Using minimum tillage and controlled traffic to reduce the risk of cropping in the Burnett.

Richard Mason, Jim Page and Martin Cloete (DPI, Kingaroy and Nambour).

Introduction

The purpose of this paper is to estimate the value of applying minimum tillage and controlled traffic technology in a peanut/maize rotation in the South Burnett. These changes are evaluated over a five-year period. The addition of a wheat crop between the peanut and maize crops combined with a reduction in tillage over the whole property improves the probability of a higher equity at the end of five years. The current peanut - maize rotation where all weed control and seedbed preparation is by tillage produces a fifty percent chance that the owner will be worse off in five years time than he is now.

A small number of peanut growers have trialed and are adopting the technology described here. Their experiences over the last five years combined with the development and research work currently in progress form the basis in the assumptions of this paper.

The benefits of minimum tillage and controlled traffic.

Water is the most limiting resource in the rain grown environment of the Burnett. The aim of minimum or zero tillage and controlled traffic is to improve the efficiency of the resources that are most limiting- rainfall and sunshine (Yule, 1995). Reducing the tillage operations to a single planting operation minimises the amount of rainfall that is required to prepare a seedbed. Maximising stubble cover by reducing tillage and including a winter crop in the rotation minimises runoff in high intensity rain to the extent that it only occurs when there is a full profile of moisture.

Controlled traffic involves containing all tractor and harvesting wheels to permanent laneways. This reduces the energy requirements of most operations, and reduces soil compaction in the cropped area thereby aiding root development and water transport through the subsoil (Tullberg, 1995).

Replacing mechanical weed control with herbicides improves the timeliness of operations and allows the maize and wheat crops to be planted on time without the loss of moisture. Spraying rather than cultivating weeds reduces labour input. Over the five years of this analysis the total labour input decreased despite the increase in total crop area. The real cost of commonly used herbicides has reduced over the last ten years but the cost of tractors and tillage equipment has risen. In time, some of the tillage equipment and one tractor could be sold from this property as the benefits of reduced tillage and controlled traffic are achieved.

In a reduced tillage system peanuts and maize continue to be grown in 90cm rows and wheat in 30cm rows. Peanuts have been successfully grown under zero tillage but there is some risk of high harvest losses if the soil is dry when the peanuts are pulled. Growing peanuts in raised beds with controlled traffic where there is a permanent wheel track every 1.8m has minimised many of the problems associated with harvesting zero tillage peanuts. A possible method for growing peanuts in a controlled traffic system was described in the last peanut conference proceedings (Mason and Tullberg, 1994).

Assumptions and Analysis

Many evaluations of minimum tillage and controlled traffic have tended to focus on the short-term benefits. This evaluation recognises the long term nature of this technology and looks at the changes over a five year period. The risks inherent in farming and technical change are accounted for by using a risk analysis technique based on @RISK software. This software calculates the probability of the full range of financial outcomes associated with uncertain and unpredictable technical outcomes, climatic and market conditions.

The current and proposed farm systems are shown in table 1. Year 1 (the current system) is based on an actual property in the Burnett and assumptions have been made as the system changes over the

five years. This information is used to generate enterprise contribution (the contribution of an enterprise to the un-allocated fixed costs of a farm) margins for each year.

Two scenarios are considered:
1. current (continuation of situation outlined for year 1 in the first column) and
2. implementation of minimum till and controlled traffic technology over a three year period, the inclusion of a winter cereal crop in the peanut/ maize rotation with the changes measured for a 5 year period (columns 1 - 5).

The red soils of the Burnett store very little water over a fallow (Bell 1997). It is this characteristic that allows a winter crop to be grown in most years without jeopardising a following maize crop. It is assumed that the "worst" and the "best" peanut yields will not change over the five years but the most likely will improve from 1.3t/ha to 1.5t/ha as the soil and water use efficiency improves. The worst maize yield will decrease over the five years from 1.8t/ha to 1.5t/ha because of the proceeding wheat crop but this is offset by an increase in the most likely yield from 3 to 3.5t/ha. Prices received for the crops have not been altered between the systems.

Variable costs have remained relatively constant for both systems. Savings in fuel, oil, repairs and maintenance on machinery have reduced in minimum tillage system but this is replaced by herbicide costs and higher fertiliser requirements.

