CROP SCIENCE SOCIETY OF S.A. INCORPORATED

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Next Meeting	**'Student Night**
Venue	**Stefanson Theatre, Rosworthy Campus**
Date	**WEDNESDAY 26th October**
Time	**7.30 pm**

Speakers

Student Presentation

Tony Rathjen has just returned from an overseas trip with a group of Ag students from Waite. They will talk about their escapades in the subcontinent – we can be sure they all learnt a lot! See also the interesting article by Stuart Richardson at the end of the Newsletter, which includes some photos of their trip.

CSS Annual Post Graduate Symposium Award – Brooke Ryan, University of Adelaide

'Cu in soil-plant systems: a stable isotope study'
Brooke was the recent recipient of the CSS Award for best student presentation at the Waite Post-Graduate Symposium. She will talk to us about her current research. on soil isotopes.

Sam Davies talking to Morgan Hunter – Engineering Manager from SA Biofuels

'Making Biodiesel on-farm'

Borlaug and the breeding of semi dwarf wheats
Tony Rathjen

Borlaug was awarded the Nobel Peace prize in 1970 for his contribution to the Green Revolution. This recognized not only his inspired breeding but his efforts in persuading the Indian government to import 18,000 t of the new semidwarf wheat seeds from Mexico but also in insisting that these new varieties would only reach their potential if there was also adequate irrigation and fertilizer. An unbelievable achievement.

At the time, India was on the point of starvation with very large quantities of wheat being imported from the USA under PL 480, legislation whereby the wheat was paid for in the soft currency, rupees. Indian production of wheat was about 11mt in 1965.

Looking back one cannot but be astounded at the breeding effort. The semidwarf genes had their origin in China, I think, and had been incorporated into a Japanese variety Norin 10. Through the period prior to 1960, I have the impression that virtually every wheat breeder in the USA tried to unsuccessfully to incorporate the genes into USA varieties, but only Vogel in Washington State was successful, and then, the story goes, only because he sowed out a spare area at the end of his seeding program and it was in this population that the key line was found. There is probably more to this story as Vogel was, with Finlay at the Waite, the major pioneer in mechanization of the breeding program which, no doubt, enabled him to test a much greater number of selections and thereby identify the successful cross Norin 10 x Brevor. Borlaug took this material to Mexico where he crossed it with the 'spring wheats' (not strictly spring wheats but rather varieties of the type which grow happily in Australia, Mexico and India).

The progeny from Borlaug's program started being named in about 1962 with the notable varieties Pitic 62 and Penjamo. But the really important material was given a 1964 tag, especially Sonalika, a variety which ultimately had at least eight separate names. (We had it as 8156 and Mexico22A and its derivatives appears in many of our hybrids and varieties). It was one of four lines introduced into the subcontinent. It was Sonalika, in Pakistan known as MexiPak, that were the basis of the Green Revolution. Wheat production shot up to 17mt in only a few years. Last year, 84mt of wheat was produced.

Borlaug addressed the International Wheat Genetics Symposium in Canberra, in 1968, and spoke of the challenges for about two and a half hours without anyone realizing or fidgeting.

His ability to work was legendary and he gathered an extraordinarily dedicated team around himself. Most of them died young, having spent up to, I have been told, 250 days a year on the road. Borlaug himself was an exception and died recently, well into his 90s, active in agricultural research and promotion to the end. A truly remarkable man.

Now there is new challenge of similar magnitude to that of the 1960s, the looming shortage of irrigation water on the IndoGangetic plain.

Borlaug was utterly insistent that breeders should make themselves totally familiar with their breeding material and target sites, so the whole team would travel for harvest from near Mexico City to the north at Obregon. While it is well-established that it is only those breeders, who have an intimate knowledge of the genetic variation of their material and its utility in fulfilling environmental and industry constraints that have substantial impacts on their crops, Borlaug was in this respect, also quite exceptional in the strength of his dedication. Likewise his dedication to farmers.

Hence the launching of the Borlaug Institute for South Asia.

The following is an exert from the speech given by Thomas Lumpkin at the opening of the new Borlaug Institute for SE Asia. The centre has commanded a $1 billion investment, which is a refreshing change considering the current lack of foresight and investment into the future of agriculture in Australia and the world.

Dr. Thomas Lumpkin

BISA Launch Speech 5 Oct 2011

This is a momentous event for CIMMYT, ICAR, South Asia and the world. Perhaps we will look back and see it as a momentous event in the history of global food security.

I am very grateful to so many of you here for making the Borlaug Institute for South Asia reality. You have been visionary. You are thinking of the future generations.

