7th ISSCT AGRICULTURAL MECHANIZATION WORKSHOP

Louisiana, USA
12-17 October, 2003

"BURNT VS. GREEN CANE MECHANIZATION - AGRICULTURAL ENGINEERING CHALLENGES"

Organized & Hosted by
The American Sugar Cane League (ASCL) &
The American Society of Sugarcane Technologist (ASSCT)

REPORT

Introduction

The 7th Agricultural Engineering Workshop was held from 12 to 17 October 2003 in Thibodaux, Louisiana. The Workshop was organised by the Agricultural Engineering Sectional Committee and hosted by the American Sugar Cane League (ASCL) under the auspices of the American Society of Sugar Cane Technologists (ASSCT). The workshop was attended by 54 delegates from 13 countries: Australia (3), Argentina (7), Colombia (3), England (1), Guatemala (1), Guadeloupe (1), Guyana (2), India (2), Mauritius (8), Reunion (1), South Africa (2) and Zimbabwe (1). The host country had the largest contingent with 22 delegates.

Mr Charlie Melancon, President and General Manager of the ASCL, officially welcomed the delegates at a formal reception on Sunday 12 October. The Workshop was officially opened on Monday 13 October by Mr John Gay, Chairman of the Board, ASCL, who presented an historical overview of the Louisiana sugar industry and the role that the ASCL plays in that industry.

Workshop delegates
(Photograph courtesy of Sugar Journal, Louisiana)

Formal session

The formal sessions were held at the Howard Johnson Lodge in Thibodaux. A total of 32 verbal and 4 poster presentations were made under the four formal session topics. Formal paper presentation sessions were held on Monday, Tuesday, Thursday and Friday. Workshop topics covered the following:

- **Monday, 13th** Green cane versus burnt cane harvesting
- **Tuesday, 14th** Green cane versus burnt cane harvesting continued
- **Thursday, 16th** Land preparation, planting, crop maintenance and trash management
- **Friday, 17th** Machinery costing and benchmarking.

Each topic was introduced by a Committee member or invited speaker, followed by presentations by the delegates, with adequate time for questions and discussions. The papers were generally of a high standard with a good mixture of practical and technical papers.

Workshop sessions

Green cane vs burnt cane harvesting

It is estimated that less than 20% of the world's more than 1 000 millions tons of sugarcane is harvested mechanically. Harvesting systems

vary widely and the choice of one system over another will depend on labour availability, labour cost, topography and climatic conditions. Many sugarcane industries are still seeking an interim step between manual and fully mechanised harvesting systems. In industries where terrain, field layout or mill receiving facilities precludes the economic use of chopper harvesters, much research is being conducted to develop suitable economic whole stalk harvesters.

It was generally agreed that, regardless of the country involved, harvesting of sugarcane without burning is difficult, as most industries expected it to be. There are still many issues that have not been resolved, particularly under certain local industry conditions. These include lower and slower harvesting rates for manual and mechanical harvesting systems respectively. Although with mechanical harvesters there is the potential for reducing harvest-to-crush delays, there is also potential for higher cane losses and poorer quality of cane being delivered to factories.

Trials have shown that by improving machine maintenance and better extractor fan speed setting an amicable balance can be found between the amount of trash delivered to the factory and acceptable cane loss. There have been some significant improvements to the gathering and feeding mechanisms and the cleaning systems of modern chopper harvesters. Tests showed that the latest chopper harvesters have increased harvesting rates, lower fuel consumption and lower extraneous matter levels in cane samples being delivered to factories.

With environmental pressure increasing to restrict burning, there is a real need to further improve machine performance, reduce the amount of extraneous matter being delivered to the factory and reduce cane losses when operating in green cane. These problems can be partly solved by improving field layouts, improving agronomic practices and developing more machine-friendly cane varieties. Another issue that raises concern is the fact that the higher the degree of mechanisation, the higher the risk of soil compaction. There is also a need to develop best management practices for individual local conditions in order to ensure economically and ergonomically sustainable cropping systems. A mechanical harvesting best practice manual has been developed in Australia and is commercially available.

The ISSCT preferred harvester testing protocol was reviewed at the workshop. It was agreed that certain sections of the protocol need clarification, while others require revision. A proposed new protocol will be drawn up and circulated to the delegates before being resubmitted to ISSCT and posting on the website.

