CROP SCIENCE SOCIETY OF S.A. INCORPORATED

C/- WAITE CAMPUS
P.M.B No 1, GLEN OSMOND, SOUTH AUSTRALIA 5064
INCORPORATING THE WEED SCIENCE SOCIETY

ABN: 68 746 893 290

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TOR – Tony Rathjen, articles welcome; fax: (08) 8303 6735 Ph: (08) 8303 7216
email: cropsssa@yahoo.com

TREASURER – Subscriptions
Sandy Kimber
PO Box 761
Clare SA 5453
Ph: (08) 8842 1718
sandy@bariniagrove.com.au

SECRETARY – Correspondence
Larn McMurray
PO Box 822
Clare 5453
Ph: (08) 8842 6265

Next Meeting **'Are nematodes the answer?'**

Venue **Richardson Theatre, Roseworthy Campus**

Date **WEDNESDAY 29th AUGUST**

Time **7.30 pm**

Speakers

Tony Craddock: Rural Directions
Tony will be talking on his longer term work with soil moisture probes and how they can be used in a cropping system.

Gavin Ash: Charles Sturt Uni
Gavin will share his work on snail control, nematodes may be the answer!!!

Tony Rathjen and students
Tony and some of his students will share some thoughts on their (recent) travels abroad.

The articles below are the result of a specific request by the editor for Millie Nicholls to set down her thoughts on water in the landscape in the Mid-North. We are grateful to her for the following as it should promote observations and discussion on the topics of infiltration rates, soil strength and permeability and the frequency of swamps and ponds in the landscape.

Millie Nicholls, North Marola, writes

I have attached a file which contains what I know about water in this region. I am sure I could find some technical papers, but I haven't had time. Most of it is personal experiences, not published and I don't have a copy of the Yacka town history, but the pictures of the river are in their local history collection.

Strangely, most of the historical material I have says very little about water, or vegetation for that matter. You would think when it was so critical that it would have been something worth mentioning in great detail. I have a copy of Eyre's description of this area, which is what you also have, and I believe that in 1842 Tolmer and a man called Thomas Burr, after looking for the missing Charles Dutton on Eyre Peninsula, came back on the eastern side of the Flinders Ranges and Burr's Report
to the Surveyor General said "This country is well wooded and watered and the grass grows as luxuriantly as I have seen in any part of the province" I'd hardly describe it like that today!!

I haven't seen the full report – only this extract. It would be interesting to look at the early survey maps as well, but it would only be possible if there was more time.

There are several things which I think have contributed to the lack of water in today's landscape. One is the loss of the perennial vegetation, which is not a very original thought! But when I drive around the Northern Agricultural Districts, for most of the year most paddocks have less than 1000kg/ha/dm, which is way too low. I am sure it is one of the reasons the lambing percentages in merino flocks are often low – the poor ewes are struggling even to stay alive if you listen to the current AWI information about the requirements of pregnant ewes.

But this overgrazing never allows the plants to grow and develop a good root system anyway – their leaves rarely get longer then 2-3 cms and that's not enough to develop a healthy plant. And the loss of the perennials, even in non arable areas, through overgrazing means that the root systems are nothing like they were in pre-European times when the dominant grasses were perennials.

And along with that, the loss of soil organic matter, which of course holds water in the soil. I have a soil test from the Perry Laboratory, done here eight years ago on native pastures that have never been ploughed. The OM is 7.30% - compared to cropped soils which I am told are often now less than 1%. A huge difference in water holding capacity.

The other thing I think is critical is tied to the health of the plants. In the work the Mid North Grasslands Group did a few years ago, we had Cliff Hignett (ex CSIRO) do some soil surveys for us. We tested a paddock that was effectively set stocked for eight months of the year, which is typical of most of the region, and paddock that had high density, short duration grazing for no more than 3 days at a time, and only when the plants had recovered from previous grazing events, and which had twice the stocking rate of the set stocked ones over the duration of a year. There was a substantial increase in the infiltration rate in the high density paddock compared to the set stocked paddock, with the soil particles bonding into stronger small aggregates, leaving relatively large pores between them. I would suggest this is due to the fact that the roots of the plants had a chance to develop in line with the leaf growth, and then when the grazing event occurred, the energy stored in the roots was used to re-grow the leaves and therefore the roots died back, and this growing/dying helped open up the soil. Plus the effect of more material for the micro-organisms to work with etc.

