.80c	84.90c	11.76c	55.76bc	21.04	18.36	87.23	13.82	13.00
LSD at 5%	N.S.	0.2639	4.289	4.629	0.6821	2.543	N.S.	N.S.	N.S.	N.S.	N.S.

LSD = Least Significant Difference
N.S. = Non-Significant
CCS = Commercial Cane Sugar
Sugar Recovery = CCS% x 0.94

CONCLUSIONS

From the results, the following conclusions can be deduced and suggested.

1- Qualitative juice characteristics were non-significantly effected by solid and liquid fertilizers separately as well as by combined applications of both solid and liquid fertilizer forms
2- Quantitative parameters, although significantly effected, but the number of millable canes and cane yield canes were statistically at par in those treatments where solid and liquid fertilizers (newly introduced) were used. This thing also supports first assumption.

However, there are some reservations in case of solid fertilizers in vogue as well as newly introduced fertilizers.

1- Application of newly introduced liquid fertilizers needs more energy and time as compare to the solid fertilizers because solid fertilizers are mostly applied at the time of sowing.
2- An illiterate farmer may face difficultly in application of liquid fertilizers.
3- The solid fertilizers are easy to handle.
4- The efficiency of solid fertilizers may decrease due to volatilization, fixation and unequal application by broad cast. On the other hand, fertigation of newly introduced fertilizers covers all these loopholes.

REFERENCES

1. Adb-El-Gawad, A.A., N.A.N. El-Din, I.H.El-Geddawi and N.B. Azazy. 1992. Influence of nitrogen and zinc application on juice quality and chemical constituents of sugarcane plants. Pak. Sugar J.Vol. VI. No. 4. P.17-24.
2. Ali, S.A., M.M.R.K. Afridi and R.G. Singh. 1997. Comparative efficiency of soil and foliar applied nitrogen in sugarcane. Indian J. of Pl. Physiology. 2(1): 75-78.
3. Anonymous. 2006. Economic survey of Pakistan. P-14.
4. Bhatti, M.A. and M.A. Khan. 1972. Fertilizer requirement studies on sugarcane in Punjab. J. Agric. Res. Pak. 10(4): 259-263.
5. De Geus, J.G. 1967. Fertilizer guide for tropical and subtropical farming. (Centre de Edtude de 1, Azota Zurich 115).
6. El-Latif, F.A.A. and A.M.I. Ismail. 2000. Response of sugarcane to foliar and soil application of potassium fertilizers. Egyptian J. of Agric. Res. 78(3): 1171-1179.
7. Hussain, I., M. Atta. 1991. Effect of NPK fertilizer application on the growth, yield and quality of autumn planted sugarcane. Pak. Sugar J., 5(1): 1-5.
8. Jan, O. 1957. The yield and quality of sugarcane as affected by graded and split application of nitrogen. Agric. Pak. 8: 331-340.
9. Korndoreer, G.H. and D.L. Anderson. 1998. Comparison of fluid and solid fertilizers for sugarcane-Brazil Sugar J. 61(2):31-33.
10. Kudachikar, V.B., Y.C. Panchal, M.B. Chetti and P.W. Basarkar 1992. Effect of micronutrient spray on growth and yield in sugarcane. Annals of Pl. Physiology. 6(2): 297-300.
11. Majeedano, H.I., Y.J. Minhas, A.D. Jarwar, S.D. Tunio and H.K. Puno. 2003. Effect of potash levels and methods of application on sugarcane yield. Pak. Sugar J. Vol. XVIII. No. 4.p.17-19.
12. Mohammed, B.D. 1989. Effect of nitrogen fertilizer and harvest time on yield and quality of sugarcane. M.Sc. Agron. Dep. Assuit University, Egypt.
13. Spencer, E.F. and G.P. Meade. 1963. Cane Sugar Hand Book. John Willey and Sons. 9th Ed. New York, USA.
14. Steel, R.G.D. and J.H. Torrie. 1980. Principles and Procedures of Statistics. Mc Graw Hill Inc; New York, USA.
15. Subirose, J.F. and F. Bertoch. 1998. Use of liquid nitrogen fertilizers in three cycles of commercial sugarcane production in Guanacaste. Agronomia-costarricense. 22(1):89-98.
16. Tabayoyong, F.T. 1958. Sugarcane fertilization according to soil type. Proc. Phil. Sug. Tech. 6: 38-50.
17. Yadav, D.V. 1993. Response behaviour of sugarcane to NPKS and micronutrients in different parts of the country. Fertilizer News. 38(10):31-33.

SCREENING OF SOME SUGARCANE (SACCARUM OFFICINARUM L.) VARIETIES FOR DIFFERENT AGRONOMIC TRAITS UNDER AGRO-CLIMATIC CONDITIONS OF UPPER SINDH PROVINCE

Bashir Ahmed Abro* and Pervaiz Ahmed Baloch**
* Quaid-e-awam Agricultural Research Intitute, Larkana, Sindh
** Coastal Agricultural Research Station, PARC, Karachi, Sindh

ABSTRACT

A field experiment was conducted to evaluate the performance of nineteen Sugarcane varieties for their different agronomic traits and yield characters in an experimental field of Quaid-e-Awam Agricultural Research Institute, Larkana, Sindh during the years 2006-07 and 2007-08. The results revealed that during the first year 2006-07 maximum cane yield of 192.47 tons ha^{-1} was recorded for the variety HoTH-300 followed by the variety LRK-2004 having cane yield of 181.37 tons ha^{-1}. The results for the second year 2007-08 revealed that the maximum cane yield of 207.52 tons ha^{-1} was recorded in variety LRK-2004 followed by the variety HoTH-300 having the cane yield of 168.61 tons ha^{-1}. The varieties LRK-2003, CP NIA-82-1026 SC-P5 and HoTH-127 also performed better for the cane yield parameter. It is concluded that these varieties could be promising varieties for general cultivation in farmers' fields of upper Sindh province.

Keywords: Sugarcane, National Uniform Varietal Yield Trial, Cane brix %, Cane yield and Upper Sindh.

