Pakistan Sugar Journal

April-June 2013

Contents

Vol. XXVIII, No.02

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Aamir Shahazad
Shakarganj Sugar Research Institute
Toba Road, JHANG
Ph: +92 47 7652801-5 Ext. 602, 603
Email: aamir.shahazad@shakarganj.com.pk

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Pakistan Rs. 1,000/-
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Pakistan Sugar Journal April-June, 2013 (1)
CAPACITY CURING MANAGEMENT OF CONTINUOUS CENTRIFUGAL MACHINES

Abdul Aziz Tahir*
*Technical Director, Ranipur Sugar Mills Limited, Ranipur

Over View
The Raw Massecuite Curing Station of Boiling House is the most cost effective Station in the point of view of Electrical, Operation and Maintenance cost heads. By controlling these heads, meaning full saving can be made which will ultimately share the profitability of the project. The Paper is the review of activities performed at continuous centrifugal station. It focused the criteria for selection of conti machine, its erection, selection of the V belts and pulleys design for power transmission, selection of machine rpm and nickel working screens, start up and operation precautions, necessary steps for capacity gaining, scheduled and preventive maintenance, basket keeping, safety devices, preventive measures to avoid major break down of the machine, technical details of different make baskets, comparative capacity test for different make machines, pay back period calculations for high capacity new machine and case study for 6000 TCD plant working with high capacity conti machines.

The presentation details:
1-Over view of a Conti Machine
2-Selection of the type of Conti Machine
3- Effect of rpm and Basket Angle
4-Space and Mechanical Structure Requirement
5-Installation/Erection precautions
6-Selection of Nickel working Screens
7-Selection of V Belts type and Pulley design for Power Transmission
8-Start up Precautions
9-Operational Parameters
10-Massecuite Feeding Arrangements
11-Massecuite Conditioning
12-Maximum Capacity Gain
13-Essential Safety Devices
14-Machine Maintenance
15-Causes of Major Machine Accidents
16-Precautions to Stop the Machine for over non crop Period
17-Comparative Technical Details of different Make Baskets
18-Comparative Capacity Run Data for Different Makes Machines
19-Payback Period of High Capacity local made Conti. Machine
20-Case Study for Replacing K1100 Conti Machines with SK1250
21-Machines for 6000 TCD Plant
22-Recommendations

Over View of a Continuous Centrifugal Machine
2- Selection of the type of Conti Machine
   It includes:
   
   A-Curing Capacity Tons/hr with given condition of
   a. Massecuite type and its:
      i. Brix
      ii. Purity
      iii. Temperature
   b. Sugar Quality
      i. Purity

   B- Basket RPM

   C. Basket Diameter and Angle
      i. Basket diameter at top
      ii. Basket angle with respect to the tangential at the centre of basket (see at Sr. no. 17)

3- Effect of rpm and Basket Angle
   A-Rpm are selected with the massecuite type, normal recommended rpm and basket angle with experience are following:
      a. 1600/ 30° at A Massecuite
      b. 1600 - 1800/ 30 ø at B Massecuite
      c. 1800 - 2000/ 34 ø at C Massecuite

   B-high rpm beyond the recommended limit may cause:
      a. Crystal damage
      b. Reduce capacity curing

   c. Decrease the V belts life
   d. Decrease the bearing life
   e- Ultimately risk operation of the Machine

   C-Low rpm against recommended limits may cause:
      a. Low quality sugar production
      b. More molasses circulation in the system

   D-lesser degree basket against the recommended angle may cause/require:
      a. Resistance to travel the massecuite/ sugar over the basket screen.
      b. More power demand for capacity run.

   E-higher degree basket beyond the recommended angle may cause:
      a. Low quality sugar production
      b. More molasses circulation in the system

4- Space and Mechanical Structure Requirement

   A- Make steel structure according to or nearest to the Manufacturer Design.
   B-Weak Structure or over loaded structure may result in:
      a. vibration transmission from one machine to other
      b. reduction in bearing life
      c. reduction in through put of the battery
      d. Basket damage or major machine accidents
      e. Constant life risk threat for the operators

5- Installation/ Erection Precautions
   a. That Machine is dynamically pre-balanced at designed rpm.
   b. The complete welding point of the structure
   c. Horizontal left right “00” balance of the structure
   d. “00” balance of the drive unit/ housing of the machine
   e. “00' balance of basket top ring after fitting
   f. Very Important to note that: Feeding Pug Mill center, Feeding Pipe of pug mill, distributor of machine is vertically in line.
   g. Pug mill feeding pipe diameter should not less than 8 inches for K1100 Machine and 10 inch for 1200/K1250 or equivalent make machines.
   h. The length of feeding pipe from main control valve to feed control valve (Agar type) equal to basket length + 1 ft. as shown in under given sketch.
Selection of Nickel Working Screens

<table>
<thead>
<tr>
<th>Mass: Type</th>
<th>Slot Size (W X L) mm</th>
<th>Open area(%)</th>
<th>Thickness (mm)</th>
<th>Slot Size (W X L) mm</th>
<th>Open area(%)</th>
<th>Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.09 X 2.70</td>
<td>11%</td>
<td>0.35</td>
<td>0.09 X 1.85</td>
<td>22.30%</td>
<td>0.353</td>
</tr>
<tr>
<td>B</td>
<td>0.06 X 2.67</td>
<td>8.00%</td>
<td>0.35</td>
<td>0.06 X 1.82</td>
<td>14.70%</td>
<td>0.33</td>
</tr>
<tr>
<td>C</td>
<td>0.04 X 2.64</td>
<td>6.50%</td>
<td>0.35</td>
<td>0.04 X 1.80</td>
<td>9.70%</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>0.06 X 2.67</td>
<td>8.00%</td>
<td>0.35</td>
<td>0.06 X 1.82</td>
<td>14.70%</td>
<td>0.33</td>
</tr>
</tbody>
</table>

- **High open area screens are cost effective but:**
  - Increase the machine capacity or improve sugar quality at given capacity.
  - Less slot distortion due to shorter slot length means extended service life of the screen with good performance.

- **Selection of Screen is a matter at C massecuite curing station:**
  - with high open area slot size of 0.04 x 1.80 mm, low quality sugar production at reduced machine capacity, slightly less molasses purity but more sugar loss due to high washing water requirement.
  - low purity of C Sugar caused low quality end sugar production with more load of molasses circulation in the system.
  - with high open area of slot size of 0.06x1.82 mm, good quality C Sugar production with capacity curing, slightly high molasses purity but lesser sugar loss due to lesser demand of washing water.
**Selection of V Belts type and Pulley design for Power Transmission V-Belts**  
**Requirement Calculation** (Ref: DRB, Design Manual for Power Transmission Belts)

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedures</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Calculate the design HP</td>
<td>Pd = 120 X 1.30 = 156 HP</td>
</tr>
<tr>
<td></td>
<td>Pd: = Pt X Fs</td>
<td>Pt: Rated Horse power</td>
</tr>
<tr>
<td></td>
<td>Pd: Design Horse Power</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FS: Service Factor (Table-No.4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Select the right V-Belt Type</td>
<td>V-Belt Type : C(Figure4)</td>
</tr>
<tr>
<td>3</td>
<td>Select the pulley diameter</td>
<td>Dp: = 229 mm</td>
</tr>
<tr>
<td></td>
<td>i. Minimum Pitch dia (Table No.3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii. Find speed ratio</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Speed ratio (RS) = nl/n2</td>
<td>Rs. = 2000/1470 = 1.36</td>
</tr>
<tr>
<td>5</td>
<td>s. Calculate the pitch diameter of the larger pulley</td>
<td>Dp:= 1.36 X 229 = 311 mm</td>
</tr>
<tr>
<td></td>
<td>Dp: Pitch diameter of larger pulley</td>
<td>Dp: Pitch diameter of smaller pulley</td>
</tr>
<tr>
<td></td>
<td>nl= rpm of larger pulley</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1. Determine the V-belt length</td>
<td>Lp=2 X</td>
</tr>
<tr>
<td></td>
<td>Lp:= = 2C + 1.57 x (Dp + dp) + (Dp - dp)' / 4C</td>
<td>1500+1.57x(229+311)+(311-229)' / (4 X 155)</td>
</tr>
<tr>
<td></td>
<td>C= centre distance (chosen)</td>
<td>LP = 3858.60 mm</td>
</tr>
<tr>
<td></td>
<td>2. Calculate the exact centre distance of pulleys after belt length is</td>
<td>(Nearest standard length from figure No.5)</td>
</tr>
<tr>
<td></td>
<td>determined</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C = b+(b= - 2 X (Dp - dp)=)' / 4</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1. Determine tilt power per Belt</td>
<td>Pr = 16.93 + 0.35 = 17.28</td>
</tr>
<tr>
<td></td>
<td>See table No. 11 basic horse power rating for C type belts</td>
<td>Arc Contact = 180 - 60 (Dp - dp) / C</td>
</tr>
<tr>
<td></td>
<td>2. Determine the arc of contact correction factor, From Table No.5</td>
<td>Arc Contact = 180 - 60 x (311 - 229)</td>
</tr>
<tr>
<td></td>
<td>3. Determine the length</td>
<td>1481.10 = 176.68</td>
</tr>
<tr>
<td></td>
<td>Correction Table No.6</td>
<td>Fo = contact correction factor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FL = length correction factor = 1.01</td>
</tr>
<tr>
<td>8</td>
<td>Calculate the No. of tilts required</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of belts = Pd (Pr + Fo + PL)</td>
<td>Numbers of belts = 155 / (17.28 + 0.99 + 1.01) = 8.09</td>
</tr>
<tr>
<td>9</td>
<td>allowance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>/la = 40 mm, /la = 75 mm Table No.7</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Summarize the V-belts derive design</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pitch diameter of smaller pulley, 220 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pitch diameter of larger pulley, 311 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Centre distance = 1481 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Belts to be used : CISO, 8 pes</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE-3 B  V belts Dimensions (mm)

<table>
<thead>
<tr>
<th>Cross Section</th>
<th>W</th>
<th>H</th>
<th>$\alpha$</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12.5</td>
<td>9.0</td>
<td>40$^\circ$</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>16.5</td>
<td>11.0</td>
<td>40$^\circ$</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>22.0</td>
<td>14.0</td>
<td>40$^\circ$</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>31.5</td>
<td>19.0</td>
<td>40$^\circ$</td>
<td></td>
</tr>
</tbody>
</table>

### Table-4 C  Minimum V-Belts Pulley Diameters (in mm)

<table>
<thead>
<tr>
<th>Cross Section</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Pitch Diameter</td>
<td>75</td>
<td>137</td>
<td>229</td>
<td>330</td>
</tr>
</tbody>
</table>
Figure 2 and Table-5 D V belts Pulley Design
- Under mentioned is a V belts pulley design guide line with dimensions in mm.

![Diagram of V belts Pulley Design]

<table>
<thead>
<tr>
<th>Cross Section</th>
<th>Datum Diameter Range</th>
<th>Datum Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Up thru 137</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Over 137</td>
<td>38</td>
</tr>
<tr>
<td>B</td>
<td>Up thru 178</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Over 178</td>
<td>38</td>
</tr>
<tr>
<td>C</td>
<td>Up thru 203</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Over 203 to &amp; incl.</td>
<td>305</td>
</tr>
<tr>
<td></td>
<td>Over 305</td>
<td>38</td>
</tr>
<tr>
<td>D</td>
<td>Up thru 330</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Over 330 to &amp; incl.</td>
<td>432</td>
</tr>
<tr>
<td></td>
<td>Over 432</td>
<td>38</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dty Ref</th>
<th>Pg</th>
<th>±0.13</th>
<th>11.68</th>
<th>6.35</th>
<th>3.76</th>
<th>10.11</th>
<th>5.68</th>
<th>9.53</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12.8</td>
<td>12.1</td>
<td>11.7</td>
<td>3.78</td>
<td>1.67</td>
<td>1.06</td>
<td>1.73</td>
<td>1.56</td>
</tr>
</tbody>
</table>

Table-6 E Accurate and Wrong design Pulleys

<table>
<thead>
<tr>
<th>Pulley and V belts Fitting</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Correct Pulley Design" /></td>
<td>Accurate size of Pulley and V Belt</td>
</tr>
<tr>
<td><img src="image2" alt="Wrong Pulley Design" /></td>
<td>Wrong design Pulley with side ways dishing, shorten the life of V belt</td>
</tr>
<tr>
<td><img src="image3" alt="Dishing Pulley" /></td>
<td>Dishing of side way of pulley as marked</td>
</tr>
</tbody>
</table>
Table-7 F  Problems, Causes and Solutions of V-Belts damaging

<table>
<thead>
<tr>
<th>Problem</th>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign object in drive</td>
<td>• Worn or damaged Pulley</td>
<td>• Replace the Pulley</td>
</tr>
<tr>
<td></td>
<td>• Lesser V belts than requirement</td>
<td>ii-iv Fit required no. of belts of same brand, same size and not mix old and new ones.</td>
</tr>
<tr>
<td></td>
<td>• Combination of different makes V belts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Old and new V belts of different sizes.</td>
<td></td>
</tr>
<tr>
<td>i. Pulley diameter too small.</td>
<td></td>
<td>i. Replace pulley with proper diameter Pulley.</td>
</tr>
<tr>
<td>ii. High temperature</td>
<td></td>
<td>ii. Remove heat source and improve ventilation</td>
</tr>
</tbody>
</table>

8- Start up Pre-cautions
Follow the instruction laid out in the Instruction Manual, other wise or additions to those also check that (Sr. No. A- I):
A. Bearings are fully greased
B. Basket is fully tightened with housing unit
C. Nickel working screens are fully tightened and sides are overlapped according to the direction of rotation and screen holding clamps are tightened.
D. No foreign material is present in the basket and massecuite distributor.
E. Top cover is placed and no air entering points left open in the casing or top cover.
F. Rotation of the machine with motor run.
G. Machine is steam heated to +/- 60ºC
H. Feeding pipe contains no cooled massecuite.
I. Steam up the feeding pipe of Pug mill at both side of the massecuite control valve to reduce the viscosity of the feeding massecuite at the start up and prevent the production at designed capacity at recommended Ampere of the Machine. If there is problem with operation at full load, check and rectify it but do not leave it pending for next crop or compromise at reduced capacity operation.

