FARMING SYSTEMS - THE NEED FOR ECONOMICS AND INTEGRATION

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Summary. Agronomy is mostly researched and presented to farmers on a piecemeal basis. There is a need for research and information output to be in a farming systems context, which takes into account farm management and profitability. Good farm profits result from attention to five areas of management. One of these - the *optimum mix of crops* - needs to be assessed over several years on a whole farm basis in well planned rotations. Extra profit results from synergies where combinations of practices solve problems of weeds, disease and fertility decline, while reducing farm costs and providing diversification and risk management. The results of agronomic research are often under-estimated if the synergies of well planned farming systems are not examined.

INTRODUCTION

Despite a lot of research on profitable and sustainable farming, the average grain farmer in Australia is not making a profit and is far from sustainable. National survey data from the Australian Bureau of Agriculture and Resource Economics (ABARE, 1994) shows less than 50% of Australian broadacre farms made a business profit (after allowing for wages of farm owners and depreciation on machinery) during the past four years (Table 1).

Table 1. Profit performance - Farms growing wheat and other crops.

Type of Farm		1989-90	1990-91	1991-2	1992-3	1993-4*s*
	Wheat and other Crops					
Proportion with negative profit (%)	72	59	41	41	53	
Income class: $200 000 to $400 000						
Average Australian farm	(% return)*	11.3	3.0	4.5	4.3	5.2
Average Queensland farm	(% return)*	6.6	2.5	5.8	2.9	6.9
Top 25% of farms	(% return)*	35.0	11.4	14.3	11.5	16.6

* Rate of return of farm business profit to opening capital at full equity.

Source: ABARE Farm surveys reports. *s*: Provisional estimates

However, while most grain farms are not making a profit, the *top 25% of farms* (with $200 000-$400 000 gross income) make good profits which represent a return of more than 10% on invested capital (Table 1).

They make good profits, in spite of adverse economic conditions by continuing to fine- tune the most profitable mix of enterprises on their farms, aiming for top yields of good quality products that the market wants, and marketing these well. The farmers who are not making a profit tend to have low yields,

produce low value crops, and lack marketing strategies or plans for timeliness and risk management. The most important ingredient of the farm profit crisis is a lack of management skills on the part of the average farmer.

There is much to be learnt from the study of profitable farms, where many aspects of production are being well integrated for maximum synergy and profit. Research needs to consider whole farm systems, economics and farm management for the results to provide meaningful output for farmers and for the research to fit well with other practices and overcome problems to improve farm profitability.

DISCUSSION

Improved farm management

Good farm managers attend to five important aspects of business management (Table 2).

Agronomic research also needs to consider these aspects of farm business management and where the output of the research will fit into profitable farming systems. There are many areas of synergy in farming systems where practices such as minimum tillage, crop rotation, and legumes fit well together and solve many farming problems as well as providing for diversity and risk management.

Table 2. Important aspects of farm business management.

1. *Optimum Enterprise Mix*
Most profitable combination of crops or enterprises
Market focus on quality products
Rotation programs with risk management and diversification
2. *Optimum Yields*
Good yields and water use efficiency
Minimum tillage, rotations and fertiliser management
Good planning and timely operations
3. *Efficiency*
Planning rotations and farm programs to minimise production costs
Minimised labour and overhead costs
Check interest rates and other administration costs
4. *Marketing*
Focus on market demand for products and quality premiums
Risk management and price insurance
Marketing strategies to improve average prices
5. *Making it Happen*
Direction and motivation, knowing what is possible
Timing - planning and managing to get things done!
Information on agronomy, markets, business etc.
Structure: the right business entity, finance and succession plans

It can be seen from this outline that farm profitability depends on much more than technical efficiency and optimum yields. There is a need to put together a profitable combination of enterprises in a rotation

program which minimises costs and attends to problems such as plant disease and risks such as frost and drought.

Good profitability emerges when the whole business is managed well - when extra premiums (for quality products, high protein etc) and extra yield (from attention to detail and avoiding problems) are realised in a diversified program which is also efficient in terms of labour and machinery costs.

Zero-tillage provides an example of a practice which is undervalued by research trials. Yield results in trials are often constrained by a lack of rotation and may include treatments with less than adequate fertility. In practice, farmers use rotations and fertiliser or legumes to avoid problems, but they also benefit from labour savings and reduced machinery costs. One of the most important benefits of zero-tillage to many wheat farmers is an improvement in yield, by as much as 100% (1, 2), which may occur in dry years when protein and prices are high. Zero-tillage should be a vital part of drought management on most grain farms.

The icing on the cake for a good farming program is a healthy soil where maintenance of structure, fertility, erosion control, earthworms and organic matter are optimised by practices which generally include crop rotation, legumes, reduced tillage and pasture leys. The synergistic aspects of combining these practices will improve water use efficiency and yield, and will also minimise land degradation. The most profitable farm is also likely to be the most sustainable (3).

