

An overview of the benefits delivered by research and new technology to farmers in South-Eastern-Australia

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Abstract

This paper examines from a farmer's viewpoint, the key benefits of research that have been delivered to farmers in South Eastern Australia: firstly, the development of the Canola industry and its consequences; secondly, the adoption of minimum tillage and zero tillage practices, thirdly the recognition of the importance of lucerne in the pasture phase; and finally research concerning the key economic drivers of profit and the management of risk.

Key Words

Pastures, Break-crops, Herbicides, Profitability, Soils

INTRODUCTION

Great benefits to the grains industry have resulted as a consequence of the delivery of well targeted research and development. This paper examines four research outcomes considered by farmers to be the most significant drivers of benefits to the industry. Outcomes include the development of the Canola crop, the adoption of minimum tillage and zero tillage, the rediscovery of lucerne and its contribution to the pasture phase, and the role of benchmarking and the key drivers of profitability. Finally, the paper focuses the increasing interest farmers now have in soils, particularly an understanding of soil biology and how the knowledge can be practiced to grow more successful crops.

DEVELOPMENT OF CANOLA

Canola has grown in importance in the past two decades and today is one of the leading drivers of farm profitability in south-eastern Australia. The development of canola crops has been fast – only 170,000 tonnes of it was produced seven years ago, and today production is close to 2 million tonnes. The move away from a dependence on traditional cereal crops and endeavours to increase profitability in the break crop cycle have been two of the key drivers in this growth, as has been the increasing importance of canola in a healthy consumer diet.

Canola was first grown in Australia in 1960, with the first commercial crops beginning in 1969. Early crops consisted entirely of Canadian varieties which did not deliver to market expectations. Low oil content in varieties combined with susceptibility to disease resulted in poor growth of the Canola industry (2). Early Canola breeding made slow progress in terms of quality and blackleg resistance. The industry was devastated by widespread blackleg disease in 1970, especially in Western Australia where yield losses of up to 80% were reported (2). The growth of the Canola industry was severely hampered by the continued lack of disease resistant varieties.

As a result breeders began working on varieties that were disease resistant, beginning with blackleg. Victoria began setting up the first breeding program in 1970 (Buzza), followed by Western Australia (Roy) and New South Wales in 1973 (Wratten). The first varieties to provide high yield and disease resistance were released in 1988, namely Maluka and Shiralee in New South Wales. The rapid expansion of Canola today is due to the increased availability of new varieties with disease and herbicide resistance, as well as the associated high yields as a consequence of advances in research and development. Current varieties of canola have the highest level of blackleg resistance of any spring canola varieties in the world (5).

The average yield of canola has substantially increased since breeding programs have been in place, with new varieties producing treble the yields of earlier varieties, making canola very profitable in its own right, as well as being an excellent break-crop for helping control root diseases of cereals.

Wheat yields are higher after canola compared to other crops such as pulses and wheat on fallow, probably because canola roots release isothiocyanates, chemicals that influence the activity of soil organisms. These chemicals reduce the activity of disease organisms, especially take-all, and thus give farmers the confidence to apply nitrogen fertiliser, thereby boosting yields even further. Tests have also shown that nitrogen levels in the soil are higher following canola than after other break-crops (3).

The development of varieties with different maturing rates has enabled the spread of canola into new zones, including the low rainfall area. Increased distribution of the canola industry has dramatically raised canola production and dramatically increased Australia's export markets, as shown in Figure 1 below.

