Premier’s NAB Agriculture Scholarship

Farming for the 21st century

Nicolet Westerhof

Elizabeth Macarthur High School

Sponsored by



Introduction:

Farming for the 21st Century is an elective in the Stage 6 Agriculture syllabus (NSW Board of Studies amended, (2009) Agriculture syllabus, Stage 6, Sydney). The elective aims to introduce students to the range of developing technologies and to appreciate their impact on agriculture. Learning in Agriculture develops in students an understanding of the need for ongoing research in an industry that not only needs to focus on feeding the growing world population, but to be productive on a reducing land size, with an increased concern for sustainability and to care for the environment. There are a number of universities in the United States of America (USA) that are leaders in agricultural research and the United States [Department](http://www.usda.gov/wps/portal/usda/usdahome) of Agriculture (USDA) and the USDA meat research centre which are working with industry to ensure that agriculture addresses the concerns of feeding the world population while being productive and sustainable.

Focus of the Study:

The focus of the study was to meet with North American researchers from Washington State University, Lincoln University, Texas Tech University, USDA research centres, Michigan State University and Guelph Veterinary College. The focus of my study was the collection of information that addresses the following:

* + Issues relating to research and development: funding sources, patents, plant breeders rights, animal welfare, legislation, contracts
	+ Evaluation of new technologies: reasons, historical development, the impact relating to economic; environmental; social; legal; managerial areas.

Further aims were to:

* + Evaluate methods that companies may use to market the new developments.
	+ Explain the reasons for adopting new developments.
	+ Analysis by examining sample research.
	+ Outline the need for ongoing research.

Significant Learning:

Upon visiting the various universities, I was able to review the work in relation to the outcomes for the elective, Farming for the 21st Century. The researchers were able to discuss the various issues relating to the specific research and development being conducted at the universities and the USDA. While similar research was being conducted, the issues varied according to the state and the research being conducted.

*Funding sources* for each place visited varied according to the university polices and the available funding. At Washington State University, Agriculture faculty, (WSU), they are conducting a number of projects in the plant area that involve working with identification of gene, gene markers and genetically modified crops. The University does some work with the companies which fund projects. The government funds projects which have national benefits and can be seen by the public to benefit all people involved in the market chain. National organisations such as the Beef Improvement Association do fund beef specific projects which impact on beef producers but they mainly apply for funding from various agricultural grants. The results of this type of research can then be made available to all people in industry not just the company supplying the funding. Some of the work with oil seeds involves finding the gene for the ideal omega fatty acid and transferring them into normal crops. Some companies like DuPont chemicals and organisations such as the National Science Foundation (NSF) are supporting the project as they have an invested interest in the outcome, especially with the possible health benefits of omega in the diet. Some projects such as developing rust resistant varieties of crops attract global funding due to the impact being felt worldwide of losses resulting from rust affecting crops. Therefore there is a global effort to find a sustainable control of rust and researchers from WSU are collaborating with a team from the University of Sydney.

At Lincoln University, Missouri, I spent the day learning about the [Aquaculture](http://www.lincolnu.edu/web/aquaculture-research/aquaculture) program. The project leaders are working with crappie and blue gill fish and have been conducting trials to grow fish commercially. The trial is being funded by the state and national governments, as there is a push towards encouraging healthy eating and meeting the demand for the increase consumption of fish. As the blue gill is a popular eating fish, native to Missouri, growing it commercially will ensure the wild stocks survive. The aim of the project is to increase the growth rate of the fish, while decreasing the time it will take to reach the ideal weight for harvesting. The next phase of the project is using feed samples from the local feed companies and to investigate which is the most effective. The aim is to see which feed performs the best and gives the best growth rate.

*Patents* are an issue that impact on some researchers. While, the USDA doesn’t encourage the researchers to patent their discoveries, some researchers do patent their work. Patents make a claim for ownership of the genetics and any research discoveries. However the process of patenting is expensive. At the USDA, there is a committee which investigates if the item is patentable. The patent of an item can mean that is not going to be readily available to the farmers. Some items that are part of joint projects with companies will be patented externally so that the company can gain financially.

Some researchers at the universities and the USDA will patent to prove their work has industry significance.

