PASTURE SEEDS

RIRDC Completed Projects in 2010 - 2011
and Research in Progress as at June 2011

RIRDC Publication No. 11/085
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RIRDC Completed Projects 2010-2011
And Research in Progress at June 2011

October 2011
RIRDC Publication No 11/085
Foreword

RIRDC releases Research in Progress summaries of continuing projects and those completed during each financial year. Our intention is to:

- provide stakeholders with early access to the results of ongoing and completed work to inform their decisions, and

- inform researchers of results to shape research directions.

Pasture Seeds Completed Projects in 2010–2011 and Research in Progress June 2011 contains short summaries of projects funded by our Pasture Seeds Program. The Program aims to deliver R&D To maximise opportunities and minimise risk for a profitable and sustainable pasture seeds industry based on a reputation for reliable supply, domestically and internationally, of a range of quality pasture seeds.

The research objectives for the Pasture Seeds Program are:

1. Industry communication and capacity building
2. Improved seed production and processing technologies
3. Environmental sustainable seed production systems
4. Monitoring, evaluating and adopting emerging sciences and technologies
5. Developing new pasture seeds products, markets and farm systems

This report is an addition to RIRDC’s diverse range of over 2000 research publications most of which are available for viewing, free downloading or purchasing online at www.rirdc.gov.au. Purchases can also be made by phoning 1300 634 313.

Craig Burns
Managing Director
Rural Industries Research and Development Corporation
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Research in Progress

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Objective

To develop molecular tools, which facilitate selection and breeding of plants with tolerance to boron (B), leading to the development of B tolerant annual medic cultivars. The aim is to develop very close or diagnostic molecular markers linked to genomic regions or candidate genes for B tolerance that can be directly implemented into the pasture breeding programs. The development of molecular markers will provide breeders with an additional tool for cost- and time-efficient selection leading to the faster development of improved pasture varieties.

Background

Boron toxicity affects approximately 50% of the grain belt of South Australia and Victoria and results in dry matter reductions of up to 40% in annual medic species. Annual medics are important components in cereal crop rotations and are a highly valued pasture species.

Losses in annual medics susceptible to B are expressed in reduced dry matter (DM) production and reduced nitrogen fixation:

- At an average dryland yield of approximately 4 tonne of DM/ha and at the reported DM reduction (approx. 40%) of intolerant annual medic species in B toxic soils, only 2.4 tonne of DM/ha could be produced. In addition to reduced DM, which is lost as stock feed, biological nitrogen fixation is also decreased to 60 kg nitrogen/ha compared to an average of 100 kg nitrogen/ha in B tolerant pastures (4 x 25 kg per tonne of DM). The lower nitrogen fixation will negatively impact on the following, generally two years of cereal crop production and thus have a long-lasting effect on growers’ incomes. The possibility to complement nitrogen losses through fertiliser adds extra costs of $1-2 per kg nitrogen.
- For a hypothetical farm size of 1,000 ha growing B susceptible annual medics every 3rd year, losses due to reduced DM production and nitrogen fixation sum up to $158,000 per annum based on the calculations:
  - 4t • 1000ha • 0.6 • 0.333 • $160 (hay price/t) = $128,000 losses in DM per annum
  - 100kg • 1000ha • 0.6 • 0.333 • $1.5 = $30,000 losses in fixed nitrogen per annum

Research

The inheritance of B tolerance was investigated in two populations from crosses between tolerant and intolerant parental lines of Medicago truncatula. By utilizing recent findings on the molecular mechanism of B tolerance in other...
plant species such as barley and the model plant Arabidopsis, we were able to develop DNA markers (8) that are inherited together with the B tolerance. This linkage between the DNA markers and B tolerance allows identifying plants with the desirable B tolerance amongst hundreds or thousands of plants. The established DNA marker assays are much faster, cheaper and non-destructive to the plant - one leaf for DNA extraction is sufficient. These aspects make the developed markers attractive to breeding programs that aim to incorporate B tolerance to develop better adapted medic varieties.

The markers will facilitate and thus accelerate the development of B tolerant varieties of annual medics. Findings are most likely transferable to related legumes such as Lucerne and pulses.

The B tolerance markers are immediately available for marker-assisted selection in breeding programs. Improved biomass, seed production and N fixation in B tolerant lines will be an incentive for growers to adopt B tolerant varieties.

