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INCORPORATING THE WEED SCIENCE SOCIETY
ABN: 68 746 893 290

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EDITOR – 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	**'Spraying Pressures and Planning Issues for the Coming Season'**
Venue	**Stefanson Theatre, Roseworthy Campus**
Date	**WEDNESDAY 29th June**
Time	**6.30 pm*******

Join us at 6.30 pm for a guided tour of the new Roseworthy Veterinarian Facility!

Speakers

Michael Zerner, University of Adelaide - ***Breeding for more competitive wheat varieties***

Plus more being arranged.

Please send us your email addresses or SMS numbers!

The Crop Science Society wants to keep up with the times and use these technologies to communicate about meetings and other items of interest.

SMS: 0408 816 533
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To be added to the list.

Utilising Chicken Litter as a Soil Improvement Agent

Tony Craddock, Julianne Fiebig and Cherie Johnson, Rural Directions Pty Ltd.

Background

In addition to chicken litter from meat chicken sheds being utilised in broadacre farming systems as an alternative nutrient source for crops, in the lower North district of SA, some growers are applying chicken litter to poor producing or problem soils in an attempt to improve them.
Low fertility sand hills and hard-setting red-brown earth soils are particularly targeted. The rates of chicken litter applied to these problem soils are often 2 to 5 times higher than district practice rates of 2.5-3t/ha with the aim of supplying high amounts of nutrients and organic matter to boost fertility levels.
These high rates may pose potential risks. Production of excessive crop growth due to high application levels of nitrogen in particular, resulting in higher screenings and "burning off" of crops in dry seasonal finishes is a key risk at least in the year of application. Another risk with very high rates of application is elevated heavy metal levels in the soil.
To investigate chicken litter as a soil improver a simple replicated demonstration trial was set up on a low fertility sandhill near Balaklava in SA's mid North cropping district in 2010. This trial included a number of different rates of chicken litter spread in Autumn prior to sowing a wheat crop. The aim is to monitor crop performance, grain quality parameters, plant tissue, grain and soil nutrient levels over several years to evaluate the effectiveness and risks associated with this use pattern for chicken litter.

Demonstration Trial

Table 3: Chicken litter Analysis (dry weight basis)

Nitrogen (%)	**Phosphorus (%)**	**Potassium (%)**	**Sulphur (%)**	**Zinc (mg/kg)**	**Manganese (mg/kg)**
1.36	3.88	1.67	0.53	360	385
Copper (mg/kg)	**Magnesium (%)**	**Lead (ug/kg)**	**Nickel (mg/kg)**	**Sodium (%)**	**Iron (mg/kg)**
135	0.53	1048	4160	0.52	1099
Arsenic (ug/kg)	**Boron (mg/kg)**	**Cadmium (ug/kg)**	**Calcium (%)**	**Chromium (ug/kg)**	
320	19.4	84	2.51	134.6	

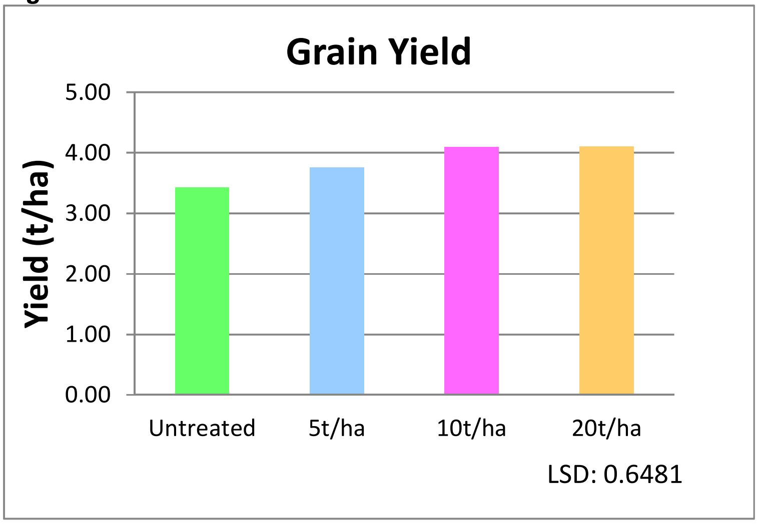
Raw, straw-based chicken litter was sourced from a commercial chicken meat farm near Mallala in SA. The chicken litter was spread on the 17th of May.
The trial was sown with Clearfield Stiletto wheat on the 28th of May 2010 together with 100kg/ha of NPK 24:16:0 fertiliser using a commercial airseeder fitted with 4" shares and finger-tyne harrows.
An additional 80/ha of urea was applied to all plots post emergence (13th July 2010). Plots were also spread with mouse bait due to high mouse numbers which caused some initial damage.
Youngest Emerged Blades (YEB's) were sampled from all plots on the 31st of August 2010.

