Organic news

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Condensed Tannins, their role in livestock nutrition and worm control

Robyn Neeson, NSW DPI, Berry

There has been increased interest in alternative (non-chemical) de-wormers to control internal parasites. This has been especially true with the continued development of resistance to worm control chemicals (anthelmintics).

Research has shown that some leguminous pasture species contain tannins which are effective at suppressing internal parasites in livestock.

Tannins are a large group of polyphenolic compounds that differ in many physical characteristics and in the way they interact with ruminant livestock metabolism. These polyphenolic compounds are characterised by having a relatively high molecular weight and the capacity to form complexes with carbohydrates and proteins. These tannins may be further categorised as hydrolysable tannins (HTs) or condensed tannins (CTs) on the basis of their structure and reactivity.

CT containing species have not only been shown to be effective in suppressing internal parasites but also in suppressing bloat in ruminant animals. Furthermore, plants with high condensed tannins have been shown to have a lower methane yield (per kg Dry Matter Intake - DMI; e.g. Woodward et al. 2004), and so may be important in methane mitigation.

Finding the ‘right’ tannin producing species which provides both nutritional benefits and which is effective at suppressing internal parasites, is however, not as easy as it sounds.

According to Min et al. (2003), low concentrations of CT (20-45 g CT/kg DM) are helpful to animals, while high forage CT concentrations (>55 g CT/kg DM) may have negative effects. If CT levels are too high, the palatability of the forage can be a major issue, and livestock productivity can be reduced. Results vary according to CT concentration and structure and the species of animal that is grazing the forage.

The CT content of some forage species is shown in Table 1.

Table 1. Condensed tannin (CT) content in different forage species.*

<table>
<thead>
<tr>
<th>Forage</th>
<th>CT g/kg of DM</th>
<th>%DM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birdsfoot trefoil</td>
<td>48</td>
<td>4.8</td>
</tr>
<tr>
<td>(Lotus corniculatus)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big trefoil</td>
<td>77</td>
<td>7.7</td>
</tr>
<tr>
<td>Sanfoin</td>
<td>29</td>
<td>2.9</td>
</tr>
<tr>
<td>Sulla</td>
<td>51-84</td>
<td>5.1-8.4</td>
</tr>
<tr>
<td>Lucerne</td>
<td>0.5</td>
<td>0.05</td>
</tr>
<tr>
<td>Sericea lespedeza</td>
<td>46-152</td>
<td>4.6-15.2</td>
</tr>
<tr>
<td>Perennial ryegrass</td>
<td>1.8</td>
<td>0.18</td>
</tr>
<tr>
<td>Chicory</td>
<td>3.1</td>
<td>0.31</td>
</tr>
<tr>
<td>Crabgrass/tall fescue</td>
<td>3.2</td>
<td>0.32</td>
</tr>
<tr>
<td>mixture</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Adapted from Min and Hart, 2003 and Min et al., 2005). * The standard used for analysis will affect the results. For these studies, a Quebracho (a tannin containing South American hard wood tree species) standard was used. Source: ATTRA 2007. Tools for Managing Internal Parasites in Small Ruminants: Sericea Lespedeza
**CT and livestock nutrition**

Tannins in low to moderate concentrations (i.e. <55 g CT/kg) can have beneficial effects in ruminants, including improved amino acid absorption, reduced bloating and increased postruminal protein absorption.

Research has shown that moderate levels of CT (20 to 40 g of CT/kg of DM) in forages (*L. corniculatus*) fed to sheep increased absorption of essential amino acids from the small intestine by 62% (Waghorn et al., 1987b). Increased milk and wool production in sheep (Barry and McNabb, 1999; Min et al., 1999), and increased milk production in dairy cows (Woodward et al., 1999) were also observed when dietary forages contained CT (20 to 40 g of CT/kg of DM). Production of milk protein in dairy cows and sheep was increased by 40% with CT-containing forages.

However, forages with high concentrations of CT (55 to 106 g of CT/kg of DM) have been shown to reduce productivity (Barry and Manley, 1984).

**CT and internal parasites**

Condensed tannins have been shown to suppress faecal egg counts and reduce worms in the digestive tract of sheep and goats.

The effectiveness of CT in controlling internal parasites is thought to come about by:

- an indirect action whereby the consumption of tannin rich fodders leads to an increase in the release of proteins in the animal’s abomasum which then counteracts the loss of protein and decreased protein absorption associated with internal parasitism; and resulting in increases in livestock resilience (Min et al., 2003; Heckendorn, 2005) and,

- through the direct action of CT with the proteins on the surface of the parasites and by disturbance of the normal physiological functions of the nematodes like mobility, food absorption or reproduction (Heckendorn, 2005).