CIMMYT is currently undergoing a transformation, becoming a major vehicle and driver of South-South cooperation. CIMMYT has recently launched a major project in Mexico, MasAgro (Sustainable Modernization of Traditional Agricultural) receiving generous support from the Mexican government.

CIMMYT and the Government of India are acting now in order to avert a future food crisis in South Asia, to address the effects of climate change, and contribute to global food security.

The impacts of population growth, changing diets, climate change, and natural resource depletion, like groundwater, are all converging in South Asia, affecting the future of agriculture. We are faced with alarming statistics.

The world's population is expected to reach 9.1 billion by 2050, 1/3 more than today. Nearly all of the increase will occur in developing countries. To feed a growing population, food production needs to increase by 70% by 2050. It needs to be done with less land, water and other inputs and despite the effects of climate change. Global demand for food is rising faster than supply. The growth in cereal yields has slowed from 3.2% per year in 1960 to slightly more than 1% today. It is not keeping up with demand.

Production growth of key crops needs to be much higher than population growth for two reasons: 1) More than 1 billion people are currently going hungry according to FAO statistics. We must provide them adequate nutrition, 2) As diets change worldwide, more middle class, more food will be required for each person. To put it in prospective, the 9 billion people expected in 2050 will consume as much food as 12 billion of today's people.

In terms of some more statistics more specific to South Asia, in 2010, South Asia's population was 1.6 billion. Its 2050 population is expected to be 2.4 billion – a 50% increase. Population growth is part of the food security equation. Hopefully the projected population growth will be less. Growing affluence and governments programs for family planning may encourage people to have fewer children. Action must be taken on this front also. But meanwhile, 50% of the world's poor live in South Asia and 75% of South Asia's poor live in rural areas, on farms. The poor often spend 50% or more of their income on food. They are the most vulnerable to rising prices and crop losses. We are seeing the impact now in the Horn of Africa, in North Africa.

However, there is hope. New science, new technologies, and new policies can dramatically increase the productivity of agriculture. Appling the newest advances in plant breeding and precision to small farmers offers the opportunity to accelerate a "Green Revolution" across South Asia.

To leverage these innovations, CIMMYT and the Government of India are establishing a state-of-the-art agriculture research facility, headquartered in India, and named for Dr. Norman Borlaug, father of the Green Revolution.

New farming practices such as precision and conservation agriculture, new plant breeding approaches such as use of whole genome selection and double haploids, and new outreach approaches such as text messaging decision-support tools, offer promising options to intensify farming and increase productivity in ways that can meet demand while reducing the impact of agriculture on the environment.

The new Borlaug Institute for South Asia will be co-centered in three Indian states: Bihar; Madhya Pradesh and Punjab. Each location is centered in very different agroecological and socio-economic conditions and will play a key role in the nation's food security.

Eventually the institute will have about 300 international scientists and technicians, world-class experts who will staff the institute. The Institute will enable CIMMYT and India to create new synergies with the best scientific institutions abroad, in meeting food security challenges at home and making additional contributions to the world.

India has world-class education, research, manufacturing, communications and marketing organizations. These will rapidly and effectively contribute to and absorb the research output of BISA for benefiting the farmers of South Asia.

A major International R&D institution like BISA will make India even a bigger centre for agricultural research in the world and this, in turn, may attract further research & development investment in the country.

A major consideration is for BISA to be complementary, not competitive with Indian institutions. For example, the three BISA locations are side by side with state agricultural universities. In each case these universities, represented here by VCs Dhillon, Kalloo and Chaudhary, are asking us to help them with a transformation of their research and curriculm.

The Government of India and the states of Bihar, Madhya Pradesh and Punjab will be leasing land to BISA and making other in-kind investments. Additional capital will be required for infrastructure development and operations. CIMMYT plans to raise this investment from private, institutional, and governmental donors.

BISA will break ground in 2011. The goal is to have the center up and running by 2012 and open major facilities in 2013

CIMMYT and India have been partners for 50 years.

CIMMYT has been a visitor here for those 50 years. Now it's time we put down some roots.

Implementing precision agriculture – keys for success.

Sam Trengove ph: 0428262057 samtrenny34@hotmail.com

Precision agriculture (PA) has the potential to provide significant improvements in the efficiency at which crop inputs are used including seed, fertiliser, fuel, herbicides, fungicides and growth regulants. This increased efficiency can be achieved through reducing inputs in parts of paddocks where they are not needed or increasing inputs where the input is limiting yield, or both.

Despite the gains that are on offer, the adoption of PA for variable rate applications is low, with a recent Kondinin survey (Farming Ahead, Jan 2010) finding that only 7% of growers have adopted variable rate applications of inputs.