Manuscript in preparation:

Completed Projects - Improved seed production and processing technologies

PRJ-002388 Development and use of diagnostic tools for subterranean clover red leaf disease

RIRDC Project No.:  
Start Date: 30/06/2008  
Finish Date: 29/06/2011  
Researcher: Alan Humphries  
Organisation: The Minister for Agriculture, Food & Fisheries acting through the South Australian Research & Development Institute  
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Email: Alan.Humphries@sa.gov.au

Objectives

To improve seed production technologies for maximizing yield, quality and processing efficiency by:

1) Developing molecular diagnostic tools for identification of subterranean clover red leaf virus (SCRLV) and other viruses known to infect subterranean clover. (Thereby providing a service to growers and industry and hence supporting both production and domestic and export sales of quality, certified sub clover seeds).

2) Establishing whether SCRLV is associated with the sub clover red leaf disease currently prevalent in seed production stands.

3) Assessing the incidence and severity of SCRLV in seed production regions.

4) Determining the level of resistance to SCRLV in varieties of sub clover and selected genebank accessions.

5) Determine the disease cycle leading to infection of the stands and develop integrated disease management (IDM) protocols.

6) Compile the results from the project in a report for RIRDC to publish.

Background

From the mid 2000’s sub clover seed producers have reported that a widespread unknown red-leaf disease has been causing yield losses of up to 60%. Subterranean clover is affected by a large number of virus diseases and are dependent on the presence and activity of vectors (aphids). Identification of viruses from visual symptoms is unreliable as the symptoms can vary and are similar to nutrient disorders and other diseases. Laboratory tests are required for positive identification. The virus diseases may result in lower herbage yields and severely decreased seed production, decline in the nutritive value and increased susceptibility to root diseases.
Subterranean clover seed producers based in South Australia have reported symptoms of sub clover red leaf virus in their seed production plots over several recent seasons. This has been greatly affecting their seed production with estimates of 60% reduction in seed yield from affected stands. The seed company, Seedmark, has raised the problem as of high priority for the industry. Hence this project seeks to address the problem faced by the sub clover seed producers.

Research

A survey of sub clover seed production fields in South Australia and western Victoria found bean leaf roll virus, alfalfa mosaic virus and cucumber mosaic virus to be present. A set of diagnostic tools for these viruses and sub clover red-leaf virus were developed. Virus transmission was studied.

Outcomes

Bean leaf roll virus, which is a relatively new virus in Australia, was found to cause red-leaf symptoms, was widespread and the cause of the red-leaf disease. The widely distributed bluegreen aphids were shown, for the first time, to transmit bean leaf roll virus. A fact sheet for the control of red-leaf disease in sub clover seed crops was developed and was sent to sub clover seed producers and posted on the internet.

Implications

This project found that bean leaf roll virus is widespread and sub clover seed producers should develop their own management strategy to minimise the risk of viruses causing yield losses. This project has developed a fact sheet that lists ten points for seed producers to consider when developing their management strategy to control red-leaf disease. The fact sheet will also be useful for sub clover pastures producers.

Publications


Completed Projects - Improved seed production and processing technologies

PRJ-005491  Herbicide Control Options for *Setaria* in Lucerne

| Start Date: | 18/12/2009 |
| Finish Date: | 01/06/2011 |
| Researcher: | Nicola Raymond |
| Organisation: | Lucerne Australia Inc. |
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Objective

This research was conducted to provide some efficacy data towards helping growers and their advisors determine the best herbicide management practice for the control of *Setaria & Panicum*.

Background

The research conducted into the control of *Setaria* (Love Grass or Whorled Pigeon Grass) in lucerne seed crops has come about largely due to the threat it is placing on the export of lucerne seed to the USA. In the USA there is a zero tolerance of *Setaria* in imported products. In recent years many shipments of Australian lucerne seed have been rejected once they have reached American shores due to contamination with *Setaria* seed. Seed marketers are now placing increasing pressure on growers to avoid seed contamination with these weeds. The seed cleaning plants will often remove 99% of the weed seeds but often this takes 3-5 passes through the cleaning plant, causing high cleaning costs, high lucerne seed cleaning losses and still no guarantee of 100% *Setaria* freedom. It is increasingly becoming apparent that the best place to control the weed is in the paddock. In order to do this, the only data available is anecdotal. This project goes some way towards providing comparative data for growers and their advisors to examine to make management decisions.