INTRODUCTION

The Sugarcane is the major crop of Pakistan. About 99% of sugar is being made from this crop. It provides molasses, baggass and is playing an important role in economy of the country. Its share in value added of agriculture and gross domestic product (GDP) are 4.5 and 0.9 percent respectively (Sattar, *et al.,* 2010). The average per hectare yield (50.28 t ha^{-1}) in Pakistan is less than other major cane growing countries of the world (Sohu, *et al.,* 2008). One and major reason for that, is our farmers do not have options regarding high yielding varieties (Majeedano, *et al.,* 2004) therefore, low yielding varieties needs to be replaced with new high yielding varieties through evolution / selection for getting self sufficiency and filling up the gap in the per hectare yield between Pakistan and other cane growing countries of the world (Nazir, *et al.,* 1990).

This crop is cultivated on more than one million hectares (Akhtar and Akhtar, 2002). It is therefore, worthwhile to test and evaluate Sugarcane cultivars for high yield potential and for other commercial traits. The scientific data collected through such studies would provide a sound base for selection of suitable varieties and would also help in carrying out the genetic analysis for further breeding programme. The development of a superior cultivar through introduction accomplishes the same purpose as the evaluation of superior variety through breeding. The newly introduced varieties may excel the already cultivated ones in yield and quality (Bahadar, *et al.,* 2000).

Considering the importance of issue and need of the time Pakistan Agricultural Research Council extended full cooperation / coordination to all the provinces of Pakistan including Sindh in providing funds, manpower, seed of new varieties and fuzz for testing and evolution / selection of new high yielding varieties to increase per hectare yield so that the cane growers could maximize their income and make the country beneficial.

Accordingly National Uniform Varietal Yield Trial (NUVYT) consisting of 19 varieties all over the provinces was conducted at Quaid-e-Awam Agricultural Research Institute Larkana, Sindh during the years 2006-07 and 2007-08 with the aim to select the high yielding Sugarcane varieties suitable for cultivation under agro climatic conditions of upper Sindh province.

MATERIALS AND METHODS

The present investigations pertaining to evaluation and selection of high yielding varieties of Sugarcane (Saccharum officinarum, L.) were conducted in an experimental field of Quaid-e-Awam Agricultural Research Institute Larkana, Sindh during the years 2006-07 and 2007-08. The experiments were laid out in Randomized Complete Block Design comprised of 19 varieties with three replications having plot size (experimental unit) of 3x9 (27 m^2). The ridges were prepared at the distance of 100 cm. The crop was planted on 18.9.2006 during the first year and on 25-10-2007 during the second year. The NPK fertilizers were applied at the rate of 275-150-150 kg ha^{-1}. 1/3 dose of N + full dose of P & K were applied at the time of planting, remaining 2^{nd} and 3^{rd} doses of N were applied at 1^{st} and 2^{nd} earthing. For weed control hand weeding, interculturing and weedicide Gezapex combi were used at the rate of 1 kg per acre. Two applications of Furadon 3G were applied in the months of April and May to control all kinds of borers. All the approved agronomic practices like hoeing, interculturing, irrigation and fertilizer application etc as recommended for the region were followed uniformly throughout the growing periods in both years. The observations were recorded on different parameters such a Germination percentage (%), Cane height (cm), Number of tillers $plant^{-1}$, Internodes $cane^{-1}$, Cane brix % and Cane yield in tons ha^{-1}.

RESULTS AND DISCUSSION

The data presented in Table 1 reveal that among the nineteen Sugarcane varieties the variety S.2000-CPSG-449 gave the highest germination % of 65.33 followed by the varieties HoTH-300 and G-T-11 having 61.00 and 59.33 germination % respectively. The lowest germination % 39.66 was recorded in variety CP-NIA-82-1026 SC-P5 during the year 2006-07.While, highest germination % of 47.33 during the year 2007-08 was recorded of the variety S.2002-US-640 followed by the varieties LRK-2003, HoTH-326 and S.2002-US-637 with germination % of 43.67, 42.67 and 42.37% respectively. The lowest value of 06.00 regarding germination % was recorded for the variety S.2002-US-560 (Table 2). The results were supported with the findings of Sattar, *et al.,* (2010) who found differences in germination of different Sugarcane varieties due to their genetic makeup transferred from their parents.

The variety LRK-2004 during the year 2006-07 gave maximum cane height of 3.80 meters followed by the variety HoTH-300 having cane height of 3.19 meters. The lowest cane height was recorded for the variety Ganj Bakhash having 1.88 meters (Table 1). During the year 2007-2008 HoTH-300 gave maximum cane height of 2.93 meters followed by the varieties

LRK-2004 and CPD-01-335 having cane heights of 2.49 meters. The lowest cane height was recorded in the variety S.2002-US-560 with 1.52 meters (Table 2). The possible reason for these results could be the genetic makeup and combination of different genes that became active and produced taller plants than other varieties. The results are in line with those reported by Baloch, *et al.,* (2004).

During the year 2006-07 variety HoTH-300 gave maximum number of 9.0 tillers plant^{-1} followed by the varieties LRK-2004 & CP-85-1491 having 8.0 tillers plant^{-1} respectively. The lowest number 4.0 tillers plant^{-1} was recorded in variety Gang Bakhash (Table 1). The variety HoTH-300 gave maximum number 8.67 tillers plant^{-1} followed by the varieties LRK-2004 and LRK-2003 having 8.33 and 6.33 tillers plant^{-1} respectively. The lowest number 3.67 tillers plant^{-1} was recorded in variety S-2002-US-560 during the second year 2007-08 (Table 2). The difference in number of tillers plant^{-1} between the varieties might be due to their different genetic potential. Significant differences among the varieties for number of tillers plant^{-1} have been reported by Nadeem, *et al.,* (2009). These results are further supported by the findings of Singh and Singh (2004) who studied considerable numbers of sugarcane varieties and found significantly varying trend of effectiveness in all varieties, regarding number of tillers plant^{-1}.

The varieties S-2002-US-560, LRK-2004 and HoTH-300 had maximum 27.0 internodes cane^{-1} respectively followed by the variety HoTH-127 having 26.0 internodes / cane^{-1}. The lowest number 19.0 internodes cane^{-1} was recorded in variety LRK-2003 during the first year (Table 1). While, during the second year variety HoTH-300 had maximum 30.33 internodes cane^{-1} followed by the variety LRK-2004 having 29.67 internodes cane^{-1}. The lowest number of internodes cane^{-1} 12.67 was recorded in variety S.2002-US-560 during the year 2007-08 (Table 2). These results are in line with Khan, *et al.,* (2003) who pointed out that different varieties had different trend for number of internodes cane^{-1}.