There are three steps involved in adopting PA and variable rate applications. They are

1. Collection of information with GPS: this could be yield, EM38, elevation or crop growth information. This information may also help to target soil and plant tests to ground truth the information collected.
2. Decision making: interpreting the results of the information collected to determine what rates of inputs should be applied and where.
3. Variable rate application: applying the inputs at the appropriate rates to where they are required.

These three steps will be discussed.

Yield maps are an important layer of information to gather for farmers getting into precision agriculture and variable rate application of inputs. Yield maps are important for several reasons

1. Yield maps are a culmination of everything that has happened during the season and provide a guide for where to look in paddocks for factors that are influencing yield.
2. Yield maps provide an indication of how profitable different parts of paddocks are.
3. Yield maps provide a guide for nutrient removal, where more nutrients are removed per ha by higher yielding crops than in lower yielding crops. It has been shown that in many cases the low yielding parts of paddocks have a high nutrient status due to low crop removal. However, this should always be confirmed with soil tests or plant nutrient analysis targeted at different production zones.
4. Yield maps provide a means of testing on farm trials and assessing whether the correct decisions have been made in variable rate applications.

There are many potential causes of variability in crop yields, including variability in soil water availability, crop rooting depth, root and foliar disease pressure, sodic, saline or compacted soils, frost, weeds, insects and nutrient deficiencies or toxicities (Figure 1).

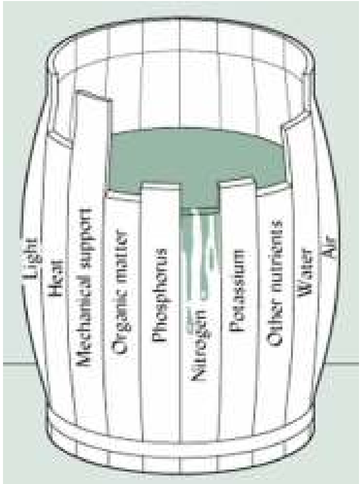

Figure1: Liebig's barrel representing Liebig's law of the minimum. The yield potential of a crop is like a barrel with unequal staves. The capacity of the barrel is limited by the stave of shortest length. The capacity of the barrel is only increased by lengthening the shortest stave until another stave becomes limiting. The full capacity of the barrel represents the genetic yield potential of the crop.

Other layers of information such as soils, crop biomass and elevation can also be used to help identify what factors are causing yields to be limited in certain parts of paddocks. For example EM38 information may help to identify soils with salinity and sodicity constraints. These layers can be useful in targeting inputs. As stated, yield maps are important; however a recent report by Kondinin (Farming Ahead, Jan 2010) states that only 20% of growers are collecting yield maps. These other layers of information provide an avenue for getting into PA where yield maps are not available.

In some cases the causes of low yield can be ameliorated and PA can help target the amelioration to where it is needed most. For example targeting gypsum only to the sodic soils or nitrogen (N) only at crop that is N deficient. However, in other cases amelioration is not possible, especially where yield variations are driven by variability in soil types and the availability of water to the crop in those different soil types. In these cases the paddock information collected, especially yield, can be used to identify different production zones. Crop inputs in each production zone can then be adjusted up or down to reach the corresponding potential yield.

PA is about targeted agronomy. Therefore traditional agronomy tools should still be utilised to understand what is going on and to help determine what rates should be targeted to different zones, including soil tests, plant tests, visual observations and consulting your agronomist.

To draw all the layers of information together and make a management decision will require the use of software that processes geographical information. This may be something that you can do yourself; most yield mapping software packages have this capability. However, if you don't have the software, time or skills to process your own maps then this job can be outsourced. There is a growing service market of both agronomists and PA specialists that can help analyse the information that you have collected and produce prescription maps for your variable rate controller.

It is often perceived that variable rate technology is expensive and this perceived cost of the technology prohibits adoption. The purchase of VRT should be treated like any other machinery purchase and assessed based on its ability to return on the investment. Returns from VRT are affected by a number of factors, some of which are related specifically to the individual property, these factors include

- The cost of inputs

- The price received for produce
- The amount of variability across paddocks
- The cost of data collection and analysis
- The size of the property
- The size of paddocks

For these reasons the returns from PA vary from property to property.

To apply inputs variable rate requires three hardware components

1. GPS: in broadacre cropping a cheap GPS with accuracy ± 5m will do the job for variable rate applications. High accuracy GPS is only required for autosteer/guidance purposes.
2. Variable rate controller: costs vary depending on what equipment is already owned and what functionality is desired.
3. Variable rate applicator: this is most often an air seeder, sprayer or spreader. If the applicator is not capable of variable rate this does not necessarily mean the purchase of new equipment is required, the equipment may be able to be retro fitted with a variable rate drive.

