CROP SCIENCE SOCIETY OF S.A. INCORPORATED

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INCORPORATING THE WEED SCIENCE SOCIETY
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Next Meeting **'Agriculture with an international flavour'**

Venue **Richardson Theatre, Roseworthy Campus**

Date **WEDNESDAY 18th SEPTEMBER**

Time **7.30 pm**

Speakers

Chris Preston - "Herbicide resistant weeds march onwards"

The continuing development of herbicide resistance is our most important topic. Surveys by the Weed Group, led by Chris and Peter Boutsalis draw attention to the upsurge in herbicide resistance, particularly in regard to the IMI tolerance in weeds which has rapidly increased in frequency, developing problems with Brome Grass (uck), and resistance to Roundup in ryegrass. **Do not miss this meeting!**

Chris has kindly stepped in as Peter has a heavy travelling program with his work, and is unsure where he will be next Wednesday – somewhere between Donald, Pt Lincoln and Goondawindi.

Agricultural Science Students:

Most of the current outstanding students in agricultural science have ambitions to be employed in consulting so their observations on diverse overseas agricultural systems will be fascinating.

"China" with **Stella Geue**, and **Jess Lemon**.

"Chile", an International Meeting of Agricultural Students, with **Renee Farrow, Amy Gutsche and Jacob Giles.**

Another Topic: Trevor Dillion wrote a "brown bible" annually, early in the new year, highlighting topic on which decisions were to be made for the next season. Current examples would be the need to use IMI resistant crops or the risk from a near monoculture of particular varieties. Is there a place for a newsletter in which various experts give their opinions on such topics? What topics should we endeavour to cover? Add your tuppence!

It is with deep regret that we record the death of one of Australia's most prominent agricultural scientists, ***Doug Reuter****, who died on the 24th of August and is mourned by his family and many, many friends. Doug was the dearly loved husband of Phyl, and loving father of Sally and Katie, father–in-law of Tim, and adored Papa to Libby, Emily and Sophie.*
His friends, including many of his colleagues joined the Funeral Service on the 30th August. Below we reproduce one of the funeral orations, by Ben Robinson, who outlined Doug's contribution to his profession.

Douglas James Reuter, the Scientist, by Ben Robinson

The basic facts:

- B Ag Sc Adelaide 1963, MAgSc Adelaide1972, Ph D Murdoch 1981 and Management of Research and Development course University of NSW 1980
- Principal Research Office Plant Nutrition then Chief of the Crop Research Branch SA Department of Agriculture 1979 and 1990
- Officer in charge of the Northfield Research Laboratories of the South Australian Department of Agriculture 1982 to 1990
- Deputy Chief CSIRO Division of soils and officer in Charge of the Adelaide Laboratories 1990
- A whole range of industry and government policy advisory and liaison committees at the national level too numerous to mention here

Those of who knew him only in his family, sporting and social spheres, may be surprised to learn that he had sufficient time left over to use his unflagging drive and energy to build an eminent career in Research and Development in Agriculture, to lead successful research teams, to help set up and develop various institutions and to provide policy advice at the state and national level.
Doug was an Agronomist, a Soil scientist, and a Plant Physiologist, as well as being

- a Manager both at the day to day level and of big picture national studies
- a Mentor to many young scientists
- an activist for his profession

Words that best describe him as a Scientist are tenacious, rigorous, focussed, time bounded and literate
He was perhaps proudest of

- His team's work on ways to manage manganese deficiency in barley around Warooka.
- His PhD work on selective plant analysis as a diagnostic method for copper and zinc deficiency in subterranean clover and annual medics.
- His leadership role in the development of new plant analytical tests for mineral nutrient deficiency in field crops in SA, and the commercial development of these tests.
- His role in the Development of the Australian Soil and Plant Analysis Council which brought agronomists, soil scientists and the fertiliser industry together to improve fertiliser advice and laboratory standards.
- Two editions of **Plant Analysis: An Interpretation Manual** (both of which I co-edited with him). This is still being used and available as an e-Book from CSIRO Publishing.