The mechanism involved may differ between different forage species.

Several options for feeding tanniferous plants have been reported, including cultivation of arable crops and inclusion in the normal rotation (Niezen et al., 1998). These can then be used for either de-worming paddocks, or the plants can be harvested and fed as hay or silage at a later date.

A number of plants have been investigated for their effectiveness in controlling internal parasites.

Forage chicory is known to improve the live weight gain in lambs and to lead to lower pasture contamination because "larval survival on chicory is lower than on grasses" (Rattray, 2003).

Research has shown that chicory has the ability to reduce the adult worm burden in infected sheep but not the ability to reduce faecal egg output and prevent incoming larvae from settling. Consequently, grazing chicory may help infected animals to balance weight loss associated with parasitic infestation and thereby enhance the build-up of immunity, but doesn’t appear suitable to decrease pasture infectivity nor to protect sheep from further infestation (Rahmann and Seip, 2006).

*Lotus corniculatus* has been shown to reduce the dagginess and flystrike in lambs (Leathwick and Atkinson 1995) and this is possibly related to reduced levels of internal parasites in sheep (Niezen et al. 1996).

Sericea lespedea tannins have also been shown to be effective in controlling coccidiosis and reducing methane emission.

Research on lambs infected with barbers pole worm (*H. contortus*) grazing Sulla, a short lived highly productive perennial legume originating from the Western Mediterranean and Northern Africa, showed reduced FEC and worm burdens (Niezen et al. 2002a; Hoste et al. 2005b). However, Sulla was shown to be inefficient against black scour worm, *T. colubriformis*. (Molan et al. 2000a; Niezen et al. 2002a). Other research (Athanasiadou et al. 2005; Tzamaloukas et al. 2005; and Pomroy and Adlington, 2006) indicates that the administration of Sulla has no effect when fed for a short period of time but if fed for longer, it may reduce FEC and have a positive effect on animal performance. This has implications for grazing management, particularly as Sulla is difficult to manage agronomically, being susceptible to competition by weeds at establishment, as well as after cutting, and it is not suitable for intensive grazing (Frame, 2005).
Factors influencing plant tannin content

The tannin content of plants varies considerably between plant species and genotype, but may also be influenced by stage of plant growth, and may vary with plant part (leaf, stem, inflorescence, and seed), season of growth and other specific environmental factors such as temperature, rainfall, cutting and defoliation by grazing herbivores including insects. More research is required in order to gain a better understanding of these influences on tannin content and for the manipulation of tannins to maximise nutritive value for animals.

Conclusion

The effectiveness of CT to suppress internal parasites depends on a number of factors including the species of parasite present in the gut, the species, age, health and immune status of the animal, the type and nutritional value of the forages grazed, as well as environmental factors which may influence crop growth rates, forage quality and consequential tannin levels.

References and further reading


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New Lotus cultivars show promise

*Dr Graeme Sandral, NSW DPI, Wagga Wagga*

One of the most promising Condensed Tannin (CT) producing pasture species for southern Australia’s moderate to high rainfall zones is birdsfoot trefoil (*Lotus corniculatus*).

Birdsfoot trefoil is well adapted to low fertility acidic soils in tablelands and slopes environments where average annual rainfall is 650 - 1,000 mm.

A project, funded by the Future Farm Industries (FFI) CRC is set to deliver new cultivars plus a comprehensive birdsfoot trefoil management package for producers across the high rainfall zones of southern Australia.

According to NSW DPI researcher, Dr. Graeme Sandral, the unique project, developed with significant input from producers and farm advisors across NSW and Victoria, will give producers a package of new tools to help adopt birdsfoot trefoil with confidence.

Testing of genotypes from South America (in particular Uruguay), North Africa and the southern Mediterranean, has resulted in the selection of three lines of birdsfoot trefoil that show significant potential for the local market as well as potential for seed sales in international markets.

“We currently have Plant Breeder’s Rights (PBR) on three promising lines of birdsfoot trefoil:

LC07AUF - selected for early and uniform flowering.

LC07AUYF - selected for yield and flowering.

LC07AT - selected for high tannin content (high tannins provide additional bloat protection and reduced methane production).

“Our project has really put them to the test across a range of practical scenarios,” Graeme said.

