CROP SCIENCE SOCIETY OF S.A. INCORPORATED

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INCORPORATING THE WEED SCIENCE SOCIETY

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Next Meeting	**'Spraying and Weeds'**
Venue	**Richardson Theatre, Roseworthy Campus**
Date	**WEDNESDAY 2nd MAY**
Time	**7.30 pm**

Speakers

Ben Fleet, Weeds Research Unit, University of Adelaide

'Fleabane: An emerging weed threat'

Ben will update us on recent fleabane trial results in SA. He will also report on the major findings from a national fleabane conference held in Wagga Wagga last month. Fleabane is appearing in more and more summer fallows and the usual herbicide tools are ineffective.

Peter Cousins, Consultant, Crystal Brook

'Spray drift regulation - the good news'

Peter has been a major advocate for a sensible approach to spray drift management and has argued against proposals for spray buffer zones proposed by the APVMA. Peter has lobbied hard locally and in Canberra for the views of the Independent Consultants Group and the Crop Science Society. At last he has some good news to share with us.

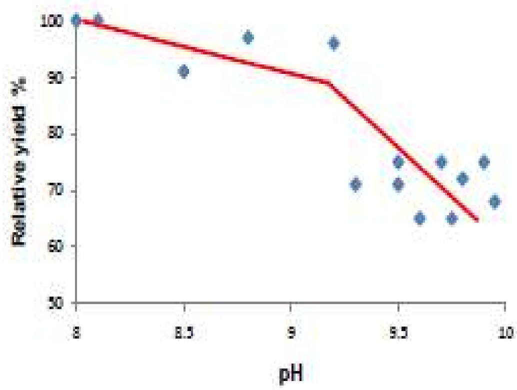
ATTENTION CSS MEMBERS:
A PhD student from Ann McNeill's group would like to obtain intact soil cores to measure phosphorus in legume and oil seed break crop roots. We would like to find sites within an approx 200km radius of Adelaide and were wondering if there were any Crop Science Society Members who were growing chickpeas, lupins, canola, vetch, peas or any other similar crops, and would be willing to allow us to collect samples from their property. If anyone is interested could they please contact ashlea.doolette@adelaide.edu.au or 83138107 (office) or 0401294963 (mobile).

Aluminium toxicity in alkaline soils

Pichu Rengasamy and David Brautigan, Soils group, The University of Adelaide

One-third of the world's soils are alkaline, highly prevalent in northern Indian subcontinent, northern African regions, semi-arid regions of Americas and southern regions of Australia. Alkaline (pH > 8) soils occupy 23.8% of the land area (172 million hectares) in Australia with pH ranging from 8 to 10.5. Over 80% of soils in agricultural zones in South Australia are alkaline, with mostly subsoil layers affected by high pH. It is estimated that the soil alkalinity costs the farming economy approximately A$ 940 million per year in lost production in Australia.

Soil constraints to agricultural productivity in alkaline soils include poor soil structure, phytotoxicity due to carbonate and aluminium species, deficiency of plant nutrients such as P, Ca, Mg, Fe, Zn and microelement toxicities including those of Al, Fe, Mn and B. In northern Indian soils, severe wheat yield reductions have been observed when the pH is above 9.2. In South Australia, subsoil alkaline pH emerged as the predominant factor in David Cooper's work, where grain yield was limited based on various soil factors which were correlated with the yield of Tamaroi (durum wheat) in 30 plots in six sites. Pot trials in our GRDC project in SA showed that the relative yields of crops (wheat, barley, chickpea and canola) were reduced by more than 30% when the soil pH was increased above 9.0. Although the soils with pH > 8 are classified as alkaline, severe limitations to wheat productivity have been observed in soils with greater than pH 9. While carbonate toxicity is an important factor, we have now significant results from our experiments to show that aluminium toxicity also occurs in soils with above 9.

