Mallee on-farm controlled traffic trials.

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INTRODUCTION

The GRDC-funded project 'Novel farming systems to improve productivity and reduce risk in the Mallee' is looking at the different arrangements of crop that are made possible with controlled traffic and machinery guidance. As part of the project, I toured controlled traffic farmers and researchers in Southern Queensland and Northern NSW towards the end of the 2000 winter cropping season, with the aim of assessing whether controlled traffic would be practical on Mallee farms. The performance of controlled traffic farms, relative to conventional farms, in a very dry season, and the positive attitudes of farmers, was very convincing. This raised the question, is controlled traffic worth doing in the Mallee for its own sake?

Mallee farmers should share the same reduced input cost and ease of management benefits as Qld/NSW farmers, but could the same yield benefits be expected? It was relatively easy to explain why controlled traffic improved yields in the Qld/NSW environment. The lack of understanding of compaction in Mallee soils, and the complexity of the role of the soil in Mallee cropping systems, made applying the same principles to the Mallee a difficult task. By accident, most farmers run some sort of controlled traffic demonstration in their existing system, and there would be some that could be considered as trials. If these trials could be harvested, then a measure of the yield benefit of controlled traffic in the Mallee could be obtained at a relatively small cost.

This article considers why controlled traffic works in the farming systems of Northern New South Wales and Southern Queensland, how it might work in the Mallee, and how the 'accidental' Mallee controlled traffic trials can be identified and harvested. To understand why controlled traffic works (or doesn't), it is important to appreciate the environments in which it has so far been successful.

SOUTHERN QUEENSLAND/NORTHERN NEW SOUTH WALES FARMING SYSTEMS

The productive capacities and problems faced by these farming systems are very different to those experienced by farmers in the Mallee. The entire area is based on brown, grey and black cracking clays (similar in appearance to Wimmera grey clay). These clays are uniform, compared to Mallee sandy loams which have a pronounced top- and sub-soil. Apart from their greater ability to store water and nutrients, the most significant characteristic of these soils is their ability to 'crack' when dry. This allows them to self-repair at least some soil compaction, each year.

The reliable rain in these areas is summer rain, which may be erratic in timing and amount, but occurs each year. Winter rainfall is completely unpredictable both in timing and quantity and may vary from almost nothing to more than is received over summer. Thus these farmers rely most heavily on summer rain. Summer crops (sorghum, dryland cotton, corn) are routinely grown and in many areas are the major, reliable part of farm income. Winter crops (wheat, chickpeas, canola) are a bonus, or part of weed management for summer crops. Winter crops are sown on stored summer moisture, with some sowing rains, and may be profitable with only 50 mm of growing season rainfall, provided the soil profile was 'full' at sowing. Much of winter crop management is directed at conserving summer rainfall.

The erratic nature of winter rainfall and the problem of conserving stored moisture means that the systems share the Mallee problem of matching nitrogen supply to water supply. However, they are aiming at prime hard protein levels so the penalties are higher. The soil profile is full of moisture at sowing and temperatures are warm, so excess nitrogen allows plants to grow quickly and use the stored soil moisture, leaving little remaining for grain-filling. Many farmers are interested in ways of applying nitrogen after a rain (ie. other than broadcasting) to overcome this problem. High sowing rates exacerbate the problems of high nitrogen (growth and hence water use, can occur even faster if there are more plants) and plant populations in cereal crops are quite low - around 80-90 plants/m2.

There are differences, too. There may be a good crop, but very little winter weed growth, if it is grown on stored moisture until the canopy closes. There were no reported problems with take-all, CCN, Rhizoctonia or Pratyclenchus. The problem disease is crown rot, and farmers could (and do) grow continuous wheat where this is not present. Water management is a big issue, with many intense rainfall events over summer. Concentrated run-off results in erosion and strategies for dealing with it either aim at getting the water off the paddock with a minimum of damage (contour banks), or trying to keep it where it falls.

While farmers in the Mallee may hear much about the problems of land clearing in this area, they might be surprised to see just how much land remains uncleared, compared to the Mallee. Many farmers also have a significant income from grazing, partly because they have large areas of land that they are unable to develop for cropping.

There are farmers in this area practising controlled traffic, and stubble retention, but there are also many farmers persisting with traditional paddock management and mechanical fallows. Lloyd O'Connell, a Toowoomba-based journalist, warned me before I arrived in Qld that there would not be many crops to see in late September, 2000. It had been a very dry winter and many farmers were grazing crops or cutting them for hay. The startling thing about the controlled-traffic farms that I visited was that they had winter crops, which would go on to produce at least fair to average yields in a very dry year. What caused the difference?

CONTROLLED TRAFFIC BENEFITS IN SOUTHERN QUEENSLAND / NORTHERN NEW SOUTH WALES

When asked about the benefits of controlled traffic, many of the farmers I visited felt that the major benefit they experienced, but had not expected, was increased simplicity and ease of management. With the path for every operation already laid out on the paddock, it was very easy to 'go out and do things'. This in turn facilitated other changes to the farming system. Eg. spraying became much easier, and made the shift to stubble retention/reduced tillage easy (if they were not already practising this).

Farmers had experienced the expected benefits of reduced input costs (from reduced overlap) and better tractor performance (from the better tractive situation on permanent tracks compared with cultivated soil). Some had bought smaller tractors or completely changed the layout of their farms. The other major benefit, of better crop performance, was obvious. Farmers attributed most of the difference in their crops to better storage of water in summer fallows.

