INNOVATION AND UPTAKE OF NEW TECHNOLOGIES IN THE NEW ZEALAND ARABLE INDUSTRY

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Abstract

The New Zealand arable industry although small on a world scale is very innovative and rapidly utilises new technologies. However, not all technologies are taken up by farmers and some technologies are partially used by farmers. This paper reviews a number of new technologies and information that have been released to farmers and discusses some of the reasons why farmers rapidly take up some new practices but slowly pick up on other technologies. Factors such as return on investment, risk, simplicity of the system and farmers perceptions are discussed in relation to fertiliser, pest management, decision support models, plant growth regulators and precision agriculture.

Overview

The New Zealand arable industry is very small on the world scale. The production of cereals is less than 1.5 million tonnes per annum and this is largely supported by the production of herbage and vegetable seeds for New Zealand and international markets. The value of seeds exported is approximately $140 million per annum with approximately $70 million used in the New Zealand pasture and turf markets. Although it is a very small industry the farmers are extremely highly skilled and very rapidly adopt and adapt to new information and new technologies in their farming systems. This has resulted in New Zealand farmers holding the world record for wheat yield (currently over 15t/ha) and producing extremely high yields of other crops such as barley, ryegrass seed and maize. The actual area in arable crops and the number of arable farmers has reduced markedly over the last 15 years, largely due to land use change to dairy, but the total New Zealand production has increased due to yield increases such as those in wheat of 250kg/ha/year for each of the last 12 years (4% p.a.) and ryegrass of 42 kg/ha per year (3% p.a.). The future success of the arable industry is dependent on farmers utilising new information and technologies in order to reduce input costs, maximise yields and improve product quality and value. The Foundation for Arable Research (FAR) is the farmer organisation which focuses on investing in research, extension and education to ensure farmers remain economically and environmentally sustainable in the future.

Where are we going?

New Zealand arable farmers face increasing pressures due to low commodity prices, increasing input costs, demands for environmental stewardship, regulation, lack of government investment and competing land uses. The varied demands, different demographics and interests of famers, mean there is a huge range in the requirement for information and new technologies and a huge variation in how farmers access and utilise these tools. FAR and the arable industry aim to address the future

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needs of the arable farmers through investing in a range of programmes that address these key issues and ensure farmers can utilise the outcomes from these investments.

What information / technologies are needed?

Farmers are very good at identifying problems that need research such as disease control, nutrient and irrigation management, all that will result in economic gains, and the outcomes of this research can often be easily and rapidly implemented into the farm business, within a crop or growing season. The risks of making these changes are relatively low and are often reversible. Increasingly the demands on farmers are in areas where it is much more difficult to identify any economic benefits, or the change is significant to the farming system and the outcomes of change are enduring. Uptake of new information in relation to precision agriculture, crop rotations, crop establishment and environmental stewardship for example will often fall into this category.

For this paper some scenarios will be used for discussion but there are similarities between these scenarios and the delivery of a range of information to farmers. The way information is packaged, presented to farmers and the uptake of new information and technologies will vary in relation to the perceived benefits, risks and skill / experience of the farmers and as such need to be carefully considered to ensure the benefits to farmers can be maximised.

What do New Zealand arable farmers take up and why?

Yield is king. New Zealand arable growers have rapidly embraced technologies that increase yields but were less inclined to embrace technologies that maintain yields while reducing input costs.

The uptake of a plant growth regulator (trinexapac-ethyl or Moddus) to increase yields by up to 50% in ryegrass was extremely rapid with over 80% of farmers using Moddus within a two year time frame. The technology was simple and relatively safe to use and there was a very high chance of achieving significant economic benefits. Since then significant investment has been made to better understand the interaction of Moddus with closing date, nitrogen and water with significant economic benefits possible. Farmers are also able to reduce inputs of N and Moddus to achieve the same yield result. Although the benefits have been delivered using the tried and tested FAR ryegrass discussion groups, which resulted in extremely rapid uptake of Moddus when it was released to the market, the uptake has been much more cautious and slower as farmers need a higher skill level and understanding to optimise the outcomes. The risks are thought to be higher as with a later closing date some productive tillers are removed and it is perceived that yield must be being reduced. The answer appears to be to continue to reinforce the message and uptake will slowly occur.