The variety CPD-01-335 gave maximum cane girth of 2.12 cm followed by the variety G-T-11 having cane girth of 2.09 cm. The lowest cane girth in cm 1.51 was recorded for the variety S-12 CPSG-449 (Table 1). The variety Ganj Bakhash gave maximum cane girth of 2.44 cm followed by the variety LRK-2004 having cane girth of 2.34 cm. The lowest cane girth in cm 1.73 was recorded in variety S.2002-US-560 (Table 2). The results are in line with the findings of Atta, *et al.,* (1991) who reported variety CP-72/34 with higher cane girth as against check BL-4 in Faisalabad.

The highest cane brix % of 22.77 was recorded in variety CPD-01-245 followed by the varieties S-2-2002-US-560 and CP-85-1491 having 21.22 and 20.47 cane brix % respectively. While, the lowest cane brix % of 15.28 was recorded in variety CP-NIA-82-1026 SCP5 during the year 2006-07. During the second year 2007-08 the highest cane brix % of 23.00 was recorded in variety CPD-01-354 followed by the variety CP NIA-82-223 having 21.22 cane brix %. While, the lowest cane brix % of 18.00 was recorded in variety CPD-01-335. The higher cane brix % in CPD-01-245, S-2-2002-US-560 and CP-85-1491 was mainly associated with the genetic makeup of the parental material of these varieties. These results agree with the findings of Ali, *et al.,* (1999) who recommended new sugarcane variety CP-77/400, which exhibited higher cane brix % as compared to variety Co-1148 in Punjab province.

The results for the year 2006-07 in (Table 1) revealed that the maximum cane yield of 192.47 tons ha^{-1} was recorded for the variety HoTH-300 followed by the variety LRK-2004 having the cane yield of 181.37 tons ha^{-1}. The varieties CP NIA-82-223 and HoTH-127 produced cane yield of 144.36 and 138.80 tons ha^{-1} respectively. The minimum cane yield of 75.75 tons ha^{-1} was recorded in variety S-2002-US-560. The results for the year 2007-08 (Table 2) revealed that the maximum cane yield of 207.52 tons ha^{-1} was recorded of the variety LRK-2004 followed by the variety HoTH-300 having the cane yield of 168.61 tons ha^{-1}. The varieties LRK-2003 and CP NIA-82-1026 SC-P5 produced cane yield of 154.90 and 149.34 tons ha^{-1} respectively. The minimum cane yield of 75.75 tons ha^{-1} was recorded for the variety S-2002-US-560. The improvement in yield component is directly associated with weight of individual cane, cane height, cane girth and number of cane internodes. Naich, *et al.,* (2006), recommended LRK-2001 and M-17 varieties of Sugarcane for general cultivation in upper Sindh as these proved good response for cane yield. Rahman, *et al.,* (2006) obtained the highest cane yield in variety Isd 32 and the lowest in Isd 31. Sohu, *et al.,* (2008) reported variety LRK-2004 with higher cane yield as against of other varieties in Larkana, Sindh.

Table-1 Growth and yield parameters of new high yielding Sugarcane (Saccharum officinarum L.,) varieties under agro-climatic conditions of upper Sindh during the year 2006-07

Sr. No.	Varieties	Germination %	Cane height (m)	Tillers Plant^{-1}	Internodes cane^{-1}	Cane girth (cm)	Cane brix %	Cane yield (t ha^{-1}
01.	CP-85-1491	57.33	2.44	8.00	24.00	1.55	20.47	125.84
02.	CP-80-1827	55.00	2.37	6.00	24.00	1.89	17.14	128.06
03.	S.2002-US-560	49.00	2.06	5.00	27.00	1.64	21.22	75.75
04.	S.2002-US-637	58.30	2.48	7.00	22.00	2.50	16.24	98.90
05.	S.2002-US-640	52.00	2.14	5.00	21.00	1.75	19.77	105.49
06.	S2000CPSG-449	65.33	2.16	6.00	21.00	1.51	20.27	112.23
07.	S.2000-CPSG-1550	51.66	2.56	6.00	22.00	1.87	20.22	133.25
08.	LRK-2003	57.00	2.10	5.00	19.00	1.66	20.12	106.60
09.	LRK-2004	54.66	3.80	8.00	27.00	1.85	17.44	181.37
10.	Ganj Bakhash	51.33	1.88	4.00	21.00	1.83	20.20	98.09
11.	G-T-11	59.33	2.26	5.00	22.00	2.90	16.58	96.23
12.	CP NIA-82-223	41.33	2.35	6.00	23.00	2.10	15.44	144.36
13.	CPNIA82-1026	39.66	2.48	5.00	21.00	1.96	15.28	96.23
14.	HoTH-127	41.66	2.49	5.00	26.00	1.97	19.27	138.80
15.	HoTH-300	61.00	3.19	9.00	27.00	1.90	17.28	192.47
16.	HoTH-326	52.33	2.48	5.00	21.00	1.54	17.49	105.49
17.	CPD-01-245	54.33	2.47	5.00	20.00	2.60	22.77	110.04
18.	CPD-01-354	54.66	2.49	6.00	21.00	1.90	19.77	103.63
19.	CPD-01-335	53.33	2.45	6.00	24.00	2.12	17.78	118.44
	Minimum	**39.66**	**1.88**	**4.00**	**19.00**	**1.51**	**15.28**	**75.75**
	Maximum	**65.33**	**3.80**	**9.00**	**27.00**	**2.90**	**22.77**	**192.47**
	Average	**44.57**	**2.46**	**5.89**	**22.79**	**1.95**	**18.67**	**119.54**

Table-2 Growth and yield parameters of new high yielding Sugarcane (Saccharum officinarum L.,) varieties under agro-climatic conditions of upper Sindh during the year 2007-08

