8th ISSCT AGRICULTURAL ENGINEERING WORKSHOP

Tucumán, Argentina
3 - 7 September 2006

"Improving Productivity under Green Cane Harvesting"

- Programme
- **Abstracts**

ABSTRACTS

- Supplementary Cleaning of Chopper Harvested Sugarcane at the Mill: Performance of a Prototype System at Ramu Sugar.
- Preliminary assessment of the performance of a machine for green cane biomass packing.
- Subsurface Drip Irrigation Experiences under Mechanized Harvesting in Green Cane at Ledesma Mill, Argentina.
- Green cane harvesting evolution at Ledesma Sugar Mill.
- The Impact of Organic Matter Conservation through Green Cane Harvesting, Rotation Breaks, Minimum Tillage and Controlled.
  Traffic on the Sugarcane Production System in Australia.
- Sugar Cane losses due to Primary Extractor Fan speed and cane variety impact in Ledesma Mill
- Classification of Sugar Cane Fields in order to Increase Chopper Extractor Harvesters Productivity and Reduce Ratoon Damage at Pantaleon Sugar Mill
- Shifting from Burnt to Green Cane Harvesting at SUCRIVOIRE - Problems and Prospects.
- Impact of Green Cane Harvesting on Cane Quality in Louisiana
- TITLE
- Green Cane Harvesting, Loading and Transport Systems Used in the South African Sugar Industry
- Effect of green-cane trash blanket on the evaporation of soil water contents.
- Evaluation of green cane harvest and crop management with a trash blanket
- The Better Sugarcane Initiative - Impacts and benefits on the Global Sugarcane Industry
- Innovative Management of Organic Matter: Integrated agronomic practices for sustainable sugar cane productivity
- Planting considerations under a green cane Minimum tillage production system.
- Effect of Elasmopalpus lignosellus attack on sugar cane under different cropping conditions in Tucumán, Argentina
- Variation and evolution of potential vegetative trash during the harvest season in the main sugarcane varieties at Tucumán, Argentina
- Influence of sugarcane variety and crop productivity on the quantity of post green cane harvest biomass.
- Sugar cane burning teledetection using MODIS data in Tucumán - Argentina.
- Evaluation of Cane Loss Monitoring Systems

Supplementary Cleaning of Chopper Harvested Sugarcane at the Mill: Performance of a Prototype System at Ramu Sugar.

C Norris[1], Engineering Consultant, A Naicker[2], Factory Manager & A Benson[2], Agriculture Manager
[1] Booker Tate Limited,
[2] Ramu Sugar Limited,

Under all but the best field conditions, significant levels of trash and leaf are an inevitable component of chopper harvested green cane. This material directly impacts on mill crushing rate, but also can have significant adverse impact on sugar quality and sugar recovery. Increasing the aggressiveness of operation of the harvester cleaning systems results in dramatic escalation in harvesting losses, and under adverse field conditions can still result in very undesirable levels of trash and leaf in the delivered cane.

Chopper harvesting of green cane therefore invariably results in an undesirable compromise between achieving "acceptable" levels of trash and leaf in the harvested sample and controlling cane loss from the harvester cleaning system.

Initial trials of a prototype single pass cane cleaning system installed at Ramu Sugar has demonstrated that a factory based system cane routinely achieve trash and leaf levels which are lower than can be achieved in "ex harvester" product, even with aggressive fan settings and under good harvesting conditions. This level of trash and leaf removal is achieved with minimal cane loss. Furthermore, the supplementary cleaning facility allows more moderate settings to be used on the harvester cleaning system, reducing the potential for cane loss in the field.

Trials have indicated the impact of supplementary cleaning on mill performance was consistent with expectations, with increases in milling rate and extraction and very significant reductions in problematic parameters such as juice color.

The presentation reviews results to date, as well as exploring issues such as system cost and the costs/issues associated with trash disposal or use.

Top

Preliminary assessment of the performance of a machine for green cane biomass packing.

Digonzelli P.; L. Alonso; E. Romero; F. Leggio Neme; J. Scandaliaris; J. Giardina; J. Alonso & S. Casen Sugar Cane Agronomy Dept., Estacion Experimental Agroindustrial Obispo Colombres Las Talitas - Tucumán - Argentina

The most frequent uses of green cane harvest residues are as: a) mulch over the field, b) ecological fuel and c) animal feed. The purpose of this work was to evaluate in a preliminary way the performance of a machine for packing green cane harvest trash. The cv LCP 85-384 planted in Tafí Viejo (Tucumán, Argentina) was used in this trial. The assessed parameters were pack weight, length and diameter, with which pack volume and density were calculated. The distance the machine had to tramp over to pack residues and the quantity of trash it could collect were also measured. For the latter, trash quantity was measured before and after the passage of the machine. The results indicated that the average weight of packs was 433.4 kilos, their diameter was 156.6 centimeters, their length 153.9 centimeters, and their volume 3 m3. The average density worked out for packs was 144.4 Kg/m3. The average distance that the machine had to be driven was 135 meters. The assessment of remaining residues indicated that the packing machine picks up 53.8 % of the trash left over after LCP 85-384 green cane harvest.

Top

Subsurface Drip Irrigation Experiences under Mechanized Harvesting in Green Cane at Ledesma Mill, Argentina.