At a meeting with Bayer at the plant breeding centre we discussed the topic of patents. Bayer use patents to protect and ensure ownership of the technology. An example is “Glytol” cotton which is the result of a large investment in creating genetically modified plant material and seeds. Instead of paying other companies, they patent their own traits. This adds marketing along with the ability to sell their traits to other companies. Bayer once paid Monsanto to use their traits; disease resistant for the Helianthus bug, but now they produce their own traits, and then give them to the plant breeder to then produce the seed.

The manager outlined that Bayer needed to create their own traits so that they are more competitive in the market. I was able to discuss the major issues with creating certain types of crops along with the issues of the competitors. The major competitors for Bayer are Monsanto, Dow and Pioneer. Bayer is creating traits that will compete with the Monsanto roundup resistance variety of cotton. We did discuss how farmers easily adopted the technology. Farmers readily adopted the new technology as long as the regulations allow and the technology does not pose a problem for the sale or marketing of the product. However, the difficulty is the negative image of the firm Monsanto

As a whole, patents are applied depending on the level of the research and the benefits for the community. One researcher has patented his gene work to protect his intellectual property.

*Animal welfare issues* relate to the research being conducted and the use animals and their welfare.

At both the USDA and Texas Tech University, I was able to meet with the Animal Welfare Liaison officers who coordinate the animal welfare team. At Texas Tech, the team consists of a range of people from the community including non-science and community representative, scientists from different departments. There are strong protocols and forms which need to be followed before a research project allowing animals can be conducted. The researcher needs to be familiar with the publication, Guide to Animal Research. They complete the forms and then apply to the committee for approval. The Welfare team review the methodology first then make suggestions if necessary to the researcher. The project is reviewed throughout the duration of the project. The role of the committee is to ensure the welfare of the animals and that the research is ethically conducted.

The University of Guelph, Ontario, Canada and Michigan State University are conducting trials using poultry to address public concerns on the manner in which poultry are farmed and housed. These animal welfare issues have led to the universities developing various housing methods that address the concerns of the public. One researcher has developed “chicken cam”, where the public can observe the poultry laying shed. This allows the public to see that the hens are being cared for and not being cruelly treated.

*Legislation*

The researchers at all universities commented that farmers will more willingly implement the research results, if the outcomes are written into legislation. Currently the major issue facing researchers is the reaction to genetically modified organisms. (GMOs). The debate has polarised the community.

 At Lincoln University, I had discussions with the research assistant about drugs being administered to treat sick fish. All drugs need to be tested and pass legislation to ensure its safety. In the fish industry, there are limited drugs available for use with fish Due to the industry being small; the drug companies are not funding the development of drugs for use with fish. The university is developing a partnership with farmers and researchers to trial the use of drugs. We had a general discussion on identification of fish diseases using plates and the BioLog Gen III to create an identification plate which will help to quickly identify the different bacterial types. A new machine helps to identify and create a data base of the disease for ease on identification. The university is working with the farmers to trial the different drugs.

I met with the grower organisations, Plains Cotton growers, Texas Corn producers and the Texas Peanut producers that work with and represent the farmers. The organisations aims are to develop positive public perceptions towards cotton growing. These organisations deal with the regulatory aspect such as labour, genomics, crop protection chemicals, spill prevention, and free trade. The Peanut Producers Association is currently working to keep the farmers up-to-date with industry changes.

Each of the universities and the USDA are conducting research to develop new technologies. They also evaluate the new technologiesbefore working with farmers to implement the research. I was able to discuss the many and varied technologies in the area of animal production and meat science.

At Lincoln University, I had a meeting with the goat and sheep team leaders who are working on various projects with sheep and cattle. One study is monitoring the grazing patterns of the sheep and cattle and how they can more effectively graze in the same paddocks. The team is also working on an easy care concept with the sheep involving the sheep lambing on pastures with minimal housing. The benefits are higher lambs survival rates and decreased diseases. There is also less labour required. The main sheep being used is the Katahdin, a hair sheep which is a developed composite breed. While their mothering ability is not the best, they have low input, good on pastures and parasite resilience and tolerate the barber’s pole better. The team is also working with the Kiki, meat goats and crossing them with Boer goats to increase parasite resistance through breeding. The project has just breed the F2 (2nd cross) which will be used to conduct the trial. With limited numbers in the project it will take 10 years to get reliable results. This project shows the importance of the number of replications to have results.