All three lines are currently going through the commercialisation and, all going well, Graeme expects that seed will be commercially available during 2015/16.
A field day held on September 21 at Yass attracted 50 people to examine *Lotus corniculatus* and its responsiveness to phosphorus.

Early results show the *Lotus corniculatus* produced by FFI CRC is more efficient at using phosphorus than sub clover. Whilst the results are preliminary, many farmers were excited as phosphorus is typically 20 to 30% of on-farm costs for grazing enterprises in the high rainfall zone (>600 mm aar) of south eastern Australia, and any savings in this input cost would have large impacts on farm profitability.

Whilst there, farmers mixed with some international visitors from INIA Uruguay. Discussions with INIA researchers revealed that where *Lotus corniculatus* is used in Uruguay it is grown on soils with lower phosphorus nutrition than those soils for white clover.

The stand at Yass is in its second year and results show promise for the inclusion of *Lotus corniculatus* into permanent pasture systems receiving greater than 650 mm average annual rainfall.

For more information contact Graeme Sandral: graeme.sandral@dpi.nsw.gov.au

“In evaluating new cultivars, we were interested in drought-tolerance with flowering time up to two months earlier than the current commercial option, ‘Goldie’.”

“We were looking for both persistence and recruitment from seed set and what we’ve got is early-flowering varieties, flowering within the time frame of cereal crops, to allow maximum seed production while there is still adequate soil moisture.”

On-farm evaluation of the new cultivars is the next stage of the project. On-farm research will focus on plant and animal production, pasture establishment, grazing management and profitability. The final package will give producers confidence when adopting the new pasture varieties.

“One particular establishment technique we are keen to look at is the difference we can achieve with a new system where we sow monoculture rows of each species in the mix,” Graeme said.

“To explain this, imagine you are standing in a paddock and as you look down the paddock you would see a row of perennial grass (say phalaris) and then two rows of birdsfoot trefoil, then phalaris and two rows of birdsfoot and so on.”

“We will compare this to the traditional method of sowing a batch of mixed seed. If it proves a successful option, producers can create these monoculture rows by placing tin dividers in their small seeds box that are pop riveted into place.”

“When they fill the seeder, they put phalaris in every third section and birdsfoot trefoil in between the phalaris.”

Graeme explained that this new method came about from discussions about how to prevent establishment failure from early competition between species.

“The competition is reduced through monoculture rows and now we want to test if that is of greater value to producers than sowing a mixture in each row.”

Mixed sowing will be compared with monoculture row sowings at a 2:1 legume to phalaris ratio.

Phalaris has been chosen as the perennial grass species, as it is currently the number one perennial grass sown across large areas of the landscape. But Graeme is quick to point out it won’t always be phalaris, but the principle applies to all perennial grasses.

The final piece in the puzzle is to determine the best grazing management for production and persistence. Researchers will compare set stocking against rotational grazing.

“In addition to comparing the two grazing strategies, we will have treatments under each regime that allow flowering and seed set, where the seed can fall to ground (seed rain) and others without seed rain (i.e. not allowing the pasture to flower).”

“The aim of this comparison is to see if seed rain promotes stand thickening, increasing the overall legume content and therefore delivering higher livestock production potential.”

“While we are not sure what to expect in terms of results, the outcome will certainly tell us what the
best management strategy will be to keep birdsfoot trefoil in the mix for the long term."


For more information contact: Dr Graeme Sandral Research Agronomist, NSW DPI. T: 02 6938 1807 Email: graeme.sandral@dpi.nsw.gov.au

Soil biology master class: an opportunity for the interested

Justine Cox, NSW DPI, Wollongbar

I attended a pilot two day masterclass on soil biology Aug 13-14 held at the University of Western Sydney (UWS), Richmond. Twelve participants including researchers, policy makers, agronomists, consultants, farmers, state government regulatory agency staff and funding bodies attended. This diversity added to the peer learning and everybody's experience and passion in soil biology contributed to making the class a resounding success. Also in attendance were a who's who of soil biology research, including Lyn Abbott, Pauline Mele, Brajesh Singh and a few local researchers in the field at UWS.

The course introduced the organisms from small to big, how they were measured, and their role(s) in the soil habitat. The lectures were engaging with a global framework and case studies. It was great to see the soil macrofauna covered in the course, as often they are relegated to little importance. As these organisms are the regulators of the microbial populations they play a part in soil function and activity.