Sergio Fadda.
Ledesma S.A.A.I., Jujuy, Argentina

The aim of this presentation is to inform some preliminary results and some characteristics of 2 trials and 2 drip irrigated commercial projects under green cane mechanic harvest at the Ledesma Mill, Jujuy, Argentina. It was stated to evaluate the economic and technical viability of this technology having as an objective the increase in productivity and a limited water supply as a main condition. These evaluations started in 1997. The first project, 28 has, was undertaken in a low fertility soil and with low water retention capacity. It was renewed and modified after the fifth cut in 2002. Its second cycle will be harvested for the fourth time during the 2006 season. In other area, medium textured soils with medium fertility, a second trial -6.8 has- which will be cut for the fifth time in harvest 2006, and 2 commercial projects - 130 and 120 has - which will be harvested as ratoon 2 and 1 respectively, were undertaken during this season. Differential productions were found regarding the treatments with 20 and 50% on behalf of the drip irrigation. Absolute productivity differences were significant in both soil types. Even tough no statistics comparatives between green and burnt cane were undertaken, some differential characteristics with some small areas which harvested prior burning were observed. Having the conservation of plants stand as a main objective, the conclusion is that conditions are of fundamental importance to obtain a very good quality of crop.

Key words: Productivity, drip irrigation, harvester, cane fields, ratoon damage.

Top

Green cane harvesting evolution at Ledesma Sugar Mill.

Miguel F. de Ullivarri, Rodolfo Difonzo

Ledesma is an agro industry, which produces sugar, alcohol, paper and energy from sugarcane. Machinery types and industry requirements were determiners for burning as a necessary practice prior to harvest. In the late 90's, trials and experiments were undertaken in a commercial green cane harvest scale with the incorporation of a new generation of harvesters and a whole vision of the agro industrial process. In addition, in the last years, environmental improvements, the keeping up of agronomic abilities from typical monoculture areas, energy requirements and experiences from other sugarcane areas in the world have led Ledesma to a sustained and continuous change towards harvest without burning. Nowadays Ledesma has 60% of mechanized green cane harvest area and a 100% is expected for 2008.

Positive aspects:

- Higher production of biomass and crop per ha.
- Higher amount of sugar per ha.
- Higher sugar yieldub per ton gross weight.
- Lower agrochemical usage in weed control.

- Lower atmospheric pollution and reduction of emissions.
- Higher capture of CO_2.
- Higher fiber in process allowing reduce gas requirement.

Negative aspects:

- Higher harvest and hauling costs.
- Higher milling and conversion costs in the industrial process.
- Reduction of the sugar % cane recovery due to higher fiber content.
- Higher humidity in bagasse
- Lower fiber quality for paper requirement.

There are also positive and negative aspects regarding weed and pest control that are being evaluated. Today Ledesma has projected its agro industrial future with mechanized harvest under green cane and trash blanket systems. The improvements have become evident in productive, economic, environmental and energetic issues.

Top

The Impact of Organic Matter Conservation through Green Cane Harvesting, Rotation Breaks, Minimum Tillage and Controlled Traffic on the Sugarcane Production System in Australia.

A.L. Garside, M.J. Bell, B.G. Robotham, G.R. Stirling and R.C. Magarey
Sugar Yield Decline Joint Venture
BSES Ltd., Davies Laboratory,
PMB Aitkenvale, Queensland, Australia 4814

The Australian sugar industry is changing from a burnt cane, long-term monoculture system with heavy reliance on intensive cultivation to remove compaction caused by the indiscriminate traffic of heavy machinery to a green cane trash blanket (GCTB) system with legume breaks, minimum/zero tillage and controlled traffic on permanent beds. Much of the research and development work for the new sugarcane cropping system was carried out by the Sugar Yield Decline Joint Venture (SYDJV), a multi-organisational, multi-discipline research group established in 1993. In this paper we discuss the research carried out on the various components of the cropping system and how they were combined to develop the new system. However, all of the components of GTTB, legume breaks, minimum tillage and controlled traffic have the common effect of organic matter conservation and through that, improvements in soil chemical, physical and biological properties.

Green Cane Trash Blanket
From a fully burnt system in the early 1980's the Australian industry is now 85% green cane harvested. In the majority of cases the trash is retained as a trash blanket. Historically, GCTB had a rather checkered entrance into the sugarcane production system. Many benefits in terms of improvements in soil properties and logistical considerations were identified, but initial yield results were variable with many comparisons with burnt cane systems were confounded by a range of factors that biased results in one direction or the other. Further, growers expressed concerns regarding productivity declines, harvesting difficulties and the need to change cropping practices and these concerns slowed the transition from a burnt cane system to GCTB. However, there is now little doubt that GCTB is well established in the industry and benefits are accruing, both in terms of productivity and sustainability.

The initial motives for adopting green GCTB varied between different regions with some growers on the wet tropical coast concerned about soil erosion and productivity decline. However, the real impetus for expansion of GCTB was a period of low rainfall and low prices in the mid-1980's. As a result of adopting GCTB many growers quickly realized substantial benefits in terms of improvements in profitability through labour and cost savings, reduced tillage and less crop loss under wet harvesting conditions. In addition, subsequent research identified other benefits such as improvements in soil organic matter, nutrient retention, more bio-diversity, soil water retention and reduced costs of weed and insect control.

