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Dear Reader,

Mr. Asghar Qureshi departed from this world on April 20, 2012. His sad demise is an irreparable loss for reader of Pakistan Sugar Journal (PSJ). Mr. M. Asghar Qureshi (the late) was founder of the journal and chairman editorial board since the year of its inception, 1984. Mr. Qureshi was most important ambassador for the journal. His enthusiasm and support has had always kept PSJ at the forefront of the sugarcane and sugar industry research work of Pakistan for the past 26 years.

At the moment, PSJ unlike other publications is the first and the only journal in Pakistan covering sugar industry research at national and international levels. PSJ offers a positive, inspiring perspective and has a solutions-based approach. Mr. Qureshi introduced a good number of scientists working on improvement of sugarcane and sugar industry to the journal. He added valuable input of bold, thought-provoking ideas and outcome of scientific results in PSJ.

This issue of PSJ is dedicated to Mr. M. Asghar Qureshi for spread of scientific knowledge for hearts and minds. PSJ following his guidelines is committed to continue this valuable contribution for years to come.

Please tell your colleagues about PSJ and encourage them take out subscription or tell them to visit our website (shakarganj.com.pk), where they can read research papers or download free pdf copy of last six years. If you prefer, you can send us their details and we will send a gratis sample copy of PSJ for your friend or colleague member to read.

Looking forward for a continued relationship with PSJ.

With best regards,

Dr. Shahid Afghan
Editor-in-Chief PSJ
BIOGRAPHY OF MR. MUHAMMAD ASGHAR QURESHI (THE LATE)

BIRTH DATE: 27th April, 1927

SAD DEMISE: 20th April, 2012 (Age: 85)

EDUCATION: M. Sc. Agricultural Chemistry,
University of Agriculture,
Faisalabad (Lyallpur)

PROFESSION: Sugar Technologist and Agriculture Scientist

Mr. Muhammad Asghar Qureshi was born in the year 1927 at Batala, India. His early education was at his village school. Mr. Qureshi was a born leader. Even if he was losing out he wouldn’t give up. He would always bounce back to solve the problem at near hand. He’d run hell for lather and never ever give up. He played his innings equipped with innovative ideas spiritedly and won his spurs.

BEST KNOWN FOR

Energy, hard work, brilliance, fear of Allah Almighty and philanthropy would best describe the late Muhammad Asghar Qureshi sahib’s personality and lifestyle during his lifetime. For sure his was a stature … larger than life. A ‘gold medalist’ in Masters of Science in Agricultural Chemistry from the University of Agriculture, Faisalabad (Lyallpur).

START OF PROFESSIONAL LIFE

Mr. Qureshi on completion of studies proceeded abroad to join Tate and Lyle of the United Kingdom. He worked in their refinery in London. He also performed in their sugar factories in the West Indies. He laid his hands on experience in Sugar Engineering in Great Britain. This scion, on return to Pakistan joined the prestigious industrial organization namely Pakistan
Industrial Development Corporation, PIDC, in its Sugar Directorate. Within a stint of six years by dint of his honest hard work and professional viability he rose to the rank of Farm Manager.

On leaving the great organization PIDC in 1959, he was picked up by Crescent Sugar Mills, Faisalabad as its General Manager for the next 11 years. Having a lot of experience, expertise, competence and honesty there, he was afforded with opportunity and resources and he put a great deal of effort into the development of byproducts of sugar and its cane.

**DISTINCTIONS AT NATIONAL AND INTERNATIONAL LEVELS**

Distinction was not only the ‘GOLD MEDAL’, in addition to it was that ever since the creation of the University of Agriculture Lyallpur. Mr. Asghar Qureshi was the first Muslim scholar of the sub-continent who earned this singular honor. Gold medal was just the beginning. You may refer to it as the tip of the iceberg, in the light of the 20-80 principle. On the basis of his professional competence one may simply entitle him ‘SUGAR TECHNOLOGIST PAR EXCELLENCE’.

**LOCAL AND FOREIGN AWARDS**

A number of other local and foreign awards were also conferred upon him. Those were certificates of recognition, trophies of honours and medals of distinction all based on his professional competence and socially interactive philanthropic stance, nature and humility.

The jewel in the crown for our very patriotic son of the soil, Mr. Muhammad Asghar Qureshi was the coveted ‘Pride of Performance’ medal, instituted by Pakistan Society of Sugar Technologists in an investiture ceremony in the year 2005.

It was Mr. Asghar’s brainchild to build, operate and transfer various plants synergizing with each other to cut down on costs while enhancing efficiency and effectiveness.
CONTRIBUTIONS FOR SUGAR INDUSTRY

1. Worked as In-charge Sugar Directorate at Punjab Industrial Development Corporation Head Office (1957 – 1959). Planned and put-up two sugar factories in West Pakistan and four in East Pakistan during this period.

2. Developed Co-products of sugarcane along with manufacture of sugar. A distillery was planned and erected to manufacture ethanol from molasses.

3. Pioneer work was done in collaboration with some Swedish firms to manufacture hard-board, soft board and particleboard from 100% bagasse as raw-material. A hardboard and soft board plant of 60 Tons/day was erected at Crescent Sugar Mills and operated successfully.

4. A particle board plant of 30 Tons/day was erected and commissioned. It was so successful that a second plant of 60 Ton/day was added just after 2 years. This was the first plant based on 100% bagasse as raw material which was put-up successfully in the subcontinent.

5. A fully integrated furniture plant was established using own manufactured particle board and hard board.

6. A urea-formaldehyde and melamine formaldehyde plant was erected to replace the imported glue.

7. Expanded the distillery from 40,000 liters per day to 260,000 liters per day relying totally on local manufacture.

8. Introduced high pressure boilers and sale of extra produced electricity to National Grid.

9. Put up a waste treatment plant on the distillery waste. Collected bio-gas so produced for generation of electricity. Bio-gas was further passed through a biological process to remove sulphur from the gas which is used as fuel on gas engines to produce 7 to 8 MW of electricity which is being sold to National Grid. This was also a first plant anywhere to use bio-gas from sugarcane molasses distillery wash.