A large number of research trials over many years had demonstrated that there was no yield response to application of fertilisers to peas. This data, although convincing to scientists, worked against all that farmers had learnt in relation to plant responses to fertilisers. It was also contrary to the advice provided by fertiliser companies and consultants, who were not prepared to make recommendations, that in their view, left them exposed to comeback from the farmer if the crop was not perfect, even though the potential savings were up to $200/ha. A further series of side by side trials run in farmers' paddocks convinced the farmers who had the trials on farm, but uptake

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beyond that was very low. The major turning point in getting reduction in use of fertiliser in peas came when a well respected farmer announced the return from not putting fertiliser on peas. In hindsight the wrong message was delivered to farmers; the challenge to what they had been taught for years was too great. If the message had been to reduce fertiliser on peas to low levels, followed by the no fertiliser on peas message, then uptake would probably have been much greater.

Plant and Food Research has developed a Wheat Calculator which can accurately forecast crop development, the timings for fertiliser, irrigation applications and the rate of inputs required. This decision support tool has been very accurate and many farmers have used the tool at some time. It was delivered to growers as part of a workshop on growing wheat and interest in the calculator was high. However, uptake and use of the calculator is lower than expected but the nitrogen management strategy and rates that the decision support tool provides have been adopted by most of the industry. Ongoing use of the calculator is low because it is not simple to use if it is not used on a regularly, is not web enabled, the weather data is not automatically updated, there is no guaranteed financial or other benefit from use of the calculator and the farmers have picked up most of the information they need to manage wheat from the workshops used to demonstrate the calculator.

Precision agriculture

Farmers are exposed to significant amounts of information on precision agriculture and the benefits it will provide for their businesses. This is an area where there has been significant technical development, but it is very difficult for farmers to understand how the technology will be best implemented on their farms, the benefits derived from the technology and the right time to invest in the new technology. A number of leading farmers and contractors are using Real Time Kinematic systems (high accuracy) and a larger number of farmers are using less accurate guidance systems but uptake is generally slow. Some of the barriers to uptake are; limited information on the benefits (particularly financial) and limited ability to determine these on an individual basis, deciding when, and at what level, to enter the market, limited skilled independent expertise available to assist with the decision process and the technology is new and often confusing for farmers not conversant with this equipment. The use of precision agriculture is expected to become essential to agriculture in the future to minimise input costs, optimise placement of inputs, minimise environmental impacts, provide documentation to support farming practices and to improve product quality. It is therefore essential that consultants and extension personnel develop skills to overcome the barriers for farmers to ensure they utilise the best precision agriculture technologies on farm.

IPM

For many years most farmers have relied on agrichemicals to control pests in crops and this enables them to respond to pest and disease outbreaks with a very easy single input. This input is often made on the advice of a consultant who, on a large arable farm has done little (area) monitoring for pests. Arable farmers receive little or no financial or market opportunity advantages for using Integrated Pest Management (IPM) practices so getting uptake is a significant challenge, even though their great grandfathers farmed without agrichemicals. IPM requires greater monitoring of fields, greater risk, probably minimal financial gain but reduced exposure to pesticides and the potential to increase populations of beneficial insects. To get uptake of IPM it is essential that extension personnel have the right skills to support the farmer and that farmers can observe

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examples of IPM working on farms around them. Unfortunately many consultants either benefit from sales of agrichemicals and / or are not prepared to risk a client having insect or disease problems on their farms. Most farmers who are early adopters of IPM will need the support of highly skilled consultants to monitor crops and assist with the transition.

Can we use age, gender and expertise to influence uptake?

Experience in the New Zealand arable industry has shown that younger farm workers, managers and women are less likely to attend field days or workshops with their older experienced peers. To overcome this FAR has established a Women in Arable group and an Arable Y's (aged under 35) group. These groups have both gone from strength to strength with monthly meetings to address topics important to the gender or age of the participants. Uptake of some of the technologies on farm can be markedly influenced by these members of the farming business. For example, Women in Arable members have shown significant interest in IPM and Arable Y's members are very interested and involved in precision agriculture and have had major involvement in uptake of these technologies on farm.

Meeting the challenges in uptake of new technologies and information?

To remain world leaders, New Zealand arable farmers need to utilise the relevant new technologies and information as soon as they are available. This will create ongoing challenges to ensure the best information is provided with skilled support and clear benefits to ensure there is uptake and the benefits can be delivered to all farmers. The technologies or information will need to be carefully assessed to identify what farmers will relate to and what will encourage them to implement these on their farms. New Zealand needs to educate people with the right skills to encourage and provide the support for uptake of these technologies on farm.

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