Research

This research trialled various pre-emergent, post-emergent and a combination of both herbicides for the control of *Setaria verticillata* in lucerne seed crops. Historically, there have been many herbicides registered in lucerne which have been used for the control of *Setaria*. As to which herbicide is the most effective for control of this weed has only ever been anecdotal. This research was conducted to provide some efficacy data. As such rates above that listed on the labels were used with some products to identify whether it improved the level of *Setaria* control. Growers should consult their advisor about resistance management strategies and appropriate label rates prior to the application of herbicides on their fields.

Outcomes

The research identified that when there are high *Setaria* populations, neither the pre-emergent or post emergent herbicides were effective on their own to control the weed. A combination of both a pre-emergent and post emergent herbicide was the most effective treatment.

Of the pre-emergent herbicides, Spinnaker® 700WDG was more effective than Stomp® 440EC for controlling *Setaria* (*Setaria verticillata*) in lucerne. Of the experimental pre-emergent herbicides evaluated in Trial 1, the Exp 2 product generally demonstrated the greatest efficacy, and achieved *Setaria* control...
equivalent to Spinnaker® at the highest rate.

Select 240EC® was the most effective post emergent herbicide for the control of Setaria, achieving superiority over Sertin® 186EC, Verdict® 520EC and Raptor®. The most effective commercially available and registered pre-emergent product in Trial 3 was Spinnaker® at 140g/ha, followed closely by Stomp®, while Spinnaker® at 105 g/ha was far less effective.

It must be noted that the trial undertaken was only conducted on one field over one year. There is no known resistance in this weed population, but the official status of this population is unknown.

**Implications**

The implications of this research will also have a major impact on the costs of control of Setaria. Before this research was conducted, the standard in field post emergent herbicide used was Sertin® at 1-1.5 L/ha. This research has identified that Select® is a more effective product for the control of Setaria. The cost of Select® at 1.5L/ha is approximately $30/ha compared to Sertin® at 1.5 L/ha at $45/ha. So the experiments showed that not only is Select® cheaper, but is far more effective that Sertin® at controlling Setaria in lucerne seed crops.

The seed cleaning data shows that in many cases a minimum of 2.5% of extra lucerne seed has to be removed to clean out the Setaria seeds. Across all of the treatments an average of 2.6% of extra lucerne was removed in the cleaning process. Based on the uncleaned yield of this trial this represents 16 kg/ha of extra lucerne lost in the cleaning process. At $3.50 / kg the loss is valued at $56/ha. These losses can be reduced with correct herbicide management practice.

In many cases where the Setaria incidence was higher the lucerne loss was also much higher (up to 36% in one treatment). This shows that Setaria control is not only about market access but also about net grower return.

**Publications**

Herbicide Control Options for Setaria in Lucerne

RIRDC PRJ-005491
Research in Progress - Developing new pasture seeds products, markets and farm systems

PRJ-003627  Improved seed production of *Lotus tenuis* for a global market

Start Date: 31/07/2009
Finish Date: 24/04/2012
Researcher: Peter Lane
Organisation: University of Tasmania
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**Objectives**

The overall project objective is to assemble a large number of accessions of *Lotus tenuis* including those already held in collection by the Tasmanian Institute of Agricultural Research (TIAR) for characterisation, evaluation of seed production and screening for tolerance to environmental stresses. Specifically the project aims are to:

1. Characterise accessions and assess seed production under field conditions
2. Assess under controlled environment conditions critical environmental factors influencing seed production, in particular the effect of daylength.
3. Screen a number of accessions for tolerance to environmental stresses such as salinity and waterlogging.
4. Investigate *L. tenuis* as a potential perennial pasture species to be produced in Southern Australia and marketed globally.

**Current Progress**

Initial assessment of 98 accessions/cultivars of *Lotus tenuis* at two field sites has been completed based on vegetative plant growth characteristics, timing and extent of flowering, pod development, pod shattering and seed yield. In general, it has been found that the majority of accessions/cultivars have grown exceptionally well at both field sites, have flowered prolifically and produced good quantities of seed. The results confirm that selection on the basis of non-pod shattering will be critical to the development of commercial cultivars. From this assessment approximately 20 accessions have been identified that satisfy a range of key criteria for further evaluation over the 2011/12 growing season.