10. Played a pivotal role in the establishment of two more sugar factories under the ambit of Shakarganj Mills Limited.
TOPO RANKING PROFESSIONAL POSITIONS

The feathers in his cap are many. All may not be countable. Just to mention a few of those are as follows:

**Chairman:** Board of Directors – FESCO, Faisalabad 2002-2010

**President:** Pakistan Society of Sugar Technologists 1963-64

**Councilor:** International Society of Sugarcane Technologies for 9 years

**Member:** Technical Committee ISSCT 1996-1999

**Managing Editor:** Pakistan Sugar Journal 1984-2012

**District Governor:** Rotary International for Pakistan 1990-1991

**Chairman:** Shakarganj Sugar Research Institute, Jhang 1990 – 2012

**Managing Director:** Shakarganj Mills Limited, Jhang 2004 – 2010

LANDMARK ACHIEVEMENT

Organized two international workshops, one on Factory Design and the other on ISSCT Engineering and Energy as Secretary of the workshop. These were the 1st international events of sugar world held for the sugar industry in Pakistan.

Death is inevitable and a reality. It is an ordain of Allah Almighty. He was a practicing Muslim so it was the clarion call for him. He was one of us ... the believers. We all bow our heads in humility as he went to his heavenly abode. We all shall miss him.

May his family, friends and acquaintances, all gain the inner strength from Almighty Allah to bear his irreparable loss. We all pray to Allah Almighty that his sweet and gentle soul may rest in peace. Amen!

“Remember man, as you pass by,
As you are now, so once was I,
As I am now, so you will be,
Prepare yourself to follow me”
Photo Gallery

International Society of Sugar Technologists Congress Philippines 1980

Inauguration of Maqbul Hall at SML

Second Excellence in Service Award at SML

Training of Sugar Technologists at SSRI

International Society of Sugar Technologists Congress, Thailand

Sugar Processing Workshop at Lahore

Rotary International Conference New Delhi, India

First Workshop on R&D activities on sugarcane crop at SSRI
ADAPTABILITY STUDY OF EXOTIC SUGARCANE CLONES UNDER FAISALABAD AGRO-CLIMATIC CONDITIONS

M. Zafar, Shafiq Ahmad, M. Azhar Munir, Abdul Ghaffar, Shahid Bashir, M. Saeed, M. Zafrullah Khan and M. Afzal

ABSTRACT

To evaluate 186 clones at primary Nursery stage (Phase-I) against standard variety CP-77-400 a non replicated single row trial was laid out having net plot size measuring 5X2.4m. Keeping in view the desirable characters, 45 clones having desirable brix % growth and other quantitative characters were selected and were promoted to Advance Nursery trial while 141 clones were rejected due to undesirable characters. However, 1021%, 11.29%, 9.67%, 6.45%, 5.37%, 5.91%, 9.13%, 4.83%, 3.76%, 5.37% and 4.30% clones were rejected, due to poor growth, pithiness, low brix %age, aerial roots, cracks sprouts disease susceptibility, insect/pest infestation, hairiness lodging and short nodal length respectively.

Key words: Clone, standard variety, trial, nursery, desirable character, pithiness, brix

INTRODUCTION

Sugarcane is an important cash crop of Pakistan (Ahmad et al., 1991, Rehman et al., 19992), which plays an important role in economic uplift of farmers, Moreover feeding of ever expanding sugar industry, totally depends upon cane cultivation. However, the notional average cane yield is 53.2 tones/ha which is far below the potential of existing cane varieties (Ann. 2007).

The yield can be enhanced by adopting the improved package of technology and by growing high yielding varieties (Heinz 1987). However development of new sugarcane varieties is not feasible in Pakistan because of intricate flowering of the plant and non availability of sugarcane breeding facilities and acclimatization (Javed et al., 2001).

Thus selection in general, forms the base line for the cane agronomist in Pakistan to develop new varieties. The variety improvement in sugarcane is equally important from the breeders and growers point of view. Potential of new genotypes needs to be tested in local environment over various locations for different years before deciding to release as new cultivar in a particular region (Basfor and cooper 1998, Pollock 1975, Ruschell 1977, Tai et al., 1982, Kanf and millers 1984, Milligan et al., 1990, Khan 1981 and Khan et al., 2000).

The clonal selection at the pre commercial stages helps in identification of improved genotypes for commercial production of sugarcane (Claz et al., 2000). All the stages in varietal selection programme are important but establishment of a good Nursery is of prime importance, because evolution of durable and dependable variety can be expected if it expands from a good nursery. Keeping in view the importance of the nursery, the present study was conducted under the agro-climatic conditions of Faisalabad.
MATERIALS AND METHODS

In primary nursery (Phase-I) 186 clones having 10 parent crosses of exotic origin received from seedling stage were tested in a non-replicated single row trial (Augmented design) having net plot size 5X2.4m, during 2008. These clones were compared with standard variety CP-77-400. Keeping in view the desirable characters such as growth vigour, frost resistance, erectness, resistance to lodging, hairiness cracks, aerial roots, tillering, sprouts, disease susceptibility, insect pest infestation, damage by sun burn and brix% age etc.

The brix reading was recorded by hand refractometer. After comparing the quantitative and qualitative character of all clones with standard variety CP-77-400, 45 clones (23.65%) were promoted to Advance Nursery trials while 141 clones (76.34%) were rejected due to undesirable characters. The selection was made by the committee of experts in the field.

RESULTS AND DISCUSSION

The performance of clones under evaluation for varietal selection programme is given in table I and II. Significant 44 clones were selected as given in table I and clones which fell under the categories of un-required characters of the sugarcane plant are given in table No. II. One parent crosses gave 75% selection and remained at top of the selection. One parent cross showed 55.55% selection for promotion to Advance Nursery trial. So the selection remained 23.65% that is 45 clones and rejection was 76.34% that is 141 clones. Characters studied in the experiment are discussed as under.