It would have been great to be able to pepper the course with Australian examples, but the amount of research in this field is small compared to other countries. We are catching up though; new advances in techniques to measure the diversity (DNA & RNA), function (molecular techniques) and community structure have proved the key into unravelling the mystery that is the soil biotic community.

We were shown through the UWS lab which has a range of hi-tech equipment for fast throughput DNA fingerprinting, other molecular techniques and plate readers for respiration of different carbon substrates. DNA research is now within reach of many projects due to improvements in the cost and speed of analysis.

Figure 3. The UWS Eucalyptus woodland free-air CO₂ enrichment (EucFACE) facility is the only one of its kind in the southern hemisphere. The site studies the effects of elevated CO₂ on water use, plant growth, soil processes and native biodiversity in a mature, established woodland in the Sydney Basin.

A field trip to the newly established climate change research site in remnant woodland showed off an impressive feat of engineering. The 10 m structure created to release carbon dioxide into an uncovered large patch of trees has to be completely removable and not damage the remnant vegetation. The activities measuring soil biology are also highly conservative, and destructive sampling has to be kept to a minimum.

This course will be of particular interest to people with only a basic understanding of soil biology and who need to be brought up to speed. It is not particularly pitched at researchers.

For more information on the course: hieinfo@lists.uws.edu.au

News, publications, commentaries & events

News & commentaries

WeedTechnics announces community grants

Jeremy Winer, founder and developer of the Steamwand® has announced the launch of the Weedtechnics 50 in 50 Community Grant program.

The Steamwand® uses the power of hot water to kill the cells in weeds and is currently being trialled in Bundaberg as an alternative to poisons and herbicides.

After initial treatment the weeds re-sprout, but the process works by germinating the seed bank and then after three more passes the weed will be completely killed.
Weedtechnics will subsidise up to 30% off the purchase of a Steamwand SW® series steam weeding apparatus to community groups across Australia. The company would like to assist 50 community groups in 50 weeks to purchase 50 steam weed control units, for use in community, school and land care projects.

To spread the word about the community grant program, the company is using social media. The grant program will commence as soon as the Weedtechnics Facebook site has 5000 likes.

If you like the 50 in 50 Grant idea, you can assist the community grant program to get started by liking Weedtechnics on Facebook: www.facebook.com/Weedtechnics

**Rural Shires inheriting a GM canola legacy**

A recent survey of roadside canola conducted by Esperance (WA) LEAF and the Conservation Council’s Citizen Science Program within the Esperance town site, has shown that 13.6% of these plants were genetically modified for Round-up resistance (See: www.cccwa.org.au/content/fugitive-gm-canola-study).

This was up from 4% over a similar area in 2011. These results follow sampling last year that showed that 62% of canola plants growing on the edge of Albany Highway, north of Williams, were genetically modified.

According to Dr Nic Dunlop, citizen science coordinator with the Conservation Council, “road transport is clearly already a significant source of fugitive GM canola plants that will contribute to the contamination of the non-GM product stream over time and to the loss of those markets. The transport of GM canola from farms to grain receival centres remains unregulated.”

“Increased herbicide resistance in agricultural weeds is a significant issue for the Main Roads Department and Rural Shires who have been hand-balled the responsibility of managing Round-up resistant canola and radish on their road reserves. This has implications for the financial, environmental and health costs of increased herbicide use.”

Cheryl Bradley from the local environment group ‘Esperance LEAF’ said that the results from their recent sampling showed that the Esperance Shire had a significant problem meeting its obligations with respect to managing fugitive GM canola. Its current roadside weed management strategy, including the use of herbicides within Esperance, should be the subject of a transparent review with an opportunity for public comment.

**Organic hemp seed farming contracts on offer**

Hemp Foods Australia is looking for Australian certified organic farmers who want to try growing hemp seed for grain. Irrigated grain farmers are preferred with a minimum area of 20 ha. Seed, licensing and agronomic advice is provided by the company. If you are interested in a contract this coming summer contact John Muir, Email: john@hempfoods.com.au Mobile: 0499 556 505

**Research, publications and reviews**

**Mulching with large round bales between covered beds using an offset round bale un-roller for weed control**

Mulching between rows of plastic used for vegetable production can be an effective practice for controlling weeds. An existing round-bale un-roller was modified to create an offset bale un-roller, allowing round bales of hay to be unrolled between planting rows with a tractor. This modification has made the practice of mulching with round bales of hay or wheat straw more efficient. This offset round-bale un-roller was used to apply hay and wheat straw mulch to between-row areas of ‘Crimson Sweet’ watermelon (Citrullus lanatus) in 2009 and 2010.
Hay and wheat (Triticum sp.) straw mulches were applied at two thicknesses, corresponding one and two layers of mulch from the round bale, respectively.