I think most of the soils in these overgrazed annual pastures we see today are terribly compacted, due to the poor root development of the plants and the effect of the continuous presence of sheep. And the water runs off quickly after a rain, and doesn't have a chance to infiltrate the soil and slowly work its way through to the water table as it should do.

Water in the Landscape

South of Robertstown there was a big lagoon – the Robertstown Lagoon - that filled most years– about 230 has in size. There is a band of lignum that still exists that outlines the edges of the swamp, but it rarely fills now – often only 8 - 10 hectares with water even in a good year.

North west of Burra there is a low lying area which was a swamp up until about fifty years ago. It still has a remnant patch of native Puccinellia (*Puccinellia stricta*)– also called Australian marsh grass, a salt tolerant native grass that lives in low lying, wet areas.

Just west of Farrell Flat, the water went north in the Farrell Flat Creek, which became the Baldry Creek, and joined with the flow from the Booborowie Valley, running into the cement drains which fed into the Bundaleer Reservoir.

The flats around Farrell Flat were waterlogged and were sedgelands – this is a quote from the South East Broughton Salinity Management Plan -

> The in-stream reedbeds of the SEBC consist of a range of plants such as common reed, bulrush, rushes and sedges. Reedbeds tend to grow in areas with permanent baseflow and/or shallow groundwater combined with high sediment loads and lack of shade. The largest extent of reedbeds is along the Broughton, lower and middle reaches of the Hutt and Hill Rivers as well as the Baldry Creek (Favier *et al.* 2004).
>
> The vegetation along and in the watercourse has changed greatly due to land clearing, grazing and the practice of cropping paddocks to the tops of the banks. In many cases the riparian zone is now dominated by annual exotic grasses with less than 10% of the over-storey.
>
> Land clearance and agricultural practices have increased overland flow and sedimentation in watercourses, which have created a habitat more favourable to the common reed to the point where it now dominates the system (Favier *et al.* 2004).
> Reed beds provide food and shelter for fish, frogs, macro-invertebrates and birds. They also reduce the water velocity along the edges of the channels and reduce erosion.
>
> There are still remnant areas of sedgeland and nardoo – but its only small remnants of what was a large area of wetlands/marshes.

The change of flows in the Hutt River are well documented. Flooding of the flats along the Hutt to the west of Hilltown was common in winter fifty years ago. There are still some areas where nardoo can be found in areas that were originally flooded by the overflow from the creek. Eyre reported the Hutt to be a "a fine chain of large deep pools ", and a few of these pools remain. The whole nature of the river has changed. There are photographs at Yacka of a clear stream flowing over a rocky stream bed - now it is choked with reeds and has a muddy base.

Booborowie Valley:

An old farmer that lives in the area told me the following story:

His father and uncle owned a hairdressers shop in Terowie. When Booborowie Station was subdivided and put up for sale (about 1913), they decided to buy a block and go farming. They rode a motor bike down to the Booborowie Station homestead, to meet the manager and get permission to look at the

blocks around the valley. The manager there told them to take a horse each from the yard, as they wouldn't get far on the motorbike. They saddled up a couple of horses, and rode through the valley to choose some suitable blocks. As they rode through the valley, the horses were up to their fetlocks in water, so they thought they would never be able to grow wheat on the floor of the valley, and chose a block just to the north east of what is now the Booborowie township, and bought it. The farmer told me it was the worst decision his father ever made!!

Colin Broad, who lived at the Booborowie homestead, told us in the early seventies that he had seen 75 families go out of the valley in his lifetime. The northern part of the valley was dairy farms between the Wars, and there was a butter factory at North Booborowie, at the property that is now known as "Lorraine". The dairy farmers cut four cuts of lucerne hay in a summer in the early days, and there were big stacks of lucerne hay all over the flats. In the early seventies, there was still a permanent stream that ran out of the hills and across the road just north of the North Booborowie Oval. It is now dry most of the year.

The round water hole, from which Booborowie gets its name, was just north of the town, and had been the main supply for the town originally. People used to take their drays with barrels on them, and fill them up at the water hole. Now, it is silted up, and the Booborowie Creek rarely flows, whereas even in the seventies it flowed during the winter.

The Bungaree property at Booborowie had paddocks called "Big Swamp" and "Little Swamp", which were named in the thirties when the property was purchased. We were told that in the fifties you could dig a post hole before lunch, and when you came back after lunch it was full of water. In the seventies, the water in the wells on the property was around 10 foot deep, although the wells themselves were twenty to thirty foot deep. The whole valley was covered in lucerne, and it grew on the higher ground as well. Now, the lucerne is limited to the lower parts of the valley, and the water table is much lower.

