

*Leading Edge, supported by the Society for Engineering in Agriculture and the Australian Centre for Precision Agriculture, provides a local and worldwide window on engineering and PA research.*

## Diverse application of ag engineering

By Gary Alcorn

This article continues a review of the many diverse opportunities in agricultural engineering. Areas of research currently undertaken by the National Centre for Engineering in Agriculture (NCEA) based in Toowoomba, Queensland reveal some of this diversity.

### EVAPORATION MITIGATION

A substantial project funded by Queensland Department of Natural Resources, Mines and Water investigating the control of evaporation from water storages was completed last year.

NCEA director Erik Schmidt is enthusiastic about further progress in this vital area of water resource management.

"The project was highly successful in raising awareness of the potential for evaporation mitigation from storages. It provided detailed assessment of evaporation reduction efficiency, mechanical durability and economic performance of five evaporation control products.

"We achieved widespread publicity and further extension of these results is continuing," he said.

Researchers Michael Scobie and Ian Craig are now actively involved in monitoring a number of storages in collaboration with several industry groups and shire councils. Information packages are being developed and negotiations are underway with a number of suppliers for product evaluation.

Further research in this area is likely to focus on the potential for controlling evaporation losses from large storages where structural solutions are less viable.

The CRC for Irrigation Futures (CRC IF) has indicated support for funding this area of work. The economic viability of evaporation control will soon be readily determined using a 'ready reckoner' being developed by FSA Consulting and NCEA through CRC IF.



**Biofilter prototype for odour management.**

### USE OF LAUNDRY WATER FOR IRRIGATION

Evan Howard and Rob Loch (Landloch) and Dr Rabi Misra completed a project funded by Toowoomba City Council investigating the potential impact of irrigation using laundry grey water on Toowoomba soils.

The study looked at the characteristics of laundry water generated by various households in Toowoomba to examine potential environmental and health implications of irrigation using untreated laundry grey water.

The impact of the laundry water on a range of local soils was assessed and demonstrated how the relatively high sodium and low salt levels in laundry water tends to cause clay dispersion and sealing of pores that reduces the ability of the soils to conduct water.

Due to public health concerns, high

clay content of soils around Toowoomba and high amounts of sodium relative to calcium and magnesium in laundry grey water, together with low levels of salt, use of laundry water may not always be an attractive option

Limited reuse of this water with subsurface irrigation systems would be possible, but the cost of installation and maintenance of such irrigation systems may prohibit widespread use.

### BIOFILTERS FOR ODOUR CONTROL FOR INTENSIVE LIVESTOCK UNITS

A project funded by the Korean National Livestock Research Institute was completed recently. It concludes a three-year project completed by QDPI&F in association with NCEA. The project evaluated biofilter technologies to reduce offensive odour emissions from intensive animal operations.

Researchers gave consideration to



**The effect of grey water on various Toowoomba soils.**

best practice in terms of media selection and biofilter design and implementation strategies to achieve maximum air quality improvement with minimal expense and disruption.

The team placed strong focus on field experimentation and identification of strategies to implement biofilter technology at existing operations. They also evaluated system performance using a combination of dynamic olfactometry, electronic nose technologies and gas chromatography — mass spectrometry.

### **INTEGRATION OF GUIDANCE TECHNOLOGIES FOR AGRICULTURAL EQUIPMENT**

AusIndustry funding to AgGuide Pty Ltd is being used to develop integrated solutions for vehicle guidance. The project seeks to integrate a range of vehicle guidance technologies to produce low cost systems with high precision. The NCEA project team (Rudi Bartels, Mark Dunn, John Billingsley and Philip Palk), is providing project coordination and developing guidance algorithms for agricultural vehicle/implement control.

### **MACHINE VISION APPLICATIONS**

NCEA has been investigating implementation of precision agriculture technologies in the macadamia industry through funding from Horticulture Australia Limited.

The primary purpose of this project was to design and develop a vision-based yield monitoring device that will relate quantity and location of nuts collected by a harvester, enabling yield from individual trees to be determined and mapped.

Nuts are identified in terms of their pick-up position as defined by their location on a bristle roller using an array of web cameras. The next task was to translate these locations into absolute locations with respect to the trees, so nuts can be

ascribed to the individual tree from which they fell.

Project researcher Mark Dunn developed the required prototype hardware (cameras, processors and location hardware) and software. Field trials have demonstrated good performance, but further development is required to improve the stability and reliability of the monitoring system.

Field trials are underway to test a vision-detection system for feral animals. NCEA researchers, through John Billingsley and Mark Dunn, play a support role to the University of Queensland in this National Heritage Trust-funded project.

Automatic gates respond to signals from the vision unit to separate sheep from goats, or in the new facilities being installed in remote areas, to identify a range of animals and direct them accordingly. Success rates of greater than 90 per cent are being achieved.

An integral part of the success of these projects is the development of a rugged outdoor camera which includes a self-contained image processing unit and combines high speed digital image processing with low power consumption.

A range of agricultural applications of computer vision is currently being investigated by the NCEA. These include:

- Development of an imaging system to quantify citrus crop load and estimate yield;
- Quantification of fodder quality using machine vision; and,
- Use of machine vision to count hens in cages and identify blockages on the egg collection belt.

### **BIOMASS CHIPPER**

A project to develop an efficient chipper for mallee eucalypts is being undertaken by Richard Sulman (BioSystems Engineering) and Harry Harris. The project is

funded by Rural Industries Research and Development Corporation as well as the Western Australian Department of Conservation and Land Management, CRC for Plant Based Management of Dryland Salinity and the Oil Mallee Company.

Short rotation woody crops like mallee eucalypts offer sustainable solutions to control water tables and salinity and when harvested yield oil, power, fibre and activated carbon.

The need for an efficient and low energy harvesting and chipping system is fundamental to system adoption.

Research focused on further reducing chipping energy and increasing blade life while also investigating performance using different feed material and the impact on chip size distributions and chip quality.

For further information on these projects visit the NCEA website ([www.ncea.org.au](http://www.ncea.org.au))

## **Australian Society for Engineering in Agriculture**

The society contributes to the development of a strong engineering involvement in agriculture to aid economic growth and environmental sustainability for the entire Australian community.

### **WHO CAN JOIN SEAg?**

Membership is open to anyone interested in the application of engineering to agriculture and related industries. This includes scientists, farmers, surveyors, technical officers, engineers, manufacturers, distributors and processors.

### **REGIONAL BRANCHES**

Members can contact their local branch to discuss activities.

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or [www.ncea.org.au/seag/seag.htm](http://www.ncea.org.au/seag/seag.htm)