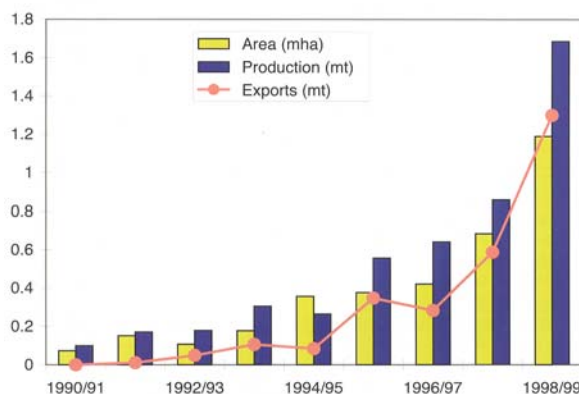


Figure 1: Australian canola area, production and exports (Source: Colton and Potter 1999)

Improved quality of Canola varieties has promoted increased profitability and assurance for canola growers. Improvements have included the reduction of linolenic acid and saturated fatty acid content, and enhanced oleic acid levels (5). New mid season varieties with a high oil and protein content are being developed to enable a greater variety of cropping options for farmers. Further, canola's responsiveness to lime has benefited the industry by encouraging liming of acidic soils. The area that canola can cover has thereby been dramatically increased.

Along with newly developed varieties, crop agronomy has greatly contributed to improving the overall success of canola. The Canola Check decision support program, developed by John Sykes of NSW Agriculture, greatly helped increase the area sown to canola in Victoria and South Australia. A critical objective of Canola Check, in terms of overall industry development, was to ensure available technology was regularly used by new and experienced growers, maximising total farm productivity. TOPCROP and industry organisations supplying information to farmers have built on this earlier work and have helped growers to increase their agronomic and marketing skills.

An additional valuable program is the Australian Crop Accreditation Scheme, which helps farmers make informed decisions on the most profitable crops available. The advent of consultants has helped the adoption of research advances in the canola industry and with the growth of the electronic information age, their activities are likely to expand rapidly in the future.

The growth of the canola industry is in part a consequence of a number of projects funded by the Grains Research and Development Corporation (GRDC), which has a continuing commitment to many canola projects that are expected to benefit farmers in south eastern Australia, including:

- National Brassica improvement projects. (South Australia, Victoria, New South Wales)
- Improved agronomy for Brassica crops in the 300 to 400 mm rainfall zone of South Australia and Victoria (South Australia)
- Identification and evaluation of alternative sources of blackleg resistance for canola, with particular emphasis on the seedling (Victoria)

The canola industry is also facing the risk of Sclerotinia outbreaks. The GRDC currently has a project in Wagga Wagga that is targeting this potential problem. The major aims include studying the epidemiology of Sclerotinia of canola in Australia, to develop an Australian Sclerotinia model, and to establish a reliable forecasting system for Sclerotinia stem rot in Australia.

DEVELOPMENT OF MINIMUM TILL/ZERO TILLAGE

Another major benefit to south east Australian farmers is the development of Minimum/Zero tillage technology, implementing productive, profitable and sustainable conditions for sustainable cropping systems.

Minimum/Zero tillage practices are greatly reducing soil degradation, such as wind and water erosion, compared to conventional farming methods. They improve soil structure and stability, and increase organic matter in the soil thus fostering increased biological activity. Minimum-tilled soils hold more moisture, and this, combined with the availability and use of a wide range of herbicides allows for greater management flexibility through tighter rotations and improved timeliness of sowing, enabling a faster response to seasonal conditions. Whilst there are initial costs in upgrading machinery for Minimum/Zero tillage systems, in the long term dramatic savings are on offer, through reduced labour costs, less additional machinery costs and reducing operation time.

Research groups across the southern states are continually working to improve the technology available for Minimum/Zero tillage systems and to provide information that increases efficiency, including machinery setups and stubble management. Research into weeds is also a high priority from research groups in relation to Minimum/Zero tillage systems. The area cropped under minimum tillage practices is widespread today as shown in Figure 2, below.