Results and Discussion

Table 4: Grain Yield and Quality Results

Treatment	**Grain Protein (%)**	**Grain Screenings (%)**	**Grain Test Weight(kg/hL)**	**Grain Yield (t/ha)**
Untreated	11.83	5.13	73.33	3.43
5t/ha	10.47	4.20	74.83	3.76
10t/ha	10.47	4.13	74.50	4.09
20t/ha	10.27	6.74	74.83	4.10
LSD 5%	n.s.	n.s.	n.s.	0.6481

Figure 1: Grain Yield



Visual responses in crop growth and vigour were clearly evident in all treatments where chicken litter was applied. Responses were proportional to the rate of chicken litter applied, with the untreated showing the least visual response and 20 tonnes per hectare showing the greatest visual response. Significant grain yield increases were measured of over 0.65 tonnes per hectare at the 10 and 20 tonne per hectare application rates. Grain quality was not significantly affected although screenings levels appeared to be slightly higher when chicken litter was applied at 20 tonnes per ha. Surprisingly the 20 t/ha treatment did not have an adverse affect on grain yield and quality given the risk off excessive crop growth and subsequent “burning off”. This is likely to be attributable to the above average spring rainfall and cool seasonal finish experienced in 2010.

Figure 2: Plant Tissue Levels – Nitrogen

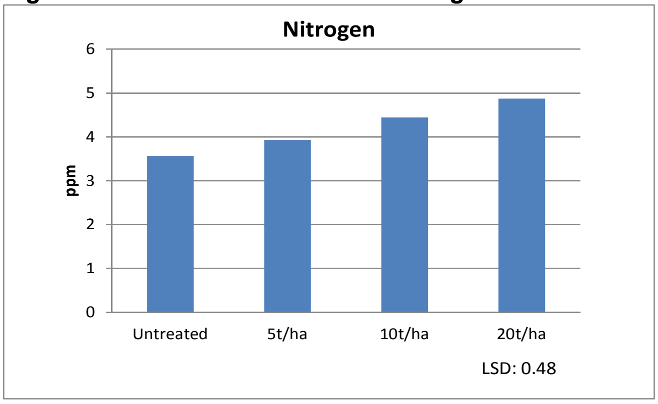


Figure 3: Plant Tissue Levels - Phosphorus

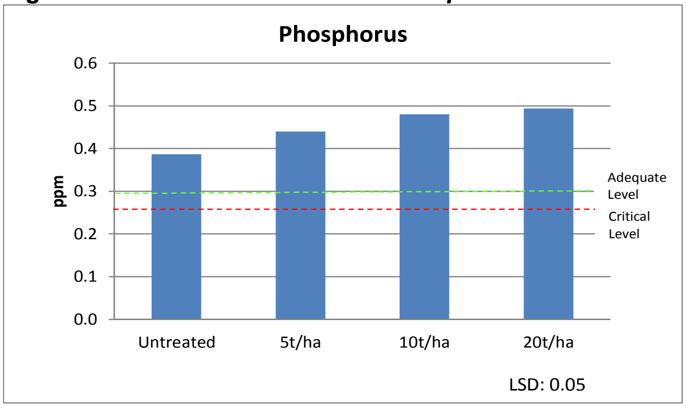


Figure 4: Plant Tissue Levels - Potassium

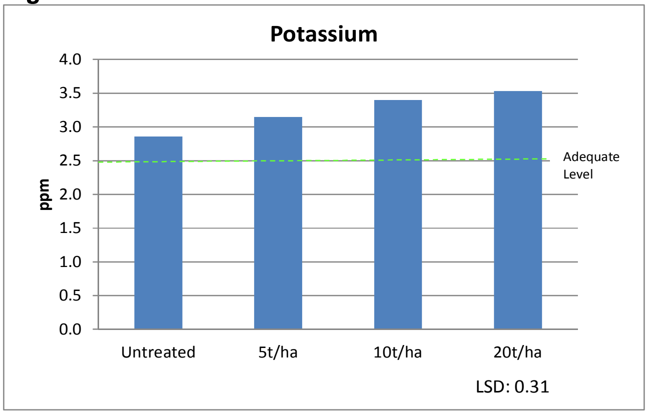


Figure 5: Plant Tissue Levels - Sulphur

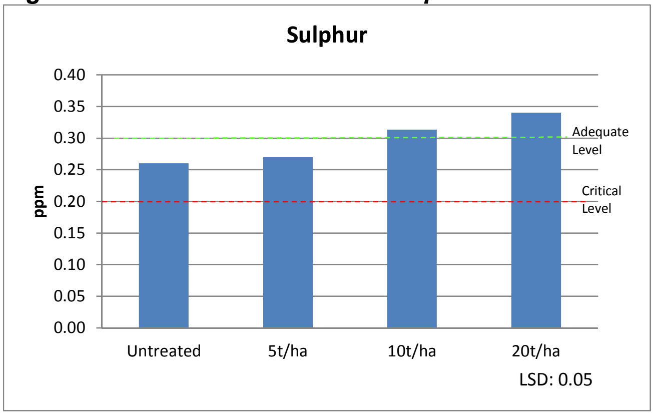


Figure 6: Plant Tissue Levels - Copper

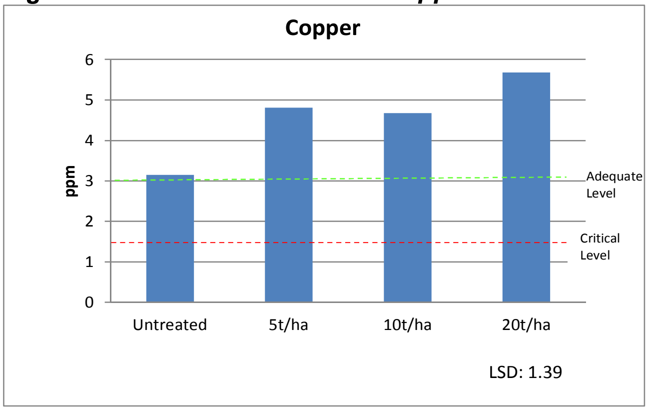


Figure 7: Plant Tissue Levels - Manganese

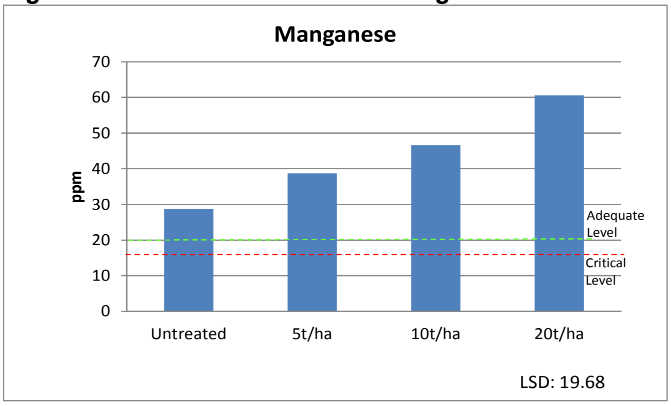
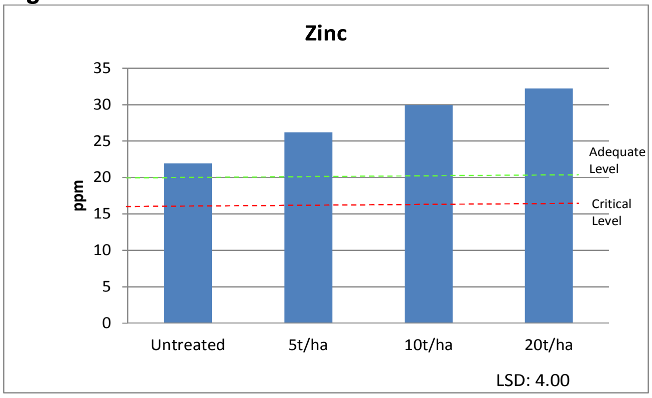


Figure 8: Plant Tissue Levels - Zinc



It is evident from figures 2-8 that there were responses in key plant nutrient levels to increasing chicken litter application rates. Although plant tissue levels of nutrients in the untreated plots were not below critical levels, nitrogen, phosphorus, potassium, sulphur, manganese, zinc, copper and levels were elevated by the application of chicken litter.

This indicates that at least a portion of the nutrients supplied in chicken litter were accessed by plants in the year of application. Although plant tissue levels of nitrogen were elevated in chicken litter treated plots, grain protein levels were not significantly different.

