Grassland Society of NSW Inc

Newsletter

Welcome to a colourful new issue of the newsletter – from this issue on we will be in full colour throughout. So in addition to being keen to receive articles, letters or ideas I would also like to receive any photos from field days, significant events or just life on your farm for the newsletter. Next year we will have a photo competition – check out the details in the first newsletter next year.

Don't forget you can receive the newsletter electronically rather than a printed version if you wish. Just email Janelle (secretary@grasslandnsw.com.au) your email details and we will add you to the list.

Many of you will be aware that the International Grassland Congress (IGC) will be holding their 22nd international conference in Sydney in September 2013. This conference will be a big event with many pre and post conference activities as well as the main congress. As such the Grassland Society of NSW state committee has decided not to hold our annual conference in 2013. We will instead concentrate on holding a number of regional activities and have recently secured funding through Meat and Livestock Australia to conduct 4-5 Pasture Updates similar to those held in 2011. Planning is underway for these activities – keep an eye on our website (www.grasslandnsw.com.au) for more details.

Planning is also well underway for the second Australian Grasslands Association technical symposium to be held in Canberra in May 2013. The theme of the symposium is Perennial Grasses in Pasture Production Systems with presentations on pasture persistence – at what cost?, quality and feed value in animal production systems, developments & innovations in perennial grass breeding and management, and opportunities and roles for perennial grasses in a changing climate. For more details go to the Australian Grasslands Association website www.australiangrasslands.org.au/

Once again the year has flown on by and it is time to wish you and your families a Merry Christmas and a happy and prosperous New Year. If you want a bit of a laugh over Christmas check out this parody of the very popular (and annoying in my opinion) song Gangnan Style – Farmer Style on YouTube – it made me chuckle http://www.youtube.com/watch?v=LX153eYcVrY

All the best

Carol Harris
Editor

In this newsletter

What is the optimum plant density for tropical perennial grass?

Lester McCormick, NSW Department of Primary Industries, Tamworth

In the past Northern NSW has followed in southern Queensland foot steps and recommended a plant density of 10 plants/m^2.

This is thought to be based on anecdotal evidence, gained from many years experience by scientists working on tropical pastures, but it does not address the issue of the optimum plant density for water use and herbage production and leaf to stem ratio, said Dr Suzanne Boschma, Senior Research Scientist with NSW Department of Primary Industries at Tamworth.

Field day participants at the Tamworth Agricultural Institute, Friday 16 November 2012 were told commercially sown tropical grass pastures in northern NSW have varying plant density due to different establishment success, resulting from a number of factors including seed quality and purity, competition from weeds and environmental conditions.

We have observed that herbage production and proportion of leaf and stem appears to change with plant density. Understanding these differences have potential implications for improving animal production, said Dr Boschma.

To answer the question on what is the optimum tropical grass plant density for northern NSW, we set up an experiment in November 2011. Five densities of Premier digit grass: 0, 1, 4, 9 and 16 plants/m^2 were established.

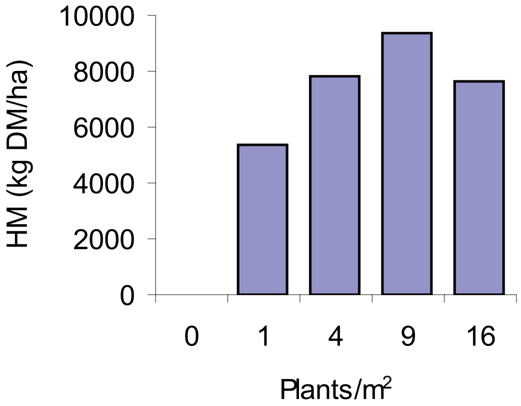


Figure 1. Herbage mass (kg DM/ha) of Premier digit grass at a range of plant densities for the period February-May 2012.

Although only assessed 3 times in the last growing season there were measured differences is herbage production and water use between the different plant densities.

The highest herbage production came from the treatments with 9 plants/m2 (8.4 t DM/ha) followed by 4 and 16 plants/m^2 (6.7 t DM/ha) (Fig. 1).

Total stored soil water levels showed that the soil water deficit increased as plant density increased. Soil water levels were lowest in May at the end of the growing season. Soil water levels were replenished over the winter (2012) period following approximately 130 mm rainfall.

In August, as the new growing season was about to commence, digit sown at 1, 4 and 9 plants/m^2 had similar levels of stored soil moisture (916-927 mm) to the fallow (0 plants/m^2) treatment, while digit at 16 plants/m^2 had about 900 mm of stored soil moisture (Fig. 2).