1. **Growth performance**
   In good agronomic practices the growth performance is a character that affects the yield of the cane crop. Growth habits, erectness, internodal length, girth of cane and stooling depends upon genetic make up which may be detected by overall performance of the cane. Keeping in view the growth performance 17 clones 10.21% were rejected on the basis of poor growth.

2. **Pithiness**
   Hollow stem of cane plant due to dead tissues is a negative character which leads to lodging and disease infestation and lowers the cane quality. In this trial 21 clones (11.29%) were rejected due to pithiness.

3. **Brix %**
   It is the percentage by weight of sucrose in pure sugar solution (Meade 1964). It was recorded by Hand Refractometer. Higher Brix% results in higher sugar recovery and vice versa. In these context 18 clones 9.67% were rejected due to lower Brix%.

4. **Aerial roots**
   These are secondary roots which spoil the quality of the cane as well as lowers the growth speed and deteriorate the crop stand, 12 clones (6.45%) were found carrier of this bad character so were rejected.
5. **Cracks**
   The cracks on stem of the cane plants deteriorate the cane quality as well as tissues due to enhancement of transpiration rate (Dillefwijn 1952) and make plants susceptible to the diseases. 10 clones (5.37%) showed this weak character and were rejected.

6. **Sprouts**
   Due to bud sprouting, which adversely affect the quality of the cane and germination of the new crop is lowered, this character appeared in 11 clones (5.91%) and these were rejected in this trial.

7. **DISEASE INFESTATION**
   Only 17 clones (9.13%) were rejected due to the infestation by different diseases in this trial. So these were rejected.

8. **Insect/Pest**
   Severe insect pest attack was observed on 5 clones (4.57%) and these were rejected.

9. **Hairiness**
   It is an undesired character which makes intercultural practices difficult as well as the harvesting of the crop and 7 clones (3.76%) were rejected due to Hairiness.

10. **Lodging**
    It is a bad character and exerts harmful effect on sugarcane yield (Borden-1942), spoils the cane quality, brix %age and growth of sugarcane crops, in this contexts 10 clones (5.37%) were rejected.

11. **NODAL PROBLEM**
    8 Clones 4.30%were rejected due to shorter internodes.
### Table-I  Parentage – wise selection

<table>
<thead>
<tr>
<th>S. No</th>
<th>Parentage</th>
<th>Total clone</th>
<th>Clone Selected</th>
<th>Clones Rejected</th>
<th>Brix Age %</th>
<th>Selected %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>S95-NSG-45</td>
<td>69</td>
<td>18</td>
<td>51</td>
<td>4-18.5</td>
<td>26.08</td>
</tr>
<tr>
<td>2.</td>
<td>HSF-240</td>
<td>9</td>
<td>5</td>
<td>4</td>
<td>14-19</td>
<td>55.55</td>
</tr>
<tr>
<td>3.</td>
<td>S96-SP228</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>13-17</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>BF-129</td>
<td>17</td>
<td>8</td>
<td>9</td>
<td>9-16</td>
<td>47.05</td>
</tr>
<tr>
<td>5.</td>
<td>ROC-1X795-2954</td>
<td>27</td>
<td>10</td>
<td>17</td>
<td>11-20</td>
<td>37.03</td>
</tr>
<tr>
<td>6.</td>
<td>Q179XVMC71-39</td>
<td>11</td>
<td>1</td>
<td>10</td>
<td>9.5-16</td>
<td>9.09</td>
</tr>
<tr>
<td>7.</td>
<td>KQ91-2616XMQ79-41030</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>9-14.5</td>
<td>0</td>
</tr>
<tr>
<td>8.</td>
<td>86A-3526X79S-2954</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>11-14.6</td>
<td>0</td>
</tr>
<tr>
<td>9.</td>
<td>79N465XKQ 87-8075</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>12-16.8</td>
<td>0</td>
</tr>
<tr>
<td>10.</td>
<td>KQ97-6460XN-14</td>
<td>4</td>
<td>3</td>
<td>38</td>
<td>5.2-14.5</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>186</strong></td>
<td><strong>45</strong></td>
<td><strong>141</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table-II  Character wise rejection

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Factor</th>
<th>No .of clones S2008SP</th>
<th>Total clones</th>
<th>Rejection %</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>Aerial roots</td>
<td>8, 13, 64, 71, 123, 164, 132, 139, 155, 168, 172, 185</td>
<td>12</td>
<td>6.45</td>
</tr>
<tr>
<td>5.</td>
<td>Cracks</td>
<td>21,25,37,38,41,54,85,140,151,163</td>
<td>10</td>
<td>5.37</td>
</tr>
<tr>
<td>6.</td>
<td>Sprouts</td>
<td>6,7,9,14,22,39,72,106,121,156,182</td>
<td>11</td>
<td>5.91</td>
</tr>
<tr>
<td>8.</td>
<td>Insect/pest susceptibility</td>
<td>12, 33, 36, 40, 52, 78, 113, 119, 141</td>
<td>9</td>
<td>4.83</td>
</tr>
<tr>
<td>9.</td>
<td>Hairiness</td>
<td>35,57,63,125,138,144,126</td>
<td>7</td>
<td>3.76</td>
</tr>
<tr>
<td>10.</td>
<td>Lodging</td>
<td>18, 20, 42, 79, 88, 101, 107, 134, 143, 179</td>
<td>10</td>
<td>5.37</td>
</tr>
<tr>
<td>11.</td>
<td>Nodal Length</td>
<td>80, 82, 104, 109, 127, 133, 158, 177</td>
<td>8</td>
<td>4.30</td>
</tr>
</tbody>
</table>
REFERENCES

RESPONSE OF TWO CANE VARIETIES TOWARDS QUALITATIVE AND QUANTITATIVE CHARACTERISTICS DUE TO SOWING OF STALE SETTS

Faqir Hussain*, Muhammad Aleem Sarwar*, Shafiq Ahmad*, Muhammad Asif Ali** and Naeem Fiaz*

* Sugarcane Research Institute, AARI, Faisalabad
** Soil and Water testing laboratory for research, AARI, Faisalabad

ABSTRACT

Two sugarcane varieties HSF-242 and CPF-236 were harvested in the last week of February, stored in shade and were sown in RCBD with the interval of three days to evaluate the effect of stale cane setts’ sowing. Germination, tillers per plant and cane yield of variety HSF-242 decreased from 39.20 to 21.59, 2.38 to 2.04 and 62.63 to 38.34 tha\(^{-1}\) respectively when it was sown with twelve days stale setts whereas germination, tillers per plant and cane yield of variety CPF-236 reduced from 37.26 to 17.50, 1.77 to 1.49 and 57.59 to 39.73 respectively under similar treatments. The experiment concluded that delayed sowing of harvested cane deed adversely affected the major quantitative parameters.