9- Operational Parameters.
(Other than to listed above)
A. Use nozzle water spray at basket to maintain Sugar quality with following conditions:
• at distance not less than 50 mm
• water temperature 60-65 ºC
• water pressure 2 kg/cm²
• good spray is observed with fish tail type nozzles spraying at two points at 180 degree to each other.
B. Avoid over washing the sugar crystals, better check is to maintain molasses brix, If at recommended molasses brix sugar quality is not achieved then check other parameters like:
• machine rpm
• number of V belts and tightening condition
• massecuite quality
• n/w screen condition
• internal cleaning of the machine casing & distributor

C. Check and maintain:
• cleaning the machine casing at defined intervals
• inspection of the sugar quality
• hourly record the data for;
• feeding massecuite temperature
• water spray temperature
• running Ampere of the machine
• bearing temperature
• sugar and molasses quality

10- Massecuite Feeding Arrangements
A- Drive less Pressure Feeding Bottle
Feeding Bottle is installed on single or group of machines

a. Merits:
   i. Pressure feeding
   ii. Drive less
   iii. Maintenance free
b. De merits
   i. Massecuite re-circulation through over flow line to mother Crystallizer damage the sugar crystals
   ii. Transmit vibration to the Machine station as a part of massecuite pump delivery line

B- Pug mill
a. Merits:
   i. work as pressure feeding bottle if installed as mentioned in Sr. No.5, figure No.1
   ii. No massecuite re-circulation
   iii. Keep the massecuite in motion
b. De merits
   i. chances of addition of foreign material if top of pug mill not properly covered with mesh screen.
   ii. more temperature loss as compared to feeding bottle
   iii. stirrer power consumption and maintenance cost.

11- Massecuite Conditioning:

Table-8

<table>
<thead>
<tr>
<th>Type of Massecuite</th>
<th>Feeding Temp.</th>
<th>Cooling Re-heating Media and Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>60°C</td>
<td>i. open air crystallizer cooling</td>
</tr>
<tr>
<td>B</td>
<td>55°C</td>
<td>• open air Crystallizer cooling to 60°C.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• one step Vertical crystallizer or Werkspoor water cooling to 55°C</td>
</tr>
<tr>
<td>C</td>
<td>58°C</td>
<td>• open air Crystallizer cooling to 60°C C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• V.C water cooling to 40°C C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• water re-heating to 58°C C</td>
</tr>
</tbody>
</table>

12- Maximum Capacity Gain
Most of the parameters are listed above, others are to:
A- Control massecuite temperature at not below than 55°C
B- Run machine at maximum recommended Ampere
C. Install Ampere meter in front of the Operator at each machine
D. Install easy operative massecuite feed control valve
E. keep clean:
   a. Inside of the machine casing
   b. N/W screen of the Machine

13- Essential safety Devices of the Machine
A. Vibration trip device
B. Bearing Temperature Indicator
C. Ampere Meter and overload running electrical trip device

c. massecuite distributor
d. hot water spray nozzles
i. Basket L-Key bolts and Top ring bolts
ii. cleaning of distributor, back liner and N/W screens
iii. greasing the bearings
iv. inspection of the V. belts condition

B- Preventive Maintenance
Check and maintain record of vibration limits of each machine running at full rpm with no load. If vibration of the machine increases the limits, immediately stop the machine and go through check up and maintenance to get back the machine in the same limits of vibration.
Recommended safe limit of vibration for machine basket is less than 1.0 mm per sec.

15- Causes of Major Machine Accidents
A- Loosen/ thread slipping of the L-Key bolts
   a. Always use L-Key Bolts of High tensile material and do not compromise on MS bolts.
   b. Replace the bolts if thread loosen and once at the start of the season.
B-Loosen the top ring bolts
   a. Always check and tighten these bolts during schedule maintenance.
C- Loosen the N/W screen from Screen holder ring
D- Damaging the N/W screen
E- Choking of the Feed distributor of the Basket
F- Cold start of the Machine with cold massecuite in the feed distributor.

G- Initial high vibration reading of the Basket during start up
H- Cold feeding of the massecuite during start run.
I- Stuck off bearings due to no greasing etc.

16. Precautions to stop Machine:
A- for interval, during operation:
   a. complete empty and steam wash the massecuite feeding pipe of Pug mill.
   b. close tightly the massecuite main control valve, no leakage should observe after its closure.
   c. blind the feeding pipe of the machine
   d. steam wash the machine to clean any massecuite and sugar crystals adhering the internal parts of the machine.
   e. Insure the distributor is free of massecuite or foreign material
f. shut off the machine and made it power off from the main control panel.

B-Permanent for over non crop period
   a. Properly grease the bearings
   b. close/blind all openings of the machine casing
   c. made few manual turns of the basket twice a week.

17- Basket Keeping
A- Mark the relevant position of L-key bolts of drive unit with basket after completion of rotary balancing of the basket.
B- Open the basket after the completion of the campaign and keep it body free at balanced position.
C- Re-fit the same basket in same machine with same drive unit at the same relevant marked position.
   This is experienced exercise which cut off more than 50 % rebalancing expenses of the basket for next crop run.

17- Comparative Technical Details of different make Baskets
(Installed at Ranipur Sugar Mills)
### Table 9: Comparative Technical Details of different make Baskets (Installed at Ranipur Sugar Mills)

<table>
<thead>
<tr>
<th>Machine Type</th>
<th>SK 1250</th>
<th>K1100</th>
<th>K1100</th>
<th>K1100</th>
<th>FCE 1250</th>
<th>SK 1250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coating Station</td>
<td>C-Massue</td>
<td>C-Massue</td>
<td>B-Massue</td>
<td>B-Massue</td>
<td>B-Massue</td>
<td>B-Massue</td>
</tr>
<tr>
<td>d1</td>
<td>1,250</td>
<td>1,100</td>
<td>1,100</td>
<td>1,100</td>
<td>1,250</td>
<td>1,250</td>
</tr>
<tr>
<td>d2</td>
<td>990</td>
<td>950</td>
<td>950</td>
<td>950</td>
<td>990</td>
<td>990</td>
</tr>
<tr>
<td>d3</td>
<td>2,200</td>
<td>2,200</td>
<td>2,200</td>
<td>2,200</td>
<td>2,200</td>
<td>2,200</td>
</tr>
<tr>
<td>L1</td>
<td>2,400</td>
<td>2,400</td>
<td>2,400</td>
<td>2,400</td>
<td>2,400</td>
<td>2,400</td>
</tr>
<tr>
<td>L2</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
</tr>
<tr>
<td>L3</td>
<td>1,200</td>
<td>1,200</td>
<td>1,200</td>
<td>1,200</td>
<td>1,200</td>
<td>1,200</td>
</tr>
<tr>
<td>L4</td>
<td>695</td>
<td>695</td>
<td>695</td>
<td>695</td>
<td>695</td>
<td>695</td>
</tr>
<tr>
<td>Nr of Baskets</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Type of Basket</td>
<td>C-Type</td>
<td>F-Type</td>
<td>F-Type</td>
<td>F-Type</td>
<td>F-Type</td>
<td>C-Type</td>
</tr>
<tr>
<td>Pole to valley center distance</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
</tr>
<tr>
<td>No of holes in basket</td>
<td>12 x 24</td>
<td>6 x 24</td>
<td>6 x 24</td>
<td>6 x 24</td>
<td>Top 72</td>
<td>2 x 29</td>
</tr>
<tr>
<td>No of slot in basket (max x cm)</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Size of hole</td>
<td>10 mm</td>
<td>6 mm</td>
<td>6 mm</td>
<td>6 mm</td>
<td>10 mm</td>
<td>10 mm</td>
</tr>
<tr>
<td>Throat area mm</td>
<td>90.00</td>
<td>6.5</td>
<td>6.5</td>
<td>6.5</td>
<td>---</td>
<td>9.00</td>
</tr>
<tr>
<td>Surface area of Basket (cm²)</td>
<td>226.8</td>
<td>277.4</td>
<td>277.4</td>
<td>277.4</td>
<td>378.1</td>
<td>278.1</td>
</tr>
<tr>
<td>Open area percent of Basket (cm²)</td>
<td>0.07</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>0.42</td>
<td>0.42</td>
</tr>
<tr>
<td>Bearings</td>
<td>Ball Bearing 02212 HU 1.1</td>
<td>Ball Bearing 02212 HU 1.1</td>
<td>Four point ball bearing HU 2211 No-2</td>
<td>Four point ball bearing HU 2211 No-2</td>
<td>Four point ball bearing HU 2211 No-2</td>
<td>Four point ball bearing HU 2211 No-2</td>
</tr>
</tbody>
</table>

### Table 10A: Comparative Capacity run Data for different make Machines (at Ranipur)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Particulars</th>
<th>SBK-1250/30°</th>
<th>FCB-1250/30°</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>value</td>
<td>Unit</td>
<td>value</td>
</tr>
<tr>
<td>1</td>
<td>Liner Used</td>
<td>22.30</td>
<td>%</td>
</tr>
<tr>
<td>2</td>
<td>Machine rpm</td>
<td>1,600</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Motor installed</td>
<td>90</td>
<td>Kw</td>
</tr>
<tr>
<td>4</td>
<td>Absorbed AMP</td>
<td>On load run</td>
<td>55</td>
</tr>
<tr>
<td>5</td>
<td>Absorbed AMP on full load</td>
<td>150-155</td>
<td>%</td>
</tr>
<tr>
<td>6</td>
<td>A-Massecuite cured</td>
<td>160</td>
<td>MP</td>
</tr>
<tr>
<td>7</td>
<td>Curing time</td>
<td>8</td>
<td>Hrs</td>
</tr>
<tr>
<td>8</td>
<td>Curing temperature</td>
<td>60</td>
<td>°C</td>
</tr>
<tr>
<td>9</td>
<td>Flow rate</td>
<td>20</td>
<td>M3/Hr</td>
</tr>
<tr>
<td>10</td>
<td>Achieved</td>
<td>30</td>
<td>T/Hr</td>
</tr>
<tr>
<td>11</td>
<td>A-Massecuite characteristics</td>
<td>Brix</td>
<td>95.00</td>
</tr>
<tr>
<td></td>
<td>Purity</td>
<td>83.50</td>
<td>83.80</td>
</tr>
<tr>
<td>12</td>
<td>a-Heavy molasses</td>
<td>Brix</td>
<td>83.90</td>
</tr>
<tr>
<td></td>
<td>Purity</td>
<td>62.57</td>
<td>63.40</td>
</tr>
<tr>
<td>13</td>
<td>a-sugar</td>
<td>Brix</td>
<td>99.90</td>
</tr>
<tr>
<td></td>
<td>Purity</td>
<td>97.88</td>
<td>97.49</td>
</tr>
<tr>
<td></td>
<td>Colour</td>
<td>651</td>
<td>ICUMSA</td>
</tr>
</tbody>
</table>

Remarks:-
- a. Other conditions of wash water temperature etc kept constant and flow rate adjusted according to sugar quality in both cases,
- b. Massecuite flow rate maintained at equal absorbed amperes in both cases.
### Table-10 B

**B- Capacity Test of Sk1250/34" Centrifugal Machine at C and B Massaceutte Curing Station at Ranpur Sugar Mills**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Machine Type</th>
<th>Mass, Curing Station</th>
<th>Description</th>
<th>Units</th>
<th>Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Liner used</td>
<td>Sk1250/34&quot;</td>
<td>Slot size</td>
<td>0.04 x 1.80</td>
<td>0.06 x 1.82</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Motor installed</td>
<td>C, Massaceutte</td>
<td>90 Kw</td>
<td>90 Kw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Absorbed Amp</td>
<td>B Massaceutte</td>
<td>50</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Absorbed Amp</td>
<td>90 -100</td>
<td>150</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Massaceutte</td>
<td>100 Cu.m</td>
<td>100 Cu.m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Curing time</td>
<td>24 Hrs</td>
<td>8 Hrs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Flow Rate</td>
<td>7.52 Cum/Hr</td>
<td>12.5 Cum/Hr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Massaceutte</td>
<td>C Massaceutte</td>
<td>B Massaceutte</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Molasses</td>
<td>Final Molasses</td>
<td>BH Molasses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Sugar</td>
<td>C Sugar</td>
<td>B Sugar</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 19- Payback period of high capacity local made conti. Machine