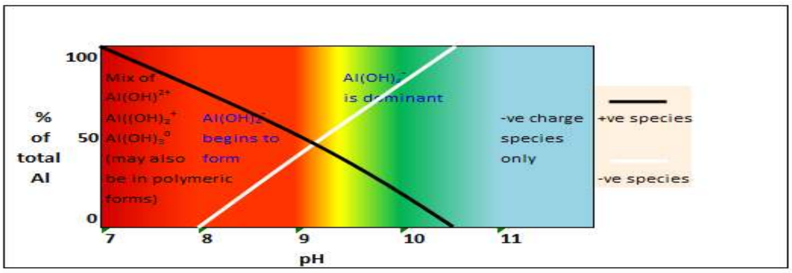


Aluminium Chemistry in alkaline soils

In acid soils (pH < 5.5), Al is known to be toxic to plants at concentrations as small as 2-3 ppm and is a major factor affecting plant development for agricultural crops. Al toxicity in alkaline soils was not considered by researchers till recently. Field surveys on wheat yields by Dr Rathjen's group led to the suspicion of aluminium toxicity in high pH soils. They conducted hydroponics experiments on wheat by maintaining pH at 9.2 and found that the aluminate ions (anionic species of Al) formed in solutions under alkaline conditions were toxic to wheat plants, significantly reducing root growth compared with alkaline medium without Al (Ma *et al.,* 2003).They concluded that Al toxicity compounded the toxic effects of alkalinity (i.e. toxicity of carbonate species).

All soils contain clay minerals such as kaolinite, illite and smectite which are alumino-silicates with high amounts of aluminium. The solubility of aluminium from clays depends on the pH of the soil solution and the formation of different species of aluminium. In acid soils, cationic forms of Al such as Al^{3+}, $Al\,OH^{2+}$ and $Al\,(OH)_2^+$ are predominant and are toxic to plants. In neutral soils (pH 5.5 to 8.0), $Al\,(OH)_3^0$ is the major form and not toxic to plants. In alkaline soils (pH > 8), the toxic form of aluminate [$Al\,(OH)_4^-$] ions start to increase.

In our experiments using NMR and electrophoresis methods, we have established that the aluminate ions are formed in significant amounts only above pH 9 in soil solutions.



Our pot experiments using artificial soil (mixture of laponite clay and acid washed sand- without any aluminium content) have shown that in addition to carbonate toxicity, aluminium is toxic to plants when the pH is above 9.0. Phytotoxicity of Al is additive to pH effects (i.e. carbonate effects) in high pH conditions.

- Al; pH 7.5 +Al; pH 7.5 -Al; pH 9.5 +Al; pH 9.5

As shown in this figure, root growth of peas is affected only when the pH of the artificial soils is >9.

Remediation of soil alkalinity

Buffering intensity of soil in the pH range 10 to 8 is low indicating low amounts of protons (acid) are needed to reduce soil pH. Glucose and molasses were effective in pH reduction by increasing bacterial and fungal activity. But, the amounts needed are not economical for dryland agriculture. In our pot and field experiments, gypsum has been found to lower the soil pH. Growing legumes (such as lucerne, vetch, faba bean and field pea) can effectively reduce rhizosphere pH by 1.0 to 1.4 units. However, after harvest and with time, soil pH increases to the original level. However, reduction of soil pH by growing legumes after application of gypsum has been found to maintain reduced pH within the study period of 6 months even after harvest.

Conclusion

In high pH soils (pH > 9), crop yields are affected significantly because of high pH as well as aluminium toxicity. By reducing the soil pH below 9, crop productivity can be enhanced in alkaline soils by avoiding the toxicity of aluminium and carbonates, nutrient deficiency (such as calcium) and other micro element toxicity. Because of low buffering intensity of alkaline soils in the pH range between 10 and 8, acidification needs through amendments can be reasonably met. Growing of legumes and application of gypsum can be effective in pH reduction to below pH 9 and can be economically beneficial in dryland agriculture. As these results are based on pot trials, field evaluation by farmers will be necessary for wide adoption.

References available from the author.

Utilising Spent Eco-Shelter Bedding as a Soil Improvement Agent

Tony Craddock and Brendan Wallis, Rural Directions Pty Ltd.

Background

Spent bedding from straw-based pig shelters has potential for use in broadacre farming systems, not only as an alternative nutrient source for crops, but also as soil improvement agent for poor producing or problem soils.

In the past most of the focus on organic byproducts has been as a fertiliser alternative but it has been noted by several growers that applying high rates (5 to10 times the “fertiliser” rates) of spent eco-shelter bedding (i.e. sand hill areas of paddocks) achieved good results in improving problem soils.

There are some potential risks in applying high rates of organic byproducts. These include “burning off” of crops due to high nitrogen application rates causing excessive crop growth which can reduce yields and grain quality in an abrupt seasonal finish, and an accumulation of heavy metals in the soil

To investigate eco-shelter bedding as a soil improver a simple replicated demonstration trial funded by Australian Pork Ltd was set up on a low fertility sandhill near Balaklava in SA’s mid North cropping district in 2011. This trial included a number of different rates of eco shelter bedding spread in Autumn prior to sowing a Fleet barley crop.