All of the hay and wheat straw mulch treatments controlled weeds significantly better than the non-treated controls in both years. There was a significant mulch-type by year interaction for weed control, with 1-year-old hay having less weed control in 2010 compared with 2009, whereas other mulches had improved weed control in 2010.

One-year-old wheat straw and new hay had the lowest levels of weed biomass present compared with new wheat straw and the no-mulch control.

Mulch thickness significantly affected weed control, with mulches applied in two layers having significantly less weed biomass than those applied in one layer. Weed pressure was significantly less in 2010 compared with 2009.

The offset bail-un-roller that has been developed to apply mulches to between-row areas of plastic-covered beds is a useful tool that can be used to efficiently unroll round bales of a variety of organic mulches for weed control.


For more information see: www2.ca.uky.edu/agc/pubs/AEN/AEN117/AEN117.pdf

For information on modifying a bale un-roller for mulching between plastic row covers see: www2.ca.uky.edu/agc/pubs/AEN/AEN117/AEN117.pdf

Comparison of organic and conventional managements on yields, nutrients and weeds in a corn–cabbage rotation

Abstract: Conventional soil management systems (SMS) use synthetic inputs to maximize crop productivity, which leads to environmental degradation. Organic SMS is an alternative that is claimed to prevent or mitigate such negative environmental impacts.

Vegetable production systems rely on frequent tillage to prepare beds and manage weeds, and are also characterized by little crop residue input. The use of crop residues and organic fertilizers may counteract the negative impacts of intensive vegetable production. To test this hypothesis, we evaluated the effect of sweet corn (Zea mays L. var. rugosa) residue incorporation in a corn—cabbage (Brassica oleracea L.) rotation on crop yields, nutrient uptake, weed biomass and soil nutrients for organic and conventional SMS in two contrasting soil types (a Chromosol and a Vertosol).

Yields of corn and cabbage under the organic SMS were not lower than the conventional SMS, possibly due to the equivalent N, P and K nutrients applied. Macro-nutrient uptake between the organic and conventional SMS did not differ for cabbage heads. Corn residue incorporation reduced the average in-crop weed biomass in cabbage crops by 22% in 2010 and by 47% in 2011. Corn residue-induced inhibitions on weed biomass may be exploited as a supplementary tool to mechanical weed control for the organic SMS, potentially reducing the negative impacts of cultivation on soil organic carbon.

Residue incorporation and the organic SMS increased the average total soil N by 7 and 4% compared with the treatments without residue and the conventional SMS, respectively, indicating the longer-term fertility gains of these treatments. Exchangeable K, but not Colwell P, in the soil was significantly increased by residue incorporation.

The clayey Vertosol conserved higher levels of nutrients than the sandy Chromosol. Yields under organic SMS can match that of conventional SMS. Residue incorporation in soil improved soil nutrients and reduced weed biomass.


Comparative life cycle assessment in the wine sector: Biodynamic vs. conventional viticulture activities in NW Spain

Abstract: Viticulture is currently experiencing a gradual shift to more sustainable production practices. Many producers see in this shift an opportunity to increase their sales, especially in a context which is greatly influenced by the reduction in wine sales due to the world economic crisis. Hence, both organic and biodynamic viticulture have begun to be applied in many vineyards as alternative attractive agricultural techniques. Nevertheless, it remains unclear which are the exact environmental benefits (or drawbacks) of applying these techniques for numerous environmental impacts, such as climate change or toxicity.

Therefore, the main goal of this study is to perform an environmental evaluation using Life Cycle Assessment (LCA) for three different viticulture techniques within a single appellation (Ribeiro, NW Spain): biodynamic cultivation sites, conventional vineyards and an intermediate biodynamic-conventional wine-growing plantation (i.e. biodynamic site lacking certification). Moreover, two methodological improvements in the field of wine LCA studies are suggested and developed in terms of land use impact categories and labour inclusion in life-cycle thinking.

Results demonstrate that biodynamic production implies the lowest environmental burdens, and the highest environmental impacts were linked to conventional agricultural practices. The main reasons for this strong decrease in environmental impacts for the biodynamic site is related to an 80% decrease in diesel inputs, due to a lower application of plant protection products and fertilisers, and the introduction of manual work rather than mechanised activities in the vineyards.