Sr. No.	Varieties	Germination %	Cane height (m)	No. of tillers Plant^{-1}	Internodes cane^{-1}	Cane girth (cm)	Cane brix %	Cane yield (t ha^{-1})
01.	CP-85-1491	40.33	2.15	5.67	25.33	2.02	20.00	142.67
02.	CP-80-1827	40.00	2.27	5.33	25.33	1.96	19.20	131.55
03.	S.2002-US-560	06.00	1.52	3.67	12.67	1.73	19.20	100.05
04.	S.2002-US-637	42.37	2.26	5.67	25.00	2.01	22.00	142.67
05.	S.2002-US-640	47.33	2.19	4.33	20.33	1.90	18.60	83.01
06.	S.2000-CPSG-449	25.67	2.31	5.67	22.67	1.96	19.00	111.17
07.	S.2000-CPSG-1550	36.33	2.27	4.67	25.00	2.08	21.00	146.37
08.	LRK-2003	43.67	2.21	6.33	20.33	2.09	22.00	154.90
09.	LRK-2004	39.67	2.49	8.33	29.67	2.34	21.00	207.52
10.	Ganj Bakhash	20.00	1.75	4.67	18.33	2.44	21.00	127.85
11.	G-T-11	28.00	1.85	4.67	20.67	2.25	20.00	108.21
12.	CP NIA-82-223	33.33	2.28	5.67	23.33	2.05	22.20	146.37
13.	CPNIA82-1026	34.00	2.30	5.33	23.33	1.95	22.00	149.34
14.	HoTH-127	23.00	2.18	5.00	27.67	1.96	20.00	143.41
15.	HoTH-300	21.33	2.93	8.67	30.33	2.30	21.20	168.61
16.	HoTH-326	42.67	2.12	4.67	25.00	1.98	22.00	135.26
17.	CPD-01-245	31.33	2.33	5.33	20.67	2.01	22.00	89.31
18.	CPD-01-354	41.00	2.44	5.00	23.00	2.21	23.00	130.07
19.	CPD-01-335	32.33	2.49	4.33	24.67	2.19	18.00	143.41
	Minimum	**06.00**	**1.52**	**3.67**	**12.67**	**1.73**	**18.00**	**83.01**
	Maximum	**47.33**	**2.93**	**8.67**	**30.33**	**2.44**	**23.00**	**207.52**
	Average	**33.07**	**2.29**	**5.42**	**23.33**	**2.08**	**20.71**	**134.83**

REFERENCES

1. Akhtar, M and M. E. Akhtar. (2002). Effect of different levels of Potassium on agronomic traits, productivity and quality of Sugarcane (Saccharum officinarum, L.). Asian Journal of Plant Sciences. Vol. 1(4) Pp: 349-351.
2. Ali, F. G., M. A. Iqbal and A. A. Chattha. (1999) Performance of some Sugarcane varieties in western Punjab. Pak. Sugar. J., 14: Pp: 6-7.
3. Annual Progress Report, Cooperative Research Programme (Sugarcane) 2006-07.
4. Atta, M., A. R. Zahid, K. H. Hasani and M. A. Bajwa. (1991). Quantitative and Qualitative performance of early maturing Sugarcane varieties at Faisalabad. Pak. Sugar. J., 5: Pp: 6-11.
5. Bahadar, K., M. Jama, M. S. Baloch, H. Azim and k. Nawab (2000). Quantitative and Qualitative attributes of Sugarcane as affected by distinct genotypes. Pakistan Journal of Biological Sciences. 3(7): Pp: 1170-1171.
6. Baloch, F. M, N. A. Soomro, S. A. Ali, T. J. A. Buriro and M. U. Usmanikhail. 2004. Comparison of quantitative and qualitative parameters of local sugarcane varieties with varieties of other provinces. Indus Journal of Plant Sciences, 3(3): 303-307.
7. Imdad, A. S., A. M. Khaskehli, P. A. Baloch and B.A. Abro (2008). "Evaluation of Yield and Yield Contributing Parameters of Different Sugarcane (Saccharum officinarum, L.) Varieties under National Uniform Varietal Trial". Pak. Sugar J., XXIII (01) Pp: 7-10.
8. Khan, M. A. H. k. Keerio, S. Junejo, R. N. Panhwar, M. A. Kaput and B. R. Qazi. 2003. Evaluation of new sugarcane genotypes developed through fuzz correlation of cane yield and yield components. Pak. J. Applied Sci., 3(4): 270-273.
9. Majeedano, H. I, F. M. Baloch, S. D. Tunio and A. D. Jarwar (2003). Yield response of different sugarcane varieties in agro-ecological conditions of Tando Jam. Pak. Sugar J., 18(1): Pp: 20-23.
10. Nadeem, M. A., M. A. Sarwar., F. Ahmad., F. Hussaiun, A. Ghaffar and A. A. Chattha (2009). Evaluation of some Sugarcane clones at Faisalabad. Pak. Sugar J., XXI (02) Pp: 2-5.
11. Naich, A. N., P. A. Baloch and B. A. Abro (2006). "Evaluation of growth and Yield Parameters of Different Sugarcane (Saccharum officinarum, L.) Varieties under National Uniform Varietal Trial". Pak. Sugar J., XXIV (03) Pp: 7-11.
12. Nazir, M., M. B. Gill., T. Mehmood and R. Ahmed (1990). Studies on pit versus flat planting of Sugarcane. Pakistan Society of Sugar Technologists. Silver Jubilee Convention Proc. 21-23 July 1990. Rawalpindi. Vol. 2S. Pp: 210-214.
13. Rahman, M. S (2006). Performance of some newly released Sugarcane varieties in Rajshahi Sugar Mills growers field under high Barind tract of Bangladesh. International Journal of Sustainable Agricultural Technology. 2 (4) Pp: 69-71.
14. Sattar, R. S., M. Ansar., M. Mehdi., F. Sheeraz and Z. Hassan (2010). Effect of management strategies and crop establishment of Sugarcane under agro climatic conditions of Jhang. Pak. Sugar J., XXV (01) Pp: 17-21.
15. Singh, R. K and D. N. Singh. 2004. Evaluation of early sugarcane varieties for sustaining high sugar recovery in Uttar Paradesh. Cooperative sugar. 31(10): 797-804.
16. Sohu, I. A., A.M. Khaskehli., P. A. Baloch and B.A. Abro (2008). "Evaluation of Yield and Yield Contributing Parameters of Different Sugarcane (Saccharum officinarum, L.,) Varieties under National Uniform Varietal Trial". Pakistan Sugar Journal XXIII (01) Pp: 7-10.