A controlled environment experiment was undertaken to investigate the effect of daylength on flowering and seed production. Under daylength treatments of 15, 16 and 17 hours of daylight, the accessions/cultivars tested have produced disappointing results in that only one accession/cultivar had flowered by the end of the experimental period. It is proposed that this experiment be repeated.

It was intended to produce a factsheet and place information on the Industry Partner’s website. This will be done over the next few months after all the data from the above experiments has been fully analysed.
Research in Progress - Environmentally sustainable seed production systems

PRJ-004993 A new blue green aphid - a biohazard to the pasture seed industry

Start Date: 15/07/2010
Finish Date: 15/05/2013
Researcher: Alan Humphries
Organisation: The Minister for Agriculture, Food & Fisheries acting through the South Australian Research & Development Institute
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Email: Alan.Humphries@sa.gov.au

Objectives

Overall objective: This project will identify and help manage the threat of a biohazard created by the emerging new blue-green aphid (BGA) in Australia.

Outcome1. Confirm the existence of a new blue green aphid biotype and measure the increased virulence and fecundity of the new biotype.

Outcome2. Determine the distribution of the new BGA biotype in Australia

Outcome 3. To develop a DNA based diagnostic tool for quick and cheap assessment of aphid biotype. To use this tool to identify the distribution of the new aphid biotype and provide an initial assessment of how quickly the aphid is spreading. This would also effectively provide an early warning for producers, allowing them to alter management approaches prior to sustaining significant damage in the field. The survey will also provide important information to breeding programs regarding the importance of having resistance to this new pest.

Outcome 4. Develop a management package targeted at lucerne seed growers to assist in managing the new BGA biotype. This will involve quantification of the level of crop damage (yield loss, mortality) caused under field conditions by the new BGA to previously resistant pasture legumes. Also, a range of control measures will be evaluated including the potential to protect seedlings with an insecticide based seed coating. The project will work with the seed industry to develop and recommend effective strategies of control.

Current Progress

Eleven BGA populations have been collected. Nine from SA, and one from both NSW and Tasmania. These populations have been cleaned of parasites and are now cultured in individual tents with insect-proof mesh to maintain their purity.

An experiment in December 2010 was conducted with each population on 2 annual medic cultivars (Sephi, which was previously tolerant, and Jemalong, which is susceptible) to identify the aphid populations that belong to the original or new biotype. From this study we conclude (by death of previously resistant Sephi) that 4 populations collected in the south east of South Australia (SA) from Kybybolite to Coomandook belong to the new biotype, as well as 3 other populations from the York Peninsula and lower Mid-North of SA. BGA populations collected from more remote regions at Kangaroo Island, Kimba (Eyre Peninsula), Launceston (Tas.) and Howlong (southern NSW) appear to be
the original biotype.

A second, larger experiment was conducted in February 2011 to repeat the above study and also included the capacity to measure reproduction rates of each aphid population on the two medic cultivars. For some unknown reason the virulence of the aphid cultures are now in decline and each BGA population failed to reproduce on Sephi. Work is currently in progress to find a reason for this obscure result. Unfortunately, it has also delayed our experiments that plan to look at the virulence of each population on a wider range of pasture legumes.

In the last week we have received reports of unusually severe aphid attacks on sub clover in southern NSW, and we are currently obtaining this population. Experiments to genotype the aphid populations with molecular markers will start in July on schedule.
## Research in Progress - Environmentally sustainable seed production systems

**PRJ-005657 Blue-banded bees as potential pollinators of lucerne**

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<td>Finish Date:</td>
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<tr>
<td>Researcher:</td>
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### Objectives

1) To investigate the ability of blue-banded bees to pollinate lucerne. Honeybees are often placed on lucerne at high densities as lucerne is not a preferred plant for honey bees. The ability of the native Australian blue-banded bee *Amegilla murrayensis* to pollinate lucerne in captivity will be examined. Flowering lucerne plants will be presented to blue-banded bees in enclosed flight compartments, and their pollination ability will be evaluated against controls of no pollination and honey bee pollination.

2) To develop permanent nesting structures for management of blue-banded bees to ensure pollinator activities on lucerne, and potentially also on other crops. Nesting walls will be designed that will house blue-banded bee aggregations at the crop sites. Different nesting substrates will be tested in confinement for their ability to attract blue-banded bees. Once established, experimental nesting walls of the preferred substrate will be built outside, and seeded with nests from the permanent breeding program that is in place at the University of Adelaide.