Table 1: The cropping systems both current and proposed

			Year 1 (current)	Year 2	Year 3	Year 4	Year 5
Area farmed (ha)			350	350	350	350	350
Area of crop (ha)	Peanuts		154	196	154	196	154
Maize			196	196	196	196	196
Wheat				100	150	154	196
Labour (hr/ha)	Peanuts		4.6	4.0	4.0	3.5	3.5
Maize			2.56	1.9	1.5	1.3	1.3
Wheat				0.88	0.88	0.88	0.88
Total (hours)			1210	1165	1042	1022	966
Yields (t/ha)	**Peanuts**	Worst	0	0	0	0	0
		Most -Likely	1.3	1.3	1.3	1.5	1.5
		Best	4.4	4.4	4.4	4.4	4.4
	Maize	Worst	1.8	1..5	1..5	1..5	1.5
		Most -Likely	3	3.3	3.4	3.5	3.5
		Best	4.2	4.2	4.2	4.2	4.2
	Wheat	Worst		0.2	0.5	0.5	0.5
		Most -Likely		1.2	1.8	1.8	1.8
		Best		3.2	3.2	3.2	3.2
Price ($/ha)	**Peanuts**	Worst	300	300	300	300	300
		Most -Likely	650	650	650	650	650
		Best	850	850	850	850	850
	Maize	Worst	120	120	120	120	120
		Most -Likely	140	140	140	140	140
		Best	240	240	240	240	240
	Wheat	Worst		90	90	90	90
		Most -Likely		130	130	130	130
		Best		200	200	200	200
Variable Costs ($/ha)	**Peanuts**		425	425	425	405	405
	Maize		206	206	206	200	200
	Wheat			97	97	97	97
Fixed Cash Costs ($/yr)		(000's)	30.5	30.5	30.5	30.5	30.5
Fixed Machinery Cost ($/ha)							
(not included above)	Peanuts		242	242	229	219	214
	Maize		90	72	56	35	35
	Wheat			24	24	24	24

The enterprise contributions and an overhead cost budget (common to both scenarios) were linked to an accounting model of profit and loss and balance sheet. The financial model was used to calculate change in equity at the end of five years for the two systems described. The opening balance sheet

position included an asset and debt structure typically associated with a peanut farm cultivating the areas denoted above.

When a risk analysis is conducted ranges of possible yield, price and cost outcomes are specified. The probability of achieving various increases in equity (equity in year five from the balance sheet) for the full range of possible yield, price and cost combinations over the five year period is then calculated by the risk analysis software. In this instance, a modified triangular distribution was used to specify expected yield and prices. A modified triangular distribution is defined by estimates of the best, most likely and worst expected outcomes with a further specification of the likelihood of the best and worst outcomes.

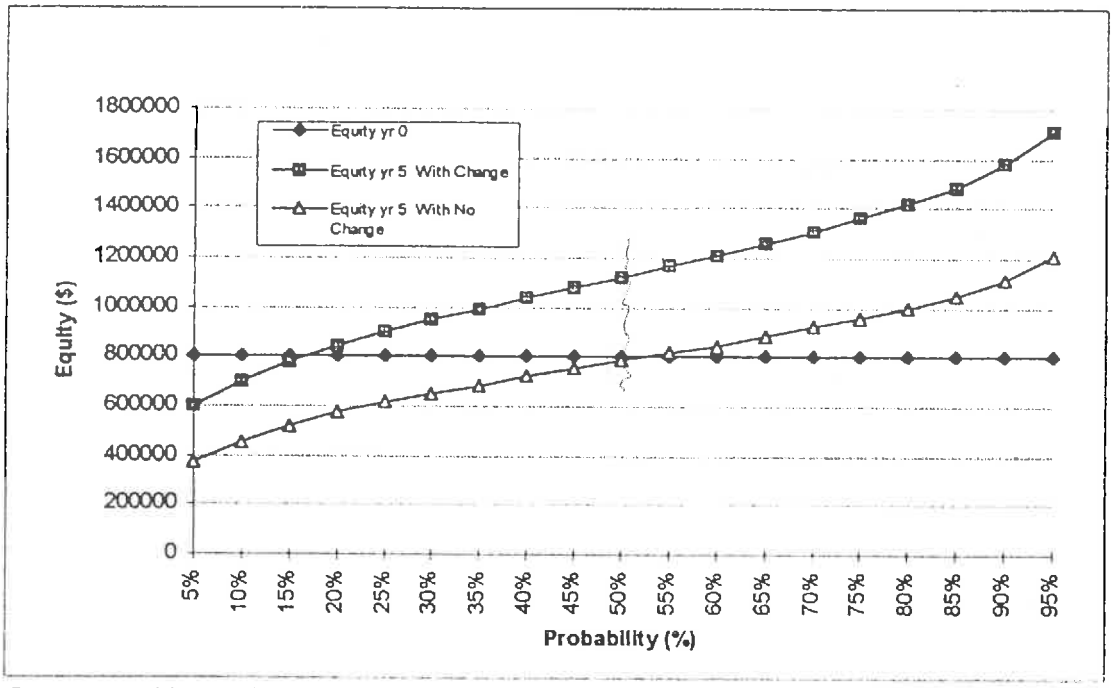
Does it pay to change?