Land preparation, planting, crop maintenance, and trash management

There are many factors to be considered when switching from burnt to green cane harvesting. The more important advantages of green cane harvesting are well documented. However, some of the benefits are countered by the suppressive effect of trash on ratoons, the harbouring of diseases and insects pests and the need for tillage. Addressing these issues will require inputs from agricultural engineers, agronomists and economists. Millers must also accept that with green cane harvesting fibre and other extraneous matter levels will increase, but that there are also gains to be made in the form of a fresher cane supply.

Much research has been carried out around the world to develop improved mechanical planters and no-tillage whole stalk and billet planters. Poor metering systems and poor billet quality have been identified as major problem areas that result in higher than normal seeding rates to ensure acceptable cane stands. Billet quality has been improved by research into better harvester maintenance and adjustment. The adoption of minimum and no-tillage planting systems as part of an improved cropping system is seen by many industries as a major advance.

Crop rotation is also seen as a desirable practice to improve soil heath and control pests and diseases. Work is being carried out to select the optimum crops and rotation cycles. Row width is also important to cater for irrigation and mechanisation requirements.

It was shown that improved field layout design improved mechanical harvesting machinery performances by reducing time lost by up to 30%. Furthermore, cane stool damage and soil in the cane sample were both reduced significantly. Other results showed that direct stool damage by infield machinery is reduced to a minimum when cane fields are planted at wider row spacings or alternative sets of row spacings that better accommodate infield transport track widths and assist in controlling traffic paths. Trials have shown that uncontrolled traffic systems can reduce cane yield by as much as 30 t/ha.

There are several new types of equipment available commercially for use in managing crop residues. Some of the equipment can be used to incorporate trash and tops into the interrow, while others, such as a modified road brush, can be used to remove the trash from the top of the cane rows. In areas where burning is prohibited, or where crop residues cause slow emergence or yield decline, this type of equipment provides growers with alternative management practices.

The concept of recovering most of the above-ground biomass during the harvesting operation is not new. The results of trials conducted in Florida, where combine harvester extractor fans were turned off, showed that the trash content averaged about 20% compared with 8% when extractor fans were in use. Truck payloads were reduced by as much as 38%. Harvester forward speed with the extractor fans off was 10% slower than when the fans were on, and harvester output was 13% lower when the fans were off. The lower harvester output can be ascribed to the increase in total cane and residue mass passing through the machine. Juice quality was similar for both harvesting approaches. The delegates agreed that enormous potential exists for maximising the value of total biomass of the sugarcane crop.

A mini precision farming workshop was scheduled as part of this session. Precision farming is based on the concept that variability in soil fertility, soil depth, microclimate and weed species all occur naturally and are site dependent, and all of these factors have a direct influence on crop production. The precision farming concept is really a combination of several relatively new technologies such as mirco-computers, global positing systems (GPS), geographic information systems (GIS), information gathering hardware and software, and the automatic control of farm machinery. The system has the potential to improve yields, and low-yield areas can be better managed to increase yields. The use of variable rate technology allows for more effective and more economic nutrient use, as well as being environment friendly. Although variable rate technology is well developed, the same cannot be said for cane yield monitors on sugarcane harvesters. The use of auto steer guidance equipment was shown to be most useful in maintaining accurate steerage in green cane harvesting and avoiding cane stool damage. Delegates agreed that precision farming should be part of an overall plan to make industries more productive, competitive, sustainable and environmentally friendly in the future.

Machinery costing and benchmarking

It was shown that in a developing world, the use of small-scale contractors on large sugarcane estates could be cheaper and gives more satisfactory service than in-house equipment fleets or large scale contractor organisations. However, for this to take place the local infrastructure must mature and be assisted and guided by the developing industry.

The Discounted Cash Flow (DCF) method of costing agricultural machinery can be used to determine the cost of mechanised operations. The DCF method takes into account factors such as effect of inflation and interest on the time value of money, as well as the implications of various income tax considerations. The DCF method can further assist in evaluating capital equipment replacement decisions. As these factors are not fully accounted for when using the popular 'Classical' machinery costing method, the use of the DCF method results in a more accurate account of machinery costs and cash flow.

Machinery and equipment costs form a major proportion of total sugarcane production costs. It is estimated that in some industries these costs can be as high as 40%. At the previous Agricultural Engineering workshop held in Malelane, South Africa, it was agreed that a standard costing method was essential and would be beneficial when reporting machinery costs at workshops and congresses. A machinery costing and performance standards protocol, based on the 'Classical' costing method, was tabled at this workshop. The proposed protocol was accepted unanimously by the delegates, and the Chairman was asked to prepare the final draft and distribute it to the delegates prior to tabling it before the ISSCT.