STUDIES ON THE PERFORMANCE OF SOME SUGARCANE GENOTYPES AT FAISALABAD

M. Ashfaq Nadeem, M. Aleem Sarwar, Abdul Ghaffar, Fayyaz Ahmad and Faqir Hussain
Sugarcane Research Institute, AARI, Faisalabad

ABSTRACT

The study reported here in was under taken with the major objective to compare the performance of sugarcane genotypes under agro climatic conditions of Faisalabad during crop season of 2004-05. Statistically significant variation among all genotypes was observed as the maximum values of germination (60.35%), tillers per plant (2.15) and number of millable canes (104.60 000t/ha) were produced by S2001-US-750, S2001-US-345 and S2001-US-129 respectively as compare to the approved commercial standard early maturing HSF-240 and medium and late maturing SPF-213. Similarly S2001-US-375 stood first with respect to cane yield (119.50 t/ha) and sugar yield (12.79 t/ha) among all the genotypes.

Keywords: Sugarcane, genotypes, cane yield, sugar yield, CCS.

INTRODUCTION

Sugarcane is playing a pivotal role in national economics as major source of sugar production. It also generates employment and by products for industrial sector. That is why sugar industry is second to textile in Pakistan which is primarily based on the mercy of sugarcane cultivation (Bahadar *et al.,* 2002). But the area under cane cultivation as well as its production has been decreased by 6.12% and 5.5% respectively in 2005-06 as compare to 2004-05 (GOP, 2006). This is because the yield potential of varieties deteriorates with the course of time due to disease susceptibility, segregation, change in edaphic and climate. So it is essential to select the varieties with high yield potential and a wide range of adoptability (Malik, 1990). Similarly cane yield and juice quality depend upon several qualitatively inherited characters which themselves are also influenced by environment. Among various technologies for increasing cane yield, variety is the pivotal and main ingredient in sugar production. Thus adoption of high yielding varieties with better quality attributes in the cheapest technology which can be adopted by the growers (Kamat and Singh, 2001). The research work conducted during the past few years regarding varietal evolution in being reviewed in the next lines.

Twenty six new canal point (CP) clones were studied by Glaz *et al.,* (1991) during two consecutive crop seasons 1989-91 at two different locations including sandy and muck soils. They separated four promising new cloens: CP85-1382, CP85-1308, CP85-1342 and CP70-1133 on the basis of their high yield. Sukkchain and Saini (1998) evaluated the performance of eight cane cultivars under water logged and high water table conditions and separated only one superior cultivar CoS8118 due to higher cane yield and commercial cane sugar. Similarly Domaingue *et al.,* (1998) released two varieties (early and mid season harvest) namely M96/82 and R573 for cultivation in low areas of Mauritius. M96/82 was recommended for low altitude and low rainfall regions while R573 for humid and sub humid regions. Saxena *et al.,* (1982) found that new clone CoS776 performed better for tillering, cane formation, juice quality and ratooning as compare to CO1158 but it produced insignificant differences for cane yield. Fasihi (1981) reported about dislikeness of BL-4 by farmers because of its high inputs requirement and difficulty in crushing with local crushers.

This experiment was conducted for the evaluation of qualitative and quantitative characteristics of sugarcane genotypes under agro climatic conditions of Faisalabad.

MATERIALS AND METHODS

A one year study was conducted during the crop season 2004-05 at Sugarcane Research Institute, Faisalabad. The experimental site was laid out in randomized complete block design in which each treatment was replicated thrice with a net plot size 4m x 9.6m. The following genotypes were included as experimental treatments:

1. S2001-US-129
2. S2001-US-274
3. S2001-US-345
4. S2001-US-375
5. S2001-US-393
6. S2001-US-395
7. S2001-US-400
8. S2001-US-423
9. S2001-US-538
10. S2001-US-576
11. S2001-US-725
12. S2001-US-750
13. S2001-US-985
14. S2001-US-999
15. SPF-213
16. HSF-240

The crop was sown in March 2004 and harvested during the same month of next year. All the agronomic and cultural practices were applied as and when considered necessary during the course of study. The data of different yield contributing parameters (number of millable canes, cane yield and sugar yield) were determined at harvest while germination and tillering data at 45 and 90 days after sowing. CCS was calculated monthly by the procedure described in laboratory manual (Anonymous, 1970) from compound samples analysis after every thirty days from Oct. to April so its statistical analysis was impossible. However the remaining data were analyzed statistically as mentioned by Steel and Torrie (1980) at probability 5% to compare their means.

RESULTS AND DISCUSSION

The results pertaining to different studied characters along with their statistical interpretation packed in table are discussed in the lines to follow.

Germination

It is the most critical physiological stage in the life cycle of a plant as without germination there is no plant. It should be sufficient to yield an optimum crop stand. A glance at the data given in table revealed that four genotypes S2001-US-129, S2001-US-395, S2001-US-725 and S2001-US-750 were statistically at par with SPF-213. Similarly when these genotypes were compared with second standard HSF-240, seven genotypes namely S2001-US-750, S2001-US-395, S2001-US-129, S2001-US-725, S2001-US-423, S2001-US-375 and S2001-US-985 produced higher germinants as 60.35%, 55.39%, 54.77%, 54.15%, 42.88%, 42.75% and 42.38% respectively. These results are also in conformity with those reported by Singh and Tyagi (1995).

Tillers per plant

It is the most critical factor that determines the overall crop stand and ultimately effects the cane yield. Tillering also fulfills deficiencies in germination. A perusal of tillering data in table showed that differences in tillering among various genotypes were significant. Nine genotypes, while comparing with medium and late maturing standard SPF-213, revealed higher number of tillers per plant. These genotypes along with tillering data were S2001-US-345 (2.15), S2001-US-375 (1.88), S2001-US-999 (1.74), S2001-US-129 (1.64), S2001-US-400 (1.53), S2001-US-985 (1.41), S2001-US-395 (1.38), S2001-US-393 (1.31) and S2001-US-576 (1.28) respectively. When these fourteen genotypes were compared with early maturing standard HSF-240, six produced higher or equal tillers per plant to it. These results coincide with those reported by Afghan *et al.,* (1994).

Number of millable canes

This parameter shows the collective interaction of germination, tillering along with resistance against insect pests and disease attack. It has the direct effect on cane yield as shown in the table. As far as the number of millable canes are concerned, five genotypes i.e. S2001-US-129 (104.60 000/ha), S2001-US-375 (104 000/ha), S2001-US-999 (103.65 000/ha), S2001-US-395 (100 000/ha) and S2001-US-985 (97.14 000/ha) crossed standard SPF-213 (92.36 000/ha) by recording more cane count than it. The four genotypes (S2001-US-129, S2001-US-375, S2001-US-999, S2001-US-395) showed higher cane count than the second standard HSF-240 (99.56 000/ha) .Nuss (1992) noticed the similar observations.

