CTF and Global Warming

J.N. Tullberg, CTF Solutions

INTRODUCTION.

Improved tillage systems are generally "environmentally friendly", particularly in terms of their potential to reduce on-farm energy use, runoff and loss of nutrients and crop chemicals to the environment. There are however confusing claims about the potential of improved systems to reduce agriculture's contribution to global warming and the possibility of farmers earning money from "carbon trading".

Agriculture contributes a significant proportion of Australia's greenhouse gasses, and this paper attempts summarise what we know now, and what we still need to know about the impact of improved systems.

GREENHOUSE GASES AND CROPPING

First a brief explanation of agriculture's greenhouse gases:

Carbon Dioxide (CO_2), the major greenhouse gas, is produced when fuel is used directly in farming. More is used indirectly to produce fertilisers and pesticides, and when organic matter decays. Biofuels are a greenhouse positive because the CO_2 released on burning biofuel was absorbed in growing the fuel crop.

Nitrous Oxide (N_2O) and Methane (CH_4) are also significant greenhouse gases. They are produced in smaller quantities than CO_2, but have a much more powerful greenhouse impact. N_2O, for instance produces about 300 times the global warming effect of CO_2, and also involves a loss of fertiliser from cropping soils. Animals produce large quantities of these gases from digestive processes and/or from manures.

Cropping agriculture can reduce its contribution to global warming both by reducing the emissions of greenhouse gases and by increasing the amount of carbon dioxide tied up in the soil (carbon sequestration). The general ideas are explained in figure 1.

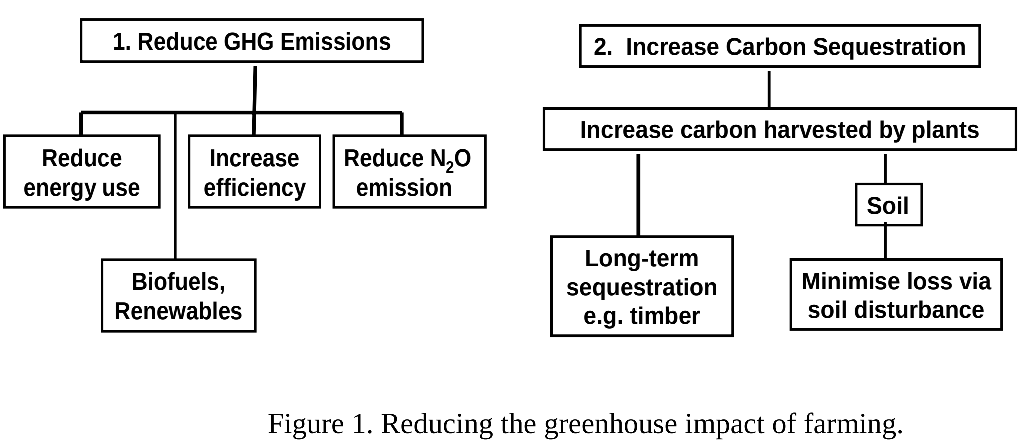

Figure 1. Reducing the greenhouse impact of farming.

THE IMPACT OF CTF

Controlled traffic farming reduces greenhouse gas emissions directly and indirectly, by reducing energy inputs, facilitating zero tillage and increasing fertiliser efficiency. Summarising these effects:

1. **Fuel Energy**. Compared with conventional, tillage based agriculture, tractor fuel requirements of uncontrolled traffic zero tillage (ZT) and controlled traffic zero tillage farming (CTF) are reduced by approximately 40% and 70% respectively. The CTF effect is a result of improved tractive efficiency and reduced draft at planting, reduced rolling resistance at harvest and spraying operations, and the total elimination of tillage. (Non-controlled traffic zero tillage will still sometimes need to eliminate wheel ruts after a wet harvest). There is good research and anecdotal evidence of these effects.

2. **Herbicide Energy**. The literature includes a variety of estimates of herbicide energy requirements in zero tillage, but none of these examine the reduction in herbicide requirement achieved by CTF. The reduction is a function of more timely spraying from permanent lanes (trafficable sooner after rain), and a further reduction occurs in those situations where agricultural chemicals can be applied in precise narrow bands. Anecdotal evidence indicates an overall mean reduction of perhaps 25%.

3. **Fertilizer Input**. Fertiliser (and seed) are generally not applied to permanent wheel tracks in CTF, reducing fertilizer costs by 10 -- 15% for narrow-spaced crops, while yield increases by about the same amount. Nitrogen fertilizer manufacture represents the biggest single energy input to many crop production systems, so CTF reduces this by 15 -- 30% per unit of production.

4. **Nitrogen Efficiency**. Research and anecdotal evidence of increased yield with less fertilizer coincide with expectations that nitrogen efficiency should increase with reduced soil compaction and improved soil biological activity in CTF. Nitrogen efficiency is generally believed to vary between 40% and 80%, so there is considerable scope for environmental and economic efficiency.

5. **Nitrous Oxide**. High concentrations of nitrogenous fertilizers are normally placed in a moist compacted seed zone at planting time, where poor internal drainage might be expected to increase denitrification and N_2O production. CTF reduces seed zone compaction and waterlogging. It also increases the practicability of aligning N supply better with crop demand by split fertilizer applications, reducing denitrification.

6. **Soil Carbon**. CTF reduces soil disturbance and improves the potential for cropping to mimic natural vegetation in maximising dry matter production (and water use) by double cropping or cover cropping. Increased soil biological activity and soil organic matter levels have been demonstrated in different environments, so increased soil carbon sequestration might be expected.

It is interesting to note that all these reductions in greenhouse gas emissions occur because controlled traffic farming improves the efficiency of management inputs -- energy, fertilizers and crop chemicals. Although we know a lot about the energy saving aspects of CTF, much less is known of its influence on fertiliser efficiency and carbon sequestration. These are important topics that require urgent investigation.

CONCLUSION

Controlled traffic farming is the key to a significant reduction in greenhouse gas emissions of broadacre crop production. Soil carbon levels should also be greater under CTF than under alternative systems. This improvement in agriculture's global warming performance can be achieved without financial penalty while simultaneously reducing costs and increasing production.

REFERENCE

The Potential of Conservation Agriculture for the Clean Development Mechanism. Report commissioned by the United Nations Asia-Pacific Centre for Agricultural Engineering and Mechanisation. (available at: http://www.unapcaem.org/admin/exb/ADImage/ConservationAgri/CA.pdf)