### Current Progress

1) A replicated experiment investigated the potential of blue-banded bees for pollination of lucerne. Blue-banded bee pollination in tunnels (in the presence and in the absence of alternative food sources) was evaluated against open pollination, alfalfa leafcutter bee pollination in a tunnel, and no pollination. Blue-banded bees did not collect pollen and their long tongue allowed them to access lucerne nectar without tripping the flower. Lucerne pod set was only 5%.

2) The use of two bee walls are under evaluation to determine their nesting success. Four types of nest substrate are being used, and so far seem to differ in their uptake of the bees. Seven blue-banded bees were attracted to these walls. A very low number. However, forty nests were made by native leafcutter bees. Interestingly, the native leafcutter bees were observed to forage on and trip the open pollinated lucerne plants close to the wall. The pod set there was exceptional, 65%. These walls are likely to be beneficial to the lucerne industry as they attract native leafcutter bees which seem to pollinate lucerne very successfully.

It is therefore suggested that the remainder of the project focuses on the use of native leafcutter bees rather than Blue-banded bees.
**Research in Progress - Environmentally sustainable seed production systems**

**PRJ-005062  Introgression of tolerance to *Pratylenchus neglectus* into annual medics**

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<td>Finish Date:</td>
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<tr>
<td>Researcher:</td>
<td>Klaus Oldach</td>
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<tr>
<td>Organisation:</td>
<td>The Minister for Agriculture, Food &amp; Fisheries acting through the South Australian Research &amp; Development Institute</td>
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<td>Email:</td>
<td><a href="mailto:Oldach.Klaus@saugov.sa.gov.au">Oldach.Klaus@saugov.sa.gov.au</a></td>
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**Objectives**

The project has two objectives:

1. To provide a comprehensive survey on nematode diseases in the major lucerne seed production zones. The predominance and relevance of the most common nematodes and soil-borne fungal pathogens of lucerne will be assessed in the major seed production regions. The survey will measure various pathogens that affect plants either in spring or autumn.

2. To develop molecular tools that help introgression of root lesion nematode (RLN) tolerance into annual medics that can be used as breeding tools and replace the lengthy and expensive phenotypic analysis. The first to achieve this is to develop a genetic map of a cross between intolerant cultivar Herald and the identified tolerant line RH-1. The genetic map will be used for the identification of the regions in the genome that are responsible for the observed RLN tolerance. Identification of these genomic regions (loci) will allow the development of molecular markers utilising the sequenced genome of the closely related species *M. truncatula*. These markers will then be used to introgress the most significant tolerance loci from tolerant line RH-1 into elite varieties to make them more productive in the presence of RLN. If time allows and for widest possible utilisation of the project outputs, we will test the new markers on suspected RLN tolerant lucerne (*Medicago sativa*) plants that have very recently been identified in SARDI’s lucerne breeding program (Ross Ballard and Alan Humphries).

**Current Progress**

Plant samples were collected from a number of seedling stands, with some being re-sampled in autumn to obtain data for two consecutive years. Less samples that were planned were taken last season due to the unusually wet conditions which caused variation in sowing dates or no sowing at all. With the aim to collect and assess 100 samples, additional sampling in the coming spring and autumn seasons will be needed. Once all sampling has been completed, all plant and soil samples will be processed for DNA quantification.

To date, 576 plants representing 30 samples have been assessed for root length, number of trifoliate leaves, nodule number and dry-weight. On a disease score scale from 0 – 5 (dead), 32% of plants obtained scores of 3 or 4, where most lateral roots were badly damaged or missing. Soil from the sample sites will be inoculum DNA quantified later. Nematode extraction identified root lesion nematode (*Pratylenchus*), stubby-root nematode (*Paratrichodorus*), ring nematode (*Criconemoides*) and stunt nematode (*Tylenchorhynchus*). Once all 100 samples have been collected, DNA analysis from soil and plant samples will precisely quantify the presence and infection caused by the four nematodes and three soil-borne fungal pathogen species.
Research in Progress - Improved seed production and processing technologies

PRJ-005279 Evaluating drop tube and sprinkler irrigation for white clover seed production

Start Date: 15/07/2010
Finish Date: 15/02/2013
Researcher: James De Barro
Organisation: Alpha Group Consulting P/L
Phone: 08 87 551 502
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Objectives