Cane yield

Cane yield is the outcome of all yield components. A perusal of data indicated that when fourteen genotypes were compared with standard SPF-213, five genotypes S2001-US-375, S2001-US-129, S2001-US-395, S2001-US-999 and S2001-US-985 gave higher yields as 119.50, 113.40, 111.60, 106.96 and 102 t/ha respectively. The similar observations were recorded when these genotypes were compared with HSF-240. The lowest cane yield (59.29 t/ha) given by S2001-US-345. A similar trend was found by Ismail (1992).

CCS

The real cane varietal quality is judged by its CCS%. The data presented in table has indicated variable CCS% for all genotypes. All the genotypes exhibited variable CCS% in which all the genotypes showed higher value of CCS% when compared with SPF-213 (9.80%). But when these genotypes compared with HSF-240 (11.58%), then three of them i.e. S2001-US-750, S2001-US-400 and S2001-US-538 crossed it by exhibiting 11.99%, 11.93% and 11.84% CCS% respectively. Verma *et al.,* (1997) advocated the same facts.

Sugar yield

It is the function of stripped cane yield and corresponding commercial cane sugar. The data table showed that all genotypes varied significantly from each other with respect to sugar yield in which five genotypes showed higher sugar yields as S2001-US-375 (12.79 t/ha), S2001-US-395 (12.31 t/ha), S2001-US-129 (11.93 t/ha), S2001-US-985 (11.69 t/ha) and S2001-US-999 (11.63 t/ha) as compare to early maturing standard HSF-240. Similarly four genotypes in addition to these five (S2001-US-400, S2001-US-393, S2001-US-538, S2001-US-750) crossed late maturing standard SPF-213 (8.93 t/ha) by yielding sugar (10.69, 9.87, 9.60, 9.22 t/ha). Variable sugar yield for different genotypes on the same pattern was also claimed by Hasabanis *et al.,* (1991).

REFERENCES

1. Afghan, S., S.A. Qureshi and N.M. Nasir. 1994. Performance of SPSG-26, a newly developed variety at Shakarganj Sugar Research Institute, Jhang. Pak. Sugar J.8 (2):7-19.
2. Anonymous. 1970. Laboratory Manual for Queensland Sugar Mills 5th Edition. Bureau of sugar experiment station, Queensland: 2.
3. Bahadar, K., M. Jamal, M.Sadiq, M. Suleman, H.Azim and M.S. Baloch. 2002. Genetic variation and ecological suitability of new sugarcane genotypes under the agro-climatic conditions of Bannu (NWFP). Pak. Sugar J.XVII (3):15-17.
4. Domaingue, R., D. Bissessur & K. Ramdoyal. 1998. M96/82 and R573, two sugarcane varieties released in 1998 for low rainfall areas of Mauritius. Revue Agricole et sucriere de L'L'Le Maurica. 77(1):20-24. [Field Crop Absts, 52(7), 1999]
5. Fasihi, S.D. 1981. Performance of BL-4 and Triton in comparison to Col. 54, the most commonly cultivated cane of Punjab. Proc. Pak. Soc, Sugar Tech. 17:249-255.
6. Glaz, B., J.M. Jr. Shine, P.Y.P Tai, J.D. Miller, C.W. Deren, J.C. Comstock and O. Jr. Sosa. 1991. Evaluation of new canal point sugarcane clones. 1990-91 harvest season. Washington, DC, USA; USDA-ARS. 26 pp. [Field Crop Absts, 46(11), 1993]
7. Government of Pakistan. 2006. Agricultural statistics of Pakistan. Ministry of Food, Agriculture and Livestock (Economic wing).
8. Hasabanis, A.B., N.B. More, M.N. Ankalkapee and B.R. Patil (991). Yield and quality of different sugarcane cultivars at Kolhapur conditions. Bharatiya Sugar.16 (6):75-78.
9. Ismail, I. 1992. [Performance of high yielding PS varieties in podsolic land in the Bungamayang area]. Keragaan varietas unggul PS pada lahan podso lik di wilayah Bungamayang. Berita-Pusat Penelitian Perkebunan Gula Indonesia. No. 6, 20-23.
10. Kamat, D.N. and J.R.P. Singh. 2001. Relative performance of sugarcane varieties under rainfed conditions. Indian Sugar. L1 (1):29-31.
11. Malik, K.B. 1990. Proposal for approval of BF-162. Sugarcane Research Institute Faisalabad: 7-10.
12. Nuss, K. 1992. N23-new variety for northern irrigated areas. S. African Sugar J. 76(8): 246. [Field Crop Absts, 47(7), 1994]
13. Saxena, M.M.S., B. Singh and S.Singh. 1982 A new sugarcane variety for Eastern Uttar Pradesh. Indian Sugar. 32(8): 419-421.
14. Singh, R.G. and S.D. Tyagi. 1995. Prospects of increasing productivity by a new early maturing sugarcane variety-CoS87216. Indian Sugar. 45(3):167-171.
15. Steel, R.D. and J.H. Torrie. 1980. Principles and Procedures of Statistics. Mc. Graw Hill Book Co. New York, U.S.A.
16. Sukhchain and A.K. Saini. 1998. Effect of waterlogging and high water table on varietal performance in sugarcane. Sugarcane. No.1,15-16. [Field Crop Absts, 51(5), 1998]
17. Verma, H.D., A.K. Choudhary and R.J.Tiwari. 1997. Performance of sugarcane varieties in medium black soils of Madhya Pradesh. Crop Research (Hisar). 13(3):569-570. [Field Crop Absts, 51(7), 1998]

Table: Yield and quality performance of various sugarcane genotypes at Faisalabad