Table 5:"Back of the Envelope" Economic Analysis

Costs	**$/ha** *(10t/ha application rate)*
Chicken litter (delivered to paddock) @ $25 per tonne	$250
Contract Spreading at $12.50 per tonne	$125
Total Costs ($/ha)	**$375**
Benefit	
660kg/ha additional wheat yield @ $250 per tonne	**$165**
Conclusion Yield Advantages will need to be sustained for greater than 2 years for the project benefits to exceed costs	

Conclusions

Wheat yield responses of up to 0.67 t/ha or 19.5% were achieved by the application of high rates of raw chicken litter to a poor producing sandy soil. In this trial, 10 tonnes per ha of chicken litter appeared to be the optimal application rate. No additional yield benefits were evident when product was applied at 20t/ha. Applications of chicken litter increased plant tissue levels of key macro and trace elements including nitrogen, phosphorus, potassium, sulphur, zinc, manganese and copper. There were significant costs associated with the supply and contract spreading of high rates of chicken litter. Indications were that at this site, yield benefits will need to be sustained for greater than two seasons to achieve a profit from the investment associated with a 10t /ha application of chicken litter.

Using capacitance moisture probes to monitor soil moisture and water use efficiency

Chris Lawson, SARDI, chris.lawson@sa.gov.au

Introduction

SARDI, along with the University of Adelaide and the Hart Field Site Group, have spent the past two and a half years measuring the influence of summer rainfall on wheat crops in the mid north. This project is a part of the nationwide GRDC water use efficiency initiative. Experiments were located at Hart (1 in 2009 and 2 in 2010), Roseworthy (1 in 2010), and Spalding (1 in 2010). We used trickle irrigation to manipulate summer water supply in two factorial experiments combining water and stubble treatments, and three factorial experiments combining water and nitrogen supply. The experiments aimed to; i) estimate wheat yield response to summer rainfall, (ii) explain yield responses in terms of capture and efficiency in the use of radiation and water, (iii) explore the incidence of the amount and disposition of stubble on storage of summer rainfall, and (iv) assess the interaction between summer rainfall and nitrogen supply.

These aims cannot be achieved without the constant measurement of soil moisture, both through the fallow period and growing season. A portable Sentek capacitance moisture probe (Diviner 2000) was used to monitor soil moisture in each experimental plot. Access tubes were installed in each plot before trickle irrigation was applied to simulate summer rainfall events. Access tubes varied in their depths, ranging from 70cm to 120cm, depending on the soil type.

Results

The 5 experiments run over 2009 and 2010, the addition of 50 to 100mm of water increased soil water content at sowing between 8 to 46mm in relation to controls that only received background summer rainfall (10-74mm). Figure 1 shows the soil moisture profile at sowing in the 2009 experiment at Hart, and table 1 the additional available water for the 100mm treatment compared to the control. Yield gain from additional water input in summer declined from 1.1 t ha^{-1} to zero when the yield of non-watered controls increased from 2.0 to 7.8 t ha^{-1}. Where yield response was related to a single resource, water or nitrogen, capture of radiation and water were major drivers of growth and yield response. Where yield response was related to the interaction between water and nitrogen, both capture and efficiency in the use of resources were important.

Amount (0 to 5 t ha^{-1}) and disposition (standing or flat) of stubble did not affect the amount or distribution of water in soils and had no detectable effect on grain yield.

High nitrogen rate was critical to capture the benefits of additional summer water and reciprocally high water supply was required to capture the benefits of nitrogen fertilisation; this highlights the resource co-limitation for wheat production in these environments.

Across experiments and treatments, grain number accounted for 88% of the variation in yield. Grain number was proportional to crop growth rate between stem elongation and anthesis; crops with high nitrogen produced 116 ± 5.0 grains per unit crop growth rate and their low nitrogen counterparts 99 ± 4.6

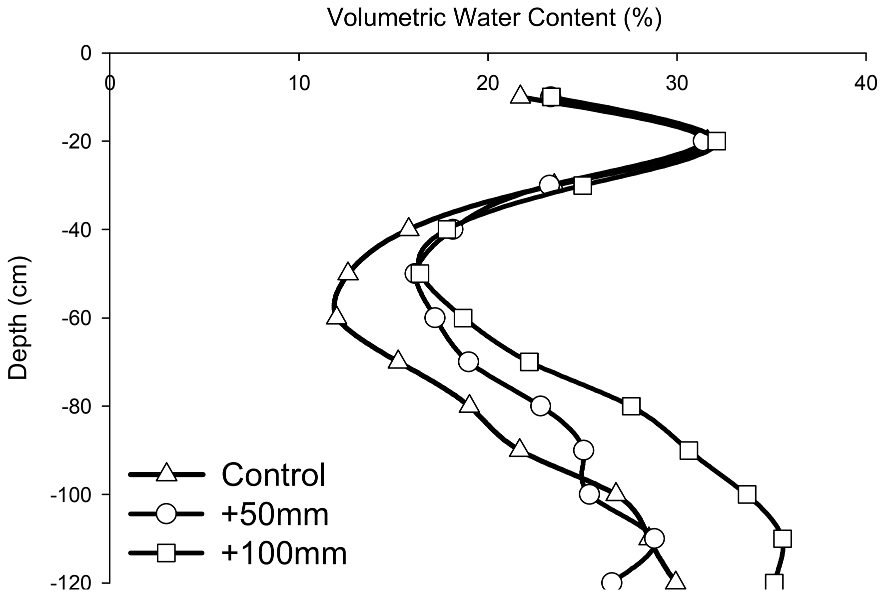


Figure 1: *Profile of mean volumetric water content for the 3 summer rainfall treatments at sowing .Values are averaged across stubble treatments*

Profile Depth (cm)	Additional Available Water (mm)
0-50	9
50-100	36
0-100	46

Table 1: *Additional available soil water at sowing for different depths in the profile. Difference between Decile 9 and Decile 1 treatments.*

Capacitance Probes

The above data gives an example of the information the moisture probes can provide for experimental purposes. The capacitance probe measured evaporation and moisture movement through the soil profile throughout the fallow period, and evapotranspiration throughout the growing season. While not done in this project, the capacitance probe data can also be used to calculate rooting depth.

Once installed, the capacitance probe is a quick and easy way of obtaining a measurement of moisture within the soil profile. This is ideal for experimental reasons, it is much quicker and less destructive than taking soil cores, and it allows us to do it as many times as we like. Previously neutron moisture meters were used for experimental measurements, these need a licence to use (because of the radiation), and also cost more than capacitance probes.

The capacitance probes also have disadvantages. Installation of access tubes is a painstaking process, particularly when you have over 200 to install! The access tube needs to be airtight with the soil, if air gaps of only 1mm on the side of the tube prevail; it can lead to a 20-30% underestimate of water content, thus installation needs to be done correctly. Calibration is also necessary, using a default or wrong calibration could lead to a 50% overestimate of water content.

In recent years interest has been increased interest in using moisture probes/loggers for cropping enterprises to aid decision making. This may give useful data once the system has been in place for some years and comparisons can be made, however they do not inform the farmer of how much soil water is available across the farm.

Interpretation of soil P tests

Sean Mason, University of Adelaide

Numerous soil P tests have been used in the past to estimate the soils capacity to supply P to a crop throughout the growth period. All these tests vary in their methodology and therefore making interpretation between each difficult. Chemical extraction methods remain the most popular with soil testing companies and they can provide rapid analysis and sample throughput. In Australia the most common extraction methods are Bray-1, Colwell P and Olsen P. Bray-1 uses an acidic extract at a soil to solution ratio of 1 to 5, both Colwell P and Olsen P methods used an alkaline extract at soil to solution ratios of 1 to 100 and 1 to 25 respectively. The most obvious difference between these tests is the pH of the extracting solution. They also differ in regards to shaking time of the soil with the extract with Bray-1, Colwell P and Olsen P having shaking times of 5 mins, 17 hours and 30 mins respectively.

Performance of soil tests with crop response

Unfortunately there have been numerous examples of documented failure of established soil testing methods, such as Colwell, Olsen and Bray, to reliably predict plant P requirements over a range of different soil types (e.g. Holford *et al*. 1985, Reuter *et al*. 1995). The main issues associated with these types of tests are 1) the large dilution used in which the soil responds to the dilution by supplying forms of P not normally available for plant uptake under field conditions, 2) Extracting solution can actually displace forms of P not available for plant uptake and 3) P availability in a soil system is driven by the presence and availability of other elements namely Ca, Fe and Al which is controlled by soil pH. Therefore adding extracting solutions at a set pH eliminates this sensitive aspect of P availability.

More recently it has been proposed that the Colwell P value undergoes further interpretation by incorporating the PBI measurement. Critical Colwell P values (point of yield plateau) have shown to increase with PBI and it is recommended that Colwell P values are assessed against this value for each paddock. It has recently been shown that this method indeed improves the Colwell P method with success rates in the order of 65% for the correct prediction of actual crop response to P in field trials. It is possible that due to the relationships between soil tests in some circumstances that the same PBI interpretation could be employed for the Olsen P and Bray P method.

Is there an alternative?

Substantial variations in soil types and soil pH provide challenges for any soil P test. **Diffusive gradients in thin films** (DGT) test is a new technique for measuring P and has recently been validated in broad acre regions of Australia. From the expanding list of field trials used, currently at 56 wheat trials, DGT has accurately predicted the response at 91 % of sites compared to the Colwell P + PBI method which has predicted 68 % of responses correctly. Assessment using Colwell P alone could not be performed due to the poor relationship of this soil test with crop response. The response to P from a limited dataset for Barley, Peas, Chickpeas, Lupins and Canola has also been accurately assessed by DGT and for each crop type DGT has outperformed the Colwell P method. For all crop types the response to P as predicted by DGT compared to the actual response seen has been > 90 % successful across all sites.