- His work on the National Land and Water Audit which took a snapshot of Australia's Natural Resources at the dawn of the 21st century and was used a as a basis for additional research on such things as soil acidification, salinization, and so on.

Any one or two of these career achievements might have satisfied a lesser man.
Doug did some overseas consulting, in Bangladesh, and in common with many of us, found this sort of work frustrating. After he retired from CSIRO he continued with some expert domestic consulting jobs.
He was passionately committed to his professional organisations

- I have already mentioned ASPAC (he was inaugural Vice-chairperson and subsequently Chairperson for two years in the 90s).
- AIAST (he was made a fellow in 1998)
- and the Soil Science Society of Australia (of which he was president of the SA branch in 1989/90).

He was a member of the Rotary Club of Burnside from 1984to 1997 and of course took responsible roles in that club. Doug worked closely with many scientific colleagues during his years in the SA Department of Agriculture (and its successors), and during the setting up of ASPAC and at CSIRO. The list is too long to print here.
None of you will be surprised that during the last 12 months Doug continued his managerial role in a purely voluntary way and encouraged, nay nagged other old grey heads to put together a history of the use of superphosphate in South Australia which has been recently published in the Institute Journal. He roped me in to do the horticulture bit, edited it and met me to discuss it a couple of times at the Store in North Adelaide and made sure that I had got it right. Same old Doug. Ken Peverill tells me he was still working in the days before he died on national soil fertility projects.
Doug and I were friends and colleagues for more than 50 years. We both started at St Marks in 1959. We were part of a small close knit group of Ag Students who completed their degrees at the Waite Institute and graduated in 1963. All of us had pretty good careers, but Doug's was outstanding. We will all miss him at the Golden Jubilee of our graduation to be held on the 18th of October.
Doug was as proud of his scientific achievements on the state and national stage as he was of Phyl and his "girls". We are proud to have known him and to have been a part of his scientific life.

Group A and B herbicide resistance in the Mallee and South East SA in 2012

Peter Boutsalis, Christopher Preston, Gurjeet Gill

Summary: A random weed survey was conducted in SA in 2012 encompassing the northern Mallee, southern Mallee and southeast. Ryegrass, brome, wild oats, wild turnip and milk thistle seeds were collected. The changes in herbicide resistance between the first survey in this region in 2007 to the current survey conducted in 2012 are presented. The most notable changes were the significant increases in resistance to trifluralin, clethodim and glyphosate in ryegrass, particularly in the southeast.

Since 2005, the GRDC has funded the University of Adelaide's Weed Science team to conduct random weed surveys across SA and Vic. Different regions are surveyed every year (Figure 1). Each region is surveyed on a 5 year rotation. In the 2012 survey, paddocks were randomly surveyed for weeds every 5 km in mid-November. At each location, the weeds and the crop present were identified and samples of ryegrass, brome, wild oats, wild turnip and milk thistle were frequently found and collected. Seeds from plants that were present were sampled. These seeds are likely to originate from resistant survivors, herbicide misses, or late germinators. Thus even if the number of resistant plants in a paddock were low and weed control had been effective, our results would indicate a level of resistance. The purpose of the surveys is to detect resistance and not the proportion of resistant individuals in each paddock. Below resistance to Group A and B herbicides is discussed.

Figure 1: Regions surveyed across south-eastern Australia since 2005

In 2012, 365 paddocks were surveyed in eastern SA in an area spanning from Loxton in the upper Mallee to Penola in the lower south east. The survey was divided into three regions, northern Mallee, southern Mallee and south-east. Weeds established from these seed samples were tested in a pot trial in May 2013. A weed sample was scored as resistant if 20% or greater survival was detected in the pot test. Where 0 to 19% survival was recorded, this was not scored as resistant.