Key words: Cane, varieties, stale, yield, quality

INTRODUCTION

Sugarcane is an important cash crop of Pakistan (Ahmad et al., 1991) which is propagated by cuttings of stalks containing buds (Dilewijin, 1952). Its growth and yield depends upon germination, tillering and cane count etc. Germination, the critical period and basis of safe cane crop (Dilewijin, 1952), is influenced by quality of seed material used. Tillering plays a pivotal role in establishing cane stand (Aslam et al., 2001). Similarly cane yield is a desirable characteristic for farmers and recoverable sugar for millers and breeder’s point of view (Atta et al., 1992).

All the above mentioned yield and quality parameters depend upon quality of seed setts used for sowing i.e. fresh healthy with non injured buds and vice versa. In Pakistan, farmers obtain cane seed from farm located hundreds of kilometers away from their field. This long distance makes their seed stale with injured buds that adversely affect various growth and yield parameters. The older buds are more prone to mechanical injury (Yadava, 1991). Thus the present study was planned with a novel idea to determine the effect of stale cane seed on germination, tillering, cane yield, CCS and sugar recovery. The literature does not support it much as a little work has been conducted in this regard.

Materials and methods: The reported studies were conducted under semi arid climate on loan soil using spring planted cane varieties HSF-242 and CPF-236. The crop was sown in deep trenches (according to treatments), fertilized @ 168-112-112 NPK kg ha\(^{-1}\) and harvested after one year. All agronomic and cultural practices like weeding, irrigation, earthing up and plant protection measures were adopted as and where considered necessary during the course of experiment.
Before sowing, double budded setts were cut, stored under cane trash to check evaporation and sown @ 80,000 DBS ha\(^{-1}\). The germination and tillers per plant were recorded 45 and 90 DAS while yield was noted at harvest. CCS and sugar recovery were calculated by crushing one composite sample from each replication of each treatment according to procedures laid out in Sugarcane Laboratory Manual for Queensland Sugar Mills (1970). All the qualitative and quantitative treatment means were subjected to statistical analysis to judge their superiority (Steel and Torrie, 1980).

The details of treatments are as follows:

T1 = Fresh cane setts used for sowing  
T2 = Tree days stale cane setts used for sowing  
T3 = Six days stale cane setts used for sowing  
T4 = Nine days stale cane setts used for sowing  
T5 = Twelve days stale cane setts used for sowing

**RESULTS AND DISCUSSION**

Germination: A decrease in germination percentage with increasing seed setts’ staleness was recorded in both varieties. In HSF-242, maximum germination (39.20%) was recorded in T1 while minimum (21.58%) in T5. Similarly maximum germination in CPF-236 was noticed in T1 (37.26%) while minimum in T5 (17.50%). These results confirm Yadava (1991) who stated that older buds were relatively less successful.

Tillers per plant: A trend analogous to germination was also found in tillers per plant in both varieties. Average tillering data envisaged, maximum number of tillers per plant (2.08) in T1 where fresh cane seed setts were sown and minimum in T5 (1.77) where 12 days old setts were used. Higher tillering due to higher germination was also examined by Ali et al., (1999) while studying the performance of different sugarcane varieties.

Cane yield: Tabulated data showed that cane yield was directly affected by germination and tillering. A higher germination and tillering produced heavy tonnage and vice versa. Twelve days stale seed gave minimum yield 38.34, 39.73 and 39.04 tha\(^{-1}\) in HSF-242, CPF-236 and on average basis respectively. Highest germination produced highest cane yield and highest tillering gave rise to highest yield was also investigated by Bajwa et al., (1993) and Atta et al., (1992) in their separate studies of sugarcane varietals trial.

CCS and sugar recovery: Results showed that both CCS and sugar recovery were interrelated with each other with respect to increasing and decreasing trend but not with germination, tillering and yield. The maximum CCS, on average basis, was noticed in T2 (14.33%) and it was followed by T3 (13.47%), T1 (13.42%), T4 (13.41%) and T5 (13.120%) in descending order. Similar trend was recorded in sugar recovery. Bajwa et al., (1993) also noticed same observations while studying performance of twelve varieties that CCS was independent of germination and yield.
Conclusion: Use of stale cane setts as seed did not affect CCS and sugar recovery but it adversely decreased germination, tillering and yield.

Table-1  Qualitative and quantitative response of sugarcane varieties to freshly and stale sown cane seed (Two years mean data)