Evergraze website to promote perennials

EverGraze is a national research, development and extension project that aims to design, test and implement farming systems based on perennials, which significantly increase profitability of livestock enterprises and at the same time reduce ground water recharge and soil loss by water and wind in the high rainfall zone of southern Australia.

The EverGraze website hosts the results of research to develop farming systems based on perennials. It includes case studies, management techniques and regional information.

For more information: www.evergraze.com.au/

The production of baby-leaf lettuce under floating crop covers

The aim of the this AUSVEG project was to investigate floating crop covers, with a particular focus on the effect on reducing foreign body contamination (from insects, wind-blow debris, and animals). A handful of unforeseen benefits were also discovered.

The crop covers were shown to reduce insect infestation by almost 90% in the best scenarios, with chemical applications reduced by at least 50% and windblown debris reduced to 0% for baby-leaf salads.

The quality, strength and shelf-life of the baby-leaf crop in the trial were indistinguishable from the control.

“It was observed over multiple trials that a very significant reduction in pest numbers can be achieved by removing the nets immediately prior to harvest,” the study stated.

Figure 6. Harvesting baby leaf lettuce, with crop covers in the foreground.

Source: https://ausveg.worldsecuresystems.com/publications/Vegenotes/Vegenotes_34.pdf
The project was hosted in Queensland’s Granite Belt region, in which crop growing times were shown to be reduced by up to 20% in cooler periods. Higher rates of soil moisture retention were also found, leading to a reduction in irrigation between 30-50% depending on the time of year.

The caveat with crop covers is that they may also inhibit normal rates of drying after a wet period.

Protection from frost and hail damage were also winning attributes of the floating covers. The nets also created a microclimate - stable temperature / moisture conditions at the level of the plant itself that allowed protected crops to grow more consistently with less variance in leaf size. They also open the door for frost-sensitive crops to be grown in colder regions.

With pesticide regulation on the rise in Europe and now Australia, as well as shifting climatic zones and consumer complaints about high levels of foreign body contamination in baby-leaf salads, floating crop covers provide a viable investment for growers looking to simultaneously address these issues and provide a higher quality product to consumers.


New compost guide

Tocal Agricultural College has published a new AgGuide on compost which covers the basics of compost making, commercial composting methods, and use of compost in farming.

For more information see:

Land use needs to incorporate ecosystem services

Allowing land use to be determined purely by agricultural markets results in considerable financial and environmental costs to the public according to a new UK study. Highly significant value increases can be obtained by incorporating all potential services and their values in land use planning. If market-dominated agricultural policies in Europe are not changed, there will be a reduction in the flow of benefits that landscapes offer society.

For more information see:
www.sciencemag.org/content/341/6141/45

Soil in Nature

The research journal ‘Nature’ has compiled an online collection of peer-reviewed articles on soils intended for college and high school students.
www.nature.com/scitable/knowledge/soil-agriculture-and-agricultural-biotechnology-84826767

Events

National Organic Week Australia

Taste the Difference, Feel the Difference, Make a Difference. Friday 4 – Sunday 13 October 2013

National Organic Week Australia (NOW) is 10 days of targeted media and locally-staged activities designed to increase awareness of the benefits of organic products and farming production systems and accelerate the uptake of these in the wider Australian community and environment.

The Centre for Organic and Resource Enterprises (CORE) in collaboration with Australian Organic Ltd hosts and promotes National Organic Week (NOW).

For more information see:
http://www.organicweek.net.au/core/

Biological control of weeds course - Wagga Wagga, 22 October

In this one day, fully accredited course, participants are trained to develop skills to identify biological control methods used in Australia and learn techniques in rearing, field collecting, releasing and monitoring biological control agents for weed management.

Registration closes 14 October and the course fee is $320 per person, GST free.

For registration call Cassie Gardiner on 6763 1276 or Julie Chapman on 6763 1285 or email tamworth.profarm@dpi.nsw.gov.au
World Soil Day December 5, 2013

World Soil day celebrates the importance of soil as a critical component of the natural system and as a vital contributor to the human commonwealth through its contribution to food, water and energy security and as a mitigator of biodiversity loss and climate change. It is celebrated particularly by the global community of 60 000 soil scientists charged with responsibility of generating and communicating soil knowledge for the common good. Many events focus on increasing the public awareness of soil and its contribution to humanity and the environment.

For more information see: