


SAIAE News-letter

South African Institute of Agricultural Engineers **December 2007**

Welcome to our last edition of SAIAE News-letter for 2007, which is also our Christmas edition.

In his Christmas Message the President mentions the many innovative challenges in applicatoins for alternative energy sources we are faced with. A revival in the participation of engineers and technicians at SAIAE activities was also noted since the introduction of the CPD by ECSA.

In a most interesting article the continuous rotating roaster is explained. Fritz Teseling, Agricultural Engineer of ROASTECH developed an apparatus that sucks heated air through soybeans inside a rotating drum. This is a relatively inexpensive and effective method to heat raw soybeans.

In his series on irrigation efficiency, Dr Neil Lecler explains the efficiency of water used in agriculture and the performance of irrigation, and water management systems is coming under constant scrutiny.
In News from tne Branches, Dr. Dan Ciolkosz tells us about the most interesting projects of the students.

Prof. JC Smithers and Mr LF Lagrange explain the construction of a de-trashing and topping device for sugarcane, undertaken by the 2007 final year students at UKZN.

From the Editorial Committee we wish all our readers a Merry Christmas and a Prosperous New Year.

Seasons' Greetings
Editor

CHRISTMAS MESSAGE 2007

Neels Bezuidenhout
President

With the current energy crisis due to the sharp monthly increases of fuel and the shortage of electricity supply, we are faced with so many new innovative challenges in applications of alternative energy sources in the current growing economical climate. The fact that the economy is growing, production increases, new businesses open and current businesses expand, causes a continuous demand for energy while the supply of electricity, profit margins of the producer and buying power of the consumer for the following four to five years to be under increasing pressure. The challenges and the role that the Agricultural Engineers and technicians can play in this environment, is legion.

Since the introduction of the Continuous Professional Development (CPD) by ECSA, we experience with appreciation a revival in the participation of engineers and technicians at SAIAE activities. SAIAE can proudly refer to the pioneering work that was done to take the lead to be the first engineering institute to present a CPD event two years ago. Since then it has grown to a number of single day CPD events with a multi day CPD event every alternative year. The SAIAE council realizes the additional responsibility. It has to ensure that there are sufficient opportunities per year for it's members to be able to retain their professional registration. We also want to make use of this opportunity to request our members to forward your needs for CPD events for us to be able to see to your needs. In 2007 we endeavored to rather bring single day CPD events closer to our members rather than a multi day CPD event. However, we are planning to have a multi day CPD event again in 2008, but there will still be single day events in the regions as well.

The SAIAE council is in the process to appoint a business manager to assist us with the arrangements of CPD events as well as the general marketing of Agricultural Engineering. The marketing duties will typically be coordinating the publishing of articles and advertisements in Agricultural related publications, coordinating radio talks, updating the web page, the compilation of a marketing DVD and the recruitment of sponsors, bursaries and students. We appeal to all our members to forward information of successful projects and any information of news value to us for publishing in the media. This will enable us to promote the Agricultural Engineering profession as an indispensable profession in society. Use SAIAE to promote the work that you have done. This is what we are there for.

We have furthermore experienced an enormous shortage of Afrikaans speaking Agricultural Engineering students who should play a very important role in the future of our most enjoyable profession. It is difficult to recruit students without bursaries. We have however made limited funds available for student loans which can fill a few gaps over the short term. We are also planning to sell advertisement space on the web, the news letter and the marketing DVD to build funds for bursaries and loans which will be administered by the SAIAE council and which we will utilize to recruit students in future. Should there be any of our members who are in a position to assist us in this regard, it will be highly appreciated.

“He who prepares today, sets the stage for tomorrow's achievements”.

May the Lord's blessing be with you in these festive days and may it be a true Christ Festival for everybody. May it rain prosperity where you walk in 2008 and come home safely.

Continuous Rotating Roaster

There is a need by animal producers to heat raw soybeans in order to destroy the trypsin inhibiter therein. Although there are already a number of commercial processes such as extrusion and micronising available which make use of different heat sources, the challenge was to develop a relatively inexpensive and more effective method that will be affordable for the average farmer.

Due to the high protein content, amongst others, a product like soybeans is particularly popular for animal feeds. The trypsin inhibiter in the raw soybean limits the intake of protein especially at monochastic animals like pigs, chickens and calves which may hamper the growth of these animals. By destroying the tryspin inhibiter, not only will the intake of protein be increased, but also the taste and the urease to mention only two.

The art with the heating process is to maintain a balance between the heating temperature and the time at which the product is exposed to the heat. It must be ensured that sufficient heat is transferred sufficiently and evenly distributed to the soybeans for the heat to reach the centre of each kernel. Should the soybeans be exposed to too high temperatures or for a too long period, 100% of the trypsin inhibitor will be destroyed, but will in the process destroy the vitamins which will negatively influence the urease of animals. According to Prof. Gary Osthoff of the Department of Food Science at the University of the Free State, the best balance is achieved by destroying 80% of the trypsin inhibiter.