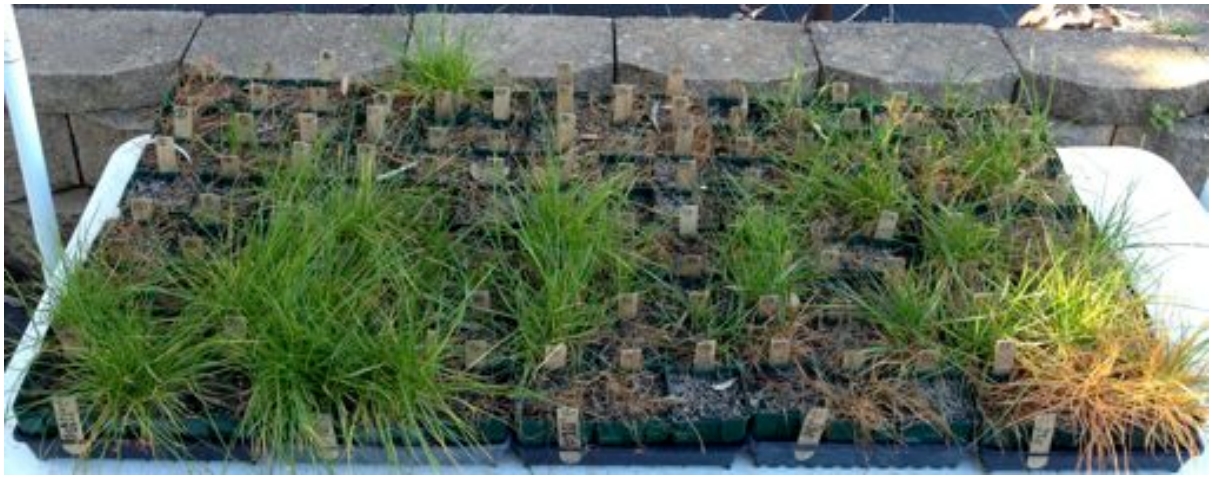
Resistance generally increased between 2007 and 2012. Increases in trifluralin resistance were discussed in a previous article. Resistance in ryegrass to the cereal selective Group A herbicides Hoegrass and Axial increased in all regions. These herbicides are still likely to remain effective in the majority of situations in the northern Mallee and southern Mallee, whereas in the southeast frequent survivors can be expected since resistance to Axial was detected in 80% of the paddocks (Table 1). Resistance to Group B sulfonylureas, represented by Glean, remained at a similar level between 2007 and 2012 with more than half the populations resistant to this herbicide. The Group B imidazolinone (IMI) herbicides, represented by Intervix, was tested in the 2012 survey, but not in the 2007 survey. Ryegrass control with Intervix was greater than with Glean with 34% of populations in the northern Mallee resistant, increasing to 60% of populations in the southeast. The proportion of Glean-resistant ryegrass biotypes that were also resistant to Intervix was 53% in the northern Mallee, 69% in the southern Mallee and 86% in the intensively cropped southeast. Therefore, poor control of ryegrass with IMI herbicides can be expected, particularly in the southeast. Resistance to clethodim (Select) remained unchanged in the Mallee with less than 5% of paddocks resistant, although the rate used was higher than in 2007 reflecting changing farmer practice. However in the south east there was a significant increase in 2012 with clethodim resistance identified in 43% of paddocks. This highlights a serious problem for controlling ryegrass in broadleaf crops, particularly canola.

Glyphosate resistance was not identified in the Mallee, but 16% of paddocks in the southeast contained glyphosate-resistant ryegrass. This is the first detection of such a high level of resistance to glyphosate in ryegrass collected from paddock sampled at random. This has major implications for use of glyphosate in broadacre cropping and highlights that reliance on glyphosate should be reduced to preserve its effectiveness.

Table 1. Percent of resistant samples identified in the South Australian Mallee and South East regions in cropping regions in 2007 and 2012. Resistance is represented by samples with ≥ 20% plant survival in pot trials.

Annual ryegrass	North Mallee		South Mallee		South East	
Herbicides (ml or g/ha)	2007	2012	2007	2012	2007	2012
Trifluralin (1500)	5	20	35	69	43	78
Hoegrass (500)	2	9	12	30	58	90
Glean (30g)	75	70	59	52	71	70
Intervix (750)	nt	34	nt	36	nt	60
Axial (300)	2	7	2	16	53	80
Select(250/350)	2*	0#	2*	2#	2*	43#
Glyphosate (1500)	nt	0	nt	0	0	16

*250ml/ha Select; #350ml/ha Select; nt- not tested in this survey



Response of ryegrass populations collected randomly from the SE of SA in 2012. Each pot is a different paddock population. Plants were sprayed with 1L/ha of Roundup Attack 3 weeks' prior. A known susceptible biotype was included (front right dying plants).