<table>
<thead>
<tr>
<th>Treatments</th>
<th>HSF-242</th>
<th></th>
<th>CPF-236</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Germination (%)</td>
<td>Tillers/plant</td>
<td>Cane yield (t ha⁻¹)</td>
<td>Sugar yield (t ha⁻¹)</td>
<td>CCS (%)</td>
<td>Sugar recovery (%)</td>
<td></td>
</tr>
<tr>
<td>T1= Fresh cane setts used for sowing</td>
<td>39.20 a</td>
<td>2.38</td>
<td>62.63 a</td>
<td>8.20 a</td>
<td>13.073</td>
<td>12.29</td>
<td></td>
</tr>
<tr>
<td>T2= Tree days stale cane setts used for sowing</td>
<td>29.24 b</td>
<td>2.30</td>
<td>48.76 b</td>
<td>6.52 b</td>
<td>15.017</td>
<td>14.12</td>
<td></td>
</tr>
<tr>
<td>T3= Six days stale cane setts used for sowing</td>
<td>23.65 bc</td>
<td>2.18</td>
<td>45.38 b</td>
<td>6.10 b</td>
<td>13.413</td>
<td>12.61</td>
<td></td>
</tr>
<tr>
<td>T4= Nine days stale cane setts used for sowing</td>
<td>22.93 c</td>
<td>2.07</td>
<td>44.96 b</td>
<td>5.91 b</td>
<td>13.077</td>
<td>12.29</td>
<td></td>
</tr>
<tr>
<td>T5= Twelve days stale cane setts used for sowing</td>
<td>21.59 c</td>
<td>2.04</td>
<td>38.34 c</td>
<td>4.92 c</td>
<td>12.877</td>
<td>12.10</td>
<td></td>
</tr>
<tr>
<td>LSD</td>
<td>5.70</td>
<td>N.S</td>
<td>5.87</td>
<td>0.96</td>
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<td></td>
<td>37.26 a</td>
<td>1.77</td>
<td>57.59 a</td>
<td>7.91 a</td>
<td>13.760</td>
<td>12.93</td>
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<tr>
<td></td>
<td>29.08 b</td>
<td>1.70</td>
<td>53.84 ab</td>
<td>7.32 ab</td>
<td>13.633</td>
<td>12.81</td>
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<tr>
<td></td>
<td>22.34 bc</td>
<td>1.64</td>
<td>47.15 bc</td>
<td>6.48 bc</td>
<td>13.530</td>
<td>12.72</td>
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<td>22.30 bc</td>
<td>1.55</td>
<td>43.56 c</td>
<td>5.99 cd</td>
<td>13.747</td>
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<td>17.50 c</td>
<td>1.49</td>
<td>39.73 c</td>
<td>5.35 d</td>
<td>13.513</td>
<td>12.70</td>
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<td></td>
<td>7.96</td>
<td>N.S</td>
<td>8.82</td>
<td>1.08</td>
<td>N.S</td>
<td>N.S</td>
<td></td>
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<tr>
<td>AVERAGE OF TWO VARIETIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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REFERENCES

SCREENING OF SUGARCANE GENETIC MATERIAL AT PRIMARY NURSERY STAGE FOR SUGARCANE AGRONOMY

M. Zafar, Shafiq Ahmad, M. Azhar Munir, Abdul Ghafar, Shahid Bashir, M. Saeed and M. Zafrullah Khan

ABSTRACT

To evaluate 175 clones against standard variety CP-77-400 a non replicated single row trial was laid out having net plot size measuring 5X2.4m. Keeping in view the desirable characters, 64 clones having desirable brix % growth and other quantitative characters were selected and promoted to Advance Nursery trial while 111 clones were rejected due to undesirable characters. However 10.2%, 8.57%, 9.71%, 6.28%, 2.85%, 3.42%, 6.28, 4.57%, 2.85%, 4.00% and 4.57 clones were rejected, due to poor growth, pithiness, low brix %age, aerial roots, cracks, sprouts, disease susceptibility, insect/pest infestation, hairiness, lodging and short inter-nodal length respectively.

Key words: Clone, standard variety, trial, nursery, desirable character, pithiness, brix

INTRODUCTION

Sugarcane is an important cash crop of Pakistan (Ahmad et al., 1991, Rehman et al., 19992), which plays an important role in economic uplift of farmers. Moreover feeding of ever expanding sugar industry totally depends upon cane cultivation. However, the national average cane yield is 53.2 tones/ha which is far below the potential of existing cane varieties (Ann.2007).

The yield can be enhanced by adopting the improved package of technology and by growing high yielding varieties (Heinz, 1987). However development of new sugarcane varieties is not feasible in Pakistan because of intricate flowering of the plant and non availability of sugarcane breeding facilities and acclimatization (Javed et al., 2001).

Thus selection in general, forms the base line for the cane agronomist in Pakistan to develop new varieties. The variety improvement in sugarcane is equally important from the breeders and growers point of view. Potential of new genotypes needs to be tested in local environment over various locations for different years before deciding to release as new cultivar in a particular region (Basfor and Cooper 1998, Pollock 1975, Ruschell-1977, Tai et al., 1982, Kanf and millers 1984, Milligan et al., 1990, Khan, 1981 and Khan et al., 2000).

The clonal selection at the pre commercial stages helps in identification of improved genotypes for commercial production of sugarcane (Claz et al., 2000). All the stages in varietal selection programme are important but establishment of a good Nursery is of prime importance, because evolution of durable and dependable variety can be expected if it expands from a good nursery. Keeping in view the importance of the nursery, the present study was conducted under the agro-climatic conditions of Faisalabad.
MATERIALS AND METHODS

In primary nursery phase-II 175 clones having 7 parent crosses of exotic origin received from seedling stage were tested in a non-replicated single row trial (Augmented design) having net plot size 5X2.4m. These clones were compared with standard variety CP-77-400. Keeping in view the desirable characters such as growth vigour, frost resistance, erectness, resistance to lodging, hairiness cracks, aerial roots, tillering, sprouts, disease susceptibility, insect pest infestation, damage by sun burn and brix% age etc.

The brix reading was recorded by hand refractometer. After comparing the quantitative and qualitative character of all clones with standard variety CP-77-400, 46 clones (34.85%) were promoted to Advance Nursery trials while 111 clones (61.81%) were rejected due to undesirable characters. The selection was made by the committee of experts in the field.

RESULTS AND DISCUSSION

The performance of clones under evaluation for varietal selection programme is given in table I and II. The Significant 61 cones were selected as given in table I and clones which fell under the categories of un-required characters of the sugarcane plant are given in table No. II. One parent cross gave 55.55% selection. One parent cross showed 50% selection and two parent crosses exhibited 48% selection for promotion to Advance Nursery trial. So the selection remained 34.85% that is 64 clones and rejection was 63.42% that is 111 clones. Characters studied in the experiment are discussed as under.

1. **Growth performance**
   In good agronomic practices the growth performance is a character that affects the yield of the cane crop. Growth habits, erectness, internodal length, girth of cane and stooling depends upon genetic make up which may be detected by overall performance of the cane. Keeping in view the growth performance 18 clones 10.28% were rejected on the basis of poor growth.