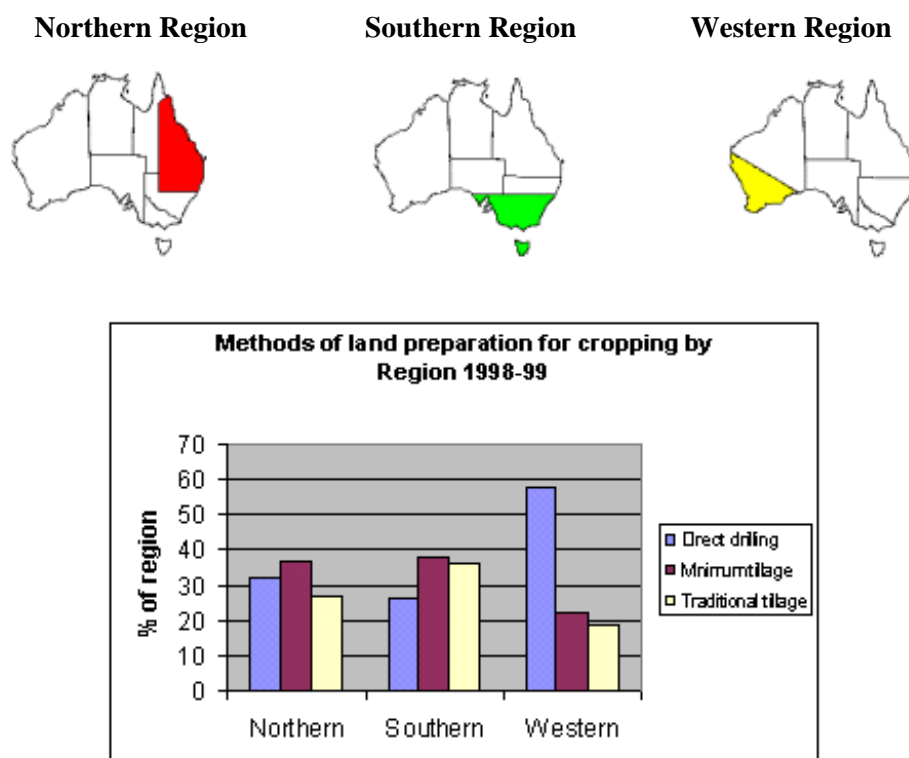


Figure 2: Use of minimum tillage practices in GRDC regions. (Source: GRDC Annual Report 2000)

The Grains Research and Development Corporation has an ongoing commitment to the development of minimum/zero tillage farming systems, including projects such as:

- Managing weeds and crop vigour under no-till farming systems development (South Australia)
- No-till technology trials for the drier Mallee conditions (South Australia)
- National Rhizoctonia disease control program (South Australia, CSIRO)

The advent of Minimum /Zero till technology has enhanced the viability of cropping systems over the long term while protecting the land from extreme soil degradation. Growth of new technology through continued research and development is currently undertaken by a diverse range of grower groups and organisations, resulting in improved and swift changes to overcoming restraining elements and improving efficiency to minimum/no tillage systems.

DEVELOPMENT OF THE PASTURE PHASE AND RECOGNITION OF THE VALUE OF LUCERNE

The use of a pasture phase has been recognised by growers since the 1950s as one of the most important advances in cropping technology. Pasture legumes have helped counter declining soil fertility, soil structural problems, and herbicide resistant weeds

The Australian legume farming system has had a narrow genetic base, with only a few subterranean clovers and a few annual and perennial medics. However through continued research, disease and drought-tolerant cultivars have been developed. An advantage of pasture legumes is their ability to handle adverse climatic and landscape features.

Another key benefit of legumes in the pasture phase is the ability to control diseases by winter cleaning. Legumes do not host many diseases such as Cereal Cyst Nematode and take-all, whereas, by contrast, cereal diseases survive the pasture phase on grass roots.

Medics are also increasingly being used, having the major advantage of being able to grow in a diverse range of soil pH types from alkaline to slightly acidic soils and low rainfall areas of southern Australia. Medics also produce more seed than subclovers and have a greater ability to regenerate than subclovers in drier conditions. Medics are a valuable component due to drought resistance through a deep rooting system and the ability to seed quickly. New technology has allowed a number of new varieties with various soil type preferences and maturities to be created. Newer varieties are also being developed to resist bluegreen and spotted alfalfa aphid species.

The use of lucerne in rotations has been especially beneficial, through its ability to reduce waterlogging and the deep drainage of water that can lead to salinity; its nitrogen fixation and its nutrient recycling; its role as a high quality fodder for grazing or hay; its control of cereal diseases, and in conjunction with a range of herbicides, its control of grass and broadleaf weeds as well as its role in reducing wind and water erosion.