Fritz Teseling, Agricultural Engineer of ROASTECH, has developed an apparatus that sucks heated air through the soybeans while moving forward inside a rotating drum. The heat source is electricity and the temperature can easily be regulated to roast soybeans at 170°C. The process is continuous and simple and the maintenance on the apparatus is negligible due to the slow rotating speed. After the soybeans have been heated, it is kept in an incubation bin for 25 to 30 minutes at approximately 120°C to ensure that the heat will migrate to the centre of the kernel.

Although the apparatus was initially designed for a capacity of 50 kg/h to roast soybeans only for animal feed for own usage, other products like maize, peanuts, coffee, nuts and chicory were also roasted successfully. Feedlots and millers are showing great interest due to the low capital outlay, low maintenance, minimal labour and easiness to control temperatures. The roaster is available in sizes as small as 10kg per hour for laboratory purposes and up to 2 ton per hour for commercial applications.

Roaster – 50kg/h (left), 200kg (right)

Irrigation efficiency:
Re-thinking concepts and seeking solutions

Dr Neil Lecler

With the increasing demand and competition for finite water resources, the efficiency of water used in agriculture and the performance of irrigation and water management systems is coming under constant scrutiny. Unfortunately the concept of irrigation efficiency is frequently misunderstood leading to the widespread belief that water just disappears with low irrigation efficiencies and re-appears with improvements. Such beliefs are an over simplification. Often the actual amount of water consumed in irrigation, i.e. the evaporated component, hardly changes at various levels of "efficiency" or could even increase with systems which are perceived to be more efficient.

Rather than thinking about irrigation efficiency as a percentage, the performance of irrigation should be considered in terms of the whole water balance, which must take into account the destination of applied water, and must include factors such as infiltration, deep percolation, surface runoff, evaporation from the soil surface, spray evaporation, wind drift, plant interception and transpiration. One needs to examine how all these factors contribute to the goal of irrigating, i.e. "spend" minimum energy, water and money in order to prevent undesirable crop water stress (economic considerations may dictate that a certain amount of stress is desirable).

There is also a widespread illusion that efficiency relates more to the type of irrigation system rather than to the way a particular system has been designed and managed. A closer analysis and refinement of existing systems and water management strategies would often yield far greater benefits than switching from one system to another.

Some key concepts concerning the water balance and associated relationships between irrigation efficiency, performance of irrigation hardware, crop yields, water management strategies and profitability are highlighted as follows:

- The uniformity or evenness with which water is applied can have a significant effect on the performance of irrigation systems and is related to the type of irrigation system and the standard to which it has been designed, operated and maintained.
- There is strong evidence that while losses due to plant intercepted water, spray evaporation and wind drift vary for different types of irrigation systems and weather, there is a degree of compensation resulting from associated reductions in transpiration, and possible also enhanced relative growth rates associated with modified micro-climates during extremely hot weather.
- The amount of irrigation water applied in relation to the available soil water storage capacity is largely determined by management. But it can also be constrained

by the type and design of the irrigation system, particularly with furrow irrigation. Management through the selection and implementation of irrigation watering schedules, or scheduling methodologies, can have a significant effect on the overall system performance, especially if the irrigation hardware is well-designed. If the irrigation hardware is poorly-designed and has a low inherent irrigation uniformity, overall performance is likely to be poor, even with appropriate watering schedules and good water management.

- Deep percolation and runoff are often exacerbated because of assumptions regarding irrigation efficiency. Thus if irrigation is assumed to be inefficient when making day-to-day water management decisions, it is likely to become inefficient. Excess applications are sometimes justified to negate poor irrigation uniformity on crop yields but it is far better practice to improve the uniformity of water applications.
- The most significant losses from a field are due to evaporation from exposed soil surface, runoff and deep percolation. These losses depend on both the type of irrigation system and its management.
- For a given type of irrigation system, which is performing at a certain level, the management strategy (e.g. a deficit irrigation management strategy) can also have a significant impact on the overall system performance. In order to determine an appropriate deficit irrigation schedule, a prediction tool to relate the estimated yields of a crop to various watering strategies, types of irrigation system, measures of irrigation application uniformity, soils, seasonal weather patterns and water supply is needed.

Hopefully, whenever someone starts a discussion on irrigation efficiency, people will now start to think about the water balance, the uniformity of water applications, the scheduling/watering strategy and where the water is going, rather than just a percentage value.