**Table No.11**

<table>
<thead>
<tr>
<th>Crop Season</th>
<th>2010-2011</th>
<th>2009-2010</th>
<th>Crop days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crushing Period</td>
<td>120</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Machine Type</td>
<td>Sk1250/34&quot;</td>
<td>K10/28&quot;</td>
<td></td>
</tr>
<tr>
<td>Average Capacity</td>
<td>12 Tons/hr</td>
<td>6 Tons/hr</td>
<td></td>
</tr>
<tr>
<td>Electric Motor Installed</td>
<td>90 Kw</td>
<td>75 Kw</td>
<td></td>
</tr>
<tr>
<td>Machine rpm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of Machines operated</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>St.No.</th>
<th>Particulars</th>
<th>Calculations</th>
<th>Units</th>
<th>Calculations</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cost of B/W Screens</td>
<td>55,000</td>
<td>50,000</td>
<td>1,00,000</td>
<td>2,40,000</td>
</tr>
<tr>
<td>2</td>
<td>Cost of V-belts</td>
<td>C-150</td>
<td>B-130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cost of Grease</td>
<td>600</td>
<td>600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cost of bearings</td>
<td>3 bearings cost</td>
<td>6 bearings cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Installed Motor</td>
<td>90</td>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorbed Load @85%</td>
<td>77</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation days</td>
<td>120</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working hour/day</td>
<td>22</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total working Hours</td>
<td>2,760</td>
<td>2,760</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity consumed</td>
<td>211,140</td>
<td>351,800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost per KwHr</td>
<td>10.50</td>
<td>10.50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grand Operational Cost</td>
<td>2,426,570</td>
<td>3,694,550</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost saving with Sk1250</td>
<td>1,844,130</td>
<td>1,844,130</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payback Period</td>
<td>120,420,000</td>
<td>4,126,750</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

_Pakistan Sugar Journal April-June, 2013 (12)_
### 20. Case Study for Replacing K-1100 Machines with SK1250 Machines for 6000 TCD Plant

**Table No. 12**

<p>| | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Station</td>
<td>Quantity</td>
<td>Installed Capacity</td>
<td>Mass, Type</td>
<td>Machine</td>
<td>No. of Units</td>
<td>Absorbed Power (kW)</td>
<td>Power @ 85% of Inst. Power</td>
</tr>
<tr>
<td>A</td>
<td>Massacuite</td>
<td>67.5</td>
<td>15.0</td>
<td>K-1100/75</td>
<td>4</td>
<td>265</td>
<td>Sk1250/90</td>
<td>30.0</td>
</tr>
<tr>
<td>B</td>
<td>Massacuite</td>
<td>22.5</td>
<td>10.0</td>
<td>K-1100/75</td>
<td>2</td>
<td>127.5</td>
<td>Sk1250/90</td>
<td>20.0</td>
</tr>
<tr>
<td>C</td>
<td>Massacuite</td>
<td>17.6</td>
<td>5.0</td>
<td>K-1100/75</td>
<td>4</td>
<td>255</td>
<td>Sk1250/90</td>
<td>10.0</td>
</tr>
<tr>
<td>D</td>
<td>Massacuite</td>
<td>7.0</td>
<td>1.0</td>
<td>K-1100/75</td>
<td>1</td>
<td>63.75</td>
<td>K1100/75</td>
<td>10.0</td>
</tr>
</tbody>
</table>

#### Electricity Saving Cost:
1. Total Power saving of the Season (kW) 256
2. Total Electric Unit saving for the Season (Rs/kW) 703800

**Total Electric operational cost saving for the Season (Rs.)** 8,445,600.0

---

**A-** Total Electric operational cost saving for the Season (Rs.) 8,445,600.0

**Maintenance Saving Cost:**
1. Maintenance Cost for 10 Nos. K-1100 machines @ Rs.215,900* per season (Rs.) 2,159,000.0
2. Maintenance Cost for 5 Nos. SK-1250 machines @ Rs.265,650* per season (Rs.) 1,328,250.0

**B-** Total Maintenance Cost Saving for 5 Nos. Sk1250 Machines (Rs.) 830,750.0

**C-** Total Saving Cost per Season (Rs.) 9,276,350.0

* Cost per Machine, Ref Table No. 11

---

### 21- Recommendations:

A- Always select right machine for right massecuite.
B- Take necessary care for its erection and start up.
C- Take all good measures for capacity gaining.
D- Operate machine at full capacity to save electric power and maintenance cost.
E- Avoid major break downs by adopting condition monitoring and preventive maintenance practices.
F- Control maintenance expenses by training personals and adopting good operation and maintenance practices.
G- Keeping Managerial checks over junior staff of the station, after all this is your own machine station.
EFFECT OF BUD NUMBER PER SEED SETT ON CROP STAND, CANE YIELD AND SUGAR RECOVERY OF SUGARCANE VARIETY THATTA-10

Y.J. Minhas*, F. M. Baloch** and Saima Minhas***

* Sugarcane Specialist, Agriculture Research Institute, Tandojam.
** Assistant Research Officer (Sugarcane), Agriculture Research Institute, Tandojam.
*** Department of Food Sciences and Technology, Sindh Agriculture University Tandojam.

ABSTRACT

The study was carried out to examine the effect of number of buds per seed sett on crop stand, cane yield and recovery of sugarcane variety Thatta during the year 2011 at Sugarcane Section, Agriculture Research Institute, Tandojam. The seed sets sown in this experiment contained 1, 2, 3, 4, 5, 6, 7 and 8-buds. The experiment was conducted in a three replicated Randomized Complete Block Design. It was noted that with the exception of germination and sugar recovery, the values for all the cane yield contributing traits were higher in crop sown with 4-budded seed setts, closely followed by 5-budded seed setts. The crop sown with 4-budded seed setts resulted in 175 cm cane length, 2.90 cm cane girth, 6.40 tillers stool-1, 23.25 internodes cane-1 and cane yield of 104.975 tons ha-1; while the crop sown with 5-budded seed setts resulted in 170.70 cm cane length, 2.2.81 cm cane girth, 5.80 tillers stool-1, 22.50 internodes cane-1 and cane yield of 100.678 tons ha-1; whereas, germination showed a different trend and with increasing number of buds, the germination was decreased simultaneously; while sugar recovery show an inconsistent trend and was unpredictable. However, the overall performance of the crop was markedly better when sown with 4-budded seed setts as compared to control i.e. generally 2-budded seed setts. Hence, it is suggested that 4-budded or 5-budded seed setts may be used for sowing of sugarcane for achieving the higher cane yields and reducing the labour cost in seed preparation.

Keywords: Sugarcane, seed sett, number of buds, cane length, girth, cane yield, recovery

INTRODUCTION

Sugarcane, Saccharum officinarum L. is an important commercial crop in developing and developed countries and is a member of Gramineae family (Miller and Gilbert, 2006). Sugarcane crop is the second major cash crop and is used as a raw material in the production of refined sugar and gur. Its share in value added in agriculture and GDP is 3.7 and 0.8 percent, respectively. Sugarcane was cultivated on an area of 1.046 thousand hectares, 5.9 percent higher than last year’s level of 988 thousand hectares. Sugarcane production for the year 2011-12 is estimated at 55.3 million tons. This shows an increase of 4.9 percent over the production of last year. The main factors contributing to the production are lucrative market prices of last year’s produce and timely availability of inputs encouraged the farmers to grow more sugarcane crop. However, the yield per hectare if compared with last year, posted a negative growth. The floods of 2010 enhanced the soil fertility of sugarcane crop, and as a result, yield per hectare posted a growth of 6.9 percent this year. However, productivity gain could be sustained because water receded very slowly in sugarcane area of lower Sindh (GOP, 2012). In the country, there are 78 sugar factories in function, while in Sindh province there are 31 sugar mills play remarkable role in the economy of the province. In Sindh province the sugarcane cultivation (2009-2010) was 280 thousand hectares with a production of 15350 thousand tons (Carroll and Rehman, 2010); while according to the Government of Sindh (GoS, 2011), the estimates for area under sugarcane in Sindh province were 270 thousand hectares, but the actual area under cane cultivation was 292.5 thousand hectares.
The effect of bud numbers in a seed set of sugarcane has been reported on the crop stand as well as yield per unit area. However, there are numerous methods of sugarcane planting and number of buds in a seed set is kept accordingly (Viator et al. 2005; Khan et al. 2005). Sugarcane is propagated from vegetative stalk cuttings (seed sets) and stalks of mature seed-cane varying from 4 to 8 ft in length are cut with a sharp edged axe that leaves the entire mature stalk intact. The seed sets with two to five buds are then placed end-to-end or side-by-side in a horizontal position in a planting furrow and covered with 2 to 3 inches of soil. The majority of planting occurs from August to October (autumn planting) and February and March (spring planting). This cane becomes established from August to November but becomes dormant in January and February due to low temperatures its foliar growth is checked (Afghan et al. 2010; Chattha et al. 2010).

In recent years, producers have faced increased challenges with planting stalks of cane with various buds or whole-stalk is also used because new varieties often lodge in July and August. Mechanically cutting the seed sets and planting lodged seed-cane with the traditional whole-stalk can result in severe nodal bud damage, with a large portion of the stalks being broken during harvesting. With the increased adoption of the chopper harvesters, the number of whole-stalk harvesters has begun to decline. Due to these changes in varieties and harvesting system, many producers are now using chopper harvesters to cut seed-cane. This type of harvester cuts stalks into 20-24 cm billets (seed sets) and is capable of cutting lodged cane. After being cut, the billets are placed in the opened furrow and covered. Moreover, farmers obtain seed-cane for propagation of sugarcane using bud culture. The main problem, however, related to this technique is bud disinfection (Legendre, 2003). In view of the significance of number of buds in a seed set of sugarcane, the present investigation was performed to investigate the effect of bud numbers on the sugarcane growth, cane yield and sugar recovery, under agro-ecological conditions of Tandojam.

MATERIALS AND METHODS

The experiment was conducted at the experimental fields of Sugarcane Section, Agri. Research Institute, Tandojam in a three replicated Randomized Complete Block Design having plot size of 8m x 3m (24m^2). Treatments included the seed sets with 1, 2, 3, 4, 5, 6, 7 and 8 buds. The fertilizers were applied at the rates of N=220 kg ha\(^{-1}\), P=120 kg ha\(^{-1}\) and K=100 kg ha\(^{-1}\). All P and K and 1/3rd of N was applied at planting time and remaining N in two equal doses at first earthing (3-1/2 months after planting) and 1-1/2 month after first earthing respectively.

Methods for recording observations

Germination (%)

Germination was recorded on the basis of total buds in a plot and number of seedlings germinated in percentage.

Cane length

Cane length was recorded at the field in the labeled sugarcane plants by measuring tape from bottom of the cane up to the last internodes in centimeters and averaged.

Cane girth

Cane girth was measured in each plot on the basis of randomly selected (tagged) plants by means of Vernier Caliper in centimeters and average was worked out.

Tillers stool\(^{1}\)

Tillers stool\(^{1}\) was observed by counting the stalks sprouted in each plant from the labeled plants in each plot and average was calculated.

Internodes cane\(^{-1}\)

Internodes cane\(^{-1}\) was counted from the bottom of the cane up to the last internodes for all the tillers in each plant in each labeled plant in each treatment plot and averaged.

Cane yield ha\(^{-1}\)(mt)

The cane yield ha\(^{-1}\) was calculated on the basis of following formula:

Yield plot\(^{1}\) of given treatment

\[
\text{Cane yield (m.t ha}^{-1}\text{)} = \frac{X \times 10000}{10000}
\]
Plot area (m²)

Sugar recovery (%)  
Polarity was determined by the procedure and method described in laboratory manual for Queensland sugar mills (Anonymous, 1970) in order to calculate Pol and sugar recovery.

The data on the above characters were collected and subjected to statistical analysis. Analysis of variance and mean separation tests were applied (Steel et al. 1997).

RESULTS AND DISCUSSION

Germination (%)  
Germination of seed plays a significant role in establishment of crop stand and subsequently affects the crop growth and yield contributing traits. The data (Table-1) indicated that the seed germination (sprouting) was highest (88.50%) when one-budded seed setts were used for sowing of sugarcane variety Thatta-10, while using seed setts with increased number of buds inversely affected the germination. In crop sown with 2-budded, 3-budded and 4-budded seed setts, the germination was 82.50, 78.40 and 75.40 percent; while in crop sown with 5-budded, 6-budded and 7-budded seed setts the germination was 73.50, 62.00 and 59.00 percent, respectively. However, crop sown with 8-budded seed setts produced germination of 52.50 percent. Johnson et al. (2011) also found similar effect of seed buds in cane on its germination and reported that sowing of sugarcane with seed having more than certain number of buds (3-5) or full stalk would result negative impact on germination, but generally the effects of increasing the number of buds in cane seed were inconsistent.

