Grassland Society of NSW Inc

Newsletter

Another successful conference has come and gone – I was unable to attend this year, but I have heard nothing, but positive feedback. Congratulations to Nathan Ferguson and his team of helpers for organising an excellent conference at Wagga Wagga in July.

Those members who were not able to attend the conference should of received their proceedings by now – if you haven't had a chance to read through the proceedings yet – make sure you do, it is full of interesting and informative papers.

At the conference, the 2012 Grassland Society of NSW, Annual General Meeting was held. At this meeting the State Executive and committee were elected for the 2012/2013 year – see the back page of the newsletter for a full listing of the executive and committee. The Society will continue to be in the capable hands of Mick Duncan as President. A copy of Mick's Presidents Report to the AGM for the 2011/2012 year is on page 15 of this newsletter.

Also in this issue of the newsletter is a wrap-up of the conference (page 2), a report on the 2012 Hay and Silage awards (page 7), and reprints of two more poster papers from the Australian Grasslands Association, Legume Symposium held in February this year.

The papers are "The evaluation of temperate perennial pasture legume species for a low to medium rainfall environment in Tasmania" on page 3 and "Annual and biennial legume evaluation in northern New South Wales on page 10.

If you haven't paid your membership subs for the 2012/2013 membership year, please do so as soon as possible. You will have received a letter with details of your membership and how to pay from the Secretary Janelle. If you have any questions please contact Janelle at secretary@grasslandnsw.com.au

As always, I am keen to hear from you the members – so any articles, letters or ideas for articles or activities are greatly appreciated. The best way to contact me is by email at carol.harris@dpi.nsw.gov.au

I hope you enjoy the newsletter

Carol Harris
Editor

In this newsletter

Grassland Conference at Wagga Wagga attracts 180 people

The 2012 Grassland Society of NSW conference held at Wagga Wagga on 24-26 July has proved a hit with farmers and advisers in livestock industries, attracting close to 180 people from across the State over the two day conference.

Conference Convenor, NSW Department of Primary Industries (NSW DPI) agronomist at Tumut, Nathan Ferguson, said people travelled from as far afield as New Zealand, Queensland, Victoria and all parts of NSW for the annual conference.

Producer John Coughlan from 'Cudal Park', Cudal, said it was great to get all sections of the agricultural community together to hear presentations based on science followed up with practical advice from farmers such as Rodney Purcell from Brungle and Oliver Cay from Cooma.

"I thought the virtual reality tour of Rodney's farm at Brungle using satellite imagery was particularly impressive as it engaged people in the changes that he has implemented on his property," he said. This approach to using satellite imagery in a 3-D fly through allowed Rodney to take producers on a virtual tour of his farm, stopping at key points to discuss features and management of the farm.

Robert Cox from 'Kooyong', Tooma, said NSW DPI's Research Officer Susan Orgill's presentation on 'Soil Carbon, variation across the landscape' was outstanding.

"Susan made carbon very interesting and got the message across that as farmers we are responsible for our soil carbon and need to manage it carefully," he said.

NSW DPI Agronomist based at Yass, Fiona Leech's, presentation on alternative fertilisers also sparked a lot of interest with its reference to some very interesting results from pasture studies.

The key message is the same as it always was, correct nutrient deficiencies with products that have suitable nutrients in them. The study highlighted that available phosphorus was low and applying products with available phosphorus in them in sufficient quantities saw a pasture response.

Mr Ferguson said bus tours covering high rainfall enterprises in the Rosewood and Tarcutta areas, a cross property planning tour at Kyeamba, and a mixed farming tour at Wagga Wagga and Collingullie were well received by attendees.

If you weren't able to attend this year's conference, or you haven't been to a conference in a while here is a sample of some of the feedback we had about this year's conference:

• "I came to the conference because getting more production out of pastures is a State wide issue"

• "All food for thought as it all builds on the little bits we know and we just add to it and add to it"

• "The good thing about the conference is that it has brought together scientists, agronomists, farmers and all sectors of agriculture putting out information that has good data behind it, makes sense and is practical"

• "The conference has provided me with the willingness to think and learn what your doing, confirmed my thoughts that fertiliser drives production. Also don't just do everything for the sake of it. The conference will help me make more informed decisions"

• "I really enjoyed the conference as a broad range of speakers allowed us to think outside the square in terms of what we are doing and maybe what we should be doing"

• "It's all very interesting that we know what we already know, that is fertiliser makes a big difference"

• "One of the best I have attended (and that includes the few that I have either convened or assisted!)"

• "It was the best Grassland Society conference I have attended over the years."

• "I thought it was the most interesting and practical conference since the 2007 conference at Queanbeyan."

• "You and your team are really to be congratulated on a very smoothly run conference - great work!"

• "I take my hat off to you, it was a terrific conference!"

• "Congratulations on a really great conference. I don't believe there was one poor session."

• "I've been to a heap of conferences, both nationally and internationally, and I can honestly say that your conference was one of the most, well organised and smooth running conferences I have been to."

A big thank you goes out to the editors of the conference papers, Carol Harris, Greg Lodge and Cathy Waters. Without the editors contribution the proceedings would not contain papers of the calibre that it has.

Also a big thank you for the time and effort Barry Jensen contributed to the design and layout of the proceedings. Again the standard and quality of the proceedings are down to your effort and contribution.

A huge thanks to Luke Pope for arranging the audio visual for the conference, every presentation was clearly seen from all parts of the auditorium and the transition between presentations was seamless.

Finally a big thank you must go to Annette Lindgren, NSW DPI Clerical Officer at Tumut and Janelle Witschi, Secretary of the Society for there tireless efforts organising and helping the conference run smoothly. Organising and running a conference is a huge task and with support it makes a big task easier, so a big thanks to everybody involved in making the 2012 conference the hit that it was.

Nathan Ferguson, Conference Convenor

The evaluation of temperate perennial pasture legume species for a low to medium rainfall environment in Tasmania.