The GRDC in conjunction with many research agencies has aided the development of a viable pasture phase in south-eastern Australia with an ongoing commitment to a number of projects, such as:

- Benefits and penalties to cereal crops sown after lucerne (CSIRO, Canberra)
- Production and environmental benefits of dewatering cropping subsoils with deep-rooted pasture legumes (CSIRO, Canberra)
- Optimising the transition from lucerne leys to the cropping phase (CSIRO, Canberra)
- A new and innovative approach to increasing nitrogen supply to crops in phased farming systems (New South Wales)
- Developing Improved Lucernes for the Southern and Western Cropping Districts of Australia (South Australia)
- Phase farming strategies for grain producers in South East Australia (Victoria)
- Lucerne management for dewatering and production in grains-based mixed farming systems (Victoria)

- Sustainable rotations through recharge control by enhanced lucerne water uptake (New South Wales)

The use of lucerne, subterranean clovers and medics in the pasture phase has allowed successive cropping phases through increased disease resistance, higher nitrogen fixation and improved soil structure. This is improving the long term sustainability of the industry in the southern areas of Australia. GRDC is supporting projects aimed at broadening the genetic base of ley pasture crops.

FAST PROJECT

The FAST (Farming And Sustainable Technology) project was supported by the Grains Research and Development Corporation to help change the way farmers look at developing profitable and sustainable farming systems. Originating in 1996, FAST was designed to highlight an understanding of the risks and opportunities that farmers need to be aware of and monitor, including how to maintain a profitable farming system and the ability to measure the performance of their own farming business. Individual farming performance can, through this monitoring, be compared to the performances of colleagues. The project has enabled farmers to measure, monitor and analyse the accomplishments of their business.

Key benchmarks have been developed to enable opportunities and threats to be recognised at a whole farm level, and to provide advice once benchmarks are calculated. Thus, growers could monitor their own farming system and identify any threats before any irreversible financial damage occurred. Major Benchmarks are shown in Table 1.

Benchmark	Weak	Medium	Strong
Disposable income per Family, \$ per family	Less than 30,000 p.a	\$30,000-\$60,000 p.a	Greater than \$60,000 p.a
Net Worth per Family, \$ per family	Less than \$500,000	\$500,000-\$1,000,000	Greater than \$1,000,000
Production System. Farm Income/ha/100mm (\$WUE)			
-Cropping Property (>65% crop)	Less than \$60	\$60-\$70	Greater than \$70
-Mixed mainly cropping (50-65%)	Less than \$50	\$50-\$60	Greater than \$60
-Mixed Mainly Livestock (35-50%)	Less than \$40	\$40-\$50	Greater than \$50
-Livestock Property (<35% crop)	Less than \$30	\$30-\$40	Greater than \$40
Farm Input Costs: Operating Costs/Income %	Greater than 60%	50-60%	Less than 50%
Farm Size: Effective Land Value per Family	Less than \$400,000	\$400,000-\$800,000	Greater than \$800,000
Debt Servicing: Financing costs as a % of total income	Greater than 15%	7-15%	Less than 7%
Machinery Depreciation: Machinery Value/Farm Income	Greater than 1.2	0.8-1.2	Less than 0.8
Non-Farm Income	Less than \$5,000	\$5,000-\$15,000	Greater than \$15,000
Land Productivity: Operating Surplus/ Land Value %	Less than 8%	8%-15%	Greater than 15%
Labour: Farm Income per Labour Unit	Less than \$100,000	\$100,000-\$150,000	Greater than \$150,000
Return on Capital (%)	Less than 2%	2%-6%	Greater than 6%

Table 1: Benchmark table of calculations for farmers (Source: Professional Farming and the Drivers of Profit)

Many farmers' attitudes to management have radically changed as a result of the project. Farmers can develop and implement innovative and viable approaches to farm management and have an early warning for any required changes that are necessary. The program highlights to farmers potential risks (production and financial) that may exist in the adoption of new technology.