Breaking the Monoculture
Rotation experiments aimed at breaking the monoculture and measuring the effect on sugarcane growth and yield were initiated by the SYDJV in early 1990's. When the rotation experiments were returned to sugarcane large yield improvements (20 - 30%) were recorded from breaking the monoculture with legume crops, such as soybeans or peanuts, pasture and bare fallow. These yield increases were associated with improvements in chemical, physical and biological soil properties, particularly the latter. Since the results of these rotation experiments have emerged there has been a substantial increase in the area planted to well managed legume crops in the Australian sugar industry. As well as conducting these rotation experiments the SYDJV carried out research into the most suitable legume species to rotate with sugarcane and the best management practices to maximize the benefits from those legumes. Traditional legume fallows were poorly managed cowpea crops that suffered from poor establishment, severe weed competition, waterlogging, and root diseases. Legumes were found to provide both a source of fixed nitrogen (a good soybean crop negating the need for any inorganic nitrogen fertilizer in the plant crop) and improvements in soil health. The nitrogen benefits can be maximized if the legume is surface mulched as opposed to traditional incorporation as the nitrogen is mineralized more slowly and thus more is available when needed by the following sugarcane crop. Further, there is increasing interest in developing crops like soybean and peanuts as complimentary cash crops in the sugarcane cropping system.

Controlled Traffic and Minimum/Zero Tillage
The SYDJV also commenced researching minimum tillage and controlled traffic as compaction resulting from heavy traffic

associated with harvester and haul-out machinery was recognized as a substantial problem Experiments where no tillage was compared with numerous passes, as in the traditional system, produced no yield losses and substantial cost savings in terms of labour, tractor hours and fuel . In addition improvements in soil physical and biological properties were measured. In other studies the effect of controlled traffic in terms of isolating crop and traffic rows resulted in a number of advantages, including substantial reductions in soil compaction.

A major problem with compaction in the sugarcane cropping system has been brought about by mis-matched row and wheel spacings. Traditionally the sugarcane crop has been grown on 1.5 m rows whereas harvesting and haul-out equipment has wheel spacings of between 1.8 - 1.9 m. With this combination and less than fastidious operators, wheel encroachment on cropped areas causing compaction and yield loss from later ratoons is largely unavoidable. The adverse effects are more pronounced under wet harvesting conditions. The perseverance with 1.5 m spacing has been based on a perception that yields will be reduced if row spacing is widened. However, recent row spacing and plant density studies have shown that sugarcane possesses a degree of environmental plasticity and that it is possible to adopt row spacings to match wheel spacing without loss of yield and thus allow controlled traffic to be implemented.

Combining Green Cane Trash Blanketing, Breaks to the Monoculture, Minimum Tillage and Controlled Traffic into the Sugarcane Cropping System.
In more recent times the SYDJV program has focused much of its effort into developing a sugarcane cropping system that combines GCTB, legume breaks, minimum/zero-tillage and controlled traffic. The system is based around row spacings compatible with wheel spacings of all equipment to avoid stool damage and minimize compaction near the cane row. Minimum tillage or direct planting is being combined with controlled traffic to reduce operational costs, minimize damage to soil physical properties, minimise adverse effects on soil biota, and conserve organic matter. Raised beds are being used in wetter areas to minimise potential adverse effects of waterlogging. Legume breaks are included to break the monoculture and provide a different root system to sugarcane, to manage root pathogens, and to provide a source of biologically fixed nitrogen. Further, by using minimum tillage, cane trash can be conserved between cane cycles further improving soil organic matter, soil physical properties and water holding capacity.

The results of large scale experiments established to integrate these components into a cropping system are providing very positive results and these will be discussed in the presentation.

Benefits of a changed sugarcane cropping system
The new sugarcane cropping system is based upon the basic agronomic principles that organic matter is the key to healthy soil, monocultures are undesirable, compaction should be avoided as much as possible, and excessive tillage destroys organic matter, soil structure, soil biota and is very costly.

The benefits that can be envisaged by adopting such a system include:

- Legume breaks provide a better-balanced biology, control root pathogens, biologically fix nitrogen and greatly reduce the need for fertilizer nitrogen, improve cane growth and yield.
- Isolation of cane and crop areas through matching wheel and row spacing can guide harvester and haul-out tracking and thus reduce the impact of compaction.
- Minimum/zero tillage, which conserves organic matter, improves soil structure, doesn't disrupt beneficial soil biota, and reduces runoff and erosion.
- Eliminates the need to till to remove compaction.
- Reduces the impact of waterlogging.
- Improves the timeliness of operations.
- Savings in fuel and labour costs.
- Indications that weeds will become less of a problem and herbicide use reduced with continual trash cover.

Top

Sugar Cane losses due to Primary Extractor Fan speed and cane variety impact in Ledesma Mill

Jorge Gómez, Gabriel del Castillo & Miguel Ullivarri
jgomez@ledesma.com.ar

During the AG Mechanization Workshop held in Louisiana in 2003, Ledesma S.A.A.I. showed the results of trials conducted to quantify the sugar losses during the different stages of the harvest process, comparing burnt and green cane harvesting.

These results highlighted the losses coming from the primary extractor were significant and the green cane had higher losses (8.7%) than burnt cane (4.0%).

After this, new trials were conducted in order to identify the factors that were contributing to this kind of losses under Ledesma's conditions in order to minimize them, as the company is increasing the green cane harvesting area.

Losses using different fan speed and cane varieties were quantified, comparing both harvest systems (green and burnt).

According with jobs done by others researchers, a close relationship between RPM and cane losses was founded, and these increased rapidly above 900-1000 RPM. All the varieties tested showed a similar trend but in different levels. The losses were higher under green cane harvesting.

Despite the EM levels were in inverse proportion to the RPM, this relationship had a low correlation, suggesting there are other factors involved.

Top

Classification of Sugar Cane Fields in order to Increase Chopper Extractor Harvesters Productivity and Reduce Ratoon Damage at Pantaleon Sugar Mill

Ricardo Guillen
Pantaleon Sugar Holdings, Guatemala, Central America

The objective of this study was to establish the economical differences between four categories, which provide adequate conditions for mechanical harvesting.

The areas classified as category "A" had ideal conditions for mechanical harvesting.
The areas classified as category "B" offered the second best conditions, but had limitations, which affected productivity such as obstacles in the field, short rows, and narrow turn roads. Areas in this category had a harvest cost increase of 6% (U.S.$0.34) per ton of cane in comparison to category "A".

The areas classified as category "C" offered very difficult operating conditions to the harvesters; inadequate varieties, sandy soils, inadequate row spacing, abundant ditches or deep drainage channels. Harvesting Category "C" areas increased the harvesting costs 25% (U.S.$1.55) per ton compared to category "A".

Lastly fields in category "D" should not be considered for mechanical harvesting. These areas presented such limitations such as irregular topography, inclines in excess of 10%, abundant and uniform rocks and sand.

Key words: Harvester, productivity, classification, cane fields, ratoon, damage.

Top

Shifting from Burnt to Green Cane Harvesting at SUCRIVOIRE - Problems and Prospects.

E Jacquin, A Jonas and M Akpangni, SUCRIVOIRE,
01BP8484, Abidjan 01, Ivory Coast

SUCRIVOIRE owns two sugar estates comprising each 5000 ha under cane in Ivory Coast. Cane is harvested manually after burning, followed by mechanical in field loading. Burning is practised as it is the only means to send clean cane to the mills. Being aware of the problems encountered in our conditions, with this mode of harvest (surface crusting under irrigation, high weed control cost, low organic matter content, cane deterioration during wet weather), the shift to green cane harvest is being envisaged. However, previous attemps to harvest green have been faced with labour reluctance, in spite of financial incentive. The cost of manual trashing prior to harvest would also increase production costs. Among other constraints to green cane harvest are increased traffic over cane rows, cane left over, extraneous matter sent to the mill and loss of Nitrogen with the application of urea over the trash blanket. However green cane harvest and trahs blanketing, over and above inreasing soil organic matter, could reduce significantly our production costs, namely through soil moisture conservation and weed control. Water pumping and severe weed infestation are responsible for high irrigation and weed control costs. Some constraints can be eliminated by trash clearing only over cane rows, but a solution to manual harvest of green cane has yet to be found.

Top

Impact of Green Cane Harvesting on Cane Quality in Louisiana

Benjamin L. Legendre
St. Gabriel Research Station
5755 LSU Ag Road St. Gabriel, Louisiana USA 70776
blegendre@agctr.lsu.edu

The ability of farmers to burn sugarcane is a significant economic factor for most sugarcane industries around the world. Burning of sugarcane before harvest eliminates from 30 to 50 percent of the leafy trash, which constitutes approximately 10 percent of the total weight of the stalk. Controlled agricultural burning allows more efficient sugarcane harvesting in the field and generally improves sugar quality and recovery in the factory. However, Louisiana is not the only state, nor is sugar production the only industry, facing the challenges posed by burning as an agricultural management tool. Until proven technology allows economically efficient harvesting without burning, it is critical for cane growers and processors to do the best job possible of managing smoke and ash. The Louisiana sugarcane industry has been proactive in its efforts to help this situation by developing the Certified Prescribed Burn Manager Program in 2000. Prior to 1993 virtually all sugarcane in Louisiana was harvested by the whole-stalk or "soldier" harvester where the sugarcane was cut green but burned on the "heap" row. With the release of the high yielding variety LCP 85-384 in 1993 there was a gradual shift towards combine harvesting and in 2005 approximately 85 percent of the Louisiana sugarcane crop was harvested by combine. However, in an effort to reduce the impact of burning on the environment, public health and welfare from smoke and ash generated from sugarcane burning, it is estimated that 70 percent of the 2005 crop (as compared to 90 percent during the 2004 crop) was harvested green. The increase in burning was the direct result of lodged conditions of the crop following the passage of two hurricanes prior to the start of the harvest season.

It has long been reported that the advantages of green cane harvesting on the raw sugar factory operations are greater overall

recovery of sugar per unit area of land, better management of harvesting operations and a reduction in the amount of dextran in the juice and, consequently, the sugar. However, there are disadvantages as well. They are more extraneous matter (trash) in harvested cane, greater concentration of waxes, ash, polysaccharide and starch in extracted juice, increased molasses production, increased sugar losses per ton of cane and reduced milling capacity resulting in increased cost per unit of sugar produced and a higher concentration of color in juice. Of course, many of these constituents will carry over into the refinery, reducing refined sugar quality. It is imperative that agronomic practices be closely aligned to harvesting requirements since adverse agronomic practices cannot usually be completely offset by improved harvester design or harvesting practices. Issues to be addressed in this presentation are developments in green cane harvesting that affect cane quality such as harvester ground speed as well as extractor fan speed. Other factors to consider include differences in the chemical makeup of varieties, the use of chemical ripeners, topping height and disease and insect complexes although not directly tied to green cane harvesting.