Another issue that was raised at the previous workshop was that of benchmarking methods and standards. It is often extremely difficult to make meaningful cost comparisons between farming enterprises that are similar, and even more so between countries or industries that are dissimilar. It was therefore proposed that a set of standard processes and procedures be drawn up for use when carrying out a benchmarking exercise to ensure portability and effective comparisons between systems.

Workshopping sessions

At the end of each topic's formal session, time was set aside for informal 'workshopping' sessions. The aim of the workshopping sessions was to give delegates an opportunity to raise issues not covered during the formal sessions, or to air their views on matters raised during the day's proceedings. These sessions were structured under the following headings:

Mechanical issues
Labour issues
Cane quality issues
Agronomic issues
Best management practices
Future research requirements.

It was generally agreed by the delegates that the workshopping sessions were useful in that they expanded on numerous issues pertaining to the day's proceedings. A summary of these sessions will be forwarded to the delegates in due course.

Business meeting

At the business meeting held at the end of the formal sessions, membership of the Agricultural Engineering Section Committee, the venue and proposed theme for the next workshop were discussed.

Delegates wishing to be considered for membership on the committee were asked to submit their names to the Chairman. The Chairman will forward the names of potential committee members to the ISSCT Technical Program and Executive Committees for consideration. The delegates unanimously proposed that the next workshop should be hosted by Argentina. Also discussed during the business meeting was the proposed theme and topics for the Agricultural Engineering sessions at the ISSCT Congress to be held in Guatemala in 2005.

Field tours

The purpose of the field trips was to expose delegates to the widest possible range of agronomic field practices, harvesting, infield loading and cane transport systems and mill receiving facilities in use in the Louisiana and Florida sugar industries.

On a half-day tour in Louisiana delegates visited the USDA research farm near Houma where they saw how field trials are mechanically harvested and weighed. Delegates were also shown a commercial harvesting operation being carried on a private farm where a single as well as a two row harvesters were being used. A visit to the Cameco Industries' Rebecca farm made up the last stop of the day. During the full day tour, delegates were shown a single row combine harvester modified to handle sprawled cane, various trash handling and management systems and a billet transloading operation. There was also a visit to the MA Patout Enterprise sugar factory located near Jeanerette. At the factory, delegates were shown a whole truck tippler offloading system and were given a guided tour of the only diffuser sugar extraction system presently in use in Louisiana. The tour also included a visit to the factory's cane quality testing facility.

A post-workshop one day tour of the Florida sugar industry was arranged by the Florida Sugar Cane League. During this tour mechanical harvesting, manual planting as well as three mechanical planting systems were demonstrated. Other stops included water management and water quality control, and stops to see a cane harvester fitted with auto steer and a variable rate fertiliser applicator. Finally, there was a drive-past visit to the Oakeelanta Corporation's co-generation plant, which is fuelled by baggase, wood chips and cane trash, and delegates also had a look at their sugar packaging plant.

Delegates viewing a mobile transloading station in Florida

General

The general consensus was that the Workshop was a great success, and many delegates commented on the quality of the presentations and general organisation. The workshop was well supported by the Louisiana and Florida sugar industries, and the organisers wish to thank these industries for their generous contributions.

A comprehensive report on the Workshop activities will be presented at the ISSCT Congress in Guatemala City, Guatemala, which is to be held from 30 January to 4 February 2005.

Acknowledgements

The Agricultural Engineering Section Committee consisting of E Meyer, (Chairman, South Africa), C Norris (Australia), E Jacquin (Mauritius), C. Richard (USA) and J Scandaliaris (Argentina) wishes to thank all of the delegates who prepared and presented papers and posters and generally participated in the Workshop and the American Sugar Cane League and its organising committee for hosting the workshop. The Committee gratefully acknowledges the support of numerous local organisations, agricultural machinery suppliers and service providers for their generous support and sponsorship. The organisers acknowledge the assistance and generosity of various organisations and individuals in staging the very successful field tours held in the Louisiana and Florida sugar industries.

Finally, the Council of ISSCT is thanked for entrusting the Agricultural Engineering Section Committee with the task of organising the Workshop and for providing financial and clerical support.