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Abstract: In response to the need to find better adapted and more persistent perennial legumes for dryland pastures in cool temperate low to medium rainfall (500-750 mm) regions, 24 species of perennial legume were evaluated for production and persistence under sheep grazing at two replicated sites in Tasmania. The sites: Cressy, annual average rainfall 628 mm and Jericho, annual average rainfall 570 mm are representative of the target region. The work identified three alternative species in Talish clover (*Trifolium tumens* Steve. ex M.Bieb.), *Trifolium ambiguum* M.Bieb. and lucerne x yellow lucerne hybrid (*Medicago sativa* L.subsp. *sativa x Medicago sativa* L. subsp. *falcata* (L.) Arcang.) as well adapted to the environmental conditions. White clover (*Trifolium repens* L.), a species commonly sown in the low to medium rainfall region failed to survive at both sites. Other alternative species identified as worthy of further consideration include *Trifolium physodes* Steve. ex M.Bieb. sulphur clover (*Trifolium ochroleucum* Huds.), alsike clover (*Trifolium hybridum*), narrowleaf trefoil (*Lotus tenuis* Waldst et Kit) and birdsfoot trefoil (*Lotus corniculatus* L.).

Introduction

White clover (*Trifolium repens* L.), red clover (*Trifolium pratense* L.), strawberry clover (*Trifolium fragiferum* L.) and lucerne (*Medicago sativa* L.subsp. *sativa*) are the four most widely used perennial legume species in grazing systems across Tasmania's low to medium rainfall (500-750 mm) region.

In this environment all of these species have adaptational deficiencies limiting their persistence. *T. repens* is at its natural limit of climatic adaptation, performing best in areas receiving more than 700 mm mean annual rainfall (Dear and Ewing, 2008). *T. pratense* has a low tolerance to moisture stress and will not survive long, dry summers. *T. fragiferum*, is more drought tolerant than *T. repens* (Dear *et al.* 2003), but is best adapted to wet or saline soils and will not survive long, dry summers. The persistence and use of *M. sativa* subsp. *sativa* is restricted by factors including water logging, acid soils and unfavourable grazing management.

Attempts to find alternative perennial legumes for temperate regions in Australia have met with little success. Lolicato (1997) evaluated a large number of perennial legume species but found nothing to match the persistence of *M. sativa* subsp. *sativa*. Li *et al.* (2008) evaluating 47 species of perennial legumes and herbs in a range of mixed farming zones across southern Australia also found no perennial legume to match the overall persistence of *M. sativa* subsp. *sativa*.

The objective of this study was to evaluate the persistence and production of a range of perennial forage legume species collected from environments similar to the target area, with the long term goal of providing producers in the target environment with well adapted alternative perennial pasture legume cultivars.

Methods

The early stages of this project saw over 1000 accessions and breeding lines, representing 80 species representing the Genera's *Anthylis, Astragalus, Coronilla, Dorycnium, Hedysarum, Lathyrus, Lotus, Medicago, Melilotus, Trifolium and Vicia,* screened and characterised for their potential to fit into the target environment. From this initial screening work, 7 commercial cultivars and 63 lines, representing the most promising material selected from 24 species representing 8 genera were sown into a randomised complete block design with 4 replications at two sites described in Table 1.

All lines were sown as seed, with sowing rates ranging from 5 kg/ha to 50 kg/ha dependant on the seed size of the line. Seed was scarified and inoculated with the appropriate strains of rhizobium prior to sowing. The seed beds were prepared by rotary hoeing in August 2005. In September 2005 the lines were sown by mixing the seed with moistened sand and surface broadcasting by hand into 1m x 2m plots, covered by hand raking and then rolled. Both sites received 300 kg/ha of 0-6-17 NPK prior to sowing, with a maintenance dressing of 200 kg/ha of 0-6-17 NPK applied in autumn 2007.

Seedling density was measured in two quadrats (0.25m x 0.25m), 4 weeks after sowing. Plant frequency (%) of each line was used as a measure of persistence. Frequency assessments were taken after the autumn breaks of 2007 and 2010. A square quadrat of steel mesh with 100 cells (each 0.1m x 0.1m) was placed in a fixed position on the ground at each assessment time. For each plot, cells containing a portion of a live plant crown of the sown species were recorded and the total number of cells containing a live crown was used to estimate frequency of occurrence. Seasonal dry matter assessments were made in years two and three. Dry matter production at Cressy was assessed either visually or by cutting one 0.25m^2 quadrat per replicate and oven drying the samples at 100^{0}C. The percentage of sown species was

Table 1. Experimental site details

Attribute	Jericho	Cressy
Latitude	42^{0}22'16.36"S	41^{0}43'57.76"S
Longitude	147^{0}18'57.19"E	147^{0}03'58.80"E
Elevation (m)	399	147
Mean annual rainfall (mm)	570	628
Mean maximum temperature (^{0}C)	15.5	18.2
Mean minimum temperature (^{0}C)	5.0	5.6
Soil texture	clay loam	sand
pH (water)	5.6	5.3
Colwell P mg/kg	9	46
Colwell K mg/kg	212	188

assessed visually in each plot. Visual ratings were used to assess herbage production at Jericho where severe drought conditions resulted in low herbage production. Both sites were grazed on a rotational system to fit in with the collection of seasonal herbage production data.

Results

Drought conditions prevailed at both sites for three of five years of the study. In 2006, 2007 and 2008 annual rainfall at the Jericho site was 56, 36 and 25 percent respectively, below the long term average. Over the same period Cressy was 40, 30 and 20 percent respectively, below the long term average (Table 2).

For seedling density, all lines of *Astragalus chinensis*, T*rifolium africanum*, *Trifolium burchellianum* and *Trifolium medium* recorded low seedling numbers, resulting in poor swards with low plant densities at both sites. Germination and early establishment of the remaining lines resulted in good swards in the initial year at both sites. Frequency data from the Jericho and Cressy evaluation sites has been combined for presentation in this paper. Results from frequency assessments confirmed the poor persistence of the three major *Trifolium* species *T. repens*, *T. pratense* and *T. fragiferum* in this environment with frequency percentages of 0, 7 and 3 respectively after 5 years (Table 3).

The most notable feature in the data is the performance of the *M. sativa* subsp. *sativa x M. sativa* subsp. *falcata*, *T. ambiguum* and *T. tumens* lines, with the best lines of the species recording frequency percentages of 92, 55 and 65 respectively after five years. This is equal to or better than the *M. sativa* subsp. *sativa* control cv. Prime with a mean frequency percentage of 60.

Lotus corniculatus persisted well at both sites up to 2007, however, three years of drought at Jericho resulted in the species suffering a large decrease in plant numbers. *Lotus corniculatus* continued to persist at Cressy. Based on frequency two other species worthy of further consideration are *T. physodes* and *T. ochroleucum*, recording frequency

Table 2. Rainfall data for the years 2005 to 2009

	Jericho		Cressy	
Year	Rainfall (mm)	Variation from the long-term mean (%)	Rainfall (mm)	Variation from the long-term mean (%)
2005	569	0	792	+26
2006	249	-56	379	-40
2007	366	-36	441	-30
2008	426	-25	500	-20
2009	687	+20	634	+1

Table 3. Species average and maximum establishment counts and frequency data taken from a combined site analysis

Species	Number of lines	2005		2007		2010	
		Seedling density (plants/m^2)		Frequency (%)		Frequency (%)	
		Mean	Highest	Mean	Highest	Mean	Highest
Astragalus chinensis	1	17	17	1	1	0	0
A. falcatus	1	135	135	15	15	3	3
*Coronilla varia**	8	46	104	13	26	10	16
Dorycnium hirsutum	1	180	180	8	8	1	1
Hedysarum coronarium	1	360	360	14	14	0	0
*Lotus corniculatus**	4	284	373	32	66	14	31
L. tenuis	1	388	388	58	58	1	1
*Medicago sativa**	1	138	138	64	64	60	60
M. sativa x falcata	2	298	316	86	87	91	92
Trifolium africanum	1	30	30	1	1	0	0
*T. ambiguum**	6	238	381	34	50	31	55
T. burchellianum	2	39	47	2	3	0	0
*T. fragiferum**	3	165	184	34	40	2	3
T. hybridum	2	318	344	12	20	0	0
T. medium	1	39	39	1	1	0	0
T. montanum	1	89	89	10	10	1	1
T. ochroleucum	3	290	342	34	39	21	28
T. pannonicum	2	260	271	4	5	1	1
T. physodes	10	194	339	21	47	14	33
*T. pratense**	7	303	377	36	41	4	7
*T. repens**	3	134	228	6	13	0	0
T. rubens	1	302	302	20	20	9	9
T. tumens	7	382	507	57	68	42	65
Vicia cracca	1	61	61	13	13	12	12
LSD (P=0.05)		61		12		10	

*including a commercial cultivar

percentages of 33 and 28 respectively across the two sites after five years.

Dry matter production data is presented as a mean species and best line ranking, based on data from four dry matter ratings and four dry matter cuts for Cressy and eight dry matter ratings for Jericho (Table 4).

The *M. sativa* subsp. *sativa* control cv. Prime ranked the highest at the Cressy site, while one of the *M. sativa* subsp. *sativa x M. sativa* subsp. *falcata* lines was the highest ranked at Jericho. A line of *T. pratense* was very consistent across both sites ranking 2nd and 3rd respectively at Cressy and Jericho.

Other species to rank in the top ten at one of the sites included *L. tenuis, T. hybridum* and *T. tumens*. These ranked higher than the two major species *T. repens* and *T. fragiferum* at both Cressy and Jericho.

The results of the dry matter cuts taken between 19th January 2006 and 15th June 2007 are not included in Table 4, however, the *M. sativa* subsp. *sativa* control cv. Prime produced the most dry matter for the period with a total of 10,087 kgDM/ha harvested. The four next productive lines were representatives from *T. pratense*, *M. sativa* subsp. *sativa* x *M. sativa* subsp. *falcata*, *T. hybridum* and *L. tenuis* with 8669, 8209, 6901 and 6784 kg DM/ha respectively.

Conclusion

This study not only provides an assessment of the relative potential adaptation and production of the species tested to dryland pastures in cool temperate low to medium rainfall (500-750 mm) regions of Tasmania, but also in similar environments around the world.

The adaptation shown by the lucerne hybrid *M. sativa* subsp. *sativa x M. sativa* subsp. *falcata*,*T. ambiguum* and *T. tumens* in this study, highlight the considerable potential these species have for long term dryland pastures across the target region. *Lotus tenuis*, *T. hybridum* and *T. pratense*, although lacking the persistence, were identified as species with potential for higher rainfall zones due to their excellent dry matter production. As a result of this and previous work commercial cultivars are now being developed in Tasmania for these six species.

Acknowledgements

The cooperation of the property owners in supplying land and assisting with grazing management of the sites is gratefully acknowledged. We also thank Gary Martin for his technical assistance.

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This paper was printed with the permission of the Australian Grasslands Association and first appeared in the "Proceedings of the Australian Legume Symposium". Australian Grasslands Association Research Series No 1, Melbourne 2012.

Table 4. Rankings (1-highest to 70- lowest ranking) for 2006 and 2007 dry matter production

Species	Number of lines	Jericho		Cressy	
		Species mean	Best line	Species mean	Best line
Astragalus chinensis	1	69	69	69	69
A. falcatus	1	66	66	64	64
*Coronilla varia**	8	57	47	58	46
Dorycnium hirsutum	1	45	45	51	51
Hedysarum coronarium	1	6	6	27	27
*Lotus corniculatus**	4	34	12	29	18
L. tenuis	1	7	7	14	14
*Medicago sativa**	1	8	8	1	1
M. sativa x falcata	2	2	1	6	5
Trifolium africanum	1	67	67	68	68
*T. ambiguum**	6	31	13	47	37
T. burchellianum	2	68	65	66	66
*T. fragiferum**	3	35	24	22	18
T. hybridum	2	22	14	9	8
T. medium	1	68	68	61	61
T. montanum	1	58	58	69	69
T. ochroleucum	3	27	22	35	28
T. pannonicum	2	51	48	34	30
T. physodes	10	39	30	45	32
*T. pratense**	7	10	3	10	2
*T. repens**	3	43	25	24	16
T. rubens	1	56	56	35	35
T. tumens	7	21	10	20	15
Vicia cracca	1	63	63	36	36

* including a commercial cultivar

Keeping you up-to-date with pasture and grassland research in Australia. Abstracts of recently published research papers will be reprinted as well as the citation and author details in you wish to follow up the full paper.

Livestock production in a changing climate: adaptation and mitigation research in Australia

B. Henry, E. Charmley, R. Eckard, JB. Gaughan and R. Hegarty

Climate change presents a range of challenges for animal agriculture in Australia. Livestock production will be affected by changes in temperature and water availability through impacts on pasture and forage crop quantity and quality, feed-grain production and price, and disease and pest distributions. This paper provides an overview of these impacts and the broader effects on landscape functionality, with a focus on recent research on effects of increasing temperature, changing rainfall patterns, and increased climate variability on animal health, growth, and reproduction, including through heat stress, and potential adaptation strategies. The rate of adoption of adaptation strategies by livestock producers will depend on perceptions of the uncertainty in projected climate and regional-scale impacts and associated risk. However, management changes adopted by farmers in parts of Australia during recent extended drought and associated heatwaves, trends consistent with long-term predicted climate patterns, provide some insights into the capacity for practical adaptation strategies.

Animal production systems will also be significantly affected by climate change policy and national targets to address greenhouse gas emissions, since livestock are estimated to contribute ~10% of Australia's total emissions and 8–11% of global emissions, with additional farm emissions associated with activities such as feed production. More than two-thirds of emissions are attributed to ruminant animals. This paper discusses the challenges and opportunities facing livestock industries in Australia in adapting to and mitigating climate change. It examines the research needed to better define practical options to reduce the emissions intensity of livestock products, enhance adaptation opportunities, and support the continued contribution of animal agriculture to Australia's economy, environment, and regional communities.

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www.publish.csiro.au/nid/40.htm

Top quality at the Hay and Silage awards

Neil Griffiths, NSW DPI Tocal

Outstanding feed quality was the feature of awards presented at the 2012 NSW Hay and Silage Awards as part of the Grassland Society of NSW conference held in Wagga Wagga.

Despite a difficult season there were high quality results in most categories with several registering the highest test results recorded in the history of the awards.

Over 180 silages and hays were considered from across the state and winners showed that it is possible to make high quality hay or silage in all regions.

Sponsors Integrated Packaging, New Holland, Pioneer and the NSW Feed Quality Service again supported the awards with over $5000 worth of prizes and discounts.

The best winter pasture conserved forage tested was silage made from ryegrass and shaftal clover chopped into a bunker for Riverlea Australia P/L of Corowa. The silage tested 10.4 ME and 15.3% crude protein (Table 1).

Next was a baled soybean silage made for Sam and Fleur Tonge of Casino using a round baler with chopper knives. This was the first time this type of silage had tested well enough to get an award , testing 10.6 ME and 23.7% crude protein.

The lucerne section was again won by Hamish and Sally Drury from Gulgong with a hay which tested 11.2 ME and 26.1 crude protein.

Andrew Green from Tamworth submitted a sample of triticale silage made under contract by Phil Rudder from Quirindi which tested 11.3 ME and 7.9% crude protein which is excellent for this type of feed.

Despite the difficult season there were six or more maize silages which tested over 11.0 MJME which was another first for these awards. The highest testing sample was submitted by Riverlea Australia P/L of Corowa with a maize silage testing 11.8 ME and 9.0% crude protein, this sample was judged the outstanding result and received the Integrated Packaging award for best hay or silage for 2012.

▲ Barry Hutton (right) from Riverlea Australia receiving award from sponsor David Coddington from Pioneer

In most categories the top samples were 2 or 3 MJME above other examples of the same feed type. The wide range of feed quality results seen in the samples considered shows the importance of knowing feed quality when feeding all animals.

▼ Paul Judge (farm manager) standing in soybean crop with Natalie Moore NSW DPI before harvest.

Table 1. Summary of results from past NSW Hay and Silage Quality Awards.

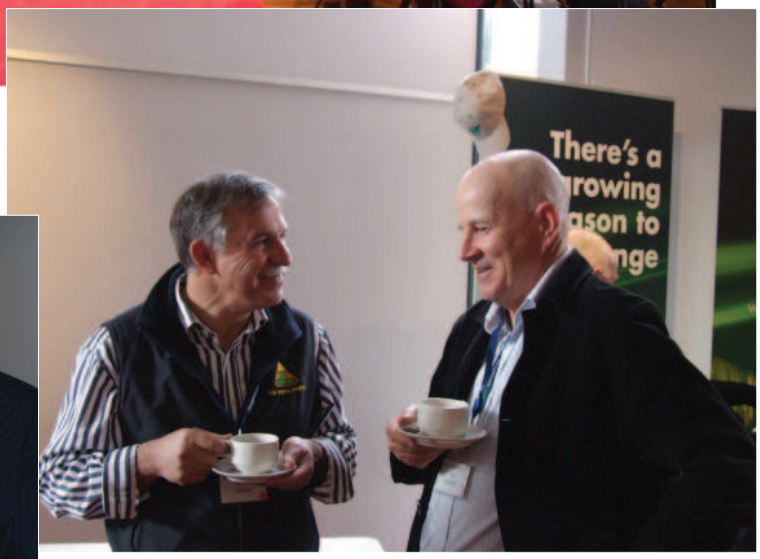
	2012		2011		2010		2009	
	ME	CP%	ME	CP%	ME	CP%	ME	CP%
Winter pasture	10.4	15.3	11.5	24.0	11.1	19.2	10.8	24.6
Summer pasture	-	-	-	-	9.6	17.3	-	-
Winter Crop	11.3	7.9	-	-	11.0	19.0	9.4	14.1
Maize	11.8	9.0	10.7	8.7	10.4	7.2	10.9	7.0
Other summer crop	10.6*	23.7*	-	-	9.9#	18.4#	-	-
Lucerne	11.2	26.1	10.9	25.7	-	-	10.4	26.8
Other crop	-	-	-	-	10.5§	14.9§	-	-

* Soybean silage, # Forage Sorghum, § Pea Hay

- designates years where there were no entries in some categories or samples tested did not achieve minimum standards for an award

Photos from the 2012 Grassland Society of NSW Conference

▼ Jennifer and John Holman, Ellenbah, Orange talking with Grassland Society of NSW President Mick Duncan



▲ Keith Garlick, Orange and Jim Laycock, Cowra catch up at the conference

◄Natham Ferguson (Conference Convenor), Oliver Cay, Cooma, Robert Cox, Tooma and John Coughlan , Cudal

▲ Members from northern NSW, Glenda and Rod Reeves, Liston catch up NSW DPI District Agronomist (Inverell) Bob McGufficke

▲ Speakers Rodney Purcell, Brungle and Belinda Hackney, Bathurst check out some clover at the NSW DPI stand.

▲ Richard Simpson, CSIRO Canberra getting ready for his presentation at the conference

Photos supplied by Luke Pope NSW DPI Cooma

Annual and biennial legume evaluation in northern New South Wales

Suz Boschma[A], Graham Crocker[A, B], Greg Lodge[A], Steve Harden[A] and Lester McCormick[A]

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Abstract: Spring herbage mass of 48 annual/biennial legumes was evaluated in ungrazed plots at the Tamworth Agricultural Institute on a Red/Brown Chromosol soil from 2003 to 2005. Entries that were not significantly different to those with the highest herbage mass were *Trifolium purpureum* (pur-A and 139465) and *Hedysarum flexuosum* (SA 35361 and SA 35362) in 2003; *H. coronarium* cvv. Necton, Aokau and Sparacia, and *H. carnosum* (SA 35358) in 2004, and *H. coronarium* cvv. Necton and Aokau, Medicago truncatula cv. Jester, *H. carnosum* (SA 35358) and both *H. flexuosum* lines in 2005.

Introduction

On the North-West Slopes of New South Wales (NSW), subterranean clover (*Trifolium subterraneum*) is traditionally the dominant annual legume sown on Chromosol soils, while annual *Medicago* spp. occur naturally and are best adapted to the heavier textured, alkaline Vertosols, with lucerne (*Medicago sativa*) the most commonly sown perennial legume grown across a range of soil types (Lodge *et al*. 1991). In this region, national plant evaluation programs, funded either through the National Annual Pasture Legume Improvement Program (NAPLIP) or the Co-operative Research Centre for Plant-based Management of Dryland Salinity, have evaluated a range of perennial legumes (Li *et al*. 2008), alternative Medicago subspecies (Li *et al*. 2010a) and chicory lines and cultivars (Li *et al*. 2010b), as well as a wide range of annual, biennial and perennial legume material (Boschma *et al*. 2011a, b). However, there remains a range of material from the genera *Trifolium, Lotus, Medicago, Trigonella, Ornithopus, Biserrula*, and *Hedysarum* that requires further testing in the predominantly summer rainfall environment of northern NSW.

This paper reports the spring herbage mass (HM, kg dry matter (DM)/ha) of 48 entries from the above genera for a three-year period, and compares and contrasts their performance.

Methods

The Tamworth Agricultural Institute (TAI), is located 5 km south-east of Tamworth, NSW (31°09' S; 150°59' E; elevation 434 m; average annual rainfall at Tamworth, 672 mm). Rainfall data were recorded daily at an automatic weather station located 500 m from the experimental area. The site was located on a Red/Brown Chromosol soil (Isbell 1996) in a paddock (~5 ha in area), with a long history (>50 years) of crop and pasture rotations (mainly winter cereals and lucerne). In the six months prior to sowing, the area received five applications of 1−2 L/ha of glyphosate (450 g a.i./L) and four weeks before sowing 1.7 L/ha of trifluralin (400 g a.i./L) was applied and incorporated by harrowing.

Forty eight annual and biennial legume entries were sown in plots (2 x 4 m) on 9 May 2003 in a spatially adjusted randomised complete block design with three replicates. Fifteen of these entries were previously evaluated in regional studies (Boschma *et al*. 2011b) including four lines that were subsequently released as cultivars. Molybdenumised single-superphosphate (8.8% phosphorus (P), 11% sulphur (S), 0.05% molybdenum) was broadcast at sowing (250 kg/ha) and single-superphosphate was applied in the second and third years (150 kg/ha) of assessment. Sowing rates for each entry were adjusted for seed size and germination percentage, with subterranean clovers being sown at a rate of 12.5 kg/ha, other clovers from 5−15 kg/ha, medics 7−10 kg/ha, serradella and *Trigonella* spp., 7−8 kg/ha, Biserrula spp., 5 kg/ha, and *Hedysarum* spp., 12.5 kg/ha. Soil cores (25-mm diameter) were collected to a depth of 0.10 m across the site on 10 September 2003 and analysed by Incitec Pivot for pH (in water and CaCl2), organic carbon, nitrate nitrogen, S, P, potassium, cation exchange capacity (CEC), calcium/magnesium ratio and electrical conductivity.

Herbage mass was assessed on 3 occasions during spring 2003 and twice in spring 2004 and 2005. Plots were not defoliated between successive assessments and the legumes were allowed to senesce at the end of spring each year. After senescence, tall, rank plots were first defoliated with a brush-cutter, before all plots were cut to a height of ~80 mm above ground level using a rotary mower with the cut material (which included some seed heads) remaining on the plots. The plots were also mown (~80 mm above ground level) in summer as required. For each plot, legume HM was determined visually using a 0−50 scale (low to high scale). At each assessment 12−15 calibration quadrats (0.5 x 0.5 m) were also visually assessed, cut to a height of ~10 mm above ground level and the harvested material dried at 800C for 48 h. Calibration quadrat scores and dry weights were regressed (linear or quadratic, R2>0.80) and plot scores converted to kg DM/ha.

Herbage mass data for October 2003 and September 2004 and 2005 were analysed and are reported in this paper (Table 1).

Examination of residuals indicated that these data did not require transformation. Data were analysed using the spatial approach of Gilmour *et al*. (1997) which accounts for field trend, and row and column effects in a linear mixed model framework using ASREML (Gilmour *et al*. 2006), with linear row and column terms fitted as fixed terms and entry and replicate effects fitted as random terms. A confidence level was calculated to indicate the probability (denoted by C) of one legume having superior herbage mass to another and one legume was considered superior to another if C ≥ 0.95, inferior if C ≤ 0.05 and similar for all other values of C.

Results and discussion

Rainfall at TAI was below average from May 2003 (sowing) to July, and again in September 2003 (Fig. 1), but above average in spring and summer (October 2003−February 2004). In the second year, rainfall in autumn-spring (March–November 2004) was below average (77% of the long-term average, LTA), while in 2005, rainfall from January–May was also well below average (34% of LTA), but above average for most months

after June (Fig. 1). The soil at the TAI site did not appear to have any chemical constraint likely to limited legume growth.

In 2003, purple clover (pur-A) had the highest HM (7549 kg DM/ha, Table 1) and was similar to both of the *H. flexuosum* lines and purple clover (139465). Hykon rose clover had the lowest HM (1634 kg DM/ha) and was similar to Nungarin and Izmir subterranean clovers and Bindaroo button medic. All *Hedysarum* entries were ranked <9th in spring 2003, <12th in spring 2004 and <8th in spring 2005, except for *H. carnosum* (SA 34401) which was ranked 32nd and 39th in spring 2003 and 2005, respectively and Sparacia sulla (ranked 18th in spring 2005).

Herbage mass was highest in 2004, ranging from 1192 (Nungarin subterranean clover) to 11234 kg DM/ha (Necton sulla). Necton sulla HM was similar to Aokau and Sparacia sulla and *H. carnosum* (SA 35358). There were 11 entries (Table 1) with low HM that were similar to Nungarin subterranean clover. In 2005, Necton sulla had the highest HM (5949 kg DM/ha), and was similar to Jester barrel medic, Aokau sulla, *H. carnosum* (SA 35358), and both *H. flexuosum* lines. Cadiz pink serradella had the lowest HM (779 kg DM/ha) and was similar to four other entries (Table 1).

A regional evaluation study at three sites [Curban, Terry Hie Hie and Moree, Boschma *et al*. (2011b)] reported that the best performing entries over two years were *T. resupinatum* cvv. Nitro and Prolific, *T. vesiculosum* cv. Cefalu, *T. isthmocarpum*, *T. glanduliferum* and *T. michelianum*, but in the current study these entries were not ranked highly. However, similar to the results of Boschma *et al*. (2011b) at the Moree site, the sulla entries tested in the current study were among the best performing entries at the TAI site which also had high levels of calcium (≥15 cmol/kg of soil) and high CEC (>20 cmol/kg of soil). While the performance of sulla entries was good in the current ungrazed study, *H. coronarium* cv. Aokau performed poorly under grazing in adjacent plots (Lodge *et al*. 2012), highlighting the risks associated with using relatively short-term assessments from ungrazed plots as a basis for selecting species that are ultimately required to be productive and persistent as long-term grazed pastures.

Acknowledgments
We thank Peter Sanson for assisting in this study which was partly funded by the Grain Research and Development Corporation, Australian Wool Innovation and NSW Department of Primary Industries.

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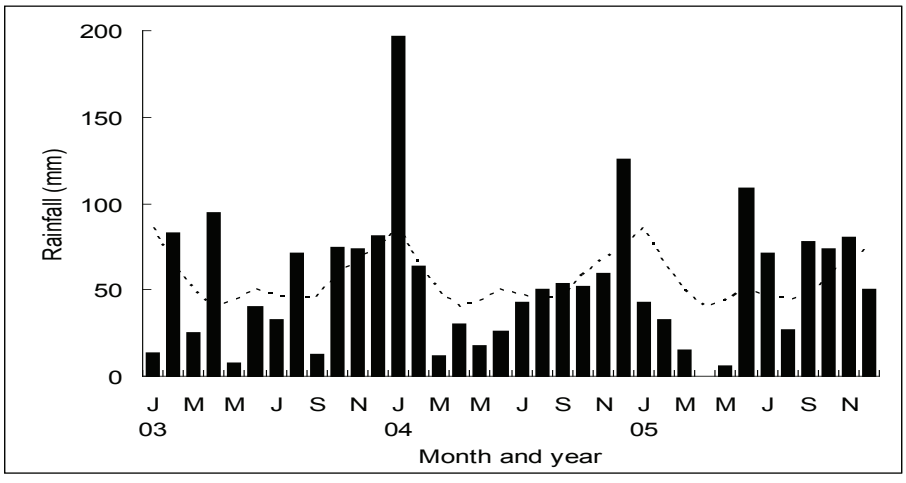

Figure 1. Actual monthly rainfall (mm, bars) for the Tamworth Agricultural Institute (2003–2005) together with the long-term average monthly rainfall (mm, dotted line) for Tamworth.

Table 1. Mean herbage mass (kg DM/ha) in spring 2003–2005 of entries sown in 2003 at the Tamworth Agricultural Institute (TAI).

Entries (species and cultivar)	Common name	Herbage mass (kg DM/ha)		
		2003	2004	2005
Trifolium brachycalycinum cv. Antas	Subterranean clover	5977	3323	3818
T. brachycalycinum cv. Clare	Subterranean clover	5414	2103	4425
T. brachycalycinum cv. Rosedale	Subterranean clover	5062	2133	4163
T. subterraneum cv. Junee	Subterranean clover	3465	1301	3353
T. subterraneum cv. Nungarin	Subterranean clover	1961	1192	2726
T. subterraneum cv. Izmir	Subterranean clover	2255	1388	3504
T. subterraneum cv. Urana	Subterranean clover	3277	2653	3798
T. subterraneum cv. Coolamon	Subterranean clover	3053	1542	3614
T. glanduliferum cv. Prima	Gland clover	5565	4352	3168
T. incarnatum cv. Caprera	Crimson clover	4646	3853	1665
T. hirtum (95 GCN)	Rose clover	3491	4415	3958
T. hirtum cv. Hykon	Rose clover	1634	2865	3602
T. isthmocarpum	Moroccan clover	4760	4034	2711
T. vesiculosum cv. Cefalu	Arrowleaf clover	5067	6975	3122
T. vesiculosum cv. Zulu	Arrowleaf clover	5532	8421	2102
T. resupinatum cv. Nitro	Persian clover	6098	5499	2722
T. resupinatum cv. Prolific	Persian clover	5496	3858	2904
T. michelianum cv. Frontier	Balansa clover	3538	4215	2952
T. michelianum cv. Paradana	Balansa clover	4042	2068	1868
T. purpureum (pur-A)	Purple clover	7549	9439	4220
T. purpureum (139465)	Purple clover	6875	8604	4233
Lotus ornithopodioides (1)		3598	2865	2933
L. ornithopodioides (6)		5280	4789	1647
L. ornithopodioides (17)		5383	3310	1171
Medicago truncatula cv. Caliph	Barrel medic	3582	1815	4121
M. truncatula cv. Jester	Barrel medic	4049	2851	5047
M. tornata x M. littoralis cv. Toreador	Disc/strand medic	3611	1870	3509
M. orbicularis cv. Bindaroo	Button medic	2097	1559	3350
M. ploymorpha cv. Cavalier	Spineless burr medic	4080	2190	3912
M. polymorpha cv. Scimitar	Spineless burr medic	3548	1426	3954
Trigonella balansae (SA 5045)		5691	3797	1966
Ornithopus compressus cv. Charano	Yellow serradella	3716	3823	3052
O. compressus cv. King	Yellow serradella	3684	4859	3328
O. compressus cv. Santorini	Yellow serradella	4186	4621	2012
O. compressus cv. Yelbini	Yellow serradella	3837	3995	3549
O. sativus cv. Cadiz	Pink serradella	5043	5522	779
O. sativus cv. Erica	Pink serradella	5280	4445	2095
O. sativus cv. Margurita	Pink serradella	5437	5307	2977
Biserrula pelecinus cv. Casbah	Biserrula	2759	5382	2895
B. pelecinus cv. Mauro	Biserrula	4409	5549	2669
Hedysarum coronarium cv. Aokau	Sulla	6162	11118	5496
H. coronarium cv. Necton	Sulla	6246	11234	5949
H. coronarium cv. Sparacia	Sulla	6408	10810	3790
H. coronarium cross	Sulla	6764	9785	4471
H. carnosum (SA 34401)	Sulla	3837	7746	2588
H. carnosum (SA 35358)		6316	10838	4954
H. flexuosum (SA 35361)		7295	8019	4944
H. flexuosum (SA 35362)		7356	9184	5623
Mean		4675	4853	3363
Average SED		434	768	671

The Grassland Society of NSW welcomes new members -

Jo Powells, Goulburn,
James Naylor, Mount Albert,
Tom & Sharon Stacy, Tumut,
Matthew Reynolds, Grahamstown,
Des Mason, Wagga Wagga,
Matt Wilson, Junee,
Paul Regan, Binalong,
Sandra Johnston, Yass,
Graeme Sandral, Wagga Wagga,
Robert Cox, Tooma,
Johannes Meier, Elsmore,
Jan Ovenden, Borambola,
Roger Crisp, Blayney,
Michael Reynolds, Adelong,
Mark Golder, Cootamundra,
Mark McClintock, Cootamundra,
John Fowler, Harefield,
John Sykes, Albury,
Funny Hill Pastoral Co, Binda
Dr Tom Nordblom, Wagga Wagga, and
Lisa Castleman, Lockhart

UNIVERSITY OF NEW ENGLAND

PhD Scholarship (Full-time, Fixed-term)
School of Environmental and Rural Science

"Ecology and control methods: Managing the invasive weed *Poa annua* in the Australian sub-Antarctic"

The School of Environmental and Rural Science at UNE is offering a unique and exciting opportunity for a motivated and independent PhD candidate to research the ecology and management of the invasive weed *Poa annua* on sub-Antarctic Macquarie Island.

Given the high conservation value of the region and threats from disturbance and climate change, well targeted control measures for invasive species are vital. Little is known about the reproductive phenology, soil seed bank of P. annua or the effect of control methods in sub-Antarctic/alpine conditions. The project will focus on those knowledge gaps and results will be used to develop effective, low-impact control options for P. annua in the sub-Antarctic, and with implications for conservation in the region more broadly, including Antarctica.

Applicants must hold a Class 1 or 2A honours (or equivalent) degree in a suitable discipline, and be an Australian citizen or permanent resident of Australia. They should have demonstrated research experience in plant/ weed ecology, invasion biology and/or soil science and previous experience conducting remote field work. They should have a proven ability to work independently and have some laboratory experience. The applicant must be capable of doing physically demanding work under challenging climatic and logistical conditions. They must be willing to travel by ship to remote field locations for periods of up to 5 months, with limited or no capacity for communication with people back home in Australia. He or she will be required to pass an Australian Antarctic Division (AAD) medical requirements prior to commencing the project. The applicant must be available for an immediate uptake of the scholarship to be ready for field work on Macquarie Island during the 2012-2013 summer season.

The scholarship provides a tax free stipend of $23,728 per year (2012 rate for full-time students) for three years and is linked to a large grant from AAD. Post-graduate training at UNE includes a dynamic academic team environment, international conference opportunities, professional development and networking. The project is a collaboration with researchers in the Terrestrial Nearshore Ecosystem Group, AAD. The student will have the option to be based at Armidale, NSW or Hobart, Tasmania.

For further information and application details, please contact Dr Paul Kristiansen by email paul.kristiansen@une.edu.au or phone 02 6773 2962.

Closing Date: Friday 12 October 2012.
Equity principles underpin all UNE policies and procedures.

Is there an overseas conference you would like to attend - why not apply for a Grassland Society of NSW Travel Grant in 2012-2013?

Travel Grants are open to financial members of the Society with at least two years of continuous membership prior to the date of application - funding is available to attend conferences or other activities associated with grassland science.

More details can be found on the website (www.grasslandnsw.com.au) under the membership tab.

Measuring Greener Pastures

A bird's eye view of what pastures are growing in southern Australia will provide insights into future research for the livestock industry. Southern Australia's first pasture audit in 17 years has found pasture varieties and their condition have changed dramatically in the past two decades.

Analyst Graham Donald, who also worked on southern Australia's first pasture audit in 1994, observed the effect of prolonged drought and the tightening economic situation for many producers has had an impact on pastures.

"The audit showed 30% of southern Australia's pastures are in decline and there has also been a substantial change in pasture composition which reflects the huge shift in the way farmers do business," Graham said.

He explained one of the biggest changes was an increase in the variety of pasture cultivars and the large-scale adoption of fodder or dual-purpose crops, reflecting a drive for increased enterprise flexibility as producers hedge their bets against climatic challenges.

State trends

The audit, funded by MLA, found the area planted to lucerne in NSW, Victoria, Tasmania, South Australia and south Western Australia had risen considerably while Tasmania also had increased plantings of cocksfoot.

South Australia had more fescue and burr medic and in Western Australia, there were more plantings of serradella. Conversely balansa clover plantings had substantially reduced.

"This could mean it was oversold in the '90s or just didn't have the persistence producers wanted," Graham said.

"The recent perturbed climate events following a period of extended drought may affect the sustainability and persistence of some pastures."

Research direction MLA Manager, Environmental and Natural Resource Management, Cameron Allan said the results of the audit will provide input to the $27 million Feedbase Investment Plan and also ensure a maximum return on producer levies by helping to identify the best R&D opportunities.

"A defendable case is required for investment decisions and historically, pasture-related information generally available is now insufficient – it lacks detail," he said.

"This audit has gathered opinions from local experts about the mix of pastures in their locality.

"Many pieces of data are combined to build a case including ABAREs statistics, volume of seed sold and local evidence but it still leaves us with an incomplete understanding of the feedbase that supports our livestock industries."

Cameron said this unique snapshot of pasture composition and condition had enormous potential.

"We hope to create a living database where this information can be more regularly updated and provide valuable support and sound justification for investment decisions made by the public and private sectors," he said.

"It could also be used to update producer tools such as the website www.pasturepicker.com.au"

Cameron said the next step is to work with public agencies and the private sector to see how this information can best be used to support industry National pasture run down 50% of NSW pastures remain in a native state.

In 1994, balansa clover covered almost 27.5 million ha across Western Australia, NSW, Queensland, South Australia, Victoria and Tasmania.

Today, there are no significant plantings of it in any state. 900,000ha of phalaris and 500,000ha of subclover in Victoria, which has 7.4 million ha of grazing area.

Native pastures make up almost a quarter of South Australia's total grazing area, excluding the rangelands, while annual medic proved the most popular improved pasture choice. 1.5% of Western Australia's grazing area is now planted to serradella. 11.4% of Tasmania's grazing area is perennial ryegrass/white clover.

For more information go to the MLA website www.mla.com.au

From the President

From the Presisdent this issue is a copy of the Presisdents report at the Grassland Society of NSW AGM at Wagga Wagga in July

I thank members for the opportunity and privilege to serve as president of the Society.

I have again enjoyed the experience of working with the committee and meeting with Grassland Society members across the State.

As I have previously stated, the Grassland Society is an increasingly important facility in the transfer and sharing of pasture and animal science. Government agencies continue to provide valuable extension services, but budgetary pressures are restricting this traditional and highly regarded activity.

Our Society is now taking on a greater role in the transfer of pasture technology across the State, in partnership with government agencies and the private sector.

Significant activities during 2011/2012 include;

- The 2011 conference at Bathurst was a very successful event, catering for beef and sheep producers and featuring topical aspects of animal nutrition. It was the first conference to be held at Bathurst and presented a high class and stimulating program. Congratulations to David Harbison and his team for a great conference.
- Membership continues to hover around 400. A good number, but we need to constantly seek new members from producer, government agency, teacher and agri-business sources.
- Our newsletter, under the expert guidance of editor, Carol Harris, continues to provide members with high quality information each quarter. Should any member feel inspired to write on topical matters, Carol would welcome letters and articles.
- The Society will again contribute to the widely respected "Pasture Varieties Used in NSW" book, having previously contributed to the very well received Tropical Perennial Grasses for Northern Inland NSW publication. (NSW DPI).
- The Society assisted with senior high school student work experience activities through the PICSE program during the year.
- Our internet site under the expert management of Leah Lane continues to grow with an increasing range of material of interest to all members. We now have a Face Book page as well as using You Tube for the first time to promote this conference in Wagga Wagga.
- Many thanks to our commercial sponsors, NSW DPI and other government agencies for valuable assistance during the year. Without this support the Society would have difficulty functioning at our current level. A full list of our sponsors appears in the conference proceedings and quarterly newsletters.
- Thanks largely to Greg Lodge, all conference proceedings papers are now available on our internet site. The exception is the 12 months after a conference, when the most recent conference papers will be available to members only.
- The Society successfully ran 5 Pasture Updates at different locations across the state, coordinated by vice president, Lester McCormick. These functions, funded by MLA, Woolworths and National Landcare Australia provided localized information to supplement our conference. If funds are again available, it is proposed to continue this activity.
- Last year saw the formation of the Australian Grasslands Association, combining our society with the Southern Australian society. This association hosted a very successful legume symposium in February and plans to hold a grass symposium in May next year. Symposium proceedings, edited by Carol Harris will provide comprehensive, topical information from research in Australia and overseas.
- On a sad note, the passing of two of our foundation members, Haydn Lloyd Davies and Drew Wright occurred earlier in the year. A full tribute to these two outstanding past members appears in our current newsletter.
- Finally, my thanks to Janelle Witschi for her valued secretarial support and Frank McRae for looking after our finances. In addition, I thank Keith Garlick for many hours spent organizing our sponsorships and the state committee members who willingly attended regular meetings, often at individual expense and contributed so well to the functioning of the Society.

Best wishes,
Mick Duncan

The Grassland Society of NSW Inc is a unique blend of people with a common interest in developing our most important resource - our Grasslands

The Grassland Society of NSW was formed in March 1985. The Society now has approx 500 members and associates, 75% of whom are farmers and graziers. The balance of membership is made up of agricultural scientists, farm advisers, consultants, and or executives or representatives of organisations concerned with fertilisers, seeds, chemicals and machinery.

The aims of the Society are to advance the investigation of problems affecting grassland husbandry and to encourage the adoption into practice of results of research and practical experience. The Society holds an annual conference, publishes a quarterly newsletter, holds field days and is establishing regional branches throughout the state.

Membership is open to any person or company interested in grassland management and the aims of the Society. For membership details go to www.grasslandnsw.com.au
or contact the Secretary at secretary@grasslandnsw.com.au or at PO Box 471 Orange 2800

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Lester McCormick (Vice President)
Janelle Witschi (Secretary)
Frank McRae (Treasurer)
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If you are interested in reactivating an old branch or forming a new branch please contact the Secretary at secretary@grasslandnsw.com.au or by mail at PO Box 471 Orange NSW 2800

Grassland Society of NSW News

Next Newsletter: The next issue of the newsletter will be circulated in December. If you wish to submit an article, short item or letter to the editor for the December newsletter please send your contribution to the Editor - Carol Harris at carol.harris@dpi.nsw.gov.au or DPI NSW 444 Strathbogie Road Glen Innes NSW 2370. The deadline for contributions to the next newsletter is November 30 2012.

Grassland Society of NSW - PO BOX 471 Orange NSW 2800, www.grasslandnsw.com.au

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