2. **Pithiness**
   Hallow stem of cane plant is negative character which leads to lodging and disease susceptibility and lowers the cane quality. In this trial 15 clones (8.57%) were rejected due to pithiness.

3. **Brix %**
   It is the percentage by weight of sucrose in pure sugar solution (Meade 1964). It was recorded by Hand Refractometer. Higher Brix% results in higher sugar recovery and vice versa. In this context 17 clones 9.71% were rejected due to lower Brix%.

4. **Aerial roots**
   These are secondary roots which spoil the quality of the cane as well as lowers the growth speed and deteriorate the crop stand 11 clones (6.28%) were found carrier of this bad character so were rejected.
5. **Cracks**
The cracks on stem of the cane plants deteriorate the cane quality as well as tissues due to enhancement of transpiration rate (Dillefwijn 1952) and make plants susceptible to the diseases. 5 clones (2.85%) showed this weak character and were rejected.

6. **Sprouts**
Due to bud sprouting, which adversely affect the quality of the cane and germination of the new crop is lowered, This character appeared in 6 clones (3.42%) and these were rejected in this trial.

7. **Disease infestation**
Only 11 clones (6.28%) were rejected due to the infestation by different diseases in this trial. So were rejected.

8. **Insect/Pest**
Severe insect pest attack was observed on 5 clones (4.57%) and these were rejected.

9. **Hairiness**
It is an undesired character which makes intercultural practices difficult as well as the harvesting of the crop and 5 clones (2.85%) were rejected due to Hairiness.

10. **Lodging**
It is a bad character and exerts harmful effect on sugarcane yield (Borden-1942), spoils the cane quality, brix % age and growth of sugarcane crops. In this contexts 7 clones (4.11%) were rejected.

11. **Inter-nodal length problem**
Length of internodes and fiber% as well as reduces sugar recovery 8 Clones 4.57% were rejected due to short inter-nodes.
### Table-1  Parentage wise selection

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name</th>
<th>Total Clone</th>
<th>Selected</th>
<th>Rejected</th>
<th>Brix Range</th>
<th>Selection %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>M2078/90 x M1246/84</td>
<td>50</td>
<td>24</td>
<td>26</td>
<td>5.5-17</td>
<td>48</td>
</tr>
<tr>
<td>2.</td>
<td>M695/69 x M1921/87</td>
<td>66</td>
<td>15</td>
<td>51</td>
<td>6-21</td>
<td>22.72</td>
</tr>
<tr>
<td>3.</td>
<td>MQ 83-204 x 86-A 3626</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>14-15</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>H 60-3802 x 795 X2954</td>
<td>13</td>
<td>3</td>
<td>10</td>
<td>10-17</td>
<td>23.07</td>
</tr>
<tr>
<td>5.</td>
<td>M 2597/79 Poly Cross</td>
<td>9</td>
<td>5</td>
<td>4</td>
<td>12-17.5</td>
<td>55.55</td>
</tr>
<tr>
<td>6.</td>
<td>M 1246/84 x M 1176/77</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>11-14</td>
<td>50</td>
</tr>
<tr>
<td>7.</td>
<td>CP70-1133 x M1551/80</td>
<td>33</td>
<td>16</td>
<td>17</td>
<td>9-20</td>
<td>48.48</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>175</strong></td>
<td><strong>64</strong></td>
<td><strong>111</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table-2  Character – wise rejection

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Factor</th>
<th>No. of clones S-2008 Misc. SP-------</th>
<th>Total Clones</th>
<th>Rejection %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Growth</td>
<td>190,193,194,197,234,247,261,269,287,290,308,324,327,334,336,343,353,358</td>
<td>18</td>
<td>10.28</td>
</tr>
<tr>
<td>4</td>
<td>Aerial Roots</td>
<td>205,241,250,271,291,300,301,302,307,332,348</td>
<td>11</td>
<td>6.28</td>
</tr>
<tr>
<td>5</td>
<td>Cracks</td>
<td>199,238,279,288,331</td>
<td>5</td>
<td>2.85</td>
</tr>
<tr>
<td>6</td>
<td>Sprouts</td>
<td>188,248,281,286,299,303</td>
<td>6</td>
<td>3.42</td>
</tr>
<tr>
<td>8</td>
<td>Insect/Pest susceptibility</td>
<td>191,206,224,294,304,310,349</td>
<td>8</td>
<td>4.57</td>
</tr>
<tr>
<td>9</td>
<td>Hairiness</td>
<td>244,258,268,305,326</td>
<td>5</td>
<td>2.85</td>
</tr>
<tr>
<td>10</td>
<td>Lodging</td>
<td>230,187,255,280,312,325,329</td>
<td>7</td>
<td>4.00</td>
</tr>
<tr>
<td>11</td>
<td>Nodal Length</td>
<td>189,228,240,256,293,309,342</td>
<td>8</td>
<td>4.57</td>
</tr>
</tbody>
</table>
REFERENCES

Impact of high rates of coal flyash on some pertinent soil characteristics and sugarcane yield in Mauritius by A. Soobadar, M. A. Bholah and K.F. NG Kee Kwong

The combustion of coal for cogeneration of electricity by the sugarcane industry in Mauritius generates annually some 20 000 tonnes of ash that need to be disposed of in an environmentally sound manner. As large scale application of ash has been reported to impart agronomic benefits but data under conditions prevailing in Mauritius are lacking, the impact of disposing 50 to 100 t/ha coal flyash in sugarcane fields on soil quality and on sugarcane production was studied in field trials at Belle Rive (>3500mm/y rainfall), Union Park (>3000 mm/y rainfall), Pamplemousses (>1500/y rainfall) and Medine (900 mm/y rainfall). Tough coal as did not affect soil pH, soil salinity and even soil exchangeable bases, its application at 100 t/ha, when compared to mineral fertilizers, resulted in a reduction of sugar yield at three sites by an average of 1.18 t sugar/ha. At the lower rate of 50 t/ha coal ash, in spite of a significant yield decrease observed at Belle Rive, sugarcane production at Pamplemousses, Union Park and Medine was not significantly different from the control. The N and k uptake by sugarcane was not influenced by the coal ash, though P uptake was enhanced on account of the supplementary P Provided in the ash. Additionally, because of its low heavy metal content, coal ash did not increase the heavy metal uptake by the sugarcane plant. In view of the adverse effects observed on sugarcane production, the disposal of rates of coal ash as high as 100 t/ha in sugarcane lands should not be contemplated.