Acknowledgement: this study was fully funded by the GRDC Project number UA00121

Clethodim tolerance in canola

Michael Zerner, SARDI (michael.zerner@sa.gov.au)

Clethodim is an important herbicide in the control of grass weeds, particularly annual ryegrass in canola and pulse crops. Increased application rates of clethodim have become common industry practice in efforts to achieve acceptable control of FOP and DIM resistant annual ryegrass. Widespread observations have suggested that canola appears much more sensitive to these higher rates than other pulse crops. Reported symptoms include delayed flowering, distorted flower buds and possible yield suppression. Crop damage may be influenced by herbicide rate, crop stress at application and possible varietal differences in tolerance.

This is the first year of a research project funded by SAGIT aiming to address the effects of clethodim on growth, development and any associated yield reductions in canola. The project also plans to identify any differing levels of tolerance amongst a range of currently grown canola cultivars and investigate the impact of application time across environments.

Preliminary Findings;

- 12 cultivars evaluated, including conventional, Clearfield and TT types.
- Strong rate response to clethodim.
- Earlier application times appear safer.
- SPAD readings indicate chlorophyll is decreased at higher rates in all cultivars (Figure 1).
- Strong visual symptoms, plants become paler green and shiny in appearance, leaves also appear to become more rigid (less droopy).
- Strong effects on flowering, flowers distorted and petals don't appear to open up freely, more severe at higher rates (Figure 2 and 3).
- Distorted flowers also leading to poor pod development.
- Degree of flower distortion different amongst cultivars (Figure 4).
- Wait and see how this transfers to yield and quality.

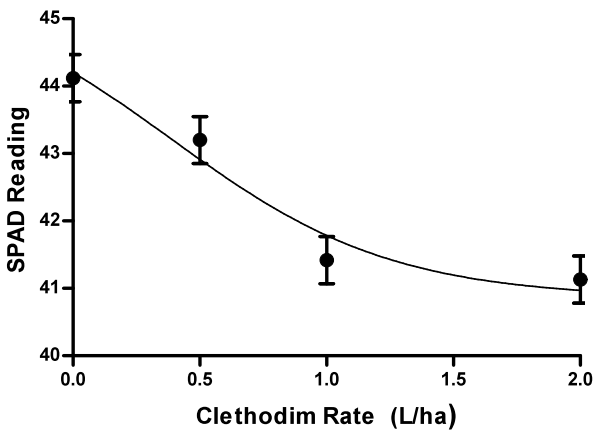


Figure 1. Chlorophyll content (SPAD) of youngest open leaf during stem elongation, following applications of clethodim at the 6-8 leaf growth stage at Roseworthy, SA during 2013.

Figure 2. Untreated plots of Hyola 50 taken at bud formation and during flowering.

Figure 3. Hyola 50 with 1 L/ha of clethodim applied. Notice the lighter colouring of the leaves and distorted flower buds compared to Figure 2.

Figure 4. Varietal tolerance; AV Garnet (left) showing less flower distortion than CB Tango (right), both treated with 2 L/ha of clethodim.

Student Report From China

Stella Geue

In July 2013 a group of 12 Agricultural Science students had the opportunity to travel to China for 2 weeks to gain an insight into their agricultural industry. The trip was dominantly focused around crop production throughout the north-eastern regions of China near Beijing. The contrast to Australia was immense in terms of China's rich, deep soil and high rainfall. Large amounts of intercropping were present in all areas visited, which allowed for year round harvesting. It was common to see corn hand-planted in between grape vines and orchards. The versatility of crops ranged from kiwi fruits, wheat, corn, mungbeans, rice, viticulture and vegetable production all within a similar geographical location.

The images above show the intensive intercropping practices employed.