Top

TITLE

Lyne, Peter

The South African sugar industry is under pressure to improve supply chain efficiencies due to a worldwide decreasing trend in profitability. Supply chain stakeholders need to find new ways to meet the challenges of rapid changes in sugar industry operations. Computer models have been used to visualise and improve supply chains and are expected to play an increasingly important role in future planning and management. Management of sugar supply chains has previously focussed on generating competitive individual supply chain components. This inter-component optimisation generally does not consider all the important interactions between components and hence the efficiency of the supply chain may be limited. Integrated supply chain modelling has been recognised as a suitable tool for supply chain management, creating new avenues for improvement. The aim of this paper is to demonstrate in concept, that an integrated supply chain model, from field to mill back-end, can be developed for the sugar industry. The research involved three primary objectives. Firstly, a brief review of existing integrated agri-supply chain models, with focus on the sugar supply chain. Secondly, the integration of current fragmented knowledge of sugar supply chains into a suitable analytical framework, named CAPCONN, and thirdly, a demonstration of CAPCONN during a mechanisation case study.

Key words: supply chain, CAPCONN, integrated model, mechanisation

Top

Green Cane Harvesting, Loading and Transport Systems Used in the South African Sugar Industry

E Meyer
22 Broadwood Drive, Umhlanga Rocks, 4319, Republic of South Africa
Eddie.Meyer@telkomsa.net

The South African sugarcane industry, like many other sugarcane industries around the world, is seeking improved farming practices in order to improve long term productivity and profitability.

As was the case in many other sugarcane industries the need to improve labour and machinery productivity lead to more and more sugarcane being burnt prior to harvesting. The adoption of a green cane harvesting systems not only has the potential to increase sugarcane yields, particularly under marginal rainfall conditions but to also improve the quality of sugarcane delivered to the factory by reducing harvest to crush delays. In addition this option should ensure improved soil sustainability and protect the environment at the same time.

The current green sugarcane harvesting methods as well as the loading and transport systems used in the South African sugarcane industry are described in this presentation. The present burning practices, labour outputs and machinery used when harvesting green sugarcane as well as recent research outcomes concerning manual cutter performances operating in burnt and green sugarcane using two different cane knives are also presented. These results clearly showed that manual cutter performance is reduced in green cane and that hand harvesting is an extremely arduous task. The study also showed that there was no difference in cutter performance when using either the long or short handled cane knife.

An integrated industry approach is essential for seeking innovations that will improve overall productivity and efficiencies. Further research is required in areas such as harvesting aids to improve manual cutter performance, selecting harvester friendly sugarcane varieties and improving field layouts in order to achieve improved manual cutter and chopper harvester performances and efficiencies.

Green cane harvesting presents the opportunity to develop new technologies, and make significant advances in productivity and profitability. Furthermore, there are real challenges and opportunities in developing new technologies to exploit the sugarcane plant to its fullest potential, such as alternative uses for sugarcane and sugarcane residues.

Key words: Sugarcane, yield, labour output and residues

Top

Effect of green-cane trash blanket on the evaporation of soil water contents.

M. Morandini, R. Figueroa & C. Hernández
Estación Experimental Agroindustrial Obispo Colombres
Williams Cross 3150 CP 4101 Las Talitas - Tucumán - Argentina.
mmorandini@eeaoc.org.ar

The retention of soil moisture by sugar cane residues after harvest is mentioned as one of the main factors that determine higher yield levels in areas where rainfall is scarce during part of the sugarcane growing cycle. Trash blanket diminishes the evaporation

levels of soil water, which is a function of soil moisture contents, among other factors. Studies were carried out in plantations located in las Talitas, Los Ralos and Ingas (Tucumán, Argentina) in order to measure soil moisture contents during different agricultural campaigns from 1996 to 2005. Plots under burnt cane and green cane management systems were surveyed, analyzing moisture losses at different farming stages. The results show that water content losses due to evapotranspiration are significantly bigger (from 40 to 110 %) in plots subjected to burning. This was clearly evident during stages where evaporation is the major cause for humidity losses, namely during sugar cane sprouting and tillering. It has to be considered that this applied to soil whose gravimetric humidity was superior to 18 % in the more superficial layers and up to 45-centimeter-deep substrata. In the case of soil with less than 18 % of gravimetric humidity, the implementation of either management system did not have a significant effect on evapotranspiration levels. Similar processes could be observed at times when canopy closure was drawing near, and up to the final stage of growth, when transpiration had a more influential effect than evaporation.

Differences in terms of soil moisture contents between plots under green cane and burnt cane harvesting systems were most noticeable in cases where rainfall or irrigation were followed by periods of moderate water deficit.