Modified dual row planting system for green cane management in the tropics by J.S. Torres, F. Villegas and A. Duran

After green cane harvesting in high yielding fields, a large amount of residues is left on the soil surface which interfere with the standard cropping practices, normally in burnt fields. A new planting system arrangement has been tested to reduce cane stool damage, soil compaction, cost of residue handling, allelopathic effects, herbicide use, and to improve irrigation efficiency. The so-called modified dual row planting (MDRP) allows for controlled traffic paths of 3.9 m wide followed by a set of three dual rows of cane at 0.8 m between rows and 2.1 m in between two adjacent pairs of dual rows. Total furrow length per hectare is equivalent to a single-row planting at 1.75 m spacing (5714 m of cane row/ha). The 3.9 m strip opens enough space to place the residues during manual cutting and leave the cane rows free of residues. The traffic of wagons loaded with cane is conducted on top of the green trash which later decomposes to enrich these areas with organic matter. During development of the plant cane, other crops can be planted to benefit from these open spaces. The MDRP, tested under different soil and climatic conditions, was found to produce a lower cane yield (10 to 20 t/ha) in plant cane as compared to the single-row planting spacing at 1.75 m spacing. After the harvest of the plant and several rations, the benefits of the MDRP, due to controlled traffic and less compaction, resulted in a more stable
Shahid Afghan & Pervez Akhtar

cane production; the cumulative cane production after four cropping cycles showed a higher cane production than the single-row planting. The MDRP also allows for a good separation of the cane windows from the trash swaths which results in at least 1% higher sugar recovery.

Preliminary results of a network of trials related to sugarcane nutrition in reunion island

In reunion island, sugarcane is grown under highly contrasting climatic conditions, from the sea level to the highlands (up to 1000 m altitude), with every different soil types. Taking this diversity into account, a network of agronomic trials was implemented in 2005 on grower farms across the island. Four main fertilization or amelioration techniques were tested:

i) Reduction of soil acidity using mill ash compared to liming materials, Maglime and Physiolith;
ii) Sustainable nutrient management based on soil analysis;
iii) Effect of a slow release fertilizer polymer-coated granular urea; and
iv) Effect of splitting nitrogen application.

In each trial, the traditional grower practices were used as control. Outcomes of the trials included: correction of soil acidity using mill ash with a sugar yield 10 to 23% higher than control; a better sugar yield per ha using sustainable nutrient management (in one of two trials); a sugar yield loss using a reduced rate (-30%) of polymer-coated granular urea; a positive impact on ratoon yield when nitrogen application was split into two events; and yield loss with a reduced rate of nitrogen (-30% N in plant cane and -20% N in ratoon). Such a network of trials should facilitate a faster adoption of research recommendations by the growers as it allows a direct exchange of information between sugarcane farmers and agronomists and addresses growers, issues.

The role of biochar in management of sugarcane

The sugarcane industry in many parts of the world produces food and energy (stationary and fuel). The industry is well positioned to offer greenhouse gas abatement and climate change mitigation. The thermal conversion, via a slow pyrolysis process, of cane residues such as green harvest trash and bagasse can produce additional thermal or electrical energy as well as biochar. Studies have shown that a commercial slow pyrolysis unit could generate over 2MWh of electricity from every four tonnes of dry trash, as well as 1.3 tonnes of biochar per hour. Biochar has characteristics similar to black carbon, and it has recently been suggested as a sequestration pathway to remove CO\textsubscript{2} from the atmosphere, long term, due to its very stable chemical structure. One ton of bagasse derived biochar would sequester in the order of 2.3 tonnes of CO\textsubscript{2} equivalents. In addition to C sequestration, biochar has other significant benefits such as
offering improved soil quality, CEC, moisture retention etc. It also has the potential to reduce emissions of greenhouse gases from cane soils, including nitrous oxide and methane. Biochars derived from cane trash and bagasse was applied in incubation studies to soils from the Burdekin region in Australia to test for reductions in emissions of greenhouse gases. We found significant declines in emissions of the greenhouse gas, nitrous oxide (N₂O), from urea-fertilized soil when bagasse biochar was applied at a rate of 10 t/ha. The agronomic performance of biochar is being assessed in a 15 plot trial conducted on a sugarcane property in the Tweed Valley, NSW. Biochars from waste were tested and included paper mill biochar and council green waste biochar. Controls included lime treatments. Each plot used 3 rows of cane and was 30 m in length to enable commercial-scale harvesting. Although no significant effects in yield were recorded for year 1, this trial is expected to continue for two more seasons allowing additional data on yield effects to be demonstrated. Our work is demonstrating that implementation of slow pyrolysis and biochar utilization in the sugarcane industry has potential to provide 1) renewable energy 2) income from waste 3) climate mitigation through stabilization of carbon 4) climate mitigation through reduced emission of N₂O from soil, and 5) improved soil fertility and agronomic performance.

Family selection improves the efficiency and effectiveness of selecting original seedlings and parents

Family selection has been used in several sugarcane breeding programs for many years, and has been shown to be superior to individual selection (also known as mass selection), in terms of gains from selection, resource efficiency, and cost of operation. Other breeding programs have expressed interest in family selection, but the technique has not been widely adopted for logistical reasons. Suggestions for overcoming the constraints to family selection are made. Family selection has also been shown to provide a superior method for estimating the breeding value of parent clones. Objective data on the performance of families provides invaluable information on the breeding performance of parent clones. Best Linear Unbiased Predictors (BLUPs) can be estimated for a range of traits from the results of family selection trials, and these are estimates of breeding value. In Australia, current research is aimed at improving the BLUP estimates by combining data across all selection programs, including family x environment interactions, and partitioning the genetic effects of each parent into additive and non-additive genetic effects.