Since September, water use increased as plant growth recommenced and treatments with the 4 to16 plants/m^2 had much lower levels of soil moisture (837-866 mm) than the 1 plant/m^2 treatment (912 mm) at the end of October 2012.

The experiment has been assessed and grazed twice since September and will continue to be assessed every 6 weeks during the growing season.

This experiment will continue for 3 years and herbage mass, water use and persistence will be recorded, to support plant density recommendations.

Funding and support for this research is provided by NSW Department of Primary Industries and Meat and Livestock Australia.

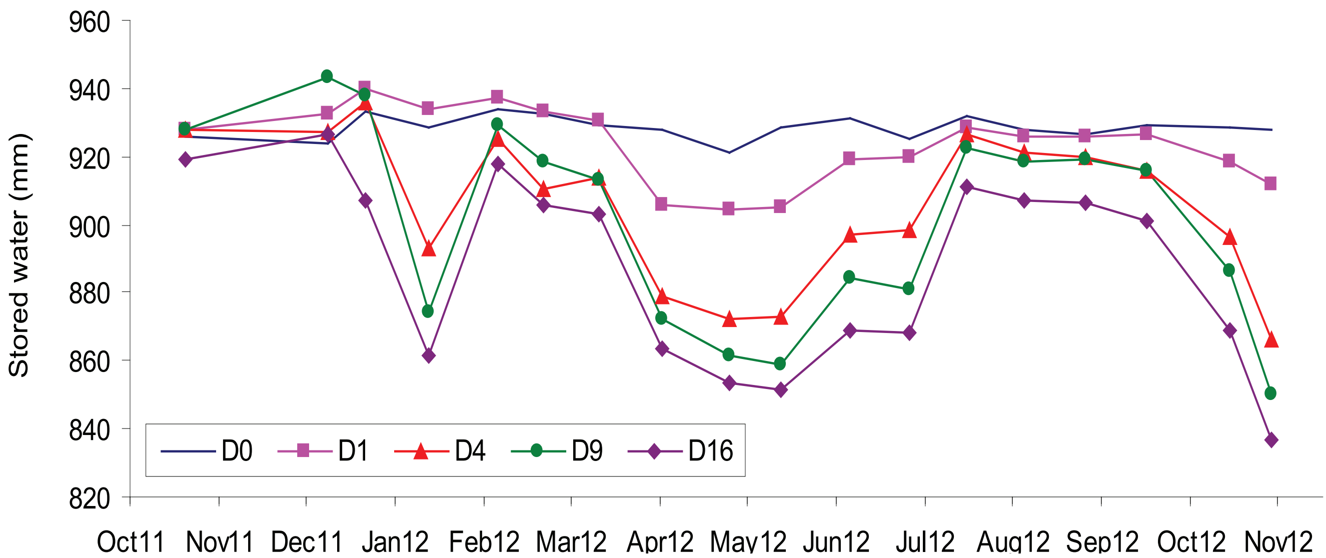


Figure 2. Stored soil moisture (mm) to 1.9 m in plots of Premier digit sown at five plant densities from November 2011- November 2012. Plant densities are 0 (D0), 1 (D1), 4 (D4), 9 (D9), and 16 plants/m2 (D16). Monthly rainfall is also shown

Local Land Services - implications for the Grassland Society of NSW

Editors note: By now most of you will be aware of the announcement by the NSW Government in November about the formation of Local Lands Services and the impact on extension staff with the Department of Primary Industries, staff at the Catchment Management Authorities and the Livestock Health and Pest Authorities.

The Grassland Society of NSW has always had a close association with the Department of Primary Industries and naturally is concerned by these comprehensive changes.

Below is an extract of letter sent to the Premier of NSW, the Minister of Primary Industries and sitting Members for regional NSW seats by the President Mick Duncan on behalf of the Society.

If you share these concerns we encourage you to contact your local member and voice your opinions.

The purpose of this letter is to express the concern of the Grassland Society of NSW for the recent, comprehensive changes proposed for the Department of Primary Industries (DPI) and specifically the extension component of Agriculture NSW.

The DPI has traditionally been a highly regarded source of unbiased advice for primary producers, agribusiness and other private sector providers across the various sectors of primary production in NSW. We are concerned that this vital source of information to the Minister and to landholders, that is based on sound principles of agricultural science, independence and equity will be lost if the proposed changes take place. Agribusiness will not of necessity “take up the slack” as it relies heavily on DPI information.