Assessing farming systems

There is always a large variation in profitability between crop options. However, Gross Margin comparisons are misleading because different fallow lengths may be used for different crops, extra benefits may arise from certain crop sequences and the labour and overhead costs may vary.

There is a need to examine whole farm systems or to compare rotations over several years to allow for varying crop frequency and consider rotational benefits such as disease control or nitrogen inputs from legumes. Also, the overheads and labour costs need to be considered. For example, cotton may require more investment in machinery and more labour while a pasture rotation may require less.

A crop might be included in a rotation because there are benefits from weed control, a reduction in risk, and/or a spread of labour and machinery requirements over the year. An example of this is growing sorghum in lower rainfall wheat areas. Sorghum may not appear to be as profitable as wheat per hectare, but could provide a rotation break for soil borne diseases and good control of winter weeds, such as wild oats. Further benefits from growing sorghum in summer and wheat in winter are a diversification of cropping, a spread of farm workload and reduced machinery requirements and farm overhead costs.

Although one crop may appear more profitable on paper, a rotational farming program which maintains fertility, controls diseases and allows timely planting and harvesting of component crops is likely to be the most profitable. Some examples of possible roations are presented in Table 3.

Table 3. Likely profit from crop rotations for a 500 ha farm receiving 650 mm rainfall, for example, Darling Downs, Queensland.

Rotation 2	Crop frequency	Deep clay soil		Light or shallow soil	
		Profit1 ($)	Return3 (%)	Profit1 ($)	Return3 (%)

Wheat - cotton W - LF- C - LF	(2 crops in 3 yrs)	63 400	7.7	716	0.1
Wheat - sorghum W - LF - S - LF	(2 crops in 3 yrs)	23 900	2.9	- 8 000	- 1.2
Sorghum, wheat 3 years W - B - W - LF - S - S - S	(5 crops in 6 years)	19 200	2.2	- 6 000	- 1.0
Wheat, cotton, sorghum W - LF - C - S - S - C - LF	(5 crops in 6 years)	63 500	7.7	8 605	1.5
Barley, sorghum and legumes B - DC - MB - S - S - DC - CP	(5 crops 4 years)	49 300	6.0	31 400	4.8

1. Based on current prices and crop yields derived from research and farmer experience

2. LF, Long Fallow; DC, Double Crop; W, Wheat; S, Sorghum; C, Cotton; B, Barley; MB, Mung Beans; CP, Chickpeas

3. Return is calculated on capital invested in land and machinery after allowance for depreciation and owner's labour.

Soil type and water holding capacity are other factors which may influence the optimum rotation. Comparisons of rotation outcomes for the Darling Downs (Table 3) show that rotations including dryland cotton are profitable on deep clay soils but, on lighter soils, an opportunity cropping system with higher crop frequency is likely to be more profitable.

Profit from system synergies

Rotations need to be flexible and to allow for changes in response to crop profitability and seasonal rainfall. In practice, most farming systems are, or should be, *opportunity* cropping systems. Crop frequency should increase with rainfall and as moisture storage is limited by soil depth.

An economic comparison of programs for eastern Downs farms (Table 4) shows the current program of many farmers is not profitable but, with opportunity cropping, legumes and zero-tillage, profit increases to a respectable level. With further efficiencies resulting from an increase in farm size, profit can be increased by a further 50%. Double cropping may not eventuate every year. A flexible program can capitalise on a double crop if there is enough soil moisture for a good chance of success. In some periods, crop frequency may be less than 100%, while in others it may approach 200%.

Table 4. Economic comparison of farming systems for a 320 ha farm (240 ha cultivation) on the eastern Downs receiving 700 mm rainfall.

	Barley, sorghum sunflower program *cultivated fallow*	Opportunity crop with legumes *zero-tillage 2*	Situation with extra 120ha leased land

Gross return ($/ha)	396	589	589
Growing costs ($/ha)	238	316	316
Overhead costs3 ($/ha)	167	167	117
Profit1($/ha)	-9	106	156

1. Based on current prices and crop yields derived from research and farmer experience

2. Mung beans and chickpeas grown, with crop frequency of 1.33.

3. Includes, rates, administration, machinery depreciation and labour

On the Western Downs (570 mm rainfall) wheat monoculture is barely profitable when the wheat yield and protein levels fall after some 25 to 30 years of cultivation (4). Nitrogen fertiliser is only profitable when used in conjunction with zero-tillage (for improved yield) and crop rotation (for disease control) and in such a system, profit would increase to $60/ha. But nitrogen fertiliser has little impact on grain protein. Wheat growing in rotation following lucerne has a profit of $172/ha due to price premiums for increased protein. With $40 per hectare from grazed lucerne, the average profit from 3 years of lucerne and 3 years of wheat after lucerne would be $97/ha. In a N deficient situation, it can be more profitable to reduce the crop are a by half in a rotation with lucerne! These examples show there are many important aspects of farming systems and farm economics which need to be considered when designing and reporting research.

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