Sr. No.	Genotypes	Germination (%)	Tillers per plant	Number of millable canes (000/ha)	Cane yield (t/ha)	CCS (%)	Sugar yield (t/ha)
1.	S2001-US-129	54.77a	1.64bcd	104.60a	113.40ab	10.52	11.93abc
2.	S2001-US-274	36.43bc	0.77gh	65.11fg	61.55h	11.42	7.03i
3.	S2001-US-345	22.18d	2.15a	56.51h	59.29h	11.18	6.63i
4.	S2001-US-375	42.75b	1.88ab	104a	119.50a	10.70	12.79a
5.	S2001-US-393	35.94bc	1.31cdef	82.99e	89.24ef	11.06	9.87ef
6.	S2001-US-395	55.39a	1.38cdef	100ab	111.60ab	11.03	12.31ab
7.	S2001-US-400	39.53bc	1.53bcde	88.71de	89.58ef	11.93	10.69de
8.	S2001-US-423	42.88b	1.03fgh	59.2gh	79.17g	10.72	8.49h
9.	S2001-US-538	30.98c	0.80gh	83.59e	81.07fg	11.84	9.60fg
10.	S2001-US-576	35.57bc	1.28def	61.11gh	63.80h	9.98	6.37i
11.	S2001-US-725	54.15a	0.63h	70.92f	80.20g	10.93	8.78gh
12.	S2001-US-750	60.35a	1.08fg	90.63cdf	76.91g	11.99	9.22fgh
13.	S2001-US-985	42.38b	1.41cdef	97.14abc	102.00cd	11.46	11.69bcd
14.	S2001-US-999	38.91bc	1.74abc	103.65a	106.96bc	10.87	11.63bcd
15.	SPF-213 (std)	57.99a	1.19efg	92.36bcd	91.18e	9.80	8.93fgh
16.	HSF-240 (std)	39.90b	1.41cdef	99.56ab	95.92de	11.58	11.11cd
	LSD at 5%	8.672	0.4348	7.718	9.442	-	1.063

Std. = Standard

LSD = Least Significant Difference

SUGAR INDUSTRY ABSTRACTS

Shahid Afghan
Shakarganj Sugar Research Institute, Jhang

Monitoring the harvesting of sugarcane and generation of yield maps in real time suivide la recolte de canne **a sucre et generation de cartes de rendement en temps reel monitoreo de la cosecha de** cana **de azucar y generacion de mapas de rendimiento en tiempo real**

J. A. Carbonell, C. A. Osorio and J. M. Ramirez (Abstract Book, 2010, XXVII ISSCT Congress Veracruz, Mexico, page. 10).

In a given area or plantation it is common to determine the variability in production that exists between harvested sugarcane fields or lots. The agroindustrial sugar sector in the Cauca River Valley of Colombia has appropriate mechanisms for determining and managing the variability of production among the cane lots, but it has not had sufficient alternatives for determining the variability within them. At present, the preharvest task of cutting the cane is done manually in most of the area, while the subsequent lifting of the stalks is done with self-driven equipment. CENICANA has developed a system that can be installed on the cane lifters, which records the weight of each bundle and its geographic position. The data are stored and transmitted by cell phone to a computer where they can be visualised for carrying out a precise monitoring of the harvest and generating yield maps. This work describes the structure of the system developed, the methodology for obtaining and transmitting the data, and how to interpret and analyse the yield maps. An analysis of a field harvest, for which it is known where there was fertilisation and where not, shows the value of each weight recorded. In this case, the best estimate of the production in the field is obtained by averaging the data from six consecutive bundles. Both the system for obtaining the data and the methodology for their analyses and the generation of yield maps can be implemented in other agricultural sectors.

A sustainable fertilisation program for a sugar factory in mexico: a principle for precision agriculture un programme de fertilisation raisonnee pour une industrie sucriere au mexique: une base pour une agriculture de precision el programa de fertilizacion sostenible para una fabrica de azucar en mexico: un principio para agricultura de precision

S. Salgado Garcia, DJ. Palma-Lopez, J. Zavala-Cruz, L.C. Lagunes-Espinoza, M. Castelan-Estrada, C. F. Ortiz-Garcia, J. F. Juarez-Lopez, O. Ruiz-Rosado, L. Armida-Alcudia and J. A. Rincon-Ramirez. (Abstract Book, 2010, XXVII ISSCT Congress Veracruz, Mexico, page. 20).

This work was carried out to determine site-specific fertiliser application rates for the different types of soil in which sugarcane is cultivated in the sugar factory *'Presidente Benito Juarez* in Mexico. Cartographic soil subunits were identified through interpretation of aerial photographs, field observations, and soil sampling to a depth of 1.2 m. In each subunit, the agrologic profiles were described, and physical and chemical analyses were done to classify the soil according to the World Soil Map. Fertilisation rates (FR) of N, P_2O_5, and K_2O for each soil subunit were estimated using a conceptual model. This model is based on the balance of nutrient demand of the crop, nutrients supplied by the soil, and fertiliser efficiency. To estimate demand, dry matter production and N, P, and K accumulation of the sugarcane aerial biomass were determined. P and K supply was calculated from the results of soil chemical analysis, plus the N contributions from crop residues and their management. Three major soil groups were found and classified as subunits. The FR for each soil subunit were (N, P_2O_5, K_2O kg/ha): 120-60-80 for Cambisol Fluvic (Eutric Clayic), Cambisol Endogleyic (Clayic Eutrit) and Cambisol Stanic (Clayic Eutric); 120-70-80 for Cambisol Endogleyic Stanic (Eutric Ferric) and Gleysol Haplic (Eutric Clayic); 160-80-80 for Vertisol Gleyic Stanic (Eutric); and 120-80-80 for Vertisol Stanic (Eutric). Fertiliser rates were adjusted based on the expected sugarcane yields for each soil subunits and soil fertility maintenance. We also generated a map of FR for each sugarcane field to allow producers to locate the relevant rate.

Breeding resistant sugarcane for managing the stem borer *Diatraea saccharalis:* progress and prospects for Louisiana amelioration varietale de la canne **a sucre pour la gestion du foreur de la tige *Diatraea saccharalis:*progres et perspectives pour la louisiane mejoramiento genetico de cana de azucar para el manejo del barrebador del tallo *Diatraea saccharalis*: progresos y proyecciones para luisiana**

William H. White, Collins A. Kimbeng, Kenneth A. Gravois and Marvellous M. Zhou. (Abstract Book, 2010, XXVII ISSCT Congress Veracruz, Mexico, page. 64).