In particular, we raise the following areas of concern for your consideration:

- The traditional DPI structure has allowed and promoted close collaboration and linkages between research and extension activities. Resulting from the creation of Local Land Services (LLS) which will separate extension officers from those engaged in research in DPI, universities , CSIRO and private research, how will these traditional linkages be maintained?

- The semi-autonomous LLS structure, each with a separate board of management, is likely to result in a significant loss of cohesion across the State. This loss will apply to activities in agricultural production and natural resource management (NRM). How does NSW DPI intend to monitor and elevate the performance of each LLS?

- What arrangements will be made to replace the current role of DPI in emergency management covering vital areas of plant (crops, horticulture) and animal health?

- CMA’s are essentially concerned with NRM matters as distinct from agricultural production. How will the new structure, influenced largely by CMA’s, cater adequately for the important food production disciplines?

- Will the proposed new LLS arrangements provide the same level of service as is currently available to primary producers and at a local level?

- We understand the proposed LLS positions, in direct contrast to DPI professional officer qualifications, do not require a tertiary level qualification in an appropriate discipline. In this case, there would clearly be a perceived downgrading of these positions as well as in the potential quality of service provided.

- How will the current output of high quality, technical publications be maintained? Such publications include the highly respected, “Ag Today” insert into “The “Land “ newspaper. As well, weed control and crop variety guides are keenly sought and extensively used by private agronomists.

I have attempted to keep this letter brief and concise, but clearly there are other areas of concern to the Society. Not the least is the welfare of DPI officers who are anxious about their future employment and conditions.

The Society is willing and keen to contribute further to this vitally important matter and our members would be happy to supply more detailed information to the committee of inquiry, currently holding stakeholder meetings across NSW.

I point out that this Society has a long, productive and close relationship with the DPI, enjoying comprehensive support from individual officers and in return providing funds for a broad range of pasture field days, an annual conference attended by many DPI agronomists and the production of highly regarded publications. The Society is non-political with our chief objective being the dissemination of sound, science-based information relevant to pasture and animal producers across NSW.

On behalf of the Society, I ask you to consider carefully the points I have raised.

I repeat my offer to provide extra information and detail as required.

Yours sincerely,
Michael R. Duncan.

President,
Grassland Society of NSW.

More information on Local Land Services can be found at the following websites

http://www.dpi.nsw.gov.au/locallandservices

http://haveyoursay.nsw.gov.au/locallandservices

New edition of the popular "Pasture Varieties used in NSW" now available

The 2012-13 edition of the NSW no its publication - Pasture Varieties used in NSW is now available.

The biennial book is now updated to help farmers decide which pasture varieties are most suitable for them.

It lists the characteristics of 107 different pasture plant species and the cultivars and varieties commercially available in NSW within each of these species.