The objective of the project is to improve the knowledge base of white clover irrigators by developing a professional approach to irrigation management. Specifically it aims to focus on the delivery of irrigation to reduce environmental water losses, increase efficiency in timing and potentially net dollar return/ML applied, enhance pollination and exhibit to the wider public a significant advancement in irrigation practices that maximise minimal water use and hence the impact on the groundwater resource. The project will show the benefit and need for continual monitoring soil moisture for the purpose of irrigation scheduling, and to give leverage and be leveraged by the developing understanding and use of crop factors and crop evapotranspiration in irrigation management. The project will serve as a case study for the use of improved irrigation delivery for centre pivots for all pasture seeds.

Current Progress

On the basis of first year results modifications to the sprinkler outputs and the soil moisture probes were undertaken prior to the closure of the white clover seed crop in October 2010. Modification of the trial design included a control which was the standard rotator configuration on the pivot and a statistically analysable replicated layout for the 2010/11 harvest. The white clover seed production season was hampered by significant rainfall. This challenged the irrigation management of the crop and hence the trial. The research was further challenged by the small plot harvester becoming unavailable at the point of harvest citing concern over the welfare of their equipment. The trial harvest process had to be modified and hand harvesting was invoked as well as use of a conventional header. Hand harvested samples are yet to be assessed. The highlight of the research this season was that soil moisture levels were able to be reduced to well below previously acceptable levels with no apparent negative impact on seed yield under any of the treatments. The soil moisture data recorded through this season will be of particular value to the irrigated white clover seed industry and to pasture irrigators in general.
Research in Progress - Improved seed production and processing technologies

PRJ-003640  Effective weed control for *Trifolium tumens* and *Dorycnium hirsutum* seed crops

| Start Date:    | 31/07/2009          |
| Finish Date:   | 24/04/2012          |
| Researcher:    | David Parsons       |
| Organisation:  | University of Tasmania |
| Email:         | dparsons@utas.edu.au |

**Objectives**

The principal project objective is to advance the development of commercial seed production for two new alternative perennial legume species, *Trifolium tumens* and *Dorycnium hirsutum*, through the establishment of an effective herbicide program for management of weeds in seed crops of these species.

Component objectives include:

1. Production of guidelines in the use of pre- and post-emergent herbicides for *T. tumens* and *D. hirsutum* commercial seed crops.

2. Increased ability of seed producers to economically produce seed of *T. tumens* and *D. hirsutum*, through improved pre- and post-establishment weed control.

3. Facilitating commercial production of two perennial legumes that are potentially both economically and environmentally important.

**Current Progress**

The first year of field experiments at Cressy and Cambridge in Tasmania to examine the effect of pre-emergent and post-emergent herbicides on seeding has been completed and results are currently being analysed. It was a difficult spring/summer to conduct such experiments, due to the excess rainfall and consequent abundance of weeds. Enough useful data was collected. Plots are currently being prepared for repeat experiments in spring. In addition, the most promising herbicides will be investigated further with glasshouse experiments. In particular, it will be important to examine the timing of herbicide application during establishment. Field experiments to examine the effects of herbicides on established crops have been planted, and plants will be sprayed once they reach sufficient maturity. A glasshouse experiment for herbicide treatment for established crops was also planted and these treatments will be applied when the plants have reached sufficient maturity. All milestones are on track, and the research is expected to continue to yield useful results.
Research in Progress - Improved seed production and processing technologies

PRJ-000479 Soft seeded sulla - a novel approach for lowering seed costs

Start Date: 01/07/2005
Finish Date: 24/04/2012
Researcher: Clinton Revell
Organisation: Department of Agriculture and Food Western Australia
Phone: (08) 9368 3596
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Email: crevell@agric.wa.gov.au

Objectives

This project has two key objectives:

1. Confirm genetic stability and validate field performance of the soft-seeded sulla (*Hedsarum coronarium*) selections identified in RIRDC project UWA-65A.

2. Commercialise an elite soft-seeded genotype of sulla for domestic and export forage/seed markets.

Current Progress

Selection of elite soft-seeded sulla germplasm from two parental lines is continuing with the objective of developing at least one new 'synthetic' cultivar. Up to 40 single plants from 10-12 families derived from each of the two parental lines were grown under irrigation in 2010. Plants were assessed for growth habit, flowering time, dry matter production, seed yield and seed retention. Bulk seed samples from each family were tested for levels of soft seed in Feb/March 2011. This process identified the families with the highest levels of soft seed, together with other desirable agronomic characters. From these families over 100 outstanding individual plants were selected and retested for levels of soft seed. Over half of these plants have a high level of viable seed and zero hard seed. Further seed is being harvested from these superior plants and will form the basis of the synthetic cultivar(s) through poly-crossing in 2011/12. In addition the best mother-plants will be retained (and cloned if possible) for further seed production in 2011/12. It is expected that by April 2012, the project will have produced about 500g of breeders seed to offer to industry.

The commercial application if this technology was tested in a 2010 field demonstration site at Karridale in the south-west of WA. This work confirmed that sulla can be effectively established using soft-seed in the pod at densities equivalent to standard sowing rates of commercial (scarified) seed.
Research in Progress - Improved seed production and processing technologies

PRJ-003760 Commercial seed technology for *Bituminaria bituminosa* var. *Albomarginata* (albo tedera)

| Start Date: | 26/11/2009 |
| Finish Date: | 24/04/2013 |
| Researcher: | Daniel Real |
| Organisation: | Department of Agriculture and Food |
| Phone: | 08 9368 3879 |
| Email: | dreal@agric.wa.gov.au |

**Objectives**

The objectives of this project are:

(i) to understand the factors influencing seed production in albo tedera.

(ii) to develop large scale and low cost technologies for harvesting and seed processing of albo tedera.

**Current Progress**

The effect of water stress on seed production was studied in a pot experiment under controlled glasshouse conditions at UWA in October 2010. Two accessions (51 and 53) were subjected to four watering regimes for six weeks (a) well watered, (b) watered once a week, (c) watered once a fortnight and (d) no water. Flower head development continued for treatments (a) and (b), stopped after 3 weeks in treatment (c) and stopped after 1 week in treatment (d). Accession (Ace. the number of the selected plant in the experiment) 51 had the best yields in treatments (a) and (b), followed by (c) and then (d). Acc. 53 had the same seed yield for the 4 treatments.

At the Medina research station in W.A., 19 accessions were characterized for their flowering time, flowering intensity, number of seeds per inflorescence, flower to seed development and seed yield with 4 consecutive harvests in a two-month period. The best seed yield was obtained with Acc. 42 that produced 350 kg/ha.

Harvest with conventional plot seed harvester was conducted in rows sprayed with a desiccant and optimum harvesting settings were adjusted for drum – concave gap, speed of drum and speed of cleaning fan. Rows of tedera recovered very well after being sprayed with the desiccant and cut by the harvester.
Research in Progress - Monitoring, evaluating and adopting emerging sciences and technologies

PRJ-004046  Polymer adhesives & colourants used in preinoculated legume pasture seed

Start Date: 12/06/2009
Finish Date: 24/04/2012
Researcher: Greg Gemell
Organisation: New South Wales Department of Industry and Investment for and on behalf of the State of NSW
Email: greg.gemell@industry.nsw.gov.au

Objectives

1. To survey the available commercial polymers, colourants and other materials used in legume pasture seed inoculation and determine their compatibility with rhizobia.

2. To assess commercially available polymers for their ability to protect rhizobia from the adverse effects of desiccation and hence improve survival of rhizobia on pre-inoculated legume pasture seed.

3. To publish the results and conduct a workshop to provide commercial seed pelletters with a decision tool for the selection of suitable materials for seed preinoculation.

4. To establish of a quality control system for the on-going monitoring of commercial preinoculated seed products.

Current Progress

The project is progressing with ten new products obtained during last year. The 10 polymer products have been included in the register. Sensitivity studies using these products with clover strains TA1 and WSM1325 have commenced and are ongoing.

29 products listed as compatible with rhizobia were screened to determine their effect on the survival of rhizobia when incorporated into peat slurries used to inoculate polyethylene beads. Three coating products were excluded from the initial sensitivity screening, were included in this assessment. For each slurry treatment, the products were applied at the recommended application rates and included a control treatment.

Viable rhizobia on beads were counted 1h, 24h and 48h after coating.

Results show that after 24h, 6 products had potentially better survival of rhizobia on beads than the control, however, after the 48h count, only one product showed a lower death rate than the control.