THE STEM borer, *Diatraea saccharalis* (F.), is an important insect pest of sugarcane in Louisiana. Growing resistant varieties is a component of the Integrated Pest Management Program as practised in Louisiana for managing this insect; however, the release of stem borer resistant varieties has been intermittent. In 1986, researchers at the USDA, Agricultural Research Service (ARS) and LSU Agricultural Center - the two breeding programs in Louisiana - initiated an effort to increase stem borer resistance without encumbering the Louisiana sugarcane variety program (LSVP) with an additional selection trait. In this approach, clones with high levels of stem borer resistance are developed at the USDA, ARS in Houma via a recurrent selection program for borer resistance (RSB) and these resistant clones are used as parents in crossing. Advancement data from the Louisiana State University AgCenter's sugarcane breeding program were evaluated to determine our success in incorporating the new resistant germplasm into the progeny advancing through this program. A statistical test using the cumulative logit model showed non-significant difference ($P > 0.05$) in advancement rates of clones between the RSB and non-RSB families. However, because of fewer seedlings derived from crosses with at least one RSB parent, very few clones were given permanent variety assignments from the RSB population; only seven in the 1991 to 2002 series. A simulation study was conducted to determine the effect of increasing selection rates on recovery of RSB clones at the different stages of the breeding program. The cumulative logit model showed that increasing selection rates from Stage I to Stage II will result in a significant increase in the number of RSB clones assigned a variety designation. From this study we propose that the number of resistant crosses be increased and the selection rate of RSB crosses at Stage I be doubled to 13%.

Biocontrol of *Chilo sacchariphagus* (lepidoptera: crambidae) a key pest of sugarcane: lessons from the past and future prospects controle biologique *Chilo sacchariphagus* (lepidoptera: crambidae) un ravageur cle de la canne **a sucre: lecons du passe et prospective future control biologico de C*hilo sacchariphagus* (lepidoptera: crambidae) una plaga clave de la cana de azucar: lecciones del pasado y prospectos del futuro**

F. R. Goebel, E. Roux, M. Marquier, J. Frandon, H. Do Thi Khanh and E. Tabone. (Abstract Book, 2010, XXVII ISSCT Congress Veracruz, Mexico, page. 91).

Biocontrol of sugarcane stem borers using *Trichogramma* releases is a common strategy used in numerous countries, and the efficacy of such releases has been proven in most cases. On Reunion Island, the key stem borer *Chilo sacchariphagus* and its egg parasitoid *Trichogramma chilonis* have been the subject of intensive research for 10 years. From the identification of the best candidate for biocontrol to mass production and experimental releases in sugarcane fields, improvement has been constantly made through the years, with successful results. In this paper, we report some of the important outcomes, problems encountered and questions that have arisen during the field experiments (Reunion) and laboratory rearing activities (Reunion and France). Behind promising results from an eco-friendly technology that is used worldwide, one of the current debates that remain is the cost of such biocontrol to the growers. Since 2008, a new research and development project has been conducted to optimise the technology of field releases as well as to increase the efficacy of mass production and storage at cold temperature. To deal with profitability and quality and establishing a new industrial process for *Trichogramma* production, a partnership has been formed with a French company, BIOTOP, which has extensive experience in biocontrol of the maize stem borer *Ostrinia nubilalis* in France.

The effect of orange rust *(Puccinia kuehnii)* on sugar yield in six sugarcane varieties in guatemala effets de la rouille orangee *(Puccinia kuehnii)* sur le rendement de six varietes de canne **a sucre au guatemala efecto de la roya naranja *(Puccinia kuehnii)* en el rendimiento de azucar en seis variedades de cana de azucar en guatemala**

W. Ovalle Saenz, H. Orozco, E. Fong and S. Garcia. (Abstract Book, 2010, XXVII ISSCT Congress Veracruz, Mexico, page. 92).

A replicated field trial was conducted to estimate the effect of orange rust (caused by *Puccinia kuehnii)* on yield in six sugarcane varieties in a plant cane crop in Guatemala. CP72-2086 is the leading variety in Guatemala constituting 57% of the crop in the 2007-08 harvest season. The other varieties (CG96-135, SP79-2233, CP88-1508, CP89-2143 and PR75-2002) showed symptoms of orange rust in September 2007 when the disease first appeared. The experimental design of the field trial was a split plot in a complete randomised block design where the main plot was variety and the sub plot fungicide treatment (treated with the fungicide Alto® (Cyproconazole) at a dose of 500 mL per ha) or untreated. The susceptible variety SP79-2233 was planted on each side of the trial and around individual plots as a natural *P. kuehnii* inoculum source. Orange rust severity in fungicide treated and untreated plots was recorded monthly from three to nine months crop age. Cane yield components (plant height, stalk diameter and stalk population) and cane weight per plot were used to estimate cane yield in tonnes of cane per hectare (TCH); sucrose concentration (Pol % cane) was also assessed at harvest. Yield losses were estimated using a regression of orange rust severity on yield (tonnes sugar per ha, TSH) for the variety CP72-2086. Data suggest that orange rust may reduce sugarcane yields in five of the six varieties. Losses in CP72-2086 were 7.67% (TCH), 8.61% (Pol % C) and 15.78% (TSH), with the regression equation $y = 20.3 - 0.2x$. The highest orange rust severity occurred at five to six months crop age in all varieties and symptoms were observed through to plant maturity.

Cogeneration potential in colombian sugar mills Potentiel de cogeneration dans les sucreries de colombie Potencial de cogeneracion en ingenios zucareros colombianos

Edgar F. Castillo M, Adolfo L. Gomez, Diego Cobo and Carlos Aguirre. (Abstract Book, 2010, XXVII ISSCT Congress Veracruz, Mexico, page. 137).

Nowadays, the Colombian sugar industry is involved in an expansion process, mainly related to the diversification of final products. In this way, since 2005 five ethanol distilleries are running, covering just 65% of total ethanol demand. Distilleries were designed coupled with a composting plant, based on vinasses and sludges from the sugar plant. Both distilleries and composting plants show many features which make them a special case in the ethanol market, so they produce a maximum of 3 L vinasse/L ethanol. Besides, in all cases, the thermal and electrical power requirements at the ethanol plant are supplied by the sugar plant. In this paper, a brief description of technological features of the typical process configuration followed by the Colombian sugar industry is shown. It comprises the steam consumption distribution by sections, the common configuration of the heat exchanger network (HEN) developed for vegetal steam usage and the role of the energetic self-sufficiency of the factory played by the bagasse quality. A set of possible scenarios for improving energy efficiency in a selected mill which comprises a modified HEN can be formulated, including a revamping of existing boiler and finally a new boiler operating at higher pressure. Based on the previous information, the state of the main Colombian cogeneration projects based on sugar cane and its potential impact on national energy supply is shown. Finally, the paper describes how Colombian governmental requirements for cogeneration plants are trying to establish a legal framework for this novel industrial activity in the country.

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