UKZN Snippets

Prof. JC Smithers and Mr LF Lagrange

Design Projects by Final Year Agricultural Engineering Students in the School of Bioresources Engineering at the University of KwaZulu-Natal

The 2007 final year Agricultural Engineering students in the School of Bioresources Engineering at the University of KwaZulu-Natal undertook the design and construction of a de-trashing and topping device for sugarcane as their final year design project. The objectives of the project were to develop a semi-mechanised machine containing a de-trashing device to remove lower, dry leaves from sugar cane and a topping device to cut off sugarcane tops.

The project was divided into three components. Mr Trevor Baier was responsible for the design and construction of the frame, Mr James Mabadi for the de-trashing device and Mr Kabelo Motebejane for the topping device.

An adjustable trailed implement frame was designed and constructed as shown in Figure 1, and the de-trashing and topping devices were mounted on the frame. Field tests of the frame indicated that further design is necessary to overcome stability of the frame on sloping ground, the large turning circle and difficulties experienced when reversing with the frame.

Figure 1. Trailed implement frame with de-trashing device attached

A band saw cutting mechanism was designed and constructed, as shown in Figure 2, to cut the tops off the sugarcane stalks. While the quality of cut in field trials was found to be good, problems associated with the flow of material and resultant clogging were encountered in the field trials.

Figure 2. De-topping device

A rotating shaft with stainless steel bristles, as shown in Figures 3 and 4, was designed and constructed to de-trash the

dry lower leaves from the sugarcane stalks. Field evaluation of the de-trasher indicated that the bristles did not damage the cane stalks, but material flow and clogging resulted in the device not working successfully.

Figure 4. Mounting of de-trashing and topping device

Figure 3. De-trashing device

Despite the unsatisfactory performance of the machine in the field, the students learnt many valuable lessons and developed significantly throughout the year. Mr Trevor Baier received awards for the best design project for his design from MBB Consulting Engineers and the KZN-SAIAE branch.

The project was funded by Ubombo Sugar in Swaziland whose contribution is gratefully acknowledged. The South African Sugarcane Research Institute is also acknowledged for making available a prototype sugarcane de-trasher which was used as a power source for the trailed implement frame. Mr Richard Robertson from MBB Consulting Engineers and the KZN-SAIAE branch are thanked for making available awards for the best design project. Mr Hugo Kuhne is also thanked for allowing the project team perform the field evaluations on his farm.

Managing Director of Gedore, Mr. Hermann Schmidz, hands a prize with tools to the best workshop student, Mr. Ashiel Jumman

SAIAE President, Mr Neels Bezuidenhout, hands over a SAIAE shield to the best Final Year student, Mr. Trevor Baier

Mr. Mike Udal of MBB Consulting Engineers hand over a MBB prize to the best Final Year student, Mr. Trevor Baier

News from the branches

Agricultural Engineering Students Design for the Future

Pietermaritzburg, 31 October 2007
Dr Dan Ciolkosz

The Chairman of the SAIAE KZN Branch bids farewell to Prof. Roland Schulze who retired

Over 80 people gathered recently at UKZN's Ukulinga Experimental Farm to witness the latest in Agricultural Engineering student designs. The meeting, hosted by the KZN Branch of the South African Institute of Agricultural Engineers (SAIAE), included an Annual General Meeting and a tasty braai, but the stars of the evening were undoubtedly the university's final year engineering students, who presented the results of their year-long design project.

This year's project was centred on the very relevant and challenging issue of harvesting green sugarcane, and included designs for an automatic topping device, de-trashing equipment, and appropriate systems for conveying the equipment in the field. Students reported on how they defined the design problem, carried out a detailed engineering design, constructed the equipment, and tested it in real-field conditions. The final product consisted of hydraulic-powerd devices mounted on an adjustable trailer, pulled and powered by "Mad Max", a one-person tractor on loan from the the South African Sugarcane Research Institute (SASRI). Generous assistance and advice for the project was also provided by Ubombo Sugar and local sugar farmer Hugo Kuhne. The students' design was on display at the meeting, and it created a great deal of discussion amongst the attendees during course of the evening.

Special awards were presented to the students in recognition of their efforts. Institute president Neels Bezuidenhout presented an award on behalf of SAIAE, Mike Udal of MBB Consulting Engineers presented an award to the student with the best written report, and Hermann Schmitt of Gedore Tools presented a toolset to the student with the best workshop skills. In addition, Gedore donated a large toolset for use by engineering students in the coming years.

The meeting's formal activities were wrapped up with a talk by Professor Jeff Smithers, the head of the UKZN School of Bioresources Engineering and Environmental Hydrology. His talk focused on the future of Agricultural Engineering Education in South Africa, and provided the crowd with an exciting glimpse of future changes to the program at the university, including new classes and the opportunity for students to select an area of emphasis within Agricultural Engineering.