Cane length (cm)  
The data on cane length of sugarcane variety Thatta-10 (Table-1) showed that the cane length was highest (175 cm) when 4-budded seed setts were used for sowing, and cane length in crop planted by using 1-budded, 2-budded and 3-budded seed setts was 150, 153 and 165 cm, respectively. The cane length in crop sown with 5-budded, 6-budded and 7-budded seed setts was 170.70, 165.50 and 160.00 cm, respectively; while the minimum cane length (155 cm) was recorded in crop sown with 8-budded seed setts. This indicates that using seed setts other than 4-buds resulted in decreased cane length. However, the results clearly suggested that for sowing of sugarcane variety Thatta-10, 4-budded or 5-budded seed setts may be used for obtaining maximum cane length. These results have been partially supported by Viator et al. (2005) who tested the effect of seed setts with different number of buds as compared to full-stalk sowing. Their results indicated that sowing full-stalk may result complex tillering and hence the height of the plant may be adversely affected. However, they have suggested seed setts up to 4 buds for achieving desired results.

Cane girth (cm)  
The cane girth of sugarcane variety Thatta-10 was measured and given in Table-1. It was observed that cane girth was maximum (2.90 cm) when crop was sown with 4-budded seed setts, and cane girth in crop planted with 1-budded, 2-budded and 3-budded seed setts was 2.36, 2.43 and 2.48 cm, respectively. The cane girth in crop sown with 5-budded, 6-budded, 7-budded and 8-budded seed setts was 2.81, 2.63, 2.56 and 2.48 cm, respectively; hence the minimum cane girth was noted in crop sown with 1-budded and 2-budded seed setts. This indicates that the crop sown with 4-budded seed setts resulted better performance for cane girth. The crop sown with seed setts below 4 buds or more than 5 buds resulted in reduced cane girth as compared to those sown with 4-budded or 5-budded seed setts. Similar results have also been reported by Legendre and Gravois (2003) who reported that for seed setts with 1-bud, 2-buds or 3-buds, more labor is needed for seed preparation and for saving the labor cost, full stalk can be used. However, full-stalk sowing system cannot be recommended for the farmers; and seed sett with 3, 4 or even 5 buds can be used for better cane development. However, the results were yet inconsistent for the treatments.
Tillers stool\(^1\)

The data (Table-1) indicated that tillers stool\(^1\) of sugarcane variety Thatta-10 were maximum (6.40) when the sugarcane crop was planted with 4-budded seed sets, and tillers in crop planted with 1-budded, 2-budded and 3-budded seed sets was 4.00, 4.60 and 5.00 stool\(^1\), respectively. The numbers of tillers in crop sown with 5-budded, 6-budded, 7-budded and 8-budded seed sets were 5.80, 5.00, 5.00 and 4.20 stool\(^1\), respectively. Thus, the minimum tillers stool\(^1\) was noted in crop sown with 1-budded and 8-budded seed sets. The results clearly showed that using seed sets with other than 4 or 5 buds was not beneficial in relation to tillers stool\(^1\) in sugarcane variety Thatta-10 and it would be suggestible that for achieving desired results in tillering capacity of Thatta-10, the crop may be planted by using seed sets with 4 or 5 buds. The findings of the present research further supported by those of Legendre (2001) who reported that number of buds per seed set up to four can commonly be observed in the US sugarcane growing areas and found no statistical difference in cane yield from planting rate, but there was a slight numeric increase in cane yield as the planting rate was increased.

### Table-1
Mean germination, cane length, cane girth and tillers stool\(^1\) of sugarcane variety Thatta-10 as affected by number of buds per seed set

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Treatments (No. of buds per seed sett)</th>
<th>Germination (%)</th>
<th>Cane length (cm)</th>
<th>Cane girth (cm)</th>
<th>Number of Tillers stool(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>1 budded seed sets</td>
<td>88.50 a</td>
<td>150.00 f</td>
<td>2.36 e</td>
<td>4.00 d</td>
</tr>
<tr>
<td>T2</td>
<td>2 budded seed sets</td>
<td>82.50 a</td>
<td>153.00 e</td>
<td>2.43 d</td>
<td>4.60 c</td>
</tr>
<tr>
<td>T3</td>
<td>3 budded seed sets</td>
<td>78.40 b</td>
<td>165.00 c</td>
<td>2.48 d</td>
<td>5.00 c</td>
</tr>
<tr>
<td>T4</td>
<td>4 budded seed sets</td>
<td>75.40 b</td>
<td>175.00 a</td>
<td>2.90 a</td>
<td>6.40 a</td>
</tr>
<tr>
<td>T5</td>
<td>5 budded seed sets</td>
<td>73.50 b</td>
<td>170.70 b</td>
<td>2.81 b</td>
<td>5.80 b</td>
</tr>
<tr>
<td>T6</td>
<td>6 budded seed sets</td>
<td>60.00 c</td>
<td>165.50 c</td>
<td>2.63 c</td>
<td>5.00 c</td>
</tr>
<tr>
<td>T7</td>
<td>7 budded seed sets</td>
<td>59.00 c</td>
<td>160.00 d</td>
<td>2.56 c</td>
<td>5.00 c</td>
</tr>
<tr>
<td>T8</td>
<td>8 budded seed sets</td>
<td>52.50 d</td>
<td>155.00 e</td>
<td>2.48 d</td>
<td>4.20 d</td>
</tr>
<tr>
<td>S.E.±</td>
<td></td>
<td>3.057</td>
<td>1.672</td>
<td>0.023</td>
<td>0.052</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td></td>
<td>6.982</td>
<td>4.154</td>
<td>0.091</td>
<td>0.584</td>
</tr>
<tr>
<td>LSD 0.01</td>
<td></td>
<td>9.446</td>
<td>6.097</td>
<td>0.153</td>
<td>0.815</td>
</tr>
</tbody>
</table>

**No. of internodes cane\(^{-1}\)**

The effect of number of buds in seed sets on internodes cane\(^{-1}\) were examined and the results (Table-2) exhibited that maximum internodes (23.25) cane\(^{-1}\) in sugarcane variety Thatta-10 were recorded in plots planted with 4-budded seed sets, and internodes in crop planted with 1-budded, 2-budded and 3-budded seed sets were 17.00, 20.25 and 21.50 cane\(^{-1}\), respectively. The number of internodes in crop sown with 5-budded, 6-budded, 7-budded and 8-budded seed sets were 22.50, 21.80, 21.00 and 20.80 cane\(^{-1}\), respectively. Thus, the lowest number of internodes cane\(^{-1}\) was noted in crop sown with 1-budded seed sets. This indicates that the internodes are directly proportional to the plant height or cane length and increasing cane length simultaneously increased the number of internodes cane\(^{-1}\). Croft (1998) performed experiments on the effect of seed set size for sowing sugarcane in Australia, and reported that at least more than 3-budded seed sets would be economical and useful for achieving desired performance in sugarcane, regardless the variety.

**Cane yield ha\(^{-1}\)**

The results in regards to cane yield ha\(^{-1}\) as affected by number of buds in seed sets and shown in Table-2 and concluded that highest cane yield of 104.975 tons ha\(^{-1}\) was achieved in plots planted with 4-budded seed sets, closely followed by 5-budded sets where the cane yield was 100.678 tons ha\(^{-1}\); while

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cane yield in crop planted with 1-budded, 2-budded and 3-budded seed sets was 81.125, 90.375 and 93.20 tons ha\(^{-1}\), respectively. The cane yield in crop sown with 6-budded, 7-budded and 8-budded seed sets was 93.10, 91.05 and 84.80 tons ha\(^{-1}\), respectively. Thus, the cane yield ha\(^{-1}\) was obtained in crop sown with 1-budded seed sets. The cane yield ha\(^{-1}\) is found associated with multiple factors which included cane length, cane girth and tillers stool\(^{-1}\). Cane yield ha\(^{-1}\) increased considerably with increasing number of buds in seed sets up to 4 or 5, but further increase in number of buds in seed sets showed adverse effect on cane yield. These results are partially supported by Legendre (2001), Legendre and Gravois (2003), Orgeron (2003), Molina et al. (2005), Viator et al. (2005) and Johnson et al. (2011) who their consolidated conclusions suggested that 4-5 buds in a seed sett would be economical in seed preparation and would result better cane yields than 1-3 buds or using full stalk as seed sett. However, some of the opinions showed that the effect of number of buds on cane yield ha\(^{-1}\) is inconsistent.

**Sugar recovery**

The data in relation to sugar recovery of sugarcane variety Thatta-10 as influenced by number of buds in seed sets, given in Table-2 showed that highest recovery of 10.56 % was recorded in crop planted with 3-budded seed sets, closely followed by 2-budded and 8-budded seed sets where the sugar recovery was 10.06 and 10.00 % respectively. However, the lower sugar recovery was recorded from all the rest treatments. These findings have suggested entirely inconsistent results regarding sugar recovery and no trend of effectiveness can be assessed for this trait related to juice quality of sugarcane variety Thatta-10 sown under different number of seed sets. Legendre and Gravois (2003) reported that effect on sugar content due to number of buds in seed sett were inconsistent and unpredictable.

### Table-2

<table>
<thead>
<tr>
<th>Treatments</th>
<th>No. of buds per seed sett</th>
<th>No. of internodes cane(^{-1})</th>
<th>Cane yield (tons ha(^{-1}))</th>
<th>Sugar recovery (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>1 budded seed sets</td>
<td>17.00 d</td>
<td>81.125 c</td>
<td>9.50 b</td>
</tr>
<tr>
<td>T2</td>
<td>2 budded seed sets</td>
<td>20.25 c</td>
<td>90.375 b</td>
<td>10.00 a</td>
</tr>
<tr>
<td>T3</td>
<td>3 budded seed sets</td>
<td>21.50 b</td>
<td>93.200 b</td>
<td>10.50 a</td>
</tr>
<tr>
<td>T4</td>
<td>4 budded seed sets</td>
<td>23.25 a</td>
<td>104.975 a</td>
<td>9.50 b</td>
</tr>
<tr>
<td>T5</td>
<td>5 budded seed sets</td>
<td>22.50 a</td>
<td>100.678 a</td>
<td>9.50 b</td>
</tr>
<tr>
<td>T6</td>
<td>6 budded seed sets</td>
<td>21.50 b</td>
<td>93.700 b</td>
<td>9.50 b</td>
</tr>
<tr>
<td>T7</td>
<td>7 budded seed sets</td>
<td>21.00 b</td>
<td>91.050 b</td>
<td>9.50 b</td>
</tr>
<tr>
<td>T8</td>
<td>8 budded seed sets</td>
<td>20.25 c</td>
<td>84.500 c</td>
<td>10.00 a</td>
</tr>
<tr>
<td>S.E.±</td>
<td></td>
<td>0.332</td>
<td>1.052</td>
<td>0.084</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td></td>
<td>1.098</td>
<td>4.541</td>
<td>0.631</td>
</tr>
<tr>
<td>LSD 0.01</td>
<td></td>
<td>1.524</td>
<td>6.287</td>
<td>0.954</td>
</tr>
</tbody>
</table>

**CONCLUSIONS**

With the exception of germination and sugar recovery, the values for all the cane yield contributing traits were higher in crop sown with 4-budded seed sets, closely followed by 5-budded seed sets. Germination showed a different trend and with increasing number of buds, the germination was decreased simultaneously; while sugar recovery show an inconsistent trend and was unpredictable.

The overall performance of the crop was markedly better when sown with 4-budded seed sets as compared to control i.e. generally 2-budded seed sets.
SUGGESTIONS

It is suggested that 4-budded or 5-budded seed sets may be used for sowing of sugarcane for achieving the higher cane yields and reducing the labor cost in seed preparation.

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زیادہ شاخصین، گناوارن دار
زربخیزلا تہ بھرہ پر پیداوار
CHEMICAL CUM CULTURAL CONTROL OF SUGARCANE LODGING

By

Muhammad Aslam*, Ghulam Sarwar*, Shafiq Ahmad**, M. Haroon Ashraf***
*Sugarcane Research Station, Khanpur. **Sugarcane Research Institute, Faisalabad
*** M. Sc Student, Agronomy Department, UAF

ABSTRACT

An investigation on the control of sugarcane lodging through chemical and cultural means was carried out at Sugarcane Research Station, Khanpur during 2010-11. The treatments included the application of Modus @ 320 ml/ac hundred days after sowing, earthing up with tractor ridger or spade and combined application of Modus and earthing up against untreated control. The results revealed significant improvement in cane weight, cane formation cane and sugar yields due to reduced cane lodging in treated plots against control. A measurable increase in cane yield and CCS up to 15.26 and 14.68 % was recorded in the plots where Modus was applied along with earthing up, respectively.

Keywords: Sugarcane, Weedicides (Modus), Yield, Recovery, Cane weight, Earthing up.