A critical element of FAST is to achieve maximum profitability rather than trying to achieve maximum production. The program is changing farmer attitudes, enabling new methodologies of achieving revenue to be realised. For example, planting the most efficient crops instead of over-farming the land to achieve high yields is a immense change of thinking for growers, but one the FAST program is fostering.

FAST helps farmers to save time, money and resources while trying to achieve maximum profit. The program demonstrates that a commitment to high input and intensive cropping regimes will not by itself guarantee a financially viable farm. Associated costs such as increased labour and operating costs, fertiliser, weed control and price risk all are considered under the project.

The greatest challenge to the FAST project at present is the management of climatic risk and its correlation with farm profitability, particularly frost and its impacts on farming systems.

A key element to the achievement of FAST is the effective communication regarding land use and financial solutions information to growers, facilitated through a variety of formats, including TOPCROP, Landcare, media, advisers and accountants. Delivery of information involves a series of publications which are presented at Grains Research and Development Corporation Expos, adviser and farmer updates. Speakers from the FAST consulting pool also attend meetings of local farm management conservation groups and farm management workshops and conferences.

ABARE figures reveal that productivity in the grains industry is increasing at around 3.2 per cent a year (4) in Australia's southern grains region. A number of factors are involved in this, from plant breeding to larger scale farming and advances in technology and machinery. The quality of management and work skills, and being able to take advantage of information flows are critical, as is risk management to improve production and price risk strategies (4).

The FAST project has moved the focus away from pushing production to a clear focus on the drivers of profit. Despite the 3.2% productivity gains to grain growers these have not been turned into profit in many cases, owing partly to falling terms of trade. FAST has enabled growers to build far more sustainable systems and to detect in advance possible threats that may impact on the viability of the farming system.

CONCLUSION

Farmers in south eastern Australia have seen significant gains in farm production and profitability as a consequence of continued research and development. Four key advances have played a major role in this progression towards increased profitability. Canola has developed to become a major break-crop providing a sound disease break as well as contributing to profits in a significant way, both as the value of the canola crop itself, and the value added to succeeding crops. Minimum and zero tillage combined with a wide range of herbicides have improved the timeliness of the seeding operation and moisture conservation, Wind and water erosion have been reduced, and over time soil structure has been improved. The rediscovery of lucerne, particularly the more winter active varieties has contributed to the overall success by providing good pastures for livestock, and an increase in nitrogen for following crops. It has contributed to the dewatering of the subsoil and to the overall sustainability of the farming system. While the benefits from grain industry research have delivered productivity gains of 3.2% per year for the last ten years, this was not necessarily reflected through farm profit. The FAST project has demonstrated to farmers that driving production and high input does not lead to profit. This project has been a major contributor to the changed attitude of grain growers to risk and has refocussed attention on to profit, not just production.

While research has delivered a great deal to grain growers the future will be difficult unless we can continue to deliver innovative solutions that will subsequently allow quantum leaps for the industry. A greater understanding of soils, soil biology, soil biota and the interaction of roots within the soil structure may provide further productivity gains by allowing growing field crops to access the moisture and nutrients that are known to be trapped in hostile sub-soils.

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REFERENCES

1. Angus, J. 2001. Nitrogen demand by Australian Agriculture. *Australian Journal of Experimental Agriculture* (in press).
2. Colton, B. and Potter, T. 1999. History. In: *Canola in Australia, The First Thirty Years*. Organising Committee of the 10th International Rapeseed Congress. 1-4.
3. Kirkegaard, J. 2000. Canola provides an unexpected boost. *Farming Ahead*. Kondinin Group. **97**. January 2000. 47.
4. Knopke, P., O'Donnell, V and Shepherd, A. 2000. *Productivity Growth in the Australian Grains Industry*. ABARE Research Report 2000.1, Canberra. 3-31.
5. Salisbury, P and Wratten, N. 1999. Brassica napus Breeding. In: *Canola in Australia, The First Thirty Years*. Organising Committee of the 10th International Rapeseed Congress. 29-37.