Key words: soil moisture, tillering, water deficit

Top

Evaluation of green cane harvest and crop management with a trash blanket

Oscar Núñez, Egbert Spaans, Jesús Pilco, Mario Soria, Xavier Vitores.
Ingenio San Carlos, Guayas, Ecuador
onunez@isc.com.ec

To evaluate the feasibility of green cane harvesting at San Carlos Sugar Mill in Ecuador, those agronomic aspects that may be affected when changing from burned to green harvest, were evaluated. Two sites (2.69 and 1.97 ha) were harvested green by hand and compared with two adjacent sites of similar size that were also harvested manually but burned. The same experiment was done for mechanical harvest, comparing four sites (8.27 to 22.29 ha) that were cut green and another four adjacent sites burned before harvest. An experimental design was not carried out, instead measurements were made in commercially harvested fields that allows for larger areas to be monitored resulting in more representative data. During harvesting, the advancement of the field laborers (TC/man/day) and of the mechanical harvesters (TC/hour) was registered and the extraneous matter content (%) in the cane delivered to the factory, were determined. Crop residues were weighed and their concentration of N, P and K was measured to estimate nutrient cycling. The effects of the trash blanket on soil water content, weed control and furrow-irrigation efficiency, were evaluated. Plant growth was assessed measuring stalk population (stalks/m) and plant height at 3 and 6 months after harvest. The amount of crop residues that remained in the field after mechanical harvesting was significantly larger under green harvesting (17 Mg/ha) compared to the burned treatment (4 Mg/ha). No differences were found for the concentration of P and K of the crop residues from green and burned, mechanically harvested cane. In the case of N, however, the concentration in the green harvest residues (0.85%) resulted significantly higher than in the burned residues (0.55%). Manual, green-cane harvesting was found to be not feasible for San Carlos Mill due to reduced advancement of the field laborers (7.5 vs. 2.4 TC/man/day) and the large size of the trash that remained in the field after harvesting which hamper subsequent mechanized operations. Advantages found under the mechanized, green-cane harvesting were reduced herbicide application and soil water conservation. Disadvantages were reduction of harvester advancement (29%) and stalk population (12%). It is necessary to continue evaluating mechanized, green-cane harvest to learn under which conditions it is favorable and to assess the long-term effects of green harvesting.

Top

The Better Sugarcane Initiative - Impacts and benefits on the Global Sugarcane Industry

R Quirk[1], H Morar[2], R Perkins[3], G Kingston[4] and W Bernquist[5]
1. Cane grower - Australia, 2. Tate & Lyle PFC - UK, 3. World Wildlife Fund - UK, 4. BSES Limited - Australia,
5. Cane Technology Centre - Brazil.

An international conference in London in June 2005 confirmed that producers and processors of sugarcane were committed to the common goal of undertaking production and processing of sugarcane in an environmentally, socially, and economically sustainable manner. This goal will be met through the Better Sugarcane Initiative (BSI). Stakeholders will be engaged in a constructive dialogue to define and develop relevant performance-based and verifiable standards to describe practices within the value chain for sustainable sugarcane systems. The BSI would also foster implementation of improved management practices to effect measurable reduction in key impacts, as there is evidence that more sustainable practices can result in improved profitability.

To achieve this goal the participants in the BSI have agreed:

- To maintain open, honest, and respectful communications;
- To develop a protocol for external communications related to the Better Sugarcane Initiative including the use of sensitive data;
- To respect differences in experience and opinion, recognizing that impacts will differ from farm to farm and region to region, as will the ability to reduce impacts;
- To form a steering committee that reflects the interests of the range of stakeholders interested in Better Sugarcane;
- The key global impacts associated with growing and processing sugarcane could be addressed in the following areas:
    - Field environmental impacts associated with soil health, water use, generation of effluents and habitat loss;
    - Labour issues were ranked as work place health and safety, child labour, casualisation of labour and wage levels;
    - Community impacts included access to water, health and education;

- Processing impacts were ranked as food and worker safety, mill environmental issues and water use.

The presentation will provide background to the BSI how it may impact on the International sugar cane industries and plans for the initiative. The authors of the paper will draw on their international experiences and knowledge to inform the workshop as to BMP in their countries of origin and associations, and will be looking for assistance from the workshop participants to broaden this knowledge, for the betterment of the global sugar industry.

Key words: Sustainability, environmental impacts, cane growing, sugar milling, Better Sugarcane

Top

Innovative Management of Organic Matter: Integrated agronomic practices for sustainable sugar cane productivity

[1]Robert G. Quirk & [2]Tim Zwemer
[1]NSW Sugarcane Farmer,Duranbah, NSW.
[2]Consultant, Duranbah, NSW.

Three years of trials on My farm have shown, that the decomposition rate of OM has been markedly accelerated by the surface spray application of small amounts (1.5Kg -3Kg/ha.) of N, simultaneous with a decrease in putrefaction following precipitation events. These observations have been accompanied by a 90% increase in production and a 25% decrease in production costs. We are in the process of quantifying the above observations, identify the relevant processes involved and thereby innovating the current, standard sugar cane farming system in Australia. We believe that if the processes that act on the decomposition of organic matter (OM) including cane trash and tops and the sucrose deposited on them during harvesting can be identified and managed and/or manipulated, a farmer will have a powerful tool to increase efficiency and better protect or enhance the environment. The treatment of residual OM is a core activity in most current farming systems. The treatment of OM dictates the timing of most other activities and directly impacts crop establishment and productivity. Current farming systems are based around the management of direct and indirect OM issues, for example, seedbed preparation, germination efficiency, cultivation efficiency, harvesting operations, and nutrient availability to name a few. The timing of most farming activities are dictated by the ability of the system to manage OM. In addition, the retention of the OM and its carbon in the soil, according to current science across a broad range of crops, has a direct impact on soil health and micro environments that in turn directly create the conditions for minimising current inputs while at the same time increasing production.

The presentation will include photographs recording the various activities ands results of the trials and the effects that they have had on the micro/macro-environment and soil health.