INTRODUCTION

Globally sugarcane is the main source for sugar production. It has become the most important cash and industrial crop of Pakistan. The agricultural sector contributes about 22% to country’s GDP with sugarcane share of 0.7% (Jamil et al., 2007). Out of 12 major Cane growing countries of the world, Pakistan ranks 5th in area and production but 11th in cane yield and 7th in sugar production. One of the important factors affecting cane and sugar yields is lodging of cane stalks. A lodged sugarcane crop is more liable to damage by rodents. Its auxiliary buds sprout or may be damaged by rotting or false tillering starts which reduces cane weight and sugar recovery. Besides yield and quality losses, lodged cane remains no fit for seed purpose. About 30% reduction in cane yield and 8.63% in CCS due to lodging has been reported by Ahmad, 1997. Sarwar et al., 2000 observed 27.50% increase in cane yield and 5.54% in CCS due to earthing up with cane ridger. In a field study under Faisalabad conditions, earthing up gave significant more cane yield over no earthing up (Anonymous, 2003). Afzal and Chattha, 2004 concluded that earthing up helps in sugarcane lodging as it gives sufficient anchorage to cane stalks. Earthing up should be done at the completion of tiller formation in the month of March for September planting and May-June for spring planting. Minhas et al., 2004 noticed that earthing up increased cane yield significantly through improvement in cane height, girth and tillers per plant. Aslam et al., 2008 carried out a two years field study and recorded 19.20% increase in final cane yield due to earthing up in pre sown sugarcane. A measurable increase in CCS was also noticed owing to reduced lodging in earthed up plots.

Keeping in view the drastic decline in cane and sugar yields due to lodging, the present studies were undertaken to chalk out strategy for reducing lodging in spring planted sugarcane.

MATERIALS AND METHODS

The studies were carried out at Sugarcane Research Station, Khanpur during 2010-11 to quantify the role of chemical and cultural means in reducing sugarcane lodging. A commercial sugarcane cultivar SPF-234 was sown by dry method in February using a seed rate of 75000 double budded setts per hectare. The experiment was laid out in RCBD with three replications and a net plot size of 6m x 10m. The row to row distance was 1.2m. The treatments included the application of Modus @ 320 ml/ac hundred days after sowing, earthing up with tractor ridger or spade and combined application of Modus and earthing up against untreated control. The crop was fertilized at the rate of 168-112-112 Kg NPK/ha. The
whole P and K were applied at the time of sowing. The N was applied in three splits, 1/3 at the completion of germination, 1/3 at tillering and remaining 1/3 at the time of earthing up in the month of May. All other cultural practices were kept uniform at recommended level. The data on different yield and quality parameters were recorded using standard procedures during the course of study. The data thus collected were analyzed using Fisher’s Analyses of Variance Techniques and the treatments were compared using Least Significance Difference Test at five percent level of probability (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Germination and Tillering
Germination is the most crucial factor which determines the plant population to a great extent and ultimately final cane yield. It denotes the activation of eye buds with formation of root primordia. The data presented in table-1 explicate that germination percentage ranged from 46.59 to 49.00. The statistical analysis of the data depicts non significant differences among the treatments with respect to germination. So far as tillers per plant are concerned, the studied practices remained at par with one another as the statistical analysis reveal non significant differences. The matching effect of different treatments on cane germination and tiller formation is probably because of the fact that all the treatments were applied after the completion of tillering. The non significant effect of earthing up on germination and tillering has also been reported by Anonymous, 2003 and Aslam et al., 2008.

Cane Weight and Density
Individual cane weight is an important character which directly contributes to final crop harvests. It is explicit from the data given in table-1 that all the treatments produced heavier canes than those of control plot. The test factors, however, remained at par with one another. The production of heavier canes in the treated plots may be due to reduced lodging. Millable cane density plays a tangible role in determining the final cane yield. A narrow glance at the data embodied in table 2 elucidate that the treatments exerted a measurable effect on cane formation. The combined application of modus and earthing up established maximum stand of 108.78 thousand canes per hectare which was comparably followed by earthed up plot with spade. It was in turn at par with alone modus application. The development of thick cane stand in treated plots may be due to reduced lodging.

Stripped Cane Yield
High cane yield is the ultimate target of each and every grower. The collation of the data set out in table 2 evinces pronounced effect of treatments in uplifting the final cane yield. The highest cane yield of 120.45 t/h was harvested from the plot where modus was applied along with earthing up. It was matchingly followed by modus alone, earthing up with spade or tractor ridger. A close perusal of data depicts 15.26% increase in cane yield due to combined application of modus and earthing up over untreated control. Better cane yield in earthed up Plots may be attributed to the reduced lodging, better cane weight and high cane formation. Significantly higher cane yield with earthing up has also been noticed by Ahmad, 1997, Sarwar et al., 2000, Anonymous, 2003, Jamil et al., 2007 and Aslam et al., 2008.

Cane Lodging
Lodging in sugarcane fields is an undesirable character which drastically lowers the final cane and sugar yields. The data packed in table 3 predict that cane lodging was confined to 10.33 percent in the plot where modus was applied along with earthing up, closely followed by alone application of modus and earthing up either with tractor or spade. The crop was lodged up to 50.33% in untreated control plot. The minimum lodging in treated plots may be ascribed to chemical effect of modus and proper soil compaction around the cane stalks due to
Earthing up which provided sufficient anchorage to cane stem against lodging. The similar observations have also been reported by Aslam et al., 2008.

**CCS and Sugar Yield**

Sugarcane is actually grown for sugar in Pakistan. It is well clear from the data presented in table 3 that CCS was improved up to 14.68% due to the adoption of different practices in the investigation. The production of better quality and more number of millable canes due to different treatments resulted in high sugar yields over control. Sugar yield was improved up to 32.19% in treated plots. Higher CCS and sugar yields in treated plots may be attributed to minimum lodging which reduced sprouting of auxiliary buds and false tillering. Improvement in cane quality as a result of earthing up has also been disclosed by Anonymous, 2003 and Aslam et al., 2008.

**CONCLUSION**

On the basis of the results recorded in the present study, it may be concluded that the application of Modus alone, earthing up or their combined application improved cane and sugar yields significantly. A wider scale testing of the studies in different agro ecological conditions is invited to strengthen the results widely.

<table>
<thead>
<tr>
<th>Table-1</th>
<th>Cane germination, tillering and weight as affected by chemical cum cultural control of sugarcane lodging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sr. No</td>
<td>Treatment</td>
</tr>
<tr>
<td>1</td>
<td>Moddus @320ml/Ac</td>
</tr>
<tr>
<td>2</td>
<td>Earthing up with Tractor</td>
</tr>
<tr>
<td>3</td>
<td>Earthing up with spade</td>
</tr>
<tr>
<td>4</td>
<td>Moddus + earthing up</td>
</tr>
<tr>
<td>5</td>
<td>Control</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td>N.S</td>
</tr>
</tbody>
</table>

Values with different letter(s) differ significantly (P=0.05)

<table>
<thead>
<tr>
<th>Table-2</th>
<th>Cane density and yield as affected by chemical cum cultural control of sugarcane Lodging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sr. No</td>
<td>Treatment</td>
</tr>
<tr>
<td>1</td>
<td>Moddus @320ml/Ac</td>
</tr>
<tr>
<td>2</td>
<td>Earthing up with Tractor</td>
</tr>
<tr>
<td>3</td>
<td>Earthing up with spade</td>
</tr>
<tr>
<td>4</td>
<td>Moddus + earthing up</td>
</tr>
<tr>
<td>5</td>
<td>Control</td>
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<td>LSD 0.05</td>
<td>N.S</td>
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</tbody>
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Values with different letter(s) differ significantly (P=0.05)

<table>
<thead>
<tr>
<th>Table-3</th>
<th>Cane lodging, CCS and sugar yield as affected by chemical cum cultural control of sugarcane lodging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sr. No</td>
<td>Treatment</td>
</tr>
<tr>
<td>1</td>
<td>Moddus @320ml/Ac</td>
</tr>
<tr>
<td>2</td>
<td>Earthing up with Tractor</td>
</tr>
<tr>
<td>3</td>
<td>Earthing up with spade</td>
</tr>
<tr>
<td>4</td>
<td>Moddus + earthing up</td>
</tr>
<tr>
<td>5</td>
<td>Control</td>
</tr>
<tr>
<td>LSD 0.05</td>
<td></td>
</tr>
</tbody>
</table>

Values with different letter(s) differ significantly (P=0.05)
Fig.1 Cane germination, tillering and cane weight as affected by lodging control treatments

Fig.2 Cane Stand, Cane and Sugar yield as affected by lodging control treatments
REFERENCES


UNITED TECHNO CORPORATION
INDUSTRIAL ENGINEERS & CANE SUGAR MACHINERY MANUFACTURER

0/S Eastern Gate Shaheed Gunj Road Sarai Sultan Lahore
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PAVING A WAY FOR SELF – RELIANCE

Pakistan Sugar Journal April-June, 2013 (27)
TRICHOGRAMMA WASPS
(EGG PARASITOIDS)

Saadia Rizwana and Asia Naheed

Natural enemies of crop pests
The genus *Trichogramma* is cosmopolitan in distribution and present in all terrestrial habitats and is one of 80 genera in the family *Trichogrammatidae*. *Trichogramma* are primary parasitoids of eggs of Lepidoptera but parasitism also occurs in eggs of other orders such as Coleoptera, Diptera, Hemiptera, Hymenoptera and Neuroptera.

*Trichogramma* species are the most studied group worldwide of egg parasitoids for biological control due to their efficiency and easy maintenance under laboratory conditions. These natural enemies are used in more than 30 countries in biological control programs against insect pests. Because these species can be found in the majority of ecosystems where they can suppress many pests, these natural enemies are favored in many commercial biological control programs. *Trichogramma chilonis* Ishii (Hymenoptera: *Trichogrammatidae*) has been used as a biological control agent against various insect pests attacking crops worldwide, including sugar cane borers, corn borers, and cotton bollworms.

**Biological Control Lab of Shakarganj Sugar Research Institute (SSRI)**

**Introduction**

SSRI established a Bio-control Laboratory in 1995 for rearing of *Trichogramma chilonis* for control of borer complex of sugarcane crop. Under laboratory condition *T. chilonis* is mass multiplied by using stored grain pest (*Sitotroga cerealella*) as a host. The production involves the multiplication of host insect on wheat grains, allowed to be parasitized by *Trichogramma*. Then eggs are clued in cards as "Tricho cards".

Two to three lacs cards are released in field every year for betterment of farmers, crop and society. A goal of this biological programme is to establish a self sustaining system. For example, a natural enemy introduced in an area with the hope that it will establish, cause the pest to fluctuate below the economic injury level.

**What is Integrated Pest Management (IPM)?**

"IPM is a sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health and environmental risks."
Biological Control

Biological control involves use of a specially chosen living organism to control a particular pest. This chosen organism might be a predator, parasite, or disease which will attack the harmful insect.

Parasitoids

Parasitoids are insects that prey on other insects and thus can be benefit to crop growers. Their eggs or larvae are usually found in or on a single insect host. The immature parasitoid develops within or on its host, ultimately killing the pest. Most parasitoids are wasps or flies.

What to look for

*Trichogramma* wasps are used worldwide as effective biological control agent. The female drills a hole through the chorion and deposits its eggs within the egg of the host. Larvae emerged from *Trichogramma* egg and feed on host insect. Venom injected by the female at the time of oviposition is believed to cause this predigestion of the egg’s contents. Pest eggs turn black. No pest larvae will emerge. One female parasitizes from one to ten eggs per day or from ten to 190 during her life. The number of eggs laid per host egg may vary from 1 to 20 or more depending upon the size of the host egg.

Appearance

Adults are very small 1/32 inch long, they have a yellow black compact body, red eyes and short antennae.

Taxonomic Rank & Life Cycle of *Trichogramma chilonis*

**Common Name:**

*Trichogramma*, Tricon

**Technical Name:**

*Trichogramma chilonis*

**Family:** Trichogrammatidae

**Order:** Hymnoptera

**Pests Attacked**

Two hundred hosts have been recorded worldwide, primarily in Lepidoptera and also Diptera, Coleoptera, and Neuroptera. Some of the major pests against which it has been used / recorded in India include sugarcane borers (*Chilo insuliferrus, Chilo sacchariphagus indicus, C. auricilius, Emmalocera depressella, Raphimetopus abutilus, Acigonasteniellus, Scirpophaga excerptalis*), rice stemborer (*Scirpophaga incertulas*), leaf-folder (*Cnaphalocrocis medinalis*), coconut blackheaded caterpillar (*Opisina arenosella*), diamond back moth (*Plutella xylostella*), cotton bollworms (*Earias vitella, E. insulana, Helicoverpa armigera, Pectinophora gossypiella*), various species of moths and butterflies.

*Trichogramma* Parasitizing pest Eggs

Cabbage Moth Eggs Parasitized by *Trichogramma*
Heliothis (American Bollworm) Eggs Parasitized by *Trichogramma*

**Time of Application**
As or when required when you see pests, cards are taken to the field and punched on the under side of the leaves to avoid the direct exposure to sun. *Trichogramma* releases in field on cards are in pupal stage. In two to three days *Trichogramma* adults emerge, search out pests eggs and destroy them by parasitism. In favorable environments, 70-80% borer egg parasitism is noticed which bring down pest population less than economic injury level.

**Release Rates on Different Crops**

<table>
<thead>
<tr>
<th>Crop</th>
<th><em>Trichogramma</em> Population/Acre</th>
<th>No. of Cards/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugarcane</td>
<td>50,000-200,000</td>
<td>15-20</td>
</tr>
<tr>
<td>Cotton</td>
<td>50,000-200,000</td>
<td>15-20</td>
</tr>
<tr>
<td>Maize</td>
<td>50,000-200,000</td>
<td>15-20</td>
</tr>
<tr>
<td>Tree and Vine Crops</td>
<td>30,000-60,000</td>
<td>8-10</td>
</tr>
<tr>
<td>Vegetables</td>
<td>50,000-200,000</td>
<td>15-20</td>
</tr>
<tr>
<td>Enclosed Areas</td>
<td>10,000-20,000</td>
<td>5-8</td>
</tr>
</tbody>
</table>

**Precautionary Measures**
1. Observe field carefully prior to release cards that there is no dangerous chemical in field damaging *Trichogramma* cards.
   i. Handle cards carefully while shifting from lab to field.
   ii. When you get cards from lab then you must release in field immediately.
   iii. Don't press cards, if pressed then cards will expire and no *Trichogramma* emergence took place.