The comparison of the current and the "new" with minimum-till and controlled traffic is shown in Graph 1. In this graph the vertical axis shows the level of equity in the business at the end of the five year period and the horizontal axis shows the probability of the different levels of equity that may eventuate depending on seasonal and market conditions and agronomic outcomes.

The change in equity due to the technology is given by the difference between the with and without lines on the graph. At each probability level a higher level of wealth ($200-250 000) is generated over the five year period compared to the current system.

This graph suggests that a peanut farmer who continues with the current method of growing peanuts has a 50% probability of negative business growth over a five year period and that he could halve his equity from around $800 000 to $400 000.

If the producer adopts a minimum till and controlled traffic the result is shown to have a high probability of increasing wealth with only a 15% chance of wealth reduction and possibility that owners equity could be doubled in five years.



Graph 1: Change in equity at end of year 5.

The assumptions this is based on are conservative. There is still the capacity for some tillage prior to the peanut crop and most of the machinery remains on the property. It was assumed that yields remained constant in the current system. Experience and research has shown that this is unlikely and yields will probably fall in the long term in the conventional system (Bridge and Bell, 1994).

Future analysis of minimum tillage and controlled traffic will be enhanced by accessing the yield probabilities generated over 85 years of rainfall data by the APSIN models for wheat, maize and peanuts. More reliable frequency distributions rather than estimates of the worst, most likely, and best yields for each of these crops will improve the accuracy of this evaluation.

Conclusion

This analysis shows the high value and low risk of including a winter cereal in a peanut - maize rotation based on minimum till and controlled traffic. The technology has a high potential pay-off with a significant reduction in the possibility that the farm will loose money as a result of the change.

This analysis goes some way to explaining why some producers in the Burnett have struggled and sold up over the last ten years and why even more will struggle in the future. If at the end of five years there is only a fifty percent chance of having a higher equity than at the start, a run of dry years will almost guarantee a lower equity. If the property has low equity to start with there is a short time frame between being viable and non-viable.

Herbicides replace mechanical weed control when appropriate and a minimal amount of capital is locked up in machinery and tractors. They use contractors and form syndicates formed to reduce the cost of machinery sitting in sheds and to achieve economies of scale. They obtain advice from a specialist that helps them with their marketing and production decisions. They see changes to the way crops are grown and sold as a challenge rather than a threat.

The system of growing peanuts using minimum tillage and controlled traffic involves change, but it can be profitable. This technology is not without its problems but the combination of innovation, development and time will overcome what today seems to be impossible. What is needed now is wide scale adoption of this technology to develop it and secure the future of the cropping industry in the Burnett.

References

Bell (1997) Pers Comm

Bridge B.J. and Bell M.J. (1994) Effects of Cropping on the Physical Fertility of Krasnozems. Australian Journal of Soil Research. **32** 1253 - 73

Mason R.M. and Tullberg J.N.(1994) Controlled Traffic - A New Tillage System for Growing Peanuts. **Australian Peanut Conference Proceedings: Gladstone**

Tullberg J.N. (1995) Controlled Traffic Common Sense or Nonsense. **National Controlled Traffic Conference Proceedings : Rockhampton**

Yule D.F. (1995) Controlled Traffic for Broadacre Dryland Farming: Better than Sliced Bread. **National Controlled Traffic Conference Proceedings : Rockhampton**