Key words: Decomposition Rates, Soil Health, Environment

Top

Planting considerations under a green cane Minimum tillage production system.

[1]Brian Robotham & [2]Chris Norris
[1]gps-Ag, Bundaberg, Australia
[2]Booker-Tate Ltd, Atherton, Australia

Green cane harvesting is accepted as offering substantial cost and conservation advantages during the ratoon phases of the sugarcane cropping cycle. However at the end of the sugarcane crop, there is a need to remove trash and cultivate the land to prepare a seedbed for the next crop. This is particularly relevant when using traditional hand planting techniques, as a good soil tilth is important to achieve high levels of crop germination and emergence. In many regions where legislation is limiting the ability to burn trash, this requirement to remove the trash is becoming an additional problem or constraint to sugarcane production.

The adoption of minimum tillage, coupled with appropriate planter technologies can dramatically reduce the costs associated with the planting operation, allow full retention of trash/crop residues and facilitate the introduction of strategies such as legume rotations. It can also allow significant "opportunity time" advantages.

This presentation briefly reviews current research data and commercial experiences on the impact of minimum tillage strategies on subsequent crop yield and on crop establishment costs.

Strategies and machinery requirements for reliable crop establishment under minimum tillage conditions are discussed, as are how different planting systems/techniques can modified to meet these requirements.

The presentation also reviews developments in machine planting within minimum tillage environments and gives recommendations on machine type and specification for a number of cropping situations. Factors such as seedcane usage, reliability of use and outcomes, capital cost and logistic support are considered.

Top

Effect of Elasmopalpus lignosellus attack on sugar cane under different cropping conditions in Tucumán, Argentina

Salvatore, A.R.; M. Acosta; G. Dip, S. Arguello and E. Willlink
Estación Experimental Agroindustrial Obispo Colombres, Argentina
asalvatore@eeaoc.org.ar

During the sprouting period, sugar cane may be affected by the lesser cornstalk borer (LCB). Its attack is associated with high

temperatures and low rainfall conditions. The damage is done by the larva which bores the shoots basal area producing galleries and killing the shoot. The objective of this work was to quantify the percentage of attacked shoots in different crop conditions, and to determine its incidence on growth, the cultural yield, and its impact on sugar production. The survey was performed between October and November 2004, in 12 sugar cane growing locations of the province. Three cultural practices were evaluated: conventional, irrigation and fields coming from green cane harvest. The healthy and attacked shoots were counted in 5 meters of row with 5 repetitions for each situation. During May 2005 the losses caused in the sugar crops were evaluated, considering as a control an unattacked lot in the same field, the same variety, and same planting date. Evaluations consisted on the collection of 5 samples randomly taken of 10 sugar canes per lot, determining their height, number of internodes and weight of each evaluated stalk, as well as factory parameters such as brix and pol %. Field observations showed differences according to the cultural practices. The irrigated lots and the ones coming from green cane harvest presented between 0% and 0.15% of bored shoots and lots coming from conventional harvest presented values between 7% and 56.97%. Important losses were determined in the cultural and factory yields. Reductions of 43.08% in the weight and 12.9% in sugar cane pol, produced a 55.14% sugar loss per ton of sugarcane. We conclude that lots with irrigation and those coming from green cane harvest are almost not affected by the LCB, and consequently a good alternative to manage this pest.

Key words: lesser cornstalk borer, green cane harvest, irrigation, damage, losses

Top

Variation and evolution of potential vegetative trash during the harvest season in the main sugarcane varieties at Tucumán, Argentina

Sopena, R.A , Mariotti , J.A . and Terán , C.H.
INTA EEA Famaillá, Tucumán, Argentina.
rasopena@correo.inta.gov.ar

In the sugarcane area of Tucuman, the combine harvesting system overcome 60 % of the cane collected, while the proportion of green harvesting is increasing rapidly. The assessment of the vegetative composition of the main varieties, is therefore important, in order to favor efficiency in cleaning operation and the remotion of non-sucrose parts, and additionally provide information concerning to the composition of the residues left in the field. The objective of this study was to assess the variation of vegetative composition along the harvesting season, identifying main components: leaves-sheaths and tops, in contrasting with millable stalks.

In years 2004 and 2005, the main varieties grown in the area , (LCP 85-384, TucCP 77-42 , CP 65-357 and RA 87-3), were evaluated between May and September, in replicated samples. The canes were stripped and topped by hand, weighting leaves-sheaths, tops and millable stalks, estimating the relationships and proportion of each component. The ratio between millable stalks (mst) to leaves-sheaths plus tops (lst) were established in each case.

Results suggest that the ratio mst/lst is more than 60%, in mid-season (July and on). In LCP 85-384 the weight-fresh top decreased, while in RA 87-3 it is evident the reduction of leaves-sheaths proportion. The mst proportion in those varieties reached 80 % in September; CP 65-357 show a high incidence of tops , until July. In this sense, the ratio mst/lst at the begining of harvest is low in relation to other varieties. TucCP 77-42 exhibits intermediate levels of leaves-sheaths and an important reduction of tops since July.

These preliminary assessment, indicate the convenience for including additional selection criteria in the breeding program, specially focused to improve the ratio mst/lst and maximize the proportion of clean cane. This is important , in view of the challenges that the industry has to face-up, in accordance to legal regulation.

Top

Influence of sugarcane variety and crop productivity on the quantity of post green cane harvest biomass.