**Advantages of Biocontrol**
1. Biological control is an environment friendly method and it does not have adverse effects on human and animals health.
2. Biological control is a long term control.
3. In biological control crops beneficial insects are save.
4. Insect pests develop resistance in response to continuous use of certain chemicals. In case of biological control no such resistance could be seen.

**Crops Protected**
Sugarcane, cotton, maize, orchids and vegetables.
Opportunities for and potential consequences of reducing nitrous oxide emissions from sugarcane crops

Use of nitrogen fertilizer is a major cause for increased atmospheric concentrations of nitrous oxide, a potent greenhouse gas. To reduce greenhouse gas emissions from sugarcane production, and so increase the crop’s attractiveness as a sustainable biofuel, it will be important to have a better understanding of nitrous oxide emissions and how they can be reduced. However, few measurements of nitrous oxide losses have been reported so far. Thus, our knowledge about nitrous oxide emissions from sugarcane production systems, and how they might vary in response to different environmental and management conditions, is limited. We compared measurements of nitrous oxide emissions with predictions from the cropping system model APSIM. We then simulated whole-of-crop nitrous oxide emissions over a range of environments and management practices in Australia. Predictions of nitrous oxide emissions were consistent with the measurements available, and greater than those from other intensive crops. Nitrous oxide emissions were predicted to vary considerably between regions, and were higher on irrigated soils and increased when trash was retained. Also, as expected, emissions were related to N fertilizer applications. Adoption of recent recommendations for reducing N fertilizer use was, in an example, predicted to reduce emissions by 40%. Further reductions in N applications and emissions, which may occur if emission trading schemes are adopted and fertilizer prices increase, were shown to reduce both emissions and profitability of sugarcane production. However, the economic value of reduced emissions is likely to be considerably less than that of the lost production. Experimental confirmation of these conclusions would be valuable.

Evaluating an ecologically-based system for sustainable management of nitrogen fertilizer

Sustainably managing N fertilizer is an increasing challenge for sugarcane production, as losses of N impact the health of ecosystems and contribute to climate change (through emissions of the greenhouse gas nitrous oxide). The N Replacement (NR) system is a new, ecologically-based concept for N management in sugarcane designed to meet this challenge. The NR system aligns N applications with actual cane production, rather than potential production, by relying on soil N reserves to buffer differences in crop N needs and N fertilizer supply in individual crops. We evaluated the NR system in 11 on-farm experiments in Australia, conducted over a wide range of environments for up to five years. Average yields in the NR treatment were similar to those achieved with the farmers’ conventional N management that had average N applications 66 kg/ha greater than in the NR treatments. Yields increased relative to the farmers’ conventional N management through time, from ~5 t/ha lower in the first crops of the experiments to 2.6 (standard error = 1.2) t/ha higher in the fourth, suggesting a physiological response in the crops to the variable N applications in the NR system. The crop N surplus, an estimate of N potentially lost to the environment, was 55% lower in the NR treatment compared with conventional N management. This reduction in N surplus was not as great as had been anticipated, as N concentrations and N uptake in cane for most crops in all
treatments were lower than those previously reported. The results show that the ecologically-based N Replacement system may deliver superior environmental outcomes without significantly reducing production. The results also show that predicting yield of the coming crop, a common basis for N management, is not necessary in sugarcane N management, provided N applications and production are matched in the longer term.

Changes in soil organic carbon stocks resulting from sugarcane cropping in the humid tropical climate of Mauritius: results from $^{13}$C natural abundance

A decline in productive capacity of soils as a consequence of long-term sugarcane monoculture, combined with an intensification of the production system, has become a major issue in several sugarcane producing countries. Maintenance of adequate levels of soil organic carbon (SOC) is crucial for the biological, chemical and physical functioning of soils. This study was conducted to determine the impact of long-term sugarcane monoculture on SOC stocks and to quantify the loss of native SOC and accretion of sugarcane-derived C following the adoption of new management practices namely derocking/landgrading and mechanized harvesting. Five study sites representing the five major soil groups under sugarcane in Mauritius were studied and a classical ‘paired-plot’ design was adopted where two sites with similar starting conditions were developed in different ways over time, with one representing the reference soil (virgin land with predominantly C$_3$ type vegetation) and the other representing the following cropping treatments: (i) fields continuously cultivated with sugarcane for more than 25 or 50 years without derocking or land grading, (ii) fields under long-term sugarcane but having undergone derocking and land grading for mechanized harvesting in the last 3 years. Soil samples were taken to a depth of 50 cm and analyzed for total organic C, $^{13}$C abundance, bulk density and stone content. Long-term sugarcane cultivation reduced SOC stocks in the surface 0–15 cm layer compared to uncultivated virgin soil but increased subsoil organic C indicating a redistribution of SOC in the deeper layers of the soil profile. Changes in total C stock in the 0–50 cm profile, following 50 years of cane cropping were not significant ($P<0.05$) compared to virgin land at any site. Data from $^{13}$C abundance measurements revealed that long-term sugarcane cultivation in fact resulted in a depletion of original SOC by 34 to 70%. However, this loss was fully compensated by C input from sugarcane residues at all sites studied, resulting in no net change in SOC stock. Moreover, adoption of mechanized cropping, which entails intensive derocking and land grading, did not have any detrimental effect on SOC stocks due to C inputs from crop residues.

Comparison of biparental and melting pot methods of crossing sugarcane in Hawaii

Sugarcane (Saccharum spp.) breeders at the Hawaiian Sugar Planters’ Association used biparental and melting pot (modified polycross) crossing methods concurrently from 1935 to 1985. While the annual effort expended to make biparental crosses exceeded the effort to make melting pot crosses over this 50-year period, annual viable seed yield from biparental crosses was usually less than 15% of that from melting pot crosses and, hence, the numbers of seedlings planted to the field from those crosses usually accounted for less than 20% of the total seedling population. In 1985, nine of the 10 sugarcane cultivars listed in Hawaii’s variety census originated from melting pot crosses; only one originated from a biparental cross. In the face of a shrinking sugar industry in Hawaii and a smaller work
force in the breeding program, the decision was made in 1985 to rely primarily on melting pot crosses for the production of commercial cultivars. From 1985 to 2005, twelve additional clones that were bred prior to 1985 eventually attained ‘commercial cultivar’ status by exceeding 1% of the total cane growing area. All twelve originated from melting pot crosses. Over the 50-year period that the two crossing methods were used, the melting pot method proved to be more labour efficient and ultimately contributed more than the biparental crossing procedure toward the development of new commercial cultivars for the Hawaiian sugar industry. From 1985 forward, the biparental crossing method was used more for introgression desired traits from exotic germplasm than for the development of commercial cultivars.

Root density and diameter of sugarcane cultivars across three locations in Cuba

The objective of the present work was to study the density and distribution of sugarcane root systems in a multi-environment trial. Experiments were planted at three locations in the South-Eastern region of Cuba, with 11 sugarcane cultivars. Measurements of root diameter and root density (root numbers/cm³) for fine (FD), thick (ThD) and total (TD) roots were taken using the profile wall method. The root system was evaluated in squares of 20 × 100 cm up to 80 cm depth below the ground surface. Cane yield data (t/ha) and its relations with root system measurements were analyzed. Genotype by environment interaction was identified using the AMMI model. Results showed significant (p<0.05) response for root density across genotypes, locations, depths and all interactions. Root depth was the major source of variation. Percentage of total root density was variable from 42.6–55.5% for 0–20 cm depth, dropping to 5.6–11.7% for 60–80 cm depth. Genotypes C86-12, C86-156, B7274 and C88-380 showed similar patterns for t/ha and TD. Moderate but significant (p<0.01) correlations were found between t/ha and FD, ThD and TD.

The Iranian sugarcane selection program: an overview of methodologies

The main sources of genetic variation, G × E interaction, response to selection and heritability values were studied in order to establish methodological bases for the selection in initial stages of the Iranian sugarcane breeding program. A representative sample of 10 bi-parental combinations was evaluated in six environments. The component of variance attributable to environment was prevailing and the genotype environment interaction was significant. Three types of environment were defined and differences between them contributed to selection efficiency. The greatest genetic variability was obtained in the northern region of Khuzestan, and the best results for selection were registered in Imam Khomeini sugar factory’s locality.

Effect of insecticides applied at sugarcane planting on Sphenophorus Levis vaurie (Coleoptera; curculionidae) control and on the yield of first two harvests

Recently, the occurrence of sugarcane fields severely damaged by Sphenophorus levis Vaurie (Coleoptera; Curculionidae) has increased in the Central-South region, the main area where sugarcane is grown in Brazil. The pest management program includes mechanical destruction of infested ratoons, which often is not enough to maintain the populations below economic injury level. The use of insecticides is therefore necessary. The objective of the present work was to evaluate the effect of insecticides applied at sugarcane planting on the
pest control and on the yield of the first two harvests. Three experiments were conducted as random block designs with six replicates. In addition to an untreated check, the following treatments were evaluated: carbofuran 2100 g/ha a.i., fipronil 200 g/ha a.i., carbofuran 2100 g/ha a.i. + fipronil 200 g/ha a.i., imidacloprid 960 g/ha a.i., thiamethoxam 375 g/ha a.i. and bifenthrin 250 g/ha a.i.. 

*S. levis* infestations and associated plant injury were evaluated by periodic samplings. Yield data were recorded for the first two harvests. No differences between the treatments and the untreated check in relation to pest population and injury were observed. However, the treatments with fipronil, imidacloprid and thiamethoxam were associated with significant yield increases for both harvests. Considering the two harvests, these increases reached 52.2 to 69.0 t/ha or 25% of yield, suggesting that these treatments can be useful in an integrated management program.

**Spatial distribution of sugarcane spittlebug, Mahanarva fimbriolata, in sugarcane fields**


Sugarcane spittlebug, *Mahanarva fimbriolata* (Stål) (Hemiptera: Cercopidae), is one of the most important pests of sugarcane in the Central-Southern region of Brazil. Information on its spatial distribution in sugarcane fields is important for the development of sampling plans, aimed at their application in integrated management programs. We studied the spatial distribution of *M. fimbriolata* in 10 mechanically harvested green cane fields in Catanduva, São Paulo State, Brazil. In each field of 1.41 ha, 150 samples were collected within a rectangular grid measuring 10 × 10.5 m, between 27 December 2007 and 1 November 2008. The Morisita index was significantly > 1 for eight fields, indicating that, in each of these fields, *M. fimbriolata* has an aggregated spatial distribution and this pattern was not affected by the infestation level. In two fields, *M. fimbriolata* occurred at random. Geostatistical analysis allowed the construction of contour maps through kriging interpolation using the spatial dependence expressed in the semivariograms for five fields. For the other three fields where *M. fimbriolata* has aggregated spatial distribution, it was not possible to construct population maps using kriging interpolation because the distance between sampling points was too large to detect spatial dependence. For the cases where the maps could be constructed, the ranges varied from 23 to 55 m and, using this information, we estimated that it was necessary to sample 6 points/ha to adequately estimate the insect population.
Background
Pakistan has one of the lowest literacy rates in the world, and the lowest among countries of comparative resources and socioeconomic conditions. According to Ministry of Education, Government of Pakistan, the overall literacy rate in the country is 46 per cent, with female literacy of 26 per cent only. Independent sources and educational experts, however, are skeptical. They place the overall literacy rate at 26 per cent and the female literacy at 12 per cent, contending that the higher figures also include those people who can hardly write anything beyond their signature. Literacy is typically described as the ability to read and write and UNESCO considers literacy as the “ability to identify, understand, interpret, create, communicate, compute and use printed and written materials associated with varying contexts”. Pakistan defines literacy as the acquisition of basic skills of reading and writing.

Shakarganj Foundation started its Adult Female Literacy Program in 2003 to educate the illiterates of the community, ranging between the ages from 15 to 50 years in a batch of 25-students through phoenixes based Jugnno Sabaq course. 130-batches of Adult Literacy Centers have been completed 3,250 students have been passed out. Keeping in view the efforts of the Shakarganj Foundation Small Grants Ambassador’s Fund Program approved a one hundred thousand USD dollar Project. Through this project Shakarganj Foundation will establish 150 adult female literacy centers in 05 union councils of district Jhang. 3,750 female learners will be benefited through this project.

Objective of the Project
In line with the mandate, Shakarganj Foundation is endeavoring to eradicate illiteracy in the rural areas covered under the business area of its parent organization and to promote education in less privileged areas of District Jhang. Under the same spirit, the organization has proposed to carry out “Adult Female Literacy Program” in 05 Union Councils (UCs) of District Jhang. These UCs fall under priority business area of its parent organization and have never been focused under any Literacy Program before. Total population of these 05 UCs is around 90,185 with approx. 13,600 households (HHs). Female population of these UCs is about 43,200 (48%). Literacy rate in these UC’s is much lesser than the District average of 47%. UC wise literacy ratios are obtained from District Statistics Department, Jhang.