Sugarcane smut in Australia: History, response and breeding strategies

Although sugarcane smut was first detected in the Ord River Irrigation Area of Western Australia in 1998, the major sugarcane areas along the east coast of Queensland and northern New South Wales were not affected by the disease until it was found near Childers in June 2006.
Since then there has been a rapid disease escalation and smut has now been found in most sugarcane regions of Queensland, but not in New South Wales. It is estimated that smut will be found on every farm in the Bundaberg-Childers, Mackay and Herbert regions in 2009 and economic losses will be recorded in some crops of susceptible varieties. This paper documents the development of the smut epidemic in Queensland, the strategy now in place to replace smut-susceptible varieties and the breeding approaches adopted pre and post-incursion. A key feature was the screening of varieties, advanced clones and parents in Indonesia from 1998 onwards. Breeding strategies aim to minimize industry economic losses and maintain the rate of genetic gain. This should results in a high proportion of resistant and intermediate varieties being harvested by 2012 and the on-going release of new highly productive, smut-resistant varieties to the Australian sugarcane industry.

Overview of sugarcane breeding in mainland China
Lin Yanquan, Deng Zuhu and Deng Haihua
This paper briefly reviews the history of sugarcane breeding in mainland China, major sugarcane research institutes in different provinces, and the development and adoption of new varieties in the past 10 years. It also highlights important benefits and progress in introducing sugarcane varieties from overseas and Taiwan, China. Progress in utilising basic germplasm for sugarcane improvement in mainland China is also briefly reviewed. Challenges facing sugarcane breeding in China and potential ways to address these are proposed.

Utilization of wild canes from China

In 2002 a collaborative program of breeding and research was commenced, aiming to utilize wild germplasm from China for sugarcane improvement in both China and Australia. Some results and recommendations arising from this program to date are reported here. The program aimed to: characterize genetic diversity in Chinese S. spontaneum and Erianthus spp. And sugarcane, and initial evaluation of the resulting progeny; assess if and how DNA markers can be used to identify genome regions of positive value from wild clones, and to assist in programs aiming to introduce new genes from wild canes into commercial cultivars; quantify genotype x environment interactions between Australia and China. Results from the genetic diversity studies indicated a high level of genetic diversity in both S. spontaneum and Erianthus arundinaceus in China, and provide a basis for targeted sampling and use of this material in future breeding efforts or for core collections. Two hundred and two crosses from a range of S. spontaneum and Erianthus clones generated viable seeds, and 100 of these crosses have been verified (to date) using DNA markers as producing true hybrids. These results were significant in relation Erianthus spp. in providing (to our knowledge) the first report of verified fertile Saccharum x Erianthus hybrids in the world, despite many past efforts. Several case study populations derived from S. spontaneum and Erianthus were used for quantitative trait loci (QTL) mapping. Several apparently important QTL for cane yield were identified from S. spontaneum. An approach to apply DNA markers in future introgression breeding in sugarcane is recommended, based on the
results and experience obtained. Another significant result was the first (to our knowledge) documentation of genotype x country interactions. Somewhat surprisingly, moderate to high (>0.6) genetic correlations in performance of families and clones between trials in China and Australia were observed, despite some contrasting environmental and management conditions. This result supports ongoing collaboration between China and Australia via exchange of selection trial results and selected germplasm.

**Impact of globalization on sugarcane pest’s biodiversity and the environment: a review of the 2009 entomology workshop**

William H. White, Eduardo Willink, Seelavarn Ganeshan, Peter R. Samson and Francois-Regis Goebel


The 7th International Society of Sugar Cane Technologists (ISSCT) Entomology Workshop was held from 20 to 24 April 2009 in San Miguel de Tucuman, Argentina under the theme; ‘Impact of Globalization on Sugarcane on Sugar Cane Pests, Biodiversity and the Environment.’ Technical selections held over three days were grouped into five subject headings; biological control of sugarcane pests; pest management; insect-plant interactions; losses due to sugarcane pests; and biological studies of sugarcane pests. Following the technical sessions, field trips allowed delegates to view important insect pests of the Argentine sugarcane industry in the field and visit the Estacion Experimental Agroindustrial Obispo Colombres, as well as cultural sites in the region surrounding San Miguel de Tucuman. The Entomology section concluded that globalisation will most likely continue to impact on the world’s sugarcane industries. The ISSCT Entomology Workshops will therefore become increasingly important as a venue for entomologists to stay abreast of impending insect threats to their industries and to keep current with new technologies that will be vital for managing potential new invaders as well as maintaining sustainability.

**Sugar losses caused by the sugarcane borer (Diatraea saccharalis) in Tucuman, Argentina**

A. R. Salvatore, M.B. Garcia, E. Romero and E. Willink


The sugarcane borer, *Diatraea saccharalis* is the most damaging pest of the sugarcane in Tucuman Province. Galleries produced in the stalk by the larvae are gateways to pathogens. Their effect generates losses in stalk weight, and reduces the quality and amount of sucrose and juice extraction in factories. The objective of this study was to evaluate the losses caused by *Diatraea saccharalis* on three sugarcane varieties and on cane under storage. During the 2005 harvest seasons, observations with three commercial varieties, LCP 85-384, TUCCP 77-42, and CP 65-357, detected significant losses on field and factory yield. Reductions of 0.42% in the stalk weight and 0.20% in pol were observed for each 1% attack, producing a 0.22% loss for each point of infestation loss on the factory yield, with a 620 to 650 g/t of cane loss of sugar, depending on the variety. In addition, the variety LCP 85-384 was assayed at three different dates: June, August and October, during the 2006 harvesting season, to evaluate the effect of storage on losses following *D. saccharalis* attack. Sugar losses were much greater after 4 days post harvest storage. This difference was higher as the harvest season progressed.
Cogeneration potential in Colombian sugar mills

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 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.

Potassium removal from distillery slops by Candida propagation

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