Romero E.R., Scandaliaris J., Digonzelli P., Alonso L., Leggio Neme F., Casen S., Tonatto J., Giardina, J. & Ullivarri J.
Estacion Experimental Agroindustrial Obispo Columbres,
Las Talitas - Tucumán - Argentina
agronomia@eeaoc.org.ar

Eliminating cane burning in management systems entails harvesting green cane mechanically, developing and implementing technological alternatives for the use of vegetal residues. The quantity of trash, which will remain on the field or serve other purposes (such as animal feed, bioenergy source, etc.) in different agroecological situations, will depend on sugarcane variety, productivity levels, harvest dates and wholestalk harvester efficiency in cane collection and clearance.

The aim of this work was to evaluate maximum quantity, real quantity and composition of post green cane harvest biomass in different agroecological zones of Tucumán's sugarcane plantation area, considering the most frequently grown varieties and differing production levels. The assessments were made during different harvesting periods: Initial (May - half of July); Medial (July's second fortnight - September's first fortnight) and Final (September's second fortnight - end of October), in cane crops of the most widely spread cultivars in Tucumán: LCP 85-384 (50 %), TUC 77-42 (23 %), CP 65-357 (18 %) and the recently introduced RA 87-3 variety (4 %). In each case, the assessments were made taking differential productivity levels into consideration. **Key Words:** burning, alternatives, productivity.

Top

Sugar cane burning teledetection using MODIS data in Tucumán - Argentina.

Tonatto, Javier
Sugar Cane Agronomy Dept., Estacion Experimental Agroindustrial Obispo Colombres
Las Talitas - Tucumán - Argentina
agronomia@eeaoc.org.ar

The introduction of Geographical Information Systems (SIG) and Teledetection in agriculture has allowed us to have spatial and temporary information adapted for the monitoring of different phenomena or processes originated by this activity. Sugar cane

cropping is the main agricultural activity in Tucumán, where the burning of plantations before harvest and the burning of residues after it are frequent. Since the enforcement of law N º 7459, a gradual decrease of burning in sugar cane plantation (5 % per year) has been expected, but up to date there is no reliable and effective method for its surveillance and control. However, the National Commission of Spatial Activities (CONAE) has made available a tool for teledetection of thermal anomalies, including the presence of high temperature sources (energy plants, etc), apart form fire occurrence. The information is obtained through "maps of heat areas" achieved by thermal sensors of the TERRA and AQUA MODIS satellite systems, whose products are generated at 1 km resolution.

The aim of this work was to keep the burning of green cane under surveillance through remote sensors, trying to validate their potential application for systematic monitoring.

It was possible to elaborate a daily database indicating fire outbreaks in the sugar cane plantation area of the province, during (June to November, 2004 and 2005). The starting and ending dates of burning, the months with major and minor percentages of fire occurrences, and the departments with major incidence of these events were determined.

The use of these systems and the validation of this methodology, based on a daily and near real time database, will allow a reliable surveillance of the management changes required for sugar cane cropping in Tucumán. Moreover, the implementation of these methods will encourage researchers and technologists to obtain new and potentially useful products.

Key words: GIS, fire, surveillance, method.

Top

Evaluation of Cane Loss Monitoring Systems

By C Whiteing[1], RJ Davis[2] and [3]EJ Schmidt

[1] BSES Limited Bundaberg

[2] FS Consulting, Formerly BSES Bundaberg

[3] National Centre for Engineering in Agriculture, Formerly BSES Bundaberg
cwhiteing@bses.org.au

The loss of cane during the harvesting process is estimated to cost the Australian Sugar Industry over $50 million per year. Development of a monitor, that would measure cane losses during harvesting operations and allow the operator to make adjustments required to improve recovery of cane, could benefit the industry by between $12.5 million and $25 million annually. (These figures should now be twice that!). Whilst the only commercially available cane loss monitor uses hood mounted sensors, a more recent development has incorporated sensor(s) located on the extractor fan hub. Both systems utilise signal processing to attempt to differentiate between the "sound" of billets versus trash passing through the extractor. This output is then used to estimate cane loss.

This presentation compares the results of a trial program where a late model harvester, fitted with both monitor systems, was fed with pre-cut and weighed cane at controlled commercially relevant cane processing rates and fan speeds, in a static test facility. Product expelled from the primary extractor (into a fine mesh "bag"), as well as the "delivered" product were accurately sorted into components and weighed. The actual cane loss from the replicated factorial trial was then compared against raw and processed data from the cane loss monitors. The study has shown that both the hood and fan sensor were unable to distinguish actual billet hits at commercial harvesting rates in unburned cane, and no relationship could be found linking either sensor signal output to number of billet hits as signal response to trash and tops dominates response due to cane billets.

The study also showed that as pour rate and fan speed increased, the selectivity of trash removal by the extractor system reduced, even under the ideal operating conditions of the workshop test facility. Significantly, this finding means that the total material mass flow through the fan can be used as a good predictor of cane loss. With appropriate modifications to processing circuitry, both systems predict mass material flow and therefore probable cane loss through the extractor fan, very well. The data also showed that even under static test conditions, less than 50% of the "missing cane" could be accounted for in product expelled from the extractor.

By using marked stalks placed in the top and bottom of the material being fed into the harvester throat, it was demonstrated that cane loss is predominantly from the top of the product traversing the feed train.

Key Words: cane loss monitors, hood sensor, fan sensor.