Most land holdings were owned by a village keeper (landlord), who leased small holdings of approximately 1 acre to families. Farming practices within these holdings were very labour intensive to ensure employment was upheld. The image opposite shows a local farmer cultivating his soil and applying granular fertiliser. The farmer was very particular about making sure the soil was tilled twice, and proud of his technology advancements to apply granular fertiliser at the same time during the second cultivation. The fertiliser was applied directly behind the rotary hoe via a plastic hose straight into the soil. It was therefore not mixed into the soil. This didn't seem to be a problem however as a10t wheat crop was a common yield in this region. Production was also reliant on sub-soil moisture as major rainfall events occur out-of-season.

It was evident that there was little information provided to the farmers in terms of international scientific papers. It is feared that if technology and scientific agriculture became too advanced, farming would become less labour intensive. Therefore an acre block will not sustain a family and the unemployment rate would dramatically increase.

These images above outline the labour intensive and often inefficient practices undertaken by local farmers.

Overall the trip proved very worthwhile for all participating students, and it was great to experience the differences in agricultural practices and production on an international level.

IAAS World Congress, Chile 2013
Attended by Renee Farrow, Jacob Giles and Amy Gutsche

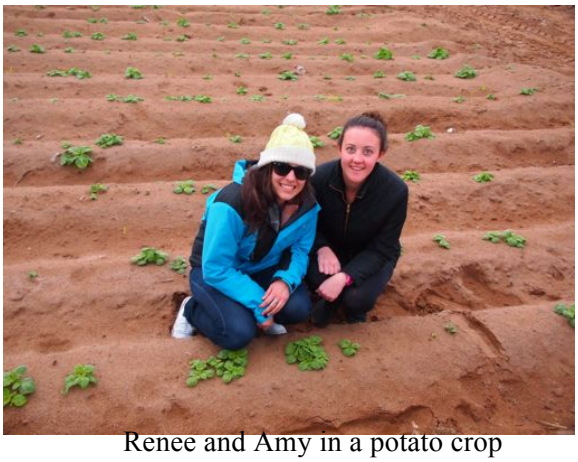
Barns, housing 1000 cows each

From the 17th July until the 6th of August, three students studying a Bachelor of Agricultural Science at Adelaide University went to the International Association of Students in Agricultural and Related Sciences (IAAS) World Congress in Chile. Renee Farrow, Jacob Giles and Amy Gutsche traveled around Chile with 60 students from across the globe visiting different Agricultural sites throughout the incredibly diverse landscapes of Chile.

Irrigation over a potato crop

Many would think of agriculture within a country such as Chile to be of second-class and somewhat lackluster (in comparison to leading agricultural hubs around the world). Latin America is not well known for its stability or wealth, and after the turmoil that Chile has seen over years gone, it was astounding to find such a high level of infrastructure, development, diversity and international relations amongst the agricultural sector. Whilst some farms remained small with outdated technology, most visited maintained efficient levels of production, on a large scale.

Exportation is a big part of Agriculture in Chile and many Chilean producers rely on the exportation industry. Despite the world financial crisis, exports out of Chile continued to increase and Chile now exports to 56 different countries and are part of the Pacific Alliance. Chile produces a vast quantity of fruits and berries, including apples, mandarins, kiwifruit, citrus, avocados, and blueberries. Beef and Pork also make up a large proportion of exports and in fact, Chile is the 5th largest pork exporter in the world.



Renee and Amy in a potato crop

Whilst we were in central Chile, we visited a horticultural farm. This farm performed a 3 crop rotation of potatoes carrots and lettuce, with each crop having a growing season of 4 months. This farm was in an area that had only 80mm of natural rainfall a year. Because of this, irrigation was very important on this farm, and in fact on many farms throughout Chile. 82% (approximately 1.2million hectares) of Agriculture in Chile is irrigated. Approximately 84% of natural water throughout Chile is lost in transit due to a lack of infrastructure. Not only this, but most of Chile has been in drought for 10 years and hence the water sources are dwindling. A water strategy is highly necessary for Chile to continue improving their Agriculture.