Demonstration Trial

Table 1: Soil test data

Nutrient	Colwell P (ppm)	PBI	Resin P (ppm)	CDGT P (ug/L)	Colwell K (ppm)	S (ppm)	Organic Carbon (%)	pH (CaCl2)
	14	5	18.6	193	234	3.83	0.6	6.1

Table 2: Treatments

Treatment 1	Untreated – No Eco-Shelter Bedding
Treatment 2	5t/ha Eco-Shelter Bedding
Treatment 3	10t/ha Eco-Shelter Bedding
Treatment 4	20t/ha Eco-Shelter Bedding

Table 3: Eco Shelter Bedding Analysis (dry weight basis)

Nitrogen (%)	Phosphorus (%)	Potassium (%)	Sulphur (%)	Zinc (mg/kg)	Manganese (mg/kg)
2.93	1.23	2.02	0.6	1157	370
Copper (mg/kg)	**Arsenic (ug/kg)**	**Lead (ug/kg)**	**Nickel (mg/kg)**	**Cadmium (ug/kg)**	**Chromium (ug/kg)**
102	1.2	2.8	6.9	1.2	8.4

Partially composted straw-based eco-shelter bedding was sourced from Leinert's Piggery near Sheoak Log in South Australia . The composted bedding was hand broadcast onto plots on the 21st of April 2011.
The trial was sown with 85 kg/ha Fleet Barley on the 28th of May 2011 together with 100kg/ha of NPK 24:16:0 fertiliser using a commercial airseeder fitted with 4" shares and finger-tyne harrows.An additional 80kg/ha of urea was applied to all plots post emergence (13th July 2011). Plots were also spread with mouse bait due to high mouse numbers which caused some initial damage. Youngest Emerged Blades (YEB) samples were taken on the 18th of August for plant tissue analysis at CSBP Laboratories in WA. Prior to sampling, plots were visually scored for plant vigour using a 0 to 10 scoring system.

Results and Discussion

Table 4: Grain Yield and Quality Results

Treatment	Protein	Screenings	Test Weight	Yield
Untreated	11.20	1.60	62.20	1.41
5t/ha	11.40	1.53	62.70	1.94
10t/ha	11.70	2.30	61.40	2.21
20t/ha	13.13	2.11	61.93	2.62
LSD 5%	1.1198	n/s	n/s	0.941

During late winter and spring, visual responses in crop growth and vigour were clearly evident in all treatments
Grain yield responses were evident with increasing rates of eco-shelter bedding. There was no significant difference in yield response between the Untreated, 5t/ha and 10t/ha plots but there was a significant yield response difference between the untreated plot and the 20t/ha plot.
The 20 tonnes per hectare application rate increased grain protein by 1.93% compared to plots with no spent bedding applied.

Conclusions

Barley yield responses of up to 1.2t/ha or an 86% increase, were observed with the application of high rates of spent eco-shelter bedding to a poor producing sandy soil. This same trend was also observed in the grain protein levels, especially the treatment of 20t/ha.Grain screenings were slightly elevated and test weight declined slightly at but the differences were not statistically significant.
Longevity of responses to high rates of spent bedding application will be important to ensure an appropriate return on investment given the significant costs so crop responses into the second year (2012) will be measured.

Improving barley establishment; barley varieties and their interaction with agronomy

GRDC 'Southern Barley Agronomy Project' Kenton Porker & Rob Wheeler, SARDI New Variety Agronomy Group

Introduction:

In recent years there has been increasing reports of 'patchiness' and poor establishment within barley crops in the Mallee, often attributed to Rhizoctonia. Many factors are known to influence a varieties ability to emerge, survive, and thrive including variety differences in early vigour, coleoptile length along with agronomic factors such as sowing depth, herbicides, seed dressings, and seed quality. A series of field trials have been conducted in the Mallee in 2010 and 2011 at Karoonda as part of the tri state Southern Australian barley agronomy project funded by GRDC. These trials aimed at developing strategies to improve crop establishment, early growth, and barley production. Outlined below are some of the key findings resulting from this research.