While at Texas Tech, I visited the university ruminant research farm, where there is research on the use of Zilmax, a hormone used on cattle to increase the weight gain. The hormone is used for cattle in their last 20 days. While the hormone is increasing productivity, there is a major concern with the tenderness of the beef. The steers once slaughtered will be assessed for tenderness. The USDA is also conducting research work on Zilmax. The results for the weight gain trial are reliable and show the farmer the weight gain that can be achieved in a short time. The result is that farmers are required to feed the animals less and have them ready for market in a shorter period of time. This is an area that requires researchers to work with other specialty researchers to ensure the most effective outcome for the industry as a whole. Once slaughtered, the meat specialist work with the carcasses to identify the most effective way to ensure a tender quality product is produced.

USDA is conducting research in a large range of areas including pig nutrition, lactobacillus, animal welfare in relation to gestation crates, gene sequencing to identify certain traits, to identify the high shedding animals and the way to minimise the impact of E-coli through meat processing and environmental work in relation to feedlot cattle and the importance of shade. The researchers are working with industry people to refine their outcomes and the recommendations. The meat science researchers have changed the lights on the meat grading device. This change has meant that the meat grading is becoming more accurate. The environmental work being done with the shade for feedlots is being driven by the animal welfare groups lobby. The environmental group has been developing a system of shades which includes a live cam to monitor the movement of the animals. While the research has not been finalised, the data is showing the most suitable system to be used by the feedlots.

The poultry animal welfare work being conducted at Michigan State University (MSU) and at Guelph University is developing a more suitable poultry caged system. They are working with industry on the standards set by Macdonalds in relation to animal welfare and suitable housing of poultry. The researchers are working with the board and conducting trials on developing a standard for non-caged systems. Creating smaller group systems with fewer birds but still allowing for ease of egg collection and manure removal. The research is showing interesting traits in birds and is developing a suitable system that will work with farmers, animal welfare lobbyists and consumers. While the work is on-going, the caged systems are being modified and the farmers are willingly taking on the new designs.

MSU is also conducting research into being able to identify using milk samples, various diseases of cattle and if the cattle are pregnant. The test is currently able to identify one specific disease, Johnes via the sample of milk. The effectiveness of extending the test to include more disease and a simple pregnancy test would be more effective for farmers, as one sample of milk could be used instead of numerous blood and hair tests to identify disease issues within the herd. The dairy herds in both MSU and Guelph are using pedometers to identify and increase in the movement of the cattle. This then indicates to the farmer the need to artificially inseminate the cattle. This system is showing to be effective resulting in an increase in calving rates for the farmers. The system is being used in some sample farms. Due to the need for farmers to higher casual labour, that is not trained to identify cows on heat. The pedometers record the data and increase in cow movement, so the farmer can then identify the cattle, instead of relying on staff.

Before releasing the data and recommendations to industry, the researchers evaluate the projects in relation to the economic, environmental, social, and legal implications along with the impact on the farmers’ managerial aspect and how can they effectively use the technology on the farm or in industry.

*Methods that companies may use to market the new developments.*

This is one area where universities varied their approaches on marketing the research to the farmers. Most universities act in an advisory capacity. The famers, when they have issues on-farm, talk to the relevant specialists at the universities. Most universities would work with a small group of farmers to further trial the research In Guelph, the farmers would use the various bedding methods and supply feedback. This has led to more farmers in the region taking on board the findings from the research. The feedback also aids the researcher to improve the quality of bedding for housed livestock.

Lincoln University has applied for funding to include promotion and marketing. The team is aiming to work on creating the markets for the farmers before they take on the commercial production of the fish, the crappie. This has involved the researchers working with industry, with farmers and consumers to create a market. Once the market is created the product will become more viable for farmers to commercially grow the fish. The University organised a field day open to local farmers to promote the research work. It was an opportunity for farmers to see the research and talk first-hand with the researchers about the findings and how to best implement the new technologies. The field day also allows the opportunity for farmers to consider how they can adopt new ideas into their management practices The University also acts as consultants to the local farmers. They contact the staff at the University with various issues and concerns on their farms. This then guides the researchers to develop projects that suit the farmers and the farmers’ needs.