Soil Compaction Reduces Infiltration Rates

Controlled traffic (CT) farmers attributed at least part of the extra water conserved in their (chemical) summer fallows to reduced compaction in un-trafficked areas, and part to stubble retention and reduced cultivation. Stubble retention reduces evaporation by shielding the soil surface from the sun. Cultivation and compaction reduce the number, size and continuity of soil pores and tend to decrease infiltration rates. Because of the intensity of summer rainfall, high infiltration rates are necessary to get the water into the soil - these crops may have to rely entirely on stored moisture. The cracks help, but once the cracks are full and the soil starts to swell, the water must move into the soil aggregates, or run off.

The movement of water into the soil is similar to water movement in pipes - it increases with the square of the diameter - so pore size is very important. Clays in their cultivated state have naturally smaller pores than sands and inherently low infiltration rates. Uncultivated clay soils may have better structure than Mallee sandy loams and higher infiltration rates. Several farmers were able to show me, on controlled traffic paddocks, where spray equipment or harvesters and trucks running off the tracks had resulted in compaction and a noticeable decrease in yield (on the compacted areas).

Implementation of controlled traffic is not as difficult as made out in the media

The other major message from Qld/NSW farmers was that controlled traffic had been easy to implement. Media articles on controlled traffic tend to focus on the sensational, eg. tractors that have their wheelbase widened to fit on the same tracks as the harvester, and explain how easy and inexpensive it is to do the modifications. Ironically, this may have the unintended effect of making controlled traffic seem more difficult than it really is. None of the farmers I visited had altered tractor wheelbases, most taking the sensible attitude that harvesting, at a time when soil is driest, is least likely to cause soil compaction! All were keen to minimise harvest traffic, but most did this by unloading only on headlands and not using chaser bins.

CAPTURING THE BENEFITS OF CONTROLLED TRAFFIC FOR THE MALLEE

Mallee farmers would undoubtedly share the same controlled-traffic benefits for management and input costs as Qld/NSW farmers. The degree to which these benefits are realised would depend on the cropping intensity and number of operations. The environmental benefit of reduced run-off, because of higher infiltration rates, would not be important in the Mallee. The big question is, are there any benefits for yield? The major yield benefits of CT in Qld/NSW relate to its effect on the soil in that system. The situation is conceptually simple - there is one major limiting factor which is available over a short period of time - water, there is a deep, relatively homogeneous soil to store it in, and controlled traffic allows more to be stored. Apart from the common limiting factor, this is so different from Mallee soils in Mallee systems, and I cannot begin to predict what the effect of compaction may be. For example, in some years compaction may actually be beneficial, if it restricts root growth and preserves soil moisture for the grain-filling period. There is very little relevant research in the Mallee to help answer the question.

There was one controlled-traffic trial in the South Australian Mallee, which demonstrated a slight yield increase after several years of trials. Deep-ripping, if the main effect was to break the zone of compaction and improve root growth into the sub-soil, should be relevant. A deep-ripping trial conducted at the Mallee

Research Station, Walpeup, was inconclusive, probably because the ripping was done at the start of a cultivated long fallow, which may have restored much of the compaction before sowing.

My theory is that the effects of compaction are not self-evident in the Mallee, because most Mallee soils do not self-repair. Most of the compaction has probably already been done. There are certainly clays in the sub-soil that crack on drying, but they are below the important zone of compaction that forms the 'plough-pan', close to the top-soil. Taking traffic off the soil would not bring about the rapid improvement seen on the cracking clays. However, there might be a slow improvement that could be quite significant after many years. Fortunately, there must be Mallee farmers who have been inadvertently conducting trials to test this theory. If you are a farmer, you may well be one of them.

MALLEE FARMERS RUN EXTENSIVE ON-FARM CONTROLLED-TRAFFIC TRIALS

On most Mallee farms there will be areas where traffic has been controlled by accident. This happens because the tractor cannot come within a certain distance of the edge of a paddock on the first round (this depends on the implements you use). Most of these areas will be confounded with the effect of trees and weeds, or other traffic eg. weed control along fence-lines, headlands in up-and-back working, truck traffic at harvest. However, there will be some areas in some cropping paddocks with minimal traffic. This constitutes a controlled-traffic demonstration (Figure 1.). If every implement you have used in the last ten years has been at least three times the width of the wheelbase of your widest tractor, then the controlled-traffic and high-traffic strips would be easy to identify and wide enough to harvest with a plot-harvester.

If you think you have a situation like this on your farm, please get in touch. We will try to get together some resources to harvest some of these 'trials' this year. Contact Ben Jones, Ag Vic, Walpeup (03) 5091 7200

PRACTICAL ASPECTS OF CONTROLLED TRAFFIC IN THE MALLEE

While the machinery aspect of controlled traffic may present no more challenge than what it does in N. NSW/ S. Qld, layout of controlled traffic farms in the Mallee presents both a problem and an opportunity. The problem is that it is difficult to run controlled traffic tracks parallel to a sandhill, because the implement tends to 'fall' down the hill behind the tractor and destroy the tracks. Running the tracks perpendicular to the hill solves this problem, but may challenge tractors that are closely matched to implement draft, if the disadvantage of going up the hill is not outweighed by extra traction from the tracks. Where the dunes are not simple, linear ones, there may be no easy solution. The opportunity lies in getting out of layouts that use headlands, instead working up-and-back, and using roads, edges of paddocks, or other unproductive land (instead sown to perennial pasture) to turn on.

CONCLUSION

The benefits of controlling traffic for yield in the Mallee are uncertain, but could potentially be determined quite easily. However, the benefits for management and input costs should be similar to those experienced by southern Queensland and northern New South Wales controlled traffic farmers.