Again, from the South East Broughton River Salinity Management Plan -

> Lucerne for grazing, seed and hay production has been grown in the Booborowie Valley since the 1920s. Due to the availability of good quality underground water many of these crops are irrigated. Due to the extraction of underground water as well as the high water use ability of lucerne the water tables have been lowered over the years.

Small townships such Wilmington and Terowie, also had to find their own water supplies, and constructed town water catchment systems which were fed by diverting water from local creeks, using weirs and dams to collect the water. These creeks are mostly now dry, and the catchment systems have collapsed. Brinkworth had dam on Allotment 12 in the Main Street, constructed for their water supply - even though the streets are now sealed, it rarely catches water today. Water supplies for the trains also often required local catchment systems. At Brinkworth, a railway dam was constructed east of the town, and it diverted water from the Magpie Creek into the dam. Then the water would run by gravity to the overhead tank in the railway yard, and to railway residences and the hotel. There was a water reserve just next to this dam, and now no water is found at either the reserve or the dam. There must have been lots of little systems like this all over the state providing water for the steam trains that have now fallen into disrepair as before there was a reticulated water supply how did they get water for the trains?

Borlaug Institute for South Asia – a new initiative for CIMMYT

By Andrew Barr, CIMMYT Board of Trustees member.

CIMMYT may be known to many of you as the International Maize and Wheat Centre based in Mexico. It has RDE activites in over 70 countries across the developing world. Australia is a generous supporter of CIMMYT through GRDC, ACIAR and AUSAID but has received great benefits from its investment – for instance, around 70% of Australia's wheat varieties have a parent from CIMMYT's breeding program.

CIMMYT has identified south Asia as a focus for increased RDE given its burgeoning population and the projected adverse impacts of climate change on its cropping belt. So in 2011 CIMMYT and the Indian Government announced a major new initiative to tackle the issues of improving the production of grain crops in south Asia. The initiative will be known as the "Borlaug Institute for South Asia", and will encompass a new research institute across three separate campuses in India. The following press release summarises the plan for the institute (from http://www.scidev.net/en/south-asia/news/borlaug-institute-south-asia-to-address-food-security-1.html);

"The Borlaug Institute for South Asia (BISA), named for the US-born agriculture scientist, will help meet rising food security challenges in developing countries by boosting research in wheat and maize.

The Indian Council of Agricultural Research (ICAR) and the International Maize and Wheat Improvement Centre (CIMMYT), Mexico, will work together to offer sophisticated crop research facilities at the new institute, spread over three locations in India.

The institute has been set up in honour of the 1970 Nobel Peace Prize winner and wheat expert Norman Borlaug (1914–2009) whose work on high-yielding, dwarf varieties of wheat helped trigger India's 'green revolution' in the 1960s.

"It would not be an overstatement to say that Norman Borlaug is a household name in India," India's minister for agriculture and food processing, Sharad Pawar, said at the launch of the institute last week (5 October).

CIMMYT director-general Thomas Lumpkin told SciDev.Net*: "The coming green revolution in South Asia will look far more technical than it did in the 1960s, but the impetus for addressing food security is just as urgent."*

"The challenge today," he said, "is to increase yields of staple crops in South Asia despite the fact that climate change, population growth, dietary changes, and natural resource degradation all pose enormous challenges to agriculture".

Lumpkin said BISA has been created to "address the challenges head on." He said providing food security was "a daunting task" and the region needed "a dedicated, world-class effort focused entirely on these problems."

Critical areas of wheat and maize research that BISA would focus on include genomics and conservation technologies such as location specific seed-fertiliser placement and supplemental irrigation systems.

BISA will also look at support tools like farmer specific mobile phone advice and provide information on farming practices, market and weather databases and integrating software.

At the launch, CIMMYT and ICAR signed an agreement to set up centres under BISA in the states of Punjab in north India, Bihar in eastern India, and Madhya Pradesh in central India.

"Each of the states comprises varied agro-ecological zones, allowing testing of diverse maize and wheat varieties and cropping practices suited to the equally varied environments of South Asia," a CIMMYT release said.

Punjab and adjacent Haryana state — together considered India's wheat bowl — were at the forefront of the green revolution that boosted wheat yields using high-yielding dwarf varieties and intensive application of irrigation and fertilisers."

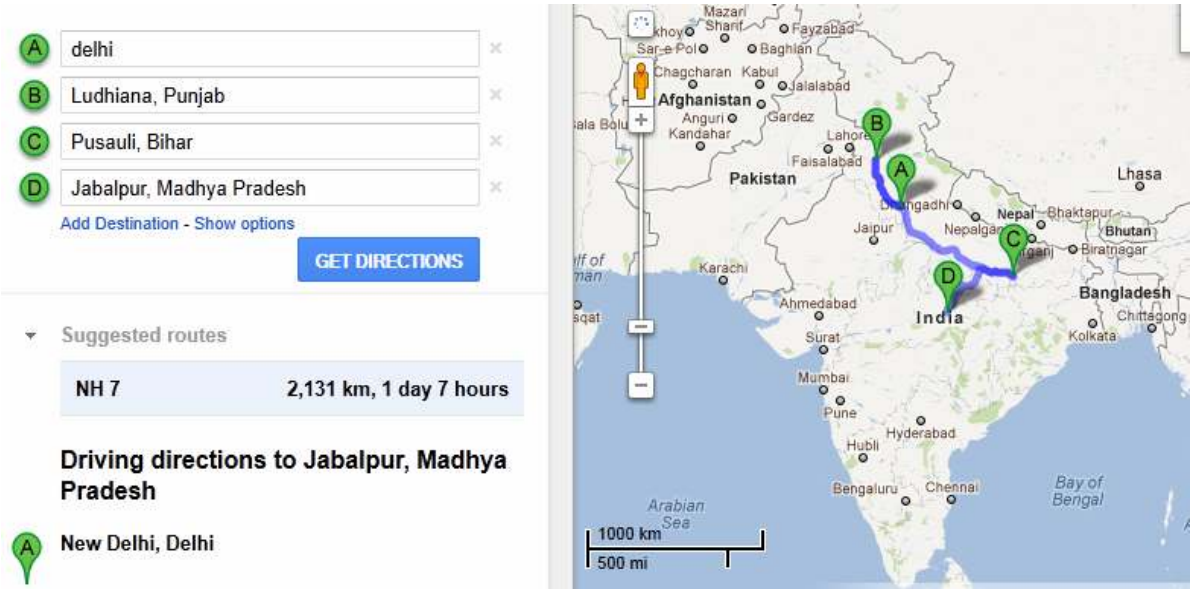

***Figure 1; Location of the three planned Borlaug Institute campuses, relative to Delhi**.*

I was lucky enough to inspect these sites in January 2012 – the generosity and goodwill toward the initiative is huge ($US2 bn dollars worth of land donated for the centres). Each centre is located on the outskirts of a major centre in 3 very different parts of the Indian grain belt. Two of the centres are virtually "greenfields" sites while one was previously a sugar cane experimental farm, so the BISA partners have the opportunity to mould entirely new facilities to tackle current challenges using the best available research technologies. Below are some photos from the trip …..

Laser levelling of irrigated areas at the Ludhiana site (Punjab state)

Local farmers discuss the BISA site at Ludhiana with Raj Gupta (CIMMYT India, left centre) and Etienne Duveiller (seconded from CIMMYT Mexico to oversee the project, right side)

Prototype seeder for sowing wheat into heavy rice stubble featuring sickle bar cutters in front of every seeding tyne. The Punjab state has a strong agricultural engineering history.

Tom Lumpkin (CIMMYT DG, foreground right) at a traditional sod turning ceremony at the Jabalpur site

“Happy Seeder” developed for sowing into heavy rice stubbles, features a rotary slasher in front of each seeding tyne which clears a path for the tyne

David Sparrow

An appreciation by Jason Eglinton and Tony Rathjen

David was born in Bournemouth, England in 1927. He graduated from the University of Reading, England with a B.Sc. (Hons) in Agricultural Botany in 1952. He was appointed Lecturer in Plant Breeding and Genetics in the Department of Agronomy, at the Waite Agricultural Research Institute of the University of Adelaide in 1960, to become the first full time barley breeder in Australia.

In his time at the Plant Breeding Institute in Cambridge before coming to Australia, working under the director Dr. G. D. H. Bell, he contributed to the production of 5 new varieties of barley, including Maris Otter, which is today acknowledged right across the brewing world as producing the finest-quality malt available.

David' appointment was funded by the Barley Research Fund, possibly the first of the grower funded research levies, which had only recently been introduced in South Australia. Support for this levy was fostered by disquiet in the Malting Industry at the rising protein levels in barley from nitrogen fixation by pasture medics, in the traditional barley growing district of Yorke Peninsula. At that time, the leader of the Breeding Programs, Dr Keith Findlay was beginning to introduce specially designed and built seeding and harvesting equipment for cereal breeding, and information and data handling by the first computer in South Australia, at the WRE at Edinburgh.

Over the following years, the wheat and barley breeding teams worked as a unit with these developing technologies so that the Waite had two of the largest, in terms of selection intensity, cereal breeding programs in the world. Significantly, this selection was carried out mostly on commercial farms, initially at Winulta, Minlaton, Monarto and Saddleworth, and this led to the continuing scientific investigations with the theme of understanding adaptation to Australian conditions.

As part of his ongoing research into barley he completed his PhD from the University of Adelaide in 1972 with a thesis entitled "Studies of genotypic differences in the malting quality of barley". Barley quality remained his primary scientific interest for the rest of his career. He continued to work as the Principal Barley breeder until his retirement in December 1992. He also contributed to 4 other barley varieties before he retired in 1992, but which were released after he retired (Barque, Sloop, Keel and Dhow).

During his career, he had three varietal releases which revolutionised the Barley Industry. The first of these in the late 1960s, **Clipper**, resulted from a cross between a locally adapted variety, Prior, selected by a Mr Prior at Glenelg, with a high quality English variety, Proctor. Apart from the improved quality, this had better standing ability and was less prone to head loss than its predecessor.

The second **Galleon**, released in the early 1980s, had a pedigree (Clipper*Hiproly)*WI2231#3), with WI2231 having the ancestry (Proctor*CI3576). The nematode resistance and reliable agronomic performance of Galleon established the large scale production of dedicated feed barley varieties which largely remains a unique feature of South Australian farming systems. The Galleon/medic pasture rotation was particularly successful on Yorke Peninsula. CI3576 is a most interesting line, collected from the north coastal region of Egypt, where it was probably grown in a small field where a barrier had been built across a wadi, so that alluvial soil collected and a primitive level of irrigation helped ensure crop growth. It is probable that barley had been grown in this circumstance for a great number of years, so the subsequent discovery of the nematode resistance, both CCN and RLN, is not surprising, and given the conditions, nor was the comparative tolerance to high levels of soil boron.

The third of his major releases was **Schooner**, from a (Prior A*Proctor)*(Proctor*CI3576) cross.
The challenge of combining nematode resistance with malting quality was not trivial and it was not until the release of **SloopSA** in 2002 that it was achieved.

This long running struggle to combine the nematode resistance with malting quality and adaptation to SA soils, which has been the dominant theme of David's breeding emphasises the size and complexity of both the barley genome and the complexity and variability of our environment. The industry needs to be wary of outlandish claims.

He had considerable influence through his teaching, both at the undergraduate and postgraduate level when he supervised a number of Ph D projects. He was greatly respected by his close colleagues for his friendship, support and sound common sense.

The sinking of the 'Barley Ute'

This remarkable event took place on the way to the Nildottie Field Day. The road to the ferry winds around a lagoon and back along the river, giving an impression of travelling uphill. On reaching the ferry ramp, David noted with dismay the punt was at the opposite side of the Murray, so he got and rang the hand bell to attract the Ferry's Master Boatman. Dismay: he had failed to engage the hand brake so the Ute rolled gently down the ramp into the river where it floated around near the ramp while water poured in through the air vents. The Punt Master hurried back, and, red faced, causing concern that he would have a heart attack, undid his dingy and attempted to rope the Ute, which nevertheless sank.

Initial news of a lone would-be-sailor marooned at Walker Flat caused some hilarity at Nildottie. Then came a heart stopping thought – Was Max Howe in the Ute with David? Fortunately not!

David was ragged about this incident almost endlessly which he, to his great credit, he took with remarkably well. With the final act in this small drama coming at David's farewell with Max presenting David with a model Ute in a bottle.

David Sparrow's contributions to the Australian Grains Industry made him a worthy recipient of Farrer Medal in 1990, the ultimate accolade in Australia for a crop-breeder, and the 1995 RACI, Cereal Chemistry Division Founders Awards. After 1995 he was also awarded the Australian Federal Governments Centenary Medal 2001, the inaugural Science Excellence Award SA for excellence in research for commercial outcomes in 2005 from the South Australian Government; and of course was made a Fellow of the Institute of Brewing and Distilling in 2005.

Along with a number of his colleagues, David Sparrow was unhappy with the introduction of Plant Variety Rights and privatization of breeding programs. Recent history with these developments have appeared to vindicate this stance. While he was an intensely private man, he had a deeply seated socialist belief that the powerful and wealthy should not use their privileges to the detriment of others in the community.

David Sparrow has served the Australian barley industry well, from farmers through to the malting and brewing industries. He investigated the failings of current varieties, understood the changes in the industry and adopted new and innovative ideas. He leaves a legacy of excellent breeding material to his successors.

David passed away in Adelaide on 22nd March aged 84 and is survived by his wife Gwyneth, daughter Karen, son Duncan and granddaughter Laura

Crop Science Society Committee – 2012/13

Position	Name	Email	Phone
President	Anthony Pfitzner	gwgfarm@bigpond.com	0429 811 984
Vice President/ Publicity Officer	VACANT		
Immediate Past President	John Both	john.both@au.nufarm.com	0418 803 055
Secretary	Larn McMurray	larn.mcmurray@sa.gov.au	8842 6265 0417898803
Treasurer	Susan Fuss	gsfuss@bigpond.com	0407 900 055
Editor & Web site coordinator	Tony Rathjen	anthony.rathjen@adelaide.edu.au Crop Science Email Address cropsssa@yahoo.com	8303 7216 8303 6735 (fax) 0408 816 533
Co-Editor	Judy Rathjen	juditrat@yahoo.com	0421 183 978
Committee Members	Paul Lush	ptlush@twpo.com.au	0417 865 257 8527 2452
	Chris Preston	christopher.preston@adelaide.edu.au	8303 7237 0488 404 120
	Tony Craddock	tcraddock@ruraldirections.com	8564 3300 0417 809 317
	Rob Wheeler	rob.wheeler@sa.gov.au	8303 9480 0401 148 935
	Peter Smith	peter.smith@urrbraehs.sa.edu.au	0411 127 478
	Jamie Wilson	jamie.wilson@viterra.com	0400 545 152
	Ben Fleet	benjamin.fleet@adelaide.edu.au	0417 976019
	Tom Robinson	anashka.farms@gmail.com	0400 291 219
	Neil Wittwer	nwittwer@peracto.com	0422 057715

Minutes from the AGM are available on the website. www.adelaide.edu.au/css/

Kenton Porker
Research Agronomist, SARDI
During July, I was fortunate to travel throughout North America and Western Canada to investigate some of the agronomic challenges facing farming systems there. During the trip, I gathered ideas and innovation from research programs and growers that may benefit the South Australia grain industry, and gained invaluable professional knowledge and experience, for which I gratefully acknowledge funding from the Yitpi Foundation and the Paul Johnston Memorial Trust. I have included a very brief snapshot of some of the issues I encountered.

One example of Glyphosate resistant weeds in US and Canada:
Kochia (kochia scoparia) is a major summer weed affecting broad acre agriculture throughout Northern America and Western Canada. Glyphosate has typically offered good control, however the reliance on Glyphosate as a broad spectrum herbicide in summer fallow and the rapid adoption and use of Roundup Ready GMO Crop technology has led to widespread Glyphosate resistance (GR) in Kochia throughout Northern America and into Southern Alberta, Canada. Kochia has proven resistant up to five times the label rate of glyphosate. Kochia thrives in hot conditions and can withstand long summers, making it a formidable pest. Kochia has spread from contract harvesters carrying seed northward on the harvest trail into Canada, and by the wind across fields. One Kochia plant can produce >15,000 seeds with up to 95% viability. The seeds spread when plants detach after the growing season and roll across the fields with the wind. These biological characteristics facilitate rapid dispersal of resistant populations. This "tumbleweed' effect is illustrated in photo below, showing how one or two GR plants can roll through a field, spreading seed. This photo was taken after the paddock was sprayed with glyphosate in a summer fallow.

Figure 1. Glyphosate resistant Kochia plants identified in Southern Alberta (Canada) in a summer chemical fallow field, seeds are spread by the wind as the plant is blown across paddock.

Figure 2 & 3. Glyphosate resistant Kochia happily growing in a Roundup Ready Corn field trial that has been sprayed three times with Glyphosate (left) and Kochia proving to be a major problem in a crop of Lentils (right) both near Dickinson, North Dakota.

Figure 4. Droughted corn crops in Ames, Iowa (North America) were starting to wilt and dry up from the base of the stem. Strong winds combined with moisture stress meant this crop effectively fell over and snapped at the base of the stem.

Figure 5. Meanwhile, a malting barley crop in Lacombe, Alberta, shows severe lodging due to excessive moisture and excellent growing conditions. This field was not sprayed with a growth regulant.