USDA uses a variety of methods to present their research findings to industry. They hold work-shops and open days for the local farmers. The various industry bodies such as The Beef Improvement Association hold conferences where the researchers are able to present the work including the detail of the methodology, the results and the recommendations. The industry then has the opportunity to discuss the implications of implementing the research and how it will benefit the industry. The USDA creates fact sheets that are available through the website and by contacting the USDA centres. All the universities are making available fact sheets and information for farmers. Farmers are also coming forward to volunteer their farms as trial locations. This assists in ensuring farm relevance of the research.

*Explain the reasons for adopting new developments.*

The farmers take on the research and they show an interest in the work. The research teams work with industry on their needs as well as developing an idea on the type of research that needs to be conducted.

*Animal Welfare legislation and public concerns.*

If certain aspects of research are mandated by the government then farmers are more willing to take on the research findings.

*Analysis – examining sample research.*

Lincoln University and aquaculture: The researchers use experimental design and use a formula to evaluate how many fish to use to make the trial effective. The program assists in the amount of treatments and replicates, and then identifies each individual fish with a microchip. While the project is in the early stages, the aim is to formulate a ratio that the fish farmers can use.

The USDA also supplied outlines of the research work along with the posters that the researchers create to present their findings. These outline the methodology behind the projects results and recommendations for implementation.

*Outline the need for ongoing research.*

At WSU, I had the opportunity to discuss the need for ongoing research. There is a wide knowledge base of agriculture available yet research is still being repeated. With the advent of the internet and better communication between researchers replication of research topics is being avoided. I had the opportunity to meet with both animal and plant based scientists to discuss their perspective on ongoing research.

Some researchers are working on a model in relation to what beef cattle producers would have to do to comply with consumer wishes on safety and environmental topics. They are using mathematical modelling to analyse the existing data. While it is not feasible to measure environmental aspects from the whole of marketing, the mathematical modelling can assist in developing management plans. This has yet to be tested in the real world. It has been identified that the consumer has a willingness to pay for sustainable production.

PhD students are encouraged to conduct research in specific areas such as working with a company on the most suitable “teat dips” which will involve the chemical, iodine in varying strengths. Research on the most effective teat dip for the various mastitis bacteria is being undertaken. Researchers are using teats from dead cows and will be placing the various bacteria onto the teats. We spoke about the importance of effective experimental design to ensure that the results are not only valid but will be applicable in the world situation.

 At the USDA, the need for ongoing research is driven by the farmer, industry needs and the government. Most researcher review the literature in their specialist area, then fill the gaps and the design the experiment.

The researchers discuss how they tend to find more questions that need answering, thus they continue to discover the answers to the questions. For example, the gene sequencing is continuing as they have identified the genome of cattle, they now need to identify the individual genes responsible for the various diseases and genetic problems which can be encountered in the cattle industry. They are working on developing a system that the farmer can use that is simple and cost effective. Another area for continued work is the metabolism of livestock.

Conclusion

The Premier’s NAB Agriculture Scholarship enabled me to meet with leading researchers and engage with emerging technologies. The researchers’ emphases on productivity and sustainability provided a coherent framework for me to assess the coherence of these two elements. Productivity and sustainability go hand-in hand for the pursuit of one in isolation from the other narrows the learning in Agriculture where students develop an understanding of the need for ongoing research in an industry that not only needs to focus on feeding the growing world population, but to be productive on a reducing land size, with an increased concern for sustainability and to care for the environment.

I would like to thank the researchers for their willingness to engage me in dialogue and for sharing the progress and outcomes of their research.

Thanks also to the Hon Barry O’Farrell, Premier and to the corporate supporter NAB, for their generosity in making this study possible.

Bibliography:

[Board of Studies](https://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/Understanding-the-curriculum/syllabuses-a-z)

[Washington State University](http://www.wsu.edu)

[Lincoln University, Jefferson City](http://www.lincolnu.edu/)

[Texas Tech University](http://www.ttu.edu)

[United States Department of Agriculture](https://www.usda.gov/)

[US Department of Agriculture – Agricultural Research Service](https://www.ars.usda.gov/)

[Michigan State University](https://msu.edu/)

[Guelph University](https://www.uoguelph.ca/)