What makes DGT different?

The DGT method attempts to mimic the physico-chemical uptake of solutes by plant roots by providing a sink for the free phosphate ion. The amount of P accumulated onto the binding layer depends on the concentration of P in the soil solution, as well as the rate the rate of re-supply. The main differences of DGT technology compared to common extraction methods are 1) No chemical is added to the soil sample, a sink is deployed in which the P in the soil diffuses towards as the method of P assessment, 2) DGT devices are deployed on soil samples at maximum water holding capacity which is more indicative of field conditions and 3) By adding water to the soil sample in a comparative less amount, the assessment of the P chemistry and availability is performed at pH levels that would occur in the field.

This method of P assessment is totally different to the commercial soil P tests that have been used in the past which is highlighted by the fact that no relationship can be obtained between DGT and Colwell P, Olsen P, Bray P when different soil types are assessed. The largest discrepancy between DGT and Colwell P occurs on low PBI soils (DGT – high, Colwell P – low) and high PBI soils (DGT – low, Colwell P – High).

When will DGT be available?
Work is currently being performed with a couple of soil testing companies to test the validity of the DGT method in a commercial soil testing environment. In addition, inter lab comparisons are also being performed to test the robustness of the DGT method between laboratories to enable quality and control of results. It is hopeful that DGT will be released in a small capacity by mid 2011 in order for a service to be up and running for the 2012 growing season.

The future
Future work will focus on developing the DGT method in order to test its validity for measuring Potassium and Sulphur in agricultural soils. These two major macro nutrients have recently become under increased scrutiny due to general negative budgets of the two – exports of K and S off the paddock are currently greater than inputs. Unfortunately the accuracy of soil tests currently used for the assessment of K and S availability in soils has been questioned. Based on soil chemical principles there is the potential that DGT will provide a more accurate assessment of K and S availability and therefore aid in the determination of the current status of these two important nutrients in broad acre cropping regions of Australia.
In addition, an accurate method that can determine P, K and S availability in soils in one assay will make DGT more attractive to soil testing companies.

a) b)

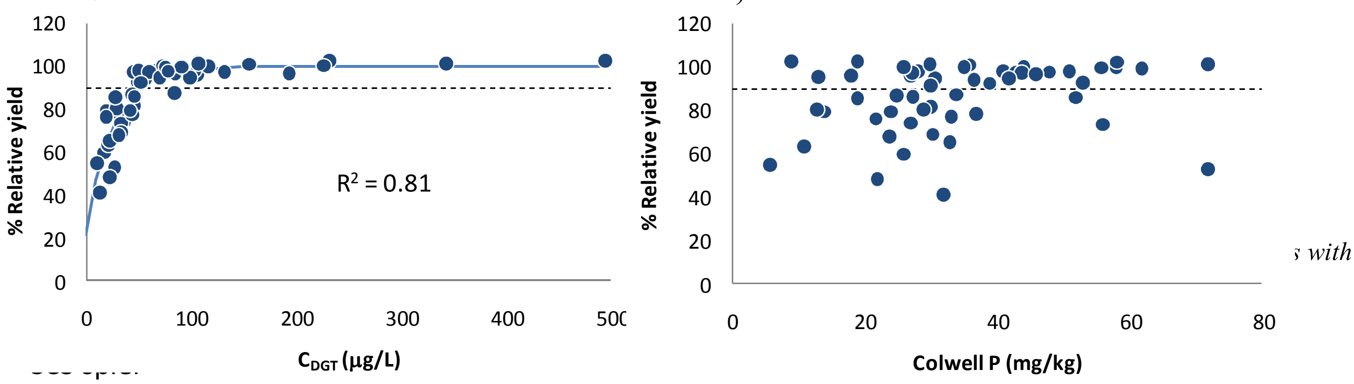


Figure 1. Soil test relationships with wheat grain response to P at 56 trial sites (2006-2010) expressed as relative yield (%), a) DGT and b) Colwell P.

a) b)

Figure 2. The DGT device, a) make of DGT device with iron (ferrihydrite) impregnated gel, b) DGT devices deployed on a saturated soil sample.

Wind erosion, Murray Plains,20th June 2011. The most severe wind since June 2003. Note the little evidence of erosion in most of the paddocks as a result of stubble retention. The most severely damaged areas are the deep sand in the left foreground and two strips from the west which are reflected by the sand graded from the fence line following the 2003 episode. Strips of undisturbed vegetation through the centre of the paddock and along the fence avoid the cumulative damage downwind. The green section on the mid right is Alison Millar's plots which were relatively undamaged and sown about a week earlier. About 1000 tons of soil was removed from the western fence after the 2003 wind!

Poor crop germination due to summer spray miss (photo: Richard Konzak)

PestFacts SA & western Victoria Edition is a free electronic newsletter service providing timely updates to growers and advisors on invertebrate pest issues in broad acre crops through the winter growing season. The service relies on feedback and field observations sent in by subscribers to alert the entire farming community. SARDI Entomology coordinates the service which is supported by GRDC through the National Invertebrate Pest Initiative (NIPI). All previous newsletter editions are available on the SARDI website at www.sardi.sa.gov.au/pestfacts.

SARDI Entomology Pest Facts
SA & western Victoria Edition

GRDC Grains Research & Development Corporation
NIPI NATIONAL INVERTEBRATE PEST INITIATIVE
Government of South Australia
SARDI SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE

Issue No. 4 June 17th 2011

Coordinators:
Kym Perry (08) 8303 9370 Email: kym.perry@sa.gov.au
Gabriella Caon (08) 8303 9536 Email: gabriella.caon@sa.gov.au
Helen DeGraaf (08) 8303 9543 Email: helen.degraaf@sa.gov.au
Fax: (08) 8303 9542

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More bronzed field beetle in canola and lupins

We have received more reports of bronzed field beetle (BFB, *Adelium brevicorne*) larvae damaging seedling canola and lupins in paddocks with high levels of stubble residue.

Agronomist Lou Flohr reported BFB larvae ringbarking lupin seedlings in a heavy stubble paddock at **Cooke Plains** in the SA Mallee. The crop was treated with alpha-cypermethrin which should provide reasonable control of BFB larvae which feed at the soil surface. Unlike canola, BFB damage is relatively uncommon in lupins as these plants can usually tolerate some feeding damage.

Agronomist Steve Richmond reported BFB larvae thinning out several emerging canola crops in the Mid North, at **Spalding**, **Mannanarie** and **Caltowie**. We also confirmed larvae for agronomist Jason McClure from a paddock near **Naracoorte**. Canola crops sown into stubble paddocks should continue to be monitored. For more information, refer to PestFacts Issue 3, 2011 (pdf).

Slaters in lentils

Slaters were suspected to have caused damage to two lentil crops. A crop at **Warooka** (Yorke Peninsula) had large patches of seedlings severed near ground level along furrows, causing plants to send out secondary shoots.

Paddock inspections by agronomist Malcolm Johnson and SARDI entomologists revealed only high numbers of slaters (approx. 5-10 per plant) under the soil surface near damaged plants. The slaters curled into a tight ball when disturbed. Slaters were also reported by consultant Bill Long in an isolated patch of damage in establishing lentils at **Mallala**. Live slaters kept in a container for a few days did feed on lentil plants but it is unclear whether they were responsible for the crop damage.

Slaters are usually not considered pests of broad acre crops in Australia but there have been isolated cases of certain species causing significant crop damage. We would like to hear of any other similar reports this season.

Earwigs and millipedes attacking canola

Like a number of other pests, earwig and millipede populations have been favoured by high stubble loads from last season's good growing conditions.

Agronomist Craig Davis reported that earwigs and millipedes have been causing reasonable amounts of damage to crops around **Saddleworth** in the Mid North. Craig says fipronil seed dressings have improved establishment of crops under millipede and earwig pressure. He also said high rates of chlorpyrifos often provides enough suppression of earwigs but does not provide 100% control.

Agronomist Steve Richmond has seen millipede damage in canola crops sown into stubble paddocks around **Jamestown**. Steve said there are few problems where the stubble has been removed (by burning etc). Consultant Peter Wendt also suspected millipede damage to a canola crop at **Moculta** in the Mid North.

Consultant Craig Wissell reported earwigs in several paddocks of early sown canola crops (now 4 true leaf stage) in the Mid North around **Clare,** stripping the leaves in areas where stubble has been retained. Several paddocks have been treated at night with synthetic pyrethroid and/or organo-phosphate insecticides to try to suppress numbers. Craig says earwigs are becoming an increasing problem throughout each growing season.

European earwigs (*Forficulina auricularia*) attack canola, lupins and cereals and can become a serious pest when present in high numbers. Adults and juveniles cause irregular chewing damage to leaf edges, cotyledons and stems similar to slug damage, hindering growth or killing plants. Earwigs can also chew through seed pods and contaminate windrows at harvest. They are normally associated with heavier soils and high levels of stubble trash.

European earwig adults range from 12 to 20mm in length. They are smooth and shiny dark brown with distinctive yellowish legs, pincers and shoulder margins. Nymphs are similar to adults but are paler in colour and wingless. Several native earwig species are also commonly found in crops but most are not significant pests. Native earwigs look similar but are reddish-brown in colour and have darker coloured abdomen and pincers.

Monitoring should be conducted at night as earwigs are nocturnal feeders. Earwigs can be a difficult pest to control and management options are limited. There are no insecticides registered for earwigs in broad acre crops. Reports indicate conventional insecticides even at high rates provide only partial suppression of earwigs. This pest is likely to require a 'systems' approach to reduce earwig populations over time in problem paddocks, including cultural strategies to reduce stubble and refuge habitat. For more information on earwigs, refer to European earwigs - DAFWA (pdf), European earwigs and European earwig fact sheet (pdf). For more information on millipedes, refer to PestFacts Issue 2, 2011 (pdf).

Mandalotus weevil found on heavy soil

We confirmed *Mandalotus* specimens for agronomist Michael Brougham who found a significant population on clay soil at **Mallala** in the Mid North. Adults had destroyed 95% of plants in two adjacent 70 and 100 hectare patches of canola that were treated and then re-sown. Another nearby canola crop was also badly damaged but salvageable. These paddocks were in cereal last season and have a history of cereal/lentil or wheat/medic rotations with little insecticide use. These weevils have probably built up in these paddocks over multiple seasons.

This observation has been particularly valuable as *Mandalotus* weevil is usually found on light calcareous soil types. We appreciate your assistance in helping us understand the distribution of this pest. For more information, refer to PestFacts Issue 3, 2011 (pdf).

Bryobia and *Balaustium* mites

Bryobia mite and *Balaustium* mite are still active in crops in the Mid North. Agronomist Michael Brougham reported *Bryobia* causing patchy damage (cupped cotyledons, stunted growth) to several 1-leaf canola crops around **Mallala** in numbers up to 20-30 mites per seedling. Michael says bifenthrin applications even at high rates do not effectively control *Bryobia*. Remember, organophosphates are more effective against this mite. Agronomist Steve Richmond found *Balaustium* damaging canola crops at **Spalding** and **Jamestown**. For more information on these mites, refer to PestFacts Issue 3, 2011 (pdf).

Unknown canola pests

Agronomist Hayden Whitwell reported damage to canola near **Kimba** on Eyre Peninsula, where the centre of two nearby 60-hectare and 300-hectare paddocks had been eaten out by an unknown pest. Only seedling stumps remained with leaves and stems missing. This damage could have been caused by a vertebrate pest (e.g. kangaroos or mice).

Agronomist Paul Ackland reported extensive damage to a canola crop at **Arthurton** on Yorke Peninsula, where many seedlings had been lopped above ground level. The damage was patchy and consistent with *Mandalotus* weevil, however only one weevil was found after extensive searching. Paul will monitor at night for weevils or other nocturnal pests.

Every season we receive a number of queries relating to unknown crop damage, often in canola. The surest way to identify the culprit of damage is a night inspection using a torch to look for nocturnal pests. Other options for monitoring include pitfall traps (a beer cup or similar sunk flush to soil level with a preservative liquid in the bottom), or placing flat objects such as tiles or hessian sacks on the ground with snail baits underneath and checking after a few days. Identifying the pest responsible for damage is important to determine the most effective control strategy.

Insect diagnostics

SARDI Entomology offers a **FREE insect diagnostic service for PestFacts subscribers**. Please send at least two intact specimens in a non-crushable container along with host food material, details of collection date, district, host-plant, description of damage caused and contact details, to:

NIPI insect diagnostic service
SARDI Entomology Unit
GPO Box 397, Adelaide 5001

Crop disease diagnostics

SARDI Field Crop Pathology Unit offers a range of diagnostic services: refer to SARDI Crop pathology diagnostic services. Crop watch is an electronic newsletter service provided by SARDI. If you would like to receive Crop Watch please send your email address to Jon Lamb, Jon Lamb Communications jlcom@chariot.net.au titled “Crop Watch request”

***PestFacts** is a FREE service providing updates throughout the growing season on an “as-needed” basis of the latest information on invertebrate pests in broad acre crops in South Australia and western Victoria. It is supported by GRDC’s National Invertebrate Pest Initiative (NIPI). All information is sent by email to subscribers. Please email a coordinator to be placed on the circulation list. Your support and feedback are essential to the success of PestFacts.*