Project Launch Ceremony
Small Grants Ambassador’s Fund Program & Shakarganj Foundation Adult Female Literacy Project launch ceremony was set up in the lush green lawn adjacent to Management House of Shakarganj Mills Limited. Participants from District Government, civil society, media representatives and Executives from Shakarganj Mills Limited were invited. The ceremony was started with the recitation from Holy Quran by Mr. Maqsood Ahmad Bhatti. Mr. Shahid Niaz District Coordination Officer Jhang formally inaugurated the Small Grants Ambassador’s Fund Program and Shakarganj Foundation Adult Female Literacy Project ceremony.
The dignitaries of the program Mr. Naseem Zahid, Executive District Officer Education Jhang Dr. Zafar (District Officer Health) Ms. Nasreen Abdullah (Deputy District Education Officer Female), Ms. Haleema Iqbal Director( Lahore College For Women University) Mr. Zahid Lodhi (Principal Chenab College) Mr. Awais Qureshi, Mr. Khalid Haidar (Assistant Governor Rotary Club) Syed Feroze Gallani (President Rotary Club), Inner wheel Club, HOD’s (SML Jhang) were welcomed by administration of Shakarganj Mills Limited.

The Project Manager welcomed the participants to the ceremony and thanked them for accepting the invitation and showing in big numbers. She highlighted the overall activities of the Shakarganj Foundation, and also briefed the participants about the SGAFP& Shakarganj Foundation Adult Female Literacy Project.

Speaking on the occasion the Chief Guest said; to get education is the right of every individual. The education for women is not only important for nation building, but it is also necessary for the everyday practical purposes. This is because, female are more responsible for rearing, caring, and teaching her child. Unless and until she possesses some sort of education herself, a mother cannot teach good values, culture, and education to her child. Although human growth and development and heredity, a mother’s role remains more important in shaping the behavior of a child. It is said that today’s children are the backbones of tomorrow’s nation. In fulfilling this purpose, the better women are educated, the better education they can give to their children. Moreover the honorable Chief Guest promised to facilitate Shakarganj Foundation by the District Government in this regard by all the means.

The Senior Executive Vice President Shakarganj Mills Limited threw light on the key project elements and conveyed many thanks to the participants.

Lunch was served to the guests at the end of the ceremony.
Background
A number of scientific studies have suggested that consumption of certain foods, such as those containing sugars, engage similar nerve pathways in the brain (those associated with pleasure) as drugs of abuse, and consequently, should be considered addictive substances.
1. It is further argued that addiction of this type leads to binge-eating and that this is responsible for the currently high prevalence of obesity in many countries.
2. Each of these three hypotheses has been questioned.
3. It is therefore important to examine separately the evidence for each of them, since acceptance of the first does not necessarily imply that the two dependent hypotheses are also valid.
4. It is also necessary to critically examine the suggestion that the addiction model provides useful insights into reasonable public policy approaches to the obesity issue.
5. The problems of rational interpretation of the conflicting evidence in these areas are compounded by doubts as to the meaning of the term “addiction” and its usefulness in clinical practice and public health discussion.
6. Most researchers in this field rely on the term “substance dependence” as defined in the psychological literature.
7. That may not be relevant.
8. Or helpful.
9. In the context of behaviour towards foods. Since consumption of calorific food is essential to survival, it is unsurprising that the human brain is programmed to find such consumption pleasurable.
10. However, key features of substance dependence include tolerance (increasing amounts of the substance are required to produce the desired effect) and the experience of serious withdrawal symptoms when intake is stopped. Neither has been observed in human subjects with respect to food.
11. Evidence for sugar “addiction” comes mainly from a limited number of animal model experiments.
12. In which “binge eating” of sugar has been observed after the availability of sugar is limited to certain times of the day. Withdrawal symptoms are induced by removal of that limited access.
13. But this may not be unique to sugar.
14. Studies like these rely on feeding regimens that involve depriving rats of access to sugar for prolonged periods of the day. The symptoms attributed to “addiction” in these animals are not seen when they are given unlimited access to sugar.
15. Suggesting that the behaviour is, at least partly, dependent on food deprivation rather than the nature of the food itself. Additionally, there is insufficient evidence on other macronutrients.
16. To determine whether this “binging” behaviour is specific to sugar or to palatable foods generally. Furthermore, it is noteworthy that these rats that are described as “binging” on sugar do not become obese, since they reduce their consumption of other food.
17. Comparable observations to this rat model have not been made in humans.
18. And no evidence of tolerance or of withdrawal symptoms have been reported in relation to sugar consumption.
19. The rat studies also include studies of brain activation patterns, and these have been reported to be similar to those activated by certain drugs of abuse. This is unsurprising, since the drugs of abuse are known to mimic the effects of food consumption in the brain.
20. There are differences, however.
21. And attempts to replicate these findings in human studies have yielded widely conflicting results.
22. Both in normal weight and obese subjects.
23. Given the lack of consistent evidence to suggest that addiction to sugar is a valid concept to describe the behaviour of even a small proportion of the human population, it could be argued that it can have no relevance to the widespread problem of obesity. In addition, there are lines of evidence from human population studies that further weaken the hypothesis that sugar consumption
addiction is commonly responsible for obesity, and these merit rehearsal.

**Sugars and Micronutrient Dilution**
Written January 2012

**Background**
A diet that is high in sugars is often assumed to reduce intake of essential micronutrients. The term employed to describe such an effect is ‘micronutrient dilution’. However, this assumption is an oversimplified view of a complicated subject which is fraught with inconsistencies and limitations in the available evidence. There are two main considerations surrounding the issue of sugars and micronutrient dilution, as described by Ruxton et al., (2010). The first is whether diets containing higher amounts of sugars indeed contain lower levels of micronutrients (a dilution effect). The second, and possibly more important consideration, is whether such diets still achieve recommended dietary intake levels of micronutrients.

**Limitations in the evidence**
Any review of the evidence on micronutrient dilution needs to address the contradictions in the scientific literature. Livingstone and Rennie (2009) discussed the issues that account for the inconsistent findings across studies. These include:

- Variations in the definition of ‘sugars’. The terms used range from “total sugars”, to “added” or “free sugars”, to the UK definition of “non-milk extrinsic sugars” (NMES). The categorization can substantially affect the observed relationship between sugars and micronutrient intake. For example, unsweetened fruit juice is conventionally included in the categories of total and NMES sugars, but may not be included in ‘added sugars’. As a result, the choice of sugars categorization can significantly affect the relationship between estimates of sugars and Vitamin C intake.

**Use of different benchmarks to assess adequacy of micronutrient intake.**
Direct estimates of micronutrient status are rarely used. Instead, estimates of requirement, in the form of dietary reference values (DRV), are compared with estimates of habitual dietary intake, in order to assess adequacy of intake. Both estimates are prone to uncertainties, and the choice of DRV can substantially alter the results of such comparisons. The DRV used can vary from the level of intake that is estimated to be inadequate for the vast majority (97.5%) of the population (Lower Nutrient Reference Intake: LNRI) to the level of intake that is judged to be adequate for the vast majority (again 97.5%) of the population (Reference Nutrient Intake: RNI). Between these extremes lies the estimated average requirement (EAR) for a particular micronutrient. Comparison with the EAR is currently proposed to form the methodological basis for assessing adequacy of micronutrient intake (WHO/FAO, 2004). With all DRVs, comparison of an estimated individual or group mean micronutrient intake with a DRV, without confirmatory biochemical or clinical measures, does not prove suboptimal nutritional status.

Evidence arising from observational studies that rely on self-reported dietary intake. Underreporting is an accepted limitation of self-reported dietary surveys (Livingstone and Black, 2003) and, as a consequence, the proportion of people estimated to have an inadequate intake of micronutrients is exaggerated. Some studies have tried to correct for underreporting by excluding data from subjects whose dietary records show implausibly low total energy intake. This still leaves subjects who may have reported plausible energy intakes but have, nonetheless, not fully reported all their food and drink consumption.

An inconsistent approach to adjusting for energy intake. Since total food energy intake appears to be the most important predictor of micronutrient intake (DoH, 1989, Gibson, 2001), one needs to control or adjust for energy intake to determine any independent effect of sugars intake. Most studies attempt to adjust for energy intake by reporting sugars intake as %energy.
Reviews of the evidence
A number of recent reviews have focused on the topic of sugars and micronutrient dilution (Gibson, 2007, Livingstone and Rennie, 2009), while Ruxton et al., (2010) evaluated the topic within a broad range of health issues related to sugars consumption. Most evidence emanates from epidemiological studies with no intervention studies specifically changing only the sugar content of the diet with the primary purpose of examining changes in micronutrient intake. However, some intervention studies have examined aspects of micronutrient intake while altering the sugars, or refined or simple carbohydrate levels, of the diet. These studies show either no impact, or only a minor impact, on nutrient adequacy (Gibson, 2007, Ruxton et al., 2010). On reviewing all available evidence, both Gibson (2007) and Ruxton et al. (2010) considered that some evidence existed for a dilution effect at high consumption levels of sugars. Gibson (2007), in a systematic review, concluded that there was some evidence that a diet containing a high proportion of added sugars (above 20% energy) was likely to be marginally lower in micronutrients than a diet containing a proportion of added sugars closer to the mean intake of the populations studied. The optimal micronutrient intakes appeared within diets which contained moderate levels of sugars, since many associations were n-shaped, with lower intakes at both high and low intakes of sugars. Ruxton et al., (2010) also reported that a dilution effect was apparent from cross-sectional studies, but with fairly consistent evidence that most diets were adequate in micronutrients. Nutrient adequacy in the presence of a high sugar intake may reflect the sources of sugar in the diet, since fortified breakfast cereals, sweetened dairy products, and juices are also important sources of micronutrients. In contrast, Livingstone and Rennie (2009) determined that the totality of evidence did not provide convincing evidence to either support or refute the notion that added sugars result in a dilution effect within the range of intakes commonly seen.

Guidelines from International Agencies
The US Dietary Guidelines Advisory Committee (USDA /HHS, 2010), whilst unable to set an upper tolerable intake level for carbohydrates in general, suggested a maximal intake level of 25% energy from added sugars based on data which suggested some micronutrient dilution effects at or above this level of intake. This suggested maximal level undoubtedly reflects the findings of the Institute of Medicine (IOM, 2002) which reported lower intakes of some micronutrients in some population sub-groups at intakes exceeding 25% energy. Added sugars intake is reportedly falling in the US, with the most recent estimates of mean intake at 14.6% energy for US children (≥2 y) and adults (Welsh et al., 2011). The UK Department of Health Committee on Medical Aspects of Food Policy (DoH, 1989) concluded that people with higher energy intake tend to eat more of all nutrients, with sugars intake being a weaker predictor of micronutrient intakes than total energy consumption. However, at any level of energy intake a higher sugars intake was associated with lower micronutrient intake. The European food Safety Authority (EFSA, 2010) felt unable to set an upper limit for (added) sugar intake and suggested that any negative associations between added sugar intake and micronutrient density were related to patterns of intake of foods from which added sugars are derived.

CONCLUSION
The associations between reported intakes of sugars and micronutrients are inconsistent between micronutrients and between age-groups and genders. In addition a clear examination of the literature is hampered by different categorizations of sugars, inconsistent use of DRVs, underreporting and inconsistent correction for energy intake. Correction for energy intake is crucial for determining the independent effect of sugars intake on micronutrient dilution. Even if a dilution effect is observed, the effect is considered to be small, and this is reflected by the lack of upper limits, or relatively high upper limits, with respect to some public health recommendations. It is not
known whether a reduced consumption of sugars would reduce the proportion of people with apparently inadequate micronutrient intakes. Although some studies have reported higher consumers of sugars to ingest lower amounts of what are considered to be nutritious foods, cause and effect has not been ascertained. In addition, a reduction of sugars intake might result in unpredictable and possibly undesirable consequences for public health if, for example, it were to lead to avoidance of fortified or micronutrient-rich foods that contain sugar.

STATEMENT
WSRO concurs with a number of recent reviews examining the association between sugars intake and micronutrient intake. These reviews suggest that although a micronutrient dilution effect may exist at very high intakes of sugars, micronutrient intake is usually adequate, with sugars consumption having a relatively minor impact on diet quality compared with total energy intake. There is no evidence that reducing the sugars intake in the diet would increase micronutrient intake in any section of the population or reduce the proportion of people with inadequate nutrient intakes.

