Society for ENGINEERING in AGRICULTURE
Ph: 02 6270 6562, Fax: 02 6273 4825
Ph: 02 9351 2947 Fax: 02 9351 3706
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LEADING EDGE

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Agriculture's role in greenhouse gas emission management

By Gary Alcorn

The recently elected federal Labor government has pledged to sign the Kyoto treaty and establish greenhouse gas management systems including carbon trading protocols.

What will be agriculture's role in limiting its contribution to CO_2 levels and providing facilities to absorb carbon from other industries? How can agricultural engineers play a leading role in this vital issue?

A research paper presented at the 2007 Society for Engineering in Agriculture Conference in late September suggested areas requiring further investigation and some useful tools to help manage this complex and ominous threat.

"Facilitation of Effective Reductions of Greenhouse Gas Emissions" was written by Guangnan Chen and Calvin Sekhesa of the National Centre for Engineering in Agriculture (NCEA), Faculty of Engineering and Surveying, University of Southern Queensland (USQ), Toowoomba, and Geoff Penton, Queensland Murray Darling Committee (QMDC).

Guangnan Chen.

CURRENT RESEARCH AND ISSUES

Overall, Australian farmers and landholders are regarded as generally not showing great interest in the current greenhouse management programs. Some of the reasons identified include: lack of conclusive research, education, extension and suitable tools, economic issues, diversity of farming systems, and uncertainty of policy and market framework.

This is further complicated by the fact that many production landholders are increasingly economically marginalised, with few resources or capabilities to invest in sustainable practices or diversified markets.

In the abstract the authors say, "Greenhouse effect is a very significant issue for the Australian agricultural and land management sector. At present, greenhouse gas emissions from Australian agriculture represent approximately 16 per cent of Australia's total national emissions.

"This paper discusses and reviews the research and key issues that need to be addressed to facilitate effective greenhouse action in Australian agriculture. It is found that all the current emission estimation tools contain no economic or mitigation components. Little is known about the most cost-effective ways to reduce agricultural emissions or enhance greenhouse sinks.

"Some initial research to address this gap is also outlined."

Guangnan says, "On one hand, there are now growing pressures from the community and general public to significantly improve the management practices of agriculture and reduce the greenhouse gas emissions from this sector.

"On the other hand, Australian agriculture is also very vulnerable to the potential impacts of climate change. For example, the gradual warming of the planet and associated climate change may lead to severely reduced rainfall and more frequent and intense droughts, with direct implications for agricultural production, and the natural ecosystems.

"Indirect impacts are also likely through changes resulting from greenhouse-induced adjustments in demand and in production, both locally and globally. The recent Stern report highlighted the potential cost of inaction on the issue of climate change," he said.

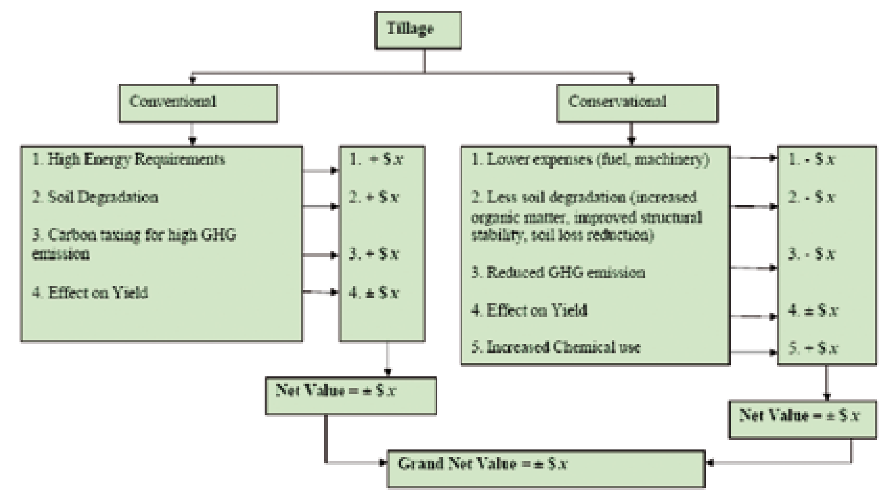
While agriculture has not been proposed to be directly included in any emission trading scheme developed so far, agriculture has demonstrated that it has considerable potential to help the mitigation of greenhouse gas emissions. In fact, it is argued that Australian greenhouse gas emissions are only 'on track' to meet Kyoto targets as a result of farmers planting trees (storage of additional carbon) and halting land clearing (reduction of emissions at source). Over the same time, emissions from the other sectors such as electricity generation are predicted to increase by as much as 60 percent from 1990 to 2010.

Despite these impressive achievements, the authors realise that neither the absolute quantities of emissions, nor the potential for mitigation of greenhouse gases from agriculture have been fully accomplished and understood.

LOOKING AFTER COTTON GROWERS

A very recent CRDC-funded research project evaluated the energy use on cotton farms. The authors are NCEA agricul-

FIGURE 1: The example of a framework for comparing the relative costs of conventional and conservation farming tillage systems – the environmental impact has been factored in the figure cost model



tural engineers Guangnan Chen and Craig Baillie.

In this project, a framework to assess the operational energy inputs of various production systems and the relative performance of a grower within an adopted system was developed.

This framework was also incorporated into a user-friendly energy assessment tool (a beta version web-enabled online energy calculator, EnergyCalc). Through the development of this on-farm energy audit tool, the operational energy costs for different cotton production systems has been determined and compared.

The authors showed that this tool is not only useful to identify total energy inputs for the overall production system, but also allows growers (the energy end users) to compare alternative farming practices or improvements at the process level.

The conference paper authors identified that the scope and diversity of Australian agriculture and its interaction with various climate variables presents major challenges to the research. But some greenhouse auditing and decision-support tools have been developed to estimate emissions from agricultural systems and to understand key processes of carbon emissions and sinks (*http://www.greenhouse.crc.org.au/tools/*).

For example, the GreenGauge model was developed by QMDC to estimate net emissions of the greenhouse gases from land-based activities that align broadly with both the Agriculture and Land Use Change and Forestry sectors identified under National Greenhouse Gas Inventory (NGGI) methodologies.

Sector-specific calculators such as Grains and Cotton Greenhouse Gas Calculators are now also available (*http://www.greenhouse.crc.org.au/tools/*; *http://www.isr.qut.edu.au/tools*). These calculators enable individual growers to roughly estimate their greenhouse footprint and compare the relative contributions from fuel, soils and nitrogen for their operation.

What remains to be defined and developed? The paper's authors advocate development of more effective tools to define best practices. They found that although a number of decision-support tools have been developed, their direct uses are still rare.

Economic issues have also not been appropriately addressed, together with the research into the socio-economic implications of climate change and mitigation actions. Consequently, little is known about the best management practices to reduce agricultural emissions, the costs of such practices, or the extent of their impact.

There are also significant uncertainties and methodological issues with current tools. In particular, the current gaps and uncertainties in measurement and experimental data will need to be addressed.

As an example of the preliminary research, they recommend that a simple input/output cost table be established to compare the relative costs of conventional and conservation farming tillage systems, with the model being broken down into three components: incomes, production expenditures, and environmental penalties, with;

Final profit =
incomes – production expenditures
– environmental damage costs

In this way, the environmental impact can be factored into the cost model. (see Figure 1)

The full text of this paper is available from the author at chengn@usq.edu.au at National Centre for Engineering in Agriculture, USQ.