Vineyard situated in a valley within the Andes

Whilst on the tour, we were very lucky to have a visit with Alex Hund Diethelm, an expert in Natural Energy Engineering. He was working with smaller farmers to help them save energy on their farms and use natural resources instead. He implemented 'mini' power plants, such as windmills and waterwheels, to harness the energy from natural resources. One farm we saw had a small dam with a windmill, and this was used to perform all the irrigation on this small-scale farm. We were also shown a waterwheel in the creek, which pumped the water from the river into 6 tanks to water the cattle on the property.

The research and innovation in Chilean agriculture continues to increase so the country can keep up its competition with North America. They are trying to maintain the sustainability within the Agriculture in Chile and are particularly aiming to increase the production from small producers. An interesting innovation that has been developed in Chile over the last 15 years was the black truffles. A lot of research and development has gone into the production of these truffles, and they are beginning to see results.

This tour was an incredible experience and we were very lucky to have the chance to go on this. We had the opportunity to see with fascinating Agriculture, make networks studies people all over the world and further our couldn't and knowledge in Agriculture. We The have done it without the kind and the sponsorship from the Yitpi Foundation, We Roseworthy Student and Campus Fund your School of Agriculture, Food and Wine. would like to thank you very much for support.


Jacob, Amy and Renee with the Chilean Minister for Agriculture, Luis Mayol Bouchon

Observations from the US and Canada – Sam Trengrove

Since September 11, 2001, the farming landscape has changed dramatically in the US and Canada, due to government policy on energy self sufficiency and growers have been very profitable over the past few years.

- 300 ethanol plants have been built across the northern US and have created many local jobs, high demand for corn and improved grower returns
- interest rates are low, machinery changeover is regular and land prices have increased significantly
- the US is nearing 15 billion gallons of ethanol from starch, the next step is to start using crop residues! Oil wells, biofuel and wind farms were other forms of alternative fuel
- crop rotations have changed greatly and once included spring wheat and barley, sunflowers and flax in the US. They are now predominantly growing GM corn and soybeans. With shorter season varieties available, corn is even being grown now in Canada, but mainly wheat and GM canola. The cost of GM hybrid corn seed is significant, between $280-$380/ha.
- seeding commences after the ground thaws and dries enough to traffic. Seeding is generally completed within 2 to 3 weeks and some growers aimed to have enough capacity to sow 10% of the cropping program in 24 hours. Soils need to be at least 10˚C to sow corn, therefore exposing some black soil with tillage helps the soil warm up. At harvest they aim to have capacity to harvest 5-8% of the crop in a 24 hour period. Some can still be harvesting after the 1st snow has fallen!
- soil compaction, wet soils and trafficability is a large issue and so tracks on tractors, seeder boxes and chaser bins are becoming more common
- soils typically have very high organic matter, generally over 3-4% and some up to 10%.
- many areas were investing heavily in tile drainage (Ag drain) to drain wet areas and reduce waterlogging.
- herbicide resistant weeds were widespread, including Roundup Ready crop volunteers. Wild oats are the major resistant grass weed in Canada. With widespread group A resistance, control in canola relies on glyphosate and glufosinate and in legumes the Clearfield imidazolinone herbicides.
- long days and mild conditions mean that crop growth is very quick, with crops sown at a similar date to ours but with most now already harvested.
- The cleanup of industry and fuels has reduced the amount of acid rain and free sulphur, so they are now having to apply S.
- Multi peril crop insurance was an important tool for most farm businesses, but appeared to distort the market and farm management decisions. In the US 65% of the insurance premium

was subsidised, however there are less direct subsidies available now than there has been historically.

Corn, a common site throughout the Midwest.

Lincolnway Ethanol plant, Nevada, Iowa.

Large feedlot industry utilising corn and dried distillers grain (DDG), a by-product from ethanol production.

Quad Trac's towing 60-74 foot seeders were common in Canada.

Precision disc planters were more common corn belt.

Growers cropping 20,000 acres + were in the operating fleets of 5 or more headers.

Machine for ripping and installing Agdrain.

The group with Terry Anderson, founder of the Autonomous Tractor Company, and the autonomous tractor in the background.

Oil wells were common. So was canola in

Calgary Stampede, the greatest outdoor Canada. show on earth!