CROP & FOOD RESEARCH

Mana Kai Rangahau

sustainable productive environments team

The Sustainable Productive Environments team develops innovative solutions that enhance the productivity of land-based systems while maintaining environmental quality.

team capabilities

Sustainability means using our land, water and air in a way that ensures these resources remain in good condition for generations to come. Scientists in the Sustainable Productive Environments team define sustainable practices and then work with clients to help develop management systems that are economically viable and environmentally sustainable.

To do this the team integrates skills in soil science, crop agronomy, plant physiology, entomology, plant pathology, weed science, molecular microbiology, computer modelling and biometrics.

The team works with the arable, vegetable, horticulture, dairy, intensive livestock and organics sectors. Clients include government departments and regional councils, growers, seed firms, fertiliser and agrochemical companies as well as food processing companies.

Research capabilities

We work with New Zealand's land-based industries to develop the knowledge and systems needed to make optimum use of land and water resources.

Research capabilities include:

- integrated crop management
- monitoring and managing soil quality
- predicting irrigation requirements and water allocation schedules
- determining crop nutrient requirements and minimising nitrate leaching
- understanding the effect of climate change on crop production
- reducing emissions of greenhouse gases from farming systems
- modelling crop growth and developing decision support systems
- controlling pests and diseases using host resistance — cultural, chemical and biological methods
- developing molecular techniques and new diagnostic systems to detect pests and pathogens
- providing technology for molecular characterisation of invertebrate populations in soil
- developing new technologies to harness the useful attributes of micro-organisms
- understanding and monitoring biodiversity
- assessing, understanding and diagnosing biosecurity risks
- investigating opportunities to develop biofuels.

Current projects

IPM FOR VEGETABLE CROPS

When a new lettuce aphid pest spread rapidly throughout New Zealand, growers everywhere ploughed under hundreds of thousands of dollars of ruined produce. Work quickly began to develop an IPM programme to target the lettuce aphid. A major goal is to reduce agrichemical use on outdoor lettuce crops, while controlling insect pests and plant diseases. The research has support from grower groups, Vegfed and the agrichemical industry, and

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funding from MAF's Sustainable Farming Fund. Successful IPM programmes have already been developed for process tomatoes, vegetable brassicas and some greenhouse crops. A new IPM programme is underway for onions and the vegetable brassica programme is being updated.

IRAP: KEEPING NUTRIENTS IN CROPS, NOT GROUNDWATER

Managing productive land so that nutrients end up in plants, not groundwater, is the aim of a significant six-year collaborative research project, Integrated Research for Aquifer Protection (IRAP). Regional planners and policymakers, and ultimately all users, will benefit from this 'big picture' view of water quality, which links the plant root zone with the underlying aquifer. The $15 million programme, which has funding from government and industry, combines the strengths of seven environmental and research organisations. The programme relates the effects of pastoral and cropping land use to groundwater quality.

GREENHOUSE GAS DOWN AND FORAGE UP

Emissions of the potent greenhouse gas, nitrous oxide, can be significantly reduced and forage yields increased by reduced tillage cultivation methods. New research investigated the effect of tillage on nitrous oxide emissions in grazed winter forage crops and found that compacted, wet soil produces more nitrous oxide. Cattle compound problems not only by pugging, but by excreting nitrogen-rich urine. Reduced tillage with direct drilling helped maintain soil structure and resistance to compaction, improved yields and reduced nitrous oxide levels.

INTEGRATED CONTROL OF POWDERY SCAB OF POTATO

Controlling powdery scab is very important to New Zealand's potato industry, and is becoming increasingly important in most of the major potato growing areas of the world. This disease is not tolerated in potato seed production, and causes severe quality problems in potatoes grown for fresh and processing markets. A long-term programme involving our plant pathologists, plant breeders and soil scientists, along with international collaboration, has shown that integrating chemical, plant resistance and cultural disease control strategies gives the best prospects for managing this disease. The research has been funded by the Foundation for Research, Science and Technology, Vegfed, and chemical and seed potato companies.

SOIL QUALITY MONITORING FOR THE ARABLE INDUSTRY

In collaboration with Lincoln University, MAF Policy and arable farmers, we have developed an on-farm soil quality monitoring system. Together with traditional soil chemical analyses, farmers can use a kit containing simple tests for soil physical and biological characteristics. Information on interpreting these tests is provided through our website. The system gives clients immediate answers to help ensure the physical, chemical and biological quality of their soil is maintained within optimum ranges.

DEVELOPING DECISION SUPPORT SYSTEMS

We work with industry groups to develop decision support systems (DSSs) for various crops. These computer-based systems help growers make decisions that influence crop yield, quality and profit. The rapid adoption of DSSs in some sectors is proof of their value, e.g. almost all New Zealand growers of process tomatoes now use the Tomato Calculator DSS. The sweetcorn model is being used in both New Zealand and Australia. We also have DSSs for maize, asparagus, squash and wine grapes. Work on the Wheat Calculator is in the final stages and a Potato Calculator is being developed.

ASSESSING INDIGENOUS APHID POPULATIONS

Some aphids transmit viruses, making them a significant pest of crops in New Zealand. Most of these species are introduced. However, New Zealand is home to an unknown number of indigenous species; seven new species have been identified in recent years. Research indicates that a group of these aphids played a central role in aphid evolution. There is increasing evidence of the significance of aphids in natural systems. Despite this, little is known about aphid biology, ecology and conservation status. Indigenous aphids are being used as a model to study the population dynamics of rare organisms in a study that is providing important information on factors influencing rarity and the impact of habitat disturbance on species survival.

MOLECULAR MICROBIOLOGY

We have developed systems for detecting and quantifying pests and diseases in plants and soils, and pest and disease contamination of food products. The technology can be used for early identification of disease and pest attack, making it an important tool for risk management. DNA diagnostic methods can also be used in managing biosecurity risks and meeting phytosanitary requirements — both critical issues in international trade.

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Research team

The team has 90 staff, based at Lincoln, Hastings, Palmerston North, Pukekohe and Auckland.