If purchasing new equipment, the following questions should be asked to ensure that the equipment will be compatible with your system

1. Is this system compatible with existing machinery and PA equipment? If the answer is yes, ask the provider for an example of where it is working successfully.
2. What specification computer and or software are required for the storage and manipulation of data? If using a consultant to process your data discuss with them what software they have.
3. For VRT can the controller on the airseeder box, sprayer or spreader be linked to another brand of GPS? If a GPS system is already owned ask about linkages between that specific brand and model.
4. What after sales support services are available for learning how to use the system and for technical problems? Is there 24 h on-farm support?

Whether adopting variable rate applications on farm or not, it is important that application equipment is calibrated well. This is both for application rate and evenness of application across its width. This is particularly important for spreaders. There are a number of factors that affect the evenness of spread width from spreaders; these commonly include spreader setup, product type and quality, wind speed and direction and the width being spread. It is important to know the limits of your spreading width and work within those. A spreader with 20% variance in rate across its spread width means that for a target application rate of 100kg/ha the application rates are varying from 80 to 120kg/ha across the spread width. This may be more than the difference in target application rate between zones.

Conclusion

The aim of precision agriculture and variable rate technology is to improve the business's bottom line, by targeting the use of crop inputs to where they will be utilised most efficiently for the greatest return on investment. This may be achieved by saving money through reducing inputs where they are not required or through increasing crop yields where inputs have been limiting, or both.

While in some cases there can be a significant cost in setting up for PA, the gains on offer can also be significant. Conducting research on the options for equipment upgrade and purchase and speaking with others that use similar equipment will help minimise costs.

Acknowledgements

The Hart Field Site Group gratefully acknowledges its collaboration with SPAA Precision Agriculture Australia and funding from the GRDC for a project to increase the adoption of PA in the Mid North through training and demonstration (SPA00010). The Hart Field Site Group also acknowledges gratefully funding from the Caring For Our Country program for the project Increasing the uptake of sustainable management practices through precision agriculture and reduced tillage systems (BO 01557).

India story for crop science

Stuart Richardson

Recently 9 third year Ag science students from the University of Adelaide embarked on a study tour to north eastern India, accompanied by Tony Rathjen. The students were Claire Gutsche (Yorktown), Stuart Richardson (Tumby Bay), Cameron Taylor (Murtoa), Allesandra Way (Adelaide Hills) Lachlan Parker (Balaklava), Andrew Lehmann (Gulnare), Caroline McGrath (Beachport), Emma Ayliffe (Mintaro) and Tom Blake (Hamilton).

The trip mainly to the two states of Haryana and Punjab, was generously subsidised by the Yitpi foundation and also the University of Adelaide.

The group spent 3-4 days in each Karnal and Ludhiana, where they looked at the local farming systems and agricultural research in those areas. They heard that this area was the food bowl of India, producing about 60% of its total wheat and rice. Even though this is such a productive area, farmers are still facing some increasingly worrying issues, and perhaps unsurprisingly very similar to those faced by producers in Australia and around the world.

For example labour shortages as interest in agriculture in younger generations diminishes, and more people move to the crowded bright lights of bustling cities. This has a huge impact especially in such labour intensive production systems; in the last year the price of contract rice transplanting had tripled.

Another expensive facet of farming we heard of was the price of land; AUS$ 300,000 /ha - needless to say we were speechless when we worked this out and had to check the conversions a couple of times!! The average farm size is 1.4 ha, but one man who farmed 40ha was visited.

Water is also a foreseeable problem, as the water table is dropping at a rate of about 1 meter per year. There is 30 m there; some quick maths will tell you there is a disaster in the pipeline (pardon the pun). All fields in this area are flood irrigated either from bores or channel networks from Himalayan runoff, there is little recharge in from rain due to Puddling - the cultivation of their rice paddies when the soil is wet to break down soil structure, creating a hard pan in the profile to stop drainage and allow standing water to be held on the field. This helps with weed control in traditional transplanted rice. Maize was being tested as a more water efficient option to replace rice in the summer or monsoon season.
A lot of the research and trials are on direct seeding of rice and residue retention, and farmer demonstration sites to get this technology on farm and adopted. Traditionally rice is germinated in a nursery and transplanted as a seedling into the field. Also a lot of residue is burnt before cultivation, or collected and fed to livestock.

The group at directorate of wheat research, Karnal

Grain Market, Punjab; where rice was being brought in bulk, cleaned and weighed into bags before being trucked to the sheller’s for husk removal.


Open bore flooding the rice paddies, contributing to their astonishing water table decline, Karnal.

Harvesting rice, near karnal.

*** Photos Caroline McGrath & Emma Ayliffe