The compatibility database has been updated with results to date of all products tested.

Discussions with seed coaters have begun, to assess compatible products on survival of rhizobia on seed using different commercial coating methods and equipment.
Research in Progress - Monitoring, evaluating and adopting emerging sciences and technologies

PRJ-000478  Establishing a seed scheme for mixed varieties of subterranean clover

| Start Date: | 01/07/2005 |
| Finish Date: | 15/10/2011 |
| Researcher: | Mark Holland |
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Objectives

The project aims to develop a seed test to identify varieties of subterranean clover and to use that test in a seed certification scheme to accredit seed lots of multiple varieties of subterranean clover. This test will be important because it will provide:

- the establishment of a seed accreditation scheme for subterranean clover that could be used to accredit seed that fails to meet the certification varietal purity or germination standards (95%).
- extension of the stand-life of crops in the Limited Generation Certification Scheme by quantifying the contamination level of visually indistinguishable varieties.
- And, an alternative test to field post (pre) control tests of certified subterranean clover seed lots and serve as a model for deployment of the technology to species having even more onerous post control requirements.

Current Progress

The test was based on protein analysis. From an exciting and hopeful start, failure of the equipment, an inability for the equipment company to replace the equipment, and therfore failure of the method, led to failure of the test. Importantly, a preliminary DNA based approach was examined and proved successful. A variation to the project was approved in March 2011 to further examine the DNA based mixed variety detection system with Dr Ghampkar. Analysis of the test results is underway and will underpin a new project validating this test.
Research in Progress - Monitoring, evaluating and adopting emerging sciences and technologies

PRJ-005348  Drop tube irrigated lucerne seed, herbage yield and plant persistence evaluation

| Start Date:          | 15/07/2010 |
| Finish Date:         | 15/05/2015 |
| Researcher:          | Simon Allen |
| Organisation:        | Lucerne Australia Inc. |
| Fax:                 | 0887 551 551 |
| Email:               | warraweepark@bigpond.com |

Objectives

1. To identify varieties of lucerne that are capable of optimising production of both seed and herbage within a given irrigation schedule with the aim of increasing net returns per mega litre of water pumped.

2. To optimise seed production for the Australian lucerne seed industry in order to achieve higher net returns per hectare.

3. To measure and compare the seed and herbage yielding performance of new and existing commercial lucerne varieties.

4. To measure and compare the seed and herbage yielding performance of experimental varieties of lucerne against current commercial varieties in order to identify and fast track superior genetics to the commercial market.

5. To conduct the proposed trial within a drop tube centre pivot irrigation system with current district best practices using the knowledge of specialised agronomists, growers and research organisations.

6. To evaluate annual plant persistence evaluation of different winter activity lucerne groups.

7. To measure and compare the seed and herbage yielding performance of new and existing lucerne varieties between the proposed drop tube centre pivot irrigation trial and the current border check irrigation trial.

Current Progress

The trial site had very good initial seedling vigour and growth different lucerne varieties. The pivot was “locked up” for seed production in mid November 2010. Like many other early “locked up” crops in the Keith district it, suffered from the early cool weather and other seasonal factors, which was reflected in the low amount of pod set throughout the different trial plots. The site was harvested on March 22nd 2011, and from the initial harvest data there was some significant variation in yield between varieties. This is yet to be verified by, the statistically analysed data from SARDI. The aim is to release the harvest results prior to the 2011 sowing season so that growers have information that will allow them to make informed decisions about variety selection.

The trial site field day was held on March 3rd 2011. A group of fifty growers, marketers and industry attended the day to inspect the trial and recieve market updates from the different seed companies. The project recieved lots of positive feedback from the growers and marketers.
Pasture Seeds Completed Projects in 2010–2011 and Research in Progress June 2011 contains short summaries of continuing projects as well as those that were completed during 2010–2011. The Pasture Seeds Program aims to deliver R&D to maximise opportunities and minimise risk for a profitable and sustainable pasture seeds industry based on a reputation for reliable supply, domestically and internationally, of a range of quality pasture seeds.

The research objectives for the Pasture Seeds Program are:

- Industry communication and capacity building
- Improved seed production and processing technologies
- Environmental sustainable seed production systems
- Monitoring, evaluating and adopting emerging sciences and technologies
- Developing new pasture seeds products, markets and farm systems

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