Variety and Sowing Depth:

Sowing depth influences a seedlings vigour and ability to emerge. Barley varieties differ in their ability to emerge from depth, due to their coleoptile length (figure1). The coleoptile is a protective sheath from which the first leaf emerges that guides the shoot up through the soil; if the seed is sown deeper than the length of the coleoptile the plant may not emerge. Trials have shown emergence from deeper sowing (80mm) can be up to 50pc less than shallow sown (30mm) in shorter coleoptile varieties such as Hindmarsh, whereas longer coleoptile varieties such as Fleet only recorded a 10% reduction.

- Hindmarsh, Flagship and Buloke are shorter coleoptile varieties, so care should be taken with seeding depth.
- Commander and Maritime have medium coleoptile lengths,
- Fleet has the longest coleoptile and best emergence from deep sowing.

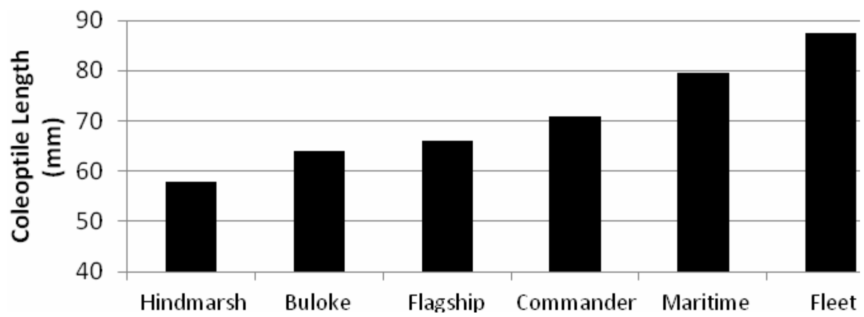


Figure 1. Average coleoptile length of barley varieties in the field at Karoonda, SA (2010 &2011)

Seed Dressings

Triadimenol based seed dressing products such as Baytan® are commonly used in SA barley crops as a cost effective early control against powdery mildew and leaf scald. However, Triadimenol based seed dressings (applied at recommended rate) have been shown to reduce coleoptile length by up to 20mm and therefore reduced establishment in varieties such as Hindmarsh when sown at depth by up to 50% (table 1 & figure 2). Findings from this research, revealed alternative products that contain Carboxin as the active ingredient (Advance®) can lengthen coleoptiles by up to 10mm and improve establishment in shorter coleoptiles varieties when applied at recommended rates. However, Carboxin based products do not offer control against powdery mildew and leaf scald. The 2011 trial included a seed treatment combining a mixture of both Triadimenol and Carboxin. The results indicate that the use of a mixture of these products can achieve coleoptiles lengths (table 1) and plant densities (figure 2) similar to an untreated control when sowing is deep; this suggests the treatment effects are additive with the Carboxin (Advance) working to counteract some of the negative establishment issues associated with using the Triadimenol based dressing (Baytan), whilst still maintaining control of Powdery Mildew, and Scald.

Table 1 The effect of seed dressing treatments on the coleoptile length (mm) of Fleet and Hindmarsh barley sown at 80 mm depth, Karoonda, 2011

Seed Dressing	Fleet		Hindmarsh	
Untreated Control	90.0	a	52.7	e
Advance®	93.0	a	65.7	c
Mixture - Adv+Bay	88.3	a	60.0	d
Baytan®	73.4	b	46.8	f
Seed treat x Variety - LSD (5%)			3.1	

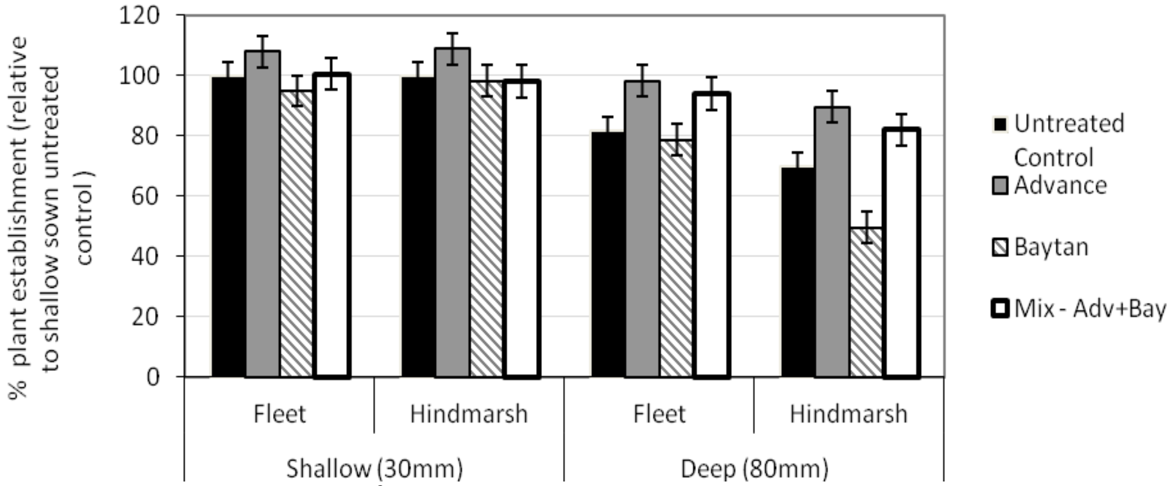


Figure 2 Plant establishment (plants/m^2) expressed as a percentage of the shallow untreated control of Fleet (134plants/m2) and Hindmarsh (124plants/m^2) when treated with seed dressings; sown shallow (30mm) and deep (80mm) at Karoonda, 2011.

Seed dressing related reductions in plant establishment and growth may or may not relate to yield losses depending on the seasonal conditions through compensation of yield components. None the less the following key outcomes from this research highlight that the impacts of deeper sowing, variety choice, and seed dressings are important for considerations for growers.

- Fungicide based seed treatments can reduce (Triadimenols ie Baytan®), or increase (Carboxin based products ie Vitafax® & Advance®), seedling coleoptile length and affect plant establishment.
- Care at sowing should be taken when Triadimenol based dressings are used in conjunction with short coleoptile varieties such as Hindmarsh.
- Combining a Triadimenol with a Carboxin based dressing may help counteract some of the plant establishment losses associated with Triadimenol.

Pre emergent herbicides

Mallee no-till farming systems are increasingly becoming more reliant on pre emergent herbicides for weed control as new chemistry such as BoxerGold® offers improved control of resistant ryegrass along with another recent new chemistry product Sakura®. Sakura will be registered in wheat but is not currently registered in barley and is therefore not recommended in barley. The newer herbicides are more water soluble than Trifluralin, and consequently there is increased potential for crop damage. Trials at Karoonda (Mallee) and Turretfield (Mid North) in 2010 and 2011 confirmed pre-emergent herbicide damage (reduced establishment and vigour) to be more pronounced at shallow sowing and when rain immediately followed application washing the herbicide onto the emerging seed (figure 3). Appropriate seed positioning is one way of avoiding herbicide damage, and must be maintained by sowing at adequate depth below the herbicide band. For the second consecutive season, sowing deeper to avoid herbicide damage has proven to offer greater benefits to varieties that can cope with the stress of deeper sowing such as Fleet (figure 3). If opting to sow deeper growers, must consider that barley varieties differ in their ability to emerge from depth, due to their coleoptile length (outlined in figure 1). There has been no yield penalty from herbicides in Fleet sown deeply. Although not ideal and despite label warnings it was still better to sow short coleoptile varieties such as Hindmarsh shallow as herbicide induced damage in Hindmarsh is still significantly less than the consequences of deeper sowing (figure 3).

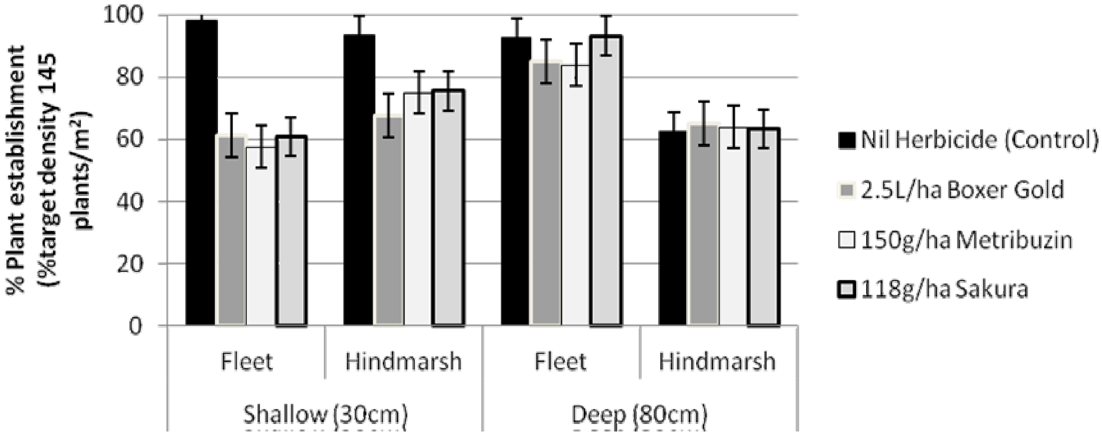


Figure 3. The effects of sowing depth and herbicide application on plant establishment (expressed as % of target plant density 145plantsm^2) of Fleet and Hindmarsh barley varieties at Karoonda, 2011.

These series of trials have confirmed that pre emergent herbicide use is one contributing factor to "patchiness" commonly seen in barley crops. The following outcomes from this research may assist growers in providing a better understanding of the interactions between the combination of herbicide, variety and sowing depth.

- Pre emergent herbicides can reduce plant establishment and vigour to a greater extent, if sowing is shallow and if a rainfall event (>5mm) follows within ten days of application.
- Herbicide safety can be improved through sowing deeper with a longer coleoptile variety such as Fleet.
- It has still been better to sow short coleoptile varieties such as Hindmarsh shallow, as herbicide induced damage can be significantly less than the consequences of deeper sowing.
- A yield penalty from herbicide damage may or may not occur depending on the extent of the herbicide damage and the seasonal growing conditions, the added weed control will likely be worth it in most cases.

Acknowledgements:

The authors acknowledge funding from GRDC for The Southern Barley Agronomy Project. Special thanks go to the New Variety Agronomy team at SARDI for help with the project, the MSFP and Peter and Hannah Loller are gratefully acknowledged for providing land for this trial work.

2012 Arthurton Chickpea Variety by Sowing Time Management Trial

Mick Lines, Larn McMurray and Jenny Davidson

Key Outcomes

- Chickpea trial yields were high in 2011, averaging 3.8t/ha across both sowing dates at Arthurton.
- Favourable growing conditions and minimal disease resulted in equal or higher yields from early sown treatments.
- PBA Slasher and the potential chickpea release CICA0603 was the equal highest yielding desi varieties sown early, and CICA0603 yielded highest late. The small seeded Genesis079 was the highest yielding kabuli type.
- Lodging of chickpeas was high in 2011, particularly where sown early. CICA0603, CICA0857 and Genesis079 were the most susceptible varieties to lodging.

Treatments

Trial type	TOS x Variety x Disease Management – Arthurton, Yorke Peninsula
Sowing dates: Early Late	 17th May 14th June
Varieties	**Genesis™079** (early maturing SK) **Genesis™090** (mid maturity SK) **Genesis™114** (late maturing LK) **CICA0857** (early maturing MK) **PBA Slasher**$^{\Phi}$ (mid maturity D) **CICA0603** (early maturing D)
Treatments	**Nil** –No control of Ascochyta Blight **Podding** - Chlorothalonil (500ml/ha) at podding. **Strategic** - Chlorothalonil (500ml/ha) at 8-10wks, early flower and podding. **Complete** – Fortnightly chlorothalonil sprays.

SK=small kabuli type, LK=large kabuli type, MK = medium kabuli, D=desi type

Trial Results

- There was no foliar disease observed in this trial in 2011, and fungicide treatments had no effect on grain yield.
- Grain yield averaged 3.8t/ha across all varieties and sowing dates.
- A sowing date by variety response for grain yield was observed for Genesis079, Genesis114 and PBA Slasher, all which yielded higher at the early sowing date (Figure 2).
- Of these varieties PBA Slasher showed the highest yield improvement from early sowing (13%).
- The potential desi release CICA0603 was the highest or equal highest yielding chickpea variety at both sowing dates.
- Genesis079 was the highest yielding kabuli variety sown early, and equal with CICA0857 at the late sowing date.

- Lodging of chickpeas was high in 2011, particularly at the earlier sowing date (Table 3).
- CICA0857 and CICA0603 showed the highest amount of lodging, followed by Genesis079. These are the earliest maturing varieties, indicating a link between lodging and plant maturity.
- The late maturing erect kabuli type Genesis114 showed the lowest amount of lodging at harvest.

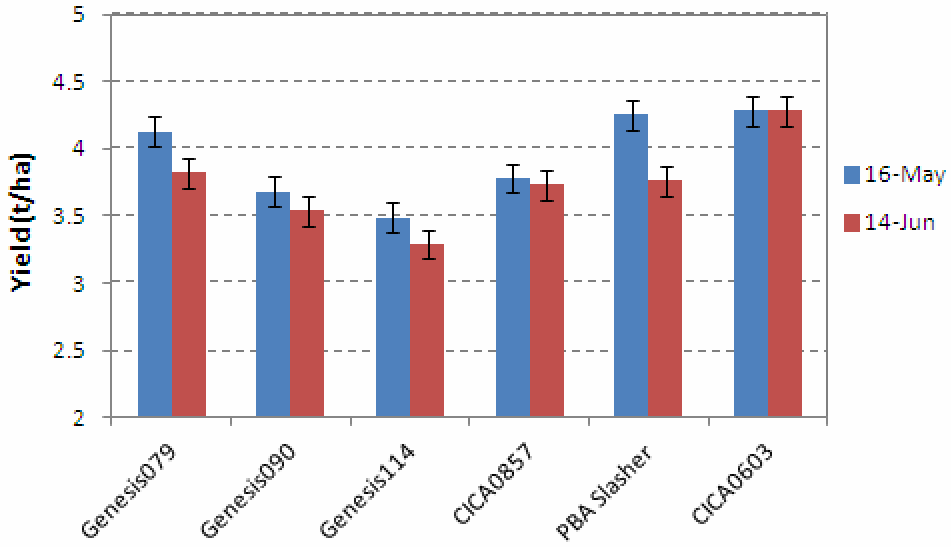


Figure 2: effect of sowing date on grain yield (t/ha) of chickpea varieties, Arthurton 2011.

Variety	Genesis 079	Genesis 090	Genesis 114	CICA0857	PBA Slasher	CICA0603	LSD (P>0.05)
16-May	4.8	5.9	7.8	2.9	6.7	3.3	**0.65**
14-June	7.8	8.6	9.0	7.6	8.1	6.7	(0.48 same sowing date)

Table 3: effect of sowing date on lodging (1-9 score*) of chickpea varieties, Arthurton 2011

* 1-9 score: 1 = flat, 9 = upright

Comments

Interest in chickpeas increased in 2011, and there were a number of chickpea crops grown across the Yorke Peninsula and areas of the mid north. With the current price of lentils low by recent standards, and high yields and prices for chickpea in 2011, interest in chickpeas for 2012 sowings is high. A brief management update is provided below.

- Sowing Date: Early sowing of chickpea in needs to be treated with caution, particularly in favourable areas. Early sowing of chickpeas has been responsible for poor pod set in some seasons due to flowering and pod set under colder temperatures e.g. 2009. Early sowing will also promote high vegetative growth and lodging in favourable longer growing regions and seasons. The risk of botrytis grey mould infections is also increased under these conditions. The earlier maturing varieties, CICA603, Genesis 079 and CICA0857 have been found to be more prone to lodging under these conditions than other varieties.

- Herbicides: Chickpeas have an added benefit over other pulses of utilising a different group of pre-emergent herbicide (isoxaflutole, or Balance®, used simultaneously with simazine), facilitating control of a different spectrum of broadleaf weeds. However labels rates of these herbicides can cause crop injury and yield loss on light, sandy soils or in cases of shallow sowing, so lower than label rates or split application timings may be required in some areas and situations.
- Plant density: 40-50 plants/m2 for desi types, 35-40 plants/m2 for small seeded kabuli types, and 30-35 plants/m2 for large seeded kabuli types. Check seed size and germination annually, due to significant seasonal seed size changes particularly in kabuli types, to maintain correct plant populations. Chickpea crops with lower than recommended plant populations are likely to be more prone to aphid infestation and virus infection.
- Fungicide seed dressings: are effective in high disease risk situations, particularly for Botrytis Grey Mould and root rot/damping off. Some protection from ascochyta blight is also provided by seed dressings, particularly when sowing ascochyta blight infected seed. Seed treatments are recommended in all regions for kabuli chickpeas due to increased issues with root rots on the emerging seedling with these types.
- Foliar fungicide management: Ascochyta blight resistant varieties have suffered minimal yield loss without foliar fungicide applications in most experiments. However foliar fungicide application at the podding stage is recommended to reduce seed infection, maximise quality and prevent yield loss. Large kabuli types have intermediate resistance and will require 1-2 pre-podding sprays along with the above.
- Resistant rye grass: Chickpeas are poor weed competitors and mature later than other pulses, limiting the use of crop topping to control resistant ryegrass. Avoid sowing chickpeas into resistant ryegrass problem paddocks to prevent weed 'blow outs'.

Notes on new and potential releases:

- The 2011 released large seeded kabuli Kalkee (previously Genesis115) has the largest seed of all the commercial kabuli varieties. However like other medium sized types it yields lower than the smaller seeded types.
- CICA0857 shows promise as a high yielding medium seeded kabuli. It has improved ascochyta blight resistance and earlier maturity compared to the larger seeded kabuli varieties, and will show more yield stability across variable seasons.
- CICA0603 is a high yielding desi chickpea with improved harvestability and grain quality. It is earlier maturing than PBA Slasher, and has shown a yield improvement of up to 10% higher than PBA Slasher, but has also shown higher susceptibility to ascochyta blight. These three varieties, together with Genesis114, have higher susceptibility to ascochyta blight than Genesis090, and are likely to need a further fungicide application than this variety.

Further information on particular varieties and their 2011 performance is available in the SARDI Harvest Report published in the Grain Business magazine.

Acknowledgements
The assistance of John Nairn, Peter Maynard, Rowan Steele, Stuart Sherriff and Matt Dare, SARDI Clare, with trial management is gratefully acknowledged.

Funding Body
Thanks to GRDC for funding this research.

NEW! RAINFED FARMING! LOCAL!

Rainfed Farming Systems,
Philip Tow, Ian Cooper, I Partridge and C Birch editors. Springer, 2011.

The release of this volume of work late last year is a cause for celebration and for congratulations to the editors and authors. It promises to be a valuable addition to the teaching material for agricultural studies, especially at the late secondary school and in TAFE and Universities.

The book encompasses a massive amount of material, being over 1300 pages in length and comprises 50 individual chapters and retailing for about $170 for the book and $160 for the electronic version. This report is therefore not so much a review as a note bringing the publication to your notice, and to give credit to the editors. Notably, as Philip and Ian were employed at Roseworthy, there has been great contribution locally. Appreciation of the book starts even from its title 'Rainfed' agricultural systems which is much better than the common 'Dryland Farming'.

Among the authors, many will be familiar to Crop Science members, including Peter Hayman, David Roget, Albert Rovira, Jeff Baldock, Jay Cummins, Nick Paltridge, David Coventry, Murray Unkovich, Mark Branson, Bill Long, Rohan Rainbow, Mike Krause, and Ian and John Rohde. (I've only glanced through a few chapters, but have already been impressed with the contributions from the Rhode's and appreciated Mark Branson's forward looking chapter on Precision Agriculture and Bill Long's discussion of the changing roles in extension).

While there is this substantial local component, the book does retain a global perspective with major contributions covering the agricultural systems elsewhere, including South Asia (especially India), North and South America, China and Africa, in 12 chapters. The other major sections look at the general principles (14 chapters),improvements to the systems (9 chapters), research and extension (5), and 9 case studies. In contrast to Australia, many of the systems elsewhere involve one or two supplementary irrigations during grain-fill.

From the little I have been able to dip into, one is impressed with the readability of the contributions. Which suggests that there has been very substantial editorial commitment to great effect in terms of the accessibility of the information.

The accessibility has also been enhanced by very detailed indexing of over 50 pages and glossaries on abbreviations, acronyms, botanical and scientific names and very complete definitions of technical terms.

On scanning through the volume wondering how to write an appreciation of this massive work, I chanced on a gem by Brian Polkinghorne regarding conditions in Tanzania, part of which is reproduced below under the question of 'How Big Is an Office Magnet?'

'We always. Invited the District Forestry Officer with us when holding the first meeting with a new village.... On the first few occasions, he came with us but I could see that the poor man was uncomfortable. During question time, the village leaders usually asked him questions about government policy and implementation and sometimes, slightly technical questions about trees. He was poorly equipped for his position that it was often embarrassing to observe his response.... he started to find excuses.... vitally important forms had to be filled in, his boss might be calling a meeting, he might have to take his child to hospital..... tea and snacks readily available.... more attractive than visiting farmers who desperately needed the advice.'

Familiar? and all this without our local crutch email!

Congratulations again to all involved! May they be vindicated by having the book used and used again for the benefit of all!

Dr Indu Sharma, Project Director of the directorate of Wheat Research at Karnal, India, cheerfully answering questions from visitors with Dr Gyandra Singh, wheat breeder in background. Dr Sharma is reputed to spend the first two hours each day in the field and is impressively well informed on agricultural and research topics.

A wheat variety trial, comparing maturity with (rear) and without (front) irrigation, at Karnal, illustrating hastened maturity under limited water supply. Farrer successfully crossed Indian wheats for their 'earliness' in his breeding program. Rice has delayed maturity under limited water supply.