References


IOM (2002) Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, proteins, and amino acids


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<th>3 Year</th>
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<td>Rs.1000</td>
<td>Rs.2000</td>
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<tr>
<td>Overseas Airmail</td>
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<td>USD 150</td>
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THE STORY OF SWEETS

1. Rasmalai

Ingredients
- Milk 3 kg
- Tatri 20-40 gm
- Baking powder ½ tsp
- Mace and nutmeg 1 pinch
- For Syrup:
  - Sugar 3 kg
  - Water ½ kg
  - Reethay 10
- For Rabri:
  - Milk 2 kg
  - Pistachios and almonds 20gm
  - Sugar 200 gm
  - Cardamom ¼ tsp

Cooking Directions
1. Boil milk in a saucepan.
2. Cook on a low heat stirring continuously, as the milk simmers a layer of cream will form on the surface.
3. Add 2 teaspoon of tatri in warm milk stir slowly until the curd will start separating from the whey.
4. Turn the flame off
5. Drain the whey using a strainer line with cheesecloth or muslin cloth.
6. Place the prepared cheese on a dry clean tray and add baking powder and a pinch of mace, nutmeg and cardamom and mix well.
7. Divide the cheese dough into equal parts and roll into a smooth oval shaped ball.
8. For Syrup: In a pan bring water to boil add sugar and stir to dissolve.
9. Boil the reethay in a separate pan of water and pour into one portion of the sugar syrup.
10. Cook this mixture on a low flame.
11. As the foam comes on the top drop in the rasmalai balls and allow cooking until it doubles in volume.
12. If it stays on the surface it means it is ready.
13. Now leave all the rasmalai balls in water.
14. Then soak it and leave it in warm milk for 30 min.
15. Then cook the 2 kg milk with cardamom and cook till thicken.
16. Add the 200 grams of sugar and pour it in a dish.
17. As it cools down add the prepared rasmalai balls in it.
18. Serve chilled and garnish with pistachios and almond

2. Mangomisu

Ingredients
- 500g mascarpone cheese
- 600ml thickened cream
- 1/3 cup (50g) icing sugar
- 2 egg yolks
- 1 vanilla bean, split, seeds scraped
- 1/2 cup (125ml) Grand Marnier
- Juice of 2 oranges
- 300g savoiardi (see note) (sponge finger biscuits)
- 3 mangoes, flesh sliced 1cm thick
- Raspberry sauce
- 1/4 cup (55g) caster sugar
- 250g fresh or frozen raspberries
- Juice of 1 lemon

Cooking Directions
1. Line the base of a 22cm spring form cake pan with plastic wrap or baking paper. Place the mascarpone, thickened cream, icing sugar, egg yolks and vanilla seeds in the bowl of an electric mixer and beat on high speed until thick and well combined.
2. Combine the Grand Marnier and orange juice in a separate bowl. Dip half the sponge fingers into the juice mixture and layer in the base of the cake pan. Spread with one-third of the mascarpone mixture, and top with one-third of the mango slices. Repeat the process, then top with the remaining mascarpone mixture, reserving the remaining mango slices to serve. Cover the cake and chill for 2 hours or until firm.
3. Meanwhile for the raspberry sauce, place the sugar and 2 tbs water in a small pan over medium heat, stirring to dissolve the sugar. Cool slightly, then add the berries and lemon juice. Whiz in a food processor until smooth, then pass through a sieve. Chill until ready to serve. (You can store the sauce, covered, in the fridge for 3-4 days).
4. To serve, carefully remove the sides and base of the cake pan and transfer the mangomisu to a platter. Decorate with curls of the reserved mango, then slice and serve with berry sauce.
Nematodes are microscopic, eel-shaped worms which live in all soils. They may be classed as either free-living or plant-parasitic. Plant parasitic nematodes have long been recognized as a limiting factor in the growth of sugarcane on the in coarse textured sandy soils. Nematodes are common pests with small size means that most people have never actually seen them. There are dozens of different types that feed on the roots, but the root-knot and lesion nematodes are the most destructive types found throughout sugarcane fields. They are now also blamed for widespread yield losses across all sugarcane.

Managing nematodes may involve using one or more techniques that have proven to reduce nematode populations. Low numbers of nematodes at the time of planting can often mean growing a crop without a lot of damage. High numbers, however, can be disastrous. Because of the quick life cycle of root-knot nematode, levels quickly rebound and cause problems to the next crop.

**Distribution and Damage**

Plant-parasitic nematodes are widely distributed in cane-growing soils, different species likely to be present in every cane field. The abundance and proportion of species will vary with soil type, climate and crop history. The two are most important pests of sugarcane being root-knot nematode (*Meloidogyne spp.*) and lesion nematode (*Pratylenchus spp.*). Stunt nematode (*Tylenchorhynchus spp.*), dagger nematode (*Xiphinema spp.*) and stubby nematode (*Paratrichodorus spp.*) also cause economic damage. But reniform nematode (*Rotylenchus spp.*) and spiral nematode (*Helicotylenchus spp.*) only cause economic damage when populations are sufficiently high.

Root-knot nematodes and lesion nematodes enter the root tips, while most other nematodes feed on the outer surface of the root.

**Life cycle**

Nematode life cycles are short, as little as 4–5 weeks in warm conditions, so populations can build up quickly. Details of the life cycles are shown in Figures 3 and 4(Source: Agrios 2004). Adult females lay several hundred eggs, either in the soil, the roots (in the case of lesion nematodes) or on the root surface (in the case of root knot nematodes). Juveniles hatch and undergo a series of four molts. Adults move slowly through the soil, attracted to the natural secretions of host plant roots. Plant parasitic nematodes require a food source in the form of living plant roots to complete their life cycle, although eggs may remain dormant in the soil for a few months.
Effect on plants
The damaged root system limits the ability of the plant to access moisture and nutrients, resulting in slower stalk growth and reduced crop yield. Root-knot nematodes cause the most severe damage to sugarcane.

Although lesion nematodes cause more subtle damage, they are quite important pests because they occur in every soil type. Results showing the population of plant parasitic nematodes in different sugarcane varieties having plant ratoon crop. Analysis was in the Nematology Laboratory of SSRI (Shakarganj Sugar Research Institute) with the collaboration of NNRC (National Nematological Research Centre) Karachi University, Karachi.

Management of nematodes
Monitor crops regularly to determine whether nematode populations are high enough to cause economic damage. Check plant roots for symptoms in fallow crops and before the 3–5 leaf stage (plant and ratoon cane). Avoid plough-out/replant where possible. Include a legume rotation in your crop cycle. Berseem can reduce PPN numbers by 80–90%. Harvest plough-out blocks early to give maximum break before planting legume crops. Make sure fallow crops are kept free of weeds—especially volunteer cane. Minimum tillage systems that preserve the trash blanket between crops help minimize populations of PPNs.

Table: 1 Population of Plant Parasitic Nematodes in Plant and Ratoon Crops of Sugarcane

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Plant Parasitic Nematodes/500 grams of soil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plant Crop</td>
</tr>
<tr>
<td>NSG-59</td>
<td>1,680</td>
</tr>
<tr>
<td>CP77-400</td>
<td>1,820</td>
</tr>
<tr>
<td>Co-1148</td>
<td>2,420</td>
</tr>
<tr>
<td>SPF-213</td>
<td>692</td>
</tr>
<tr>
<td>SPF-234</td>
<td>2,640</td>
</tr>
<tr>
<td>HSF-242</td>
<td>1,590</td>
</tr>
<tr>
<td>CPF-237</td>
<td>985</td>
</tr>
<tr>
<td>SPF-238</td>
<td>3,135</td>
</tr>
<tr>
<td>HSF-240</td>
<td>326</td>
</tr>
<tr>
<td>NSG-555</td>
<td>1,040</td>
</tr>
</tbody>
</table>
WEEDS OF SUGARCANE CROP

By
Muhammad Asad

Sugarcane weeds are uninvited plants growing in the cultivated crops. Share different inputs with the crop like light, nutrients, water, space and carbon dioxide. Due to weed infestation 15 to 35% reduction in sugarcane yield was reported. Sugar yield reduction also depends on many factors such as weed types, infestation time and density of weed.

Now we first, identify the types of weeds
A wide range of weeds reported in sugarcane crop such as winter (Lehli), summer weeds like grasses (Khabal), net sedges (Deela), broad leaf weeds (Tandla), annual weeds (Cholai) and perennial weeds (Jhonson grass). These compete with sugarcane for every input at each stage. Detail of weeds as per growth phase is given in table-1.

Growth period of weeds
The active period of weed growth started in 3rd week and remained up to 9th week after plantation of sugarcane. The critical period of weed-crop competition in sugarcane prolonged between 30-120 days after plantation of sugarcane.

How to suppress sugarcane crop growth by weeds
The weeds in sugarcane suppress the growth in different manner. Nut sedge is very common weed, which compete with crop mainly for moisture and reduce the crop germination. Perennial weeds like Bermuda grass and morning glory (common name for over 1,000 flowering species) affect sugarcane tillering and elongation stage. The wide range of weeds affected sugarcane crop through their different root systems, energy cycle, varying height and germination period.

Controlling measures of weeds infestation

1. Preventative measure:
   For control of weed infestation following preventative measure should be adopted.
   - Clean farm equipment before moving from one location to another.
   - Cleaning of water channels
   - Eradicate the weeds before seeding to prevent its dispersal
   - Clean field bunds and farm roads

2. Cultural measure:
   - Mulching of sugar-cane trash should be adopted to control weeds (Fig.1).
   - Crop rotation significantly reduced the weed population.
   - Inter cropping in sugarcane makes a practice to control weeds because no space left for weeds germination (e.g. sugar cane with wheat or barseem).
   - After inter row cultivation of sugarcane crop Shakarganj Tiger Compost that is a good source of organic matter, NPK and micro nutrient may be used in ratoon and planted crop.

3. Mechanical measure:
The mechanical control techniques most often used are hoeing and tillage. Schedule for hoeing of newly & ratoon crop is given in Table-2.

4. Chemical measure:
Chemically weed control practice must be adopted on the basis of morphology of weeds (broad & narrow leaves) and application time as pre-emergence (Fig.2) and post emergence (Fig.3) of selective or non selective herbicides as given in table-3.
### Table-1  Description of sugarcane crop weeds

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>English names (Local names)</th>
<th>Bionomical Names</th>
<th>Description</th>
<th>seasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Nut sedge (Deela)</td>
<td><em>Cyperus rotundas</em> L.</td>
<td>Narrow leaf (sedge)</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>Bermuda grass (Khabal)</td>
<td><em>Cynodon dactylon</em> L.</td>
<td>Narrow leaf (grass)</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Johnson grass</td>
<td><em>Sorghum halepense</em> L.</td>
<td>Narrow leaf (grass)</td>
<td>Summer</td>
</tr>
<tr>
<td>04</td>
<td>Horse purslane (itsit)</td>
<td><em>Trianthema portulacastrum</em> L.</td>
<td>Broad leaf</td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>(Tandla)</td>
<td><em>Digera muricata</em> L.</td>
<td>Broad leaf</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>White sweet clover (Bhakhra)</td>
<td><em>Melilotus alba</em> L.</td>
<td>Broad leaf</td>
<td></td>
</tr>
<tr>
<td>07</td>
<td>Green Amaranth (Cholai)</td>
<td><em>Amaranthus viridis</em> L.</td>
<td>Broad leaf</td>
<td></td>
</tr>
<tr>
<td>08</td>
<td>Chick weed or White weed</td>
<td><em>Ageratum conyzoides</em> L.</td>
<td>Broad leaf</td>
<td></td>
</tr>
<tr>
<td>09</td>
<td>Creeping Thistle (Leh)</td>
<td><em>Cirsium arvense</em> L.</td>
<td>Broad leaf</td>
<td>Winter</td>
</tr>
<tr>
<td>10</td>
<td>field bindweed (Lehli)</td>
<td><em>Convolvulus arvensis</em> L.</td>
<td>Broad leaf</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Toothed dock (Jangli Palak)</td>
<td><em>Rumex dentatus</em> L.</td>
<td>Broad leaf</td>
<td></td>
</tr>
</tbody>
</table>

### Table-2  Tillage Schedule in sugarcane crop

<table>
<thead>
<tr>
<th></th>
<th>✔ 1st hoeing after mid April using inter row cultivator</th>
<th>✔ 2nd hoeing in May using inter row cultivator</th>
<th>✔ Earthing up at the end of May using ridger</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Newly planted</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb. Sown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sept. Sown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sept. Sown</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early harvesting (Nov.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late harvesting (Feb.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ratoon</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early harvesting (Nov.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late harvesting (Feb.)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table-3  Description of herbicides dose, nature and spectrum

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name</th>
<th>Dose</th>
<th>Nature</th>
<th>Spectrum</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Dual Gold</td>
<td>500 – 600 ml/acre</td>
<td>pre emergence</td>
<td>Broad spectrum (Selective)</td>
</tr>
<tr>
<td>02</td>
<td>Amentrine + Atrazine</td>
<td>1kg/acre</td>
<td>post emergence</td>
<td>Broad spectrum (Selective)</td>
</tr>
<tr>
<td>03</td>
<td>Sun star</td>
<td>20 g/acre</td>
<td>post emergence</td>
<td>Narrow leaf (Nut Sedge)</td>
</tr>
<tr>
<td>04</td>
<td>Lumax-xtra</td>
<td>400 -500 ml/acre</td>
<td>post emergence</td>
<td>Narrow leaf (Nut Sedge)</td>
</tr>
<tr>
<td>05</td>
<td>Glyphosate</td>
<td>2 L/acre</td>
<td>Post emergence</td>
<td>Non selective</td>
</tr>
</tbody>
</table>

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*Fig.1 Mulching in sugarcane crop*  
*Fig.2 Pre-emergence herbicide application*  
*Fig.3 Post-emergence herbicide application*
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Asia Naheed
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