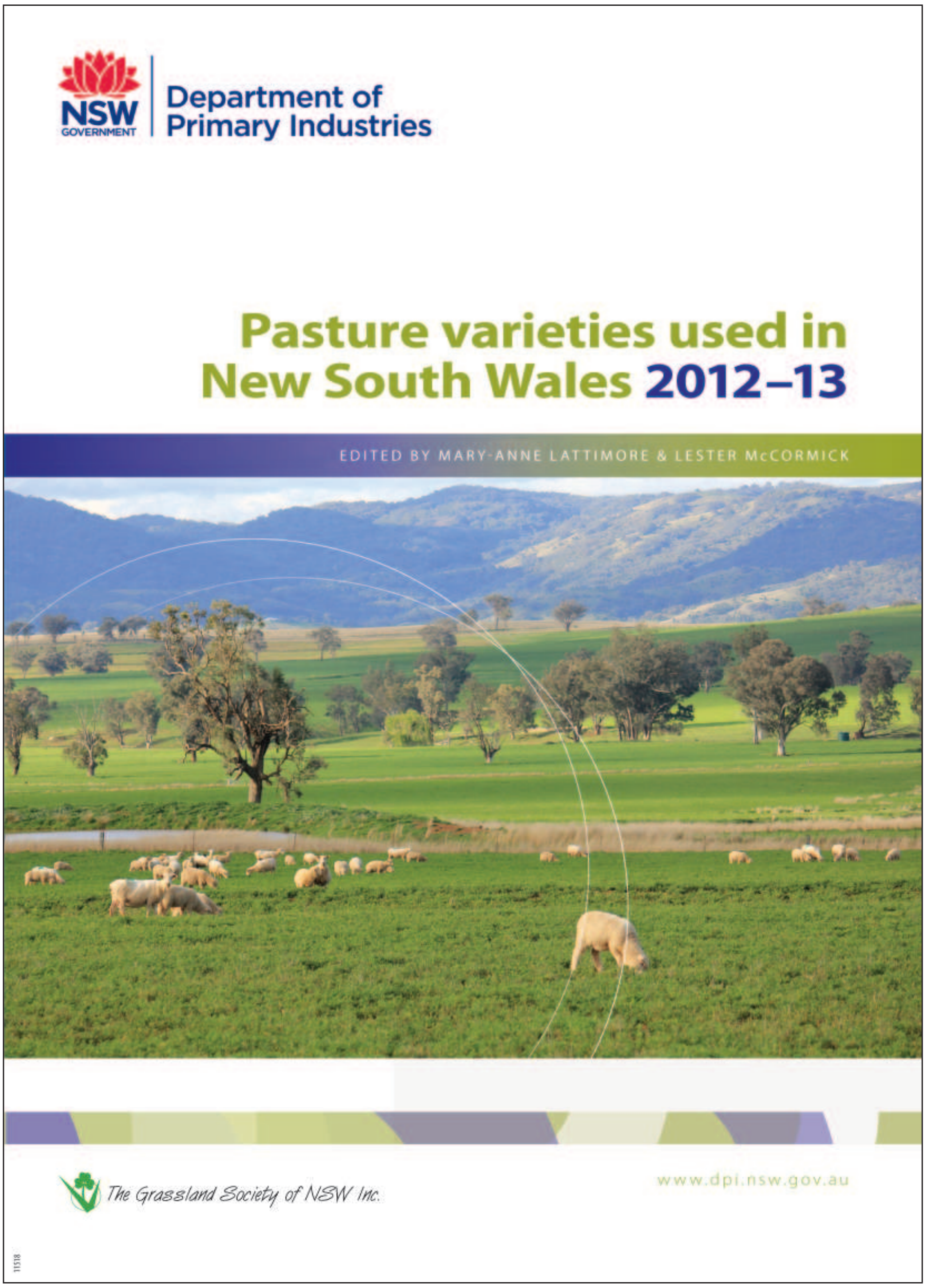
Edited by district agronomist Mary-Anne Lattimore (Yanco) and Technical Specialist Pastures (North) Lester McCormick (Tamworth), the book covers both tropical and temperate pasture legumes, grass and herb species sold in NSW. It includes introduced and native species.

“This book will help sort out the plethora of varieties available,” Ms Lattimore said.

“For example, there are now more than 100 varieties of ryegrass and around 50 varieties of lucerne available but it’s important to know which ones will suit a particular enterprise or environment.”

A description is given about each species, including its preferred rainfall and soil type, any special information about its habits, growth, resistance to pests and diseases, and the varieties currently available.

The book includes other useful information such as legume inoculants and inoculation, livestock disorders associated with pasture improvement, plant breeders’ rights, seed certification and average seed counts for major pasture species.



One helpful appendix details the points to consider when selecting a pasture mix. This section looks matching pasture with enterprise, soil type and fertility, landscape (i.e. aspect), plant characteristics and grazing management.

The book also contains a list of seed and inoculant suppliers and points readers to other valuable information sources.

The Grassland Society of NSW, NSW DPI and commercial companies involved in the seed industry sponsored the book.

Past editions of the book have been used widely by farmers, agronomists, seed merchants and agriculture students. This edition is sure to be no different.

Order a copy of the book - Pasture Varieties used in NSW 2012-2102 from your local DPI office or the DPI bookshop, 1800 028 374, bookshop@dpi.nsw.gov.au

On the first page of the book is a Feedback Form relating to how useful the reader finds the book, the relevance of the various sections and what improvements can be made to future editions. The Editors of the book would appreciate you taking 5 minutes of your time to complete the Feedback Form and return to Mary-Anne Lattimore.

For further information on Pasture Varieties used in NSW 2012-13 contact Mary-Anne Lattimore on (02) 6951 2695, or mary-anne.lattimore@dpi.nsw.gov.au

Application of marker assisted selection in white clover (*Trifolium repens* L.)

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Abstract: Our paper is focused on a preliminary proof of concept study to evaluate marker assisted selection for a key stolon trait, node number (NN), within a random mating white clover breeding population. Microsatellite (SSR) markers identified from previous quantitative trait locus (QTL) studies were selected to screen a random sample of 450 phenotyped individuals from a breeding population to establish marker: trait associations for NN. Using phenotype and marker indices, a series of five contrasting polycross combinations, each comprising 22 individuals, were developed based on: 1) high phenotype value (PH); 2) markers associated with high phenotype (M+); 3) markers associated with low phenotype (M-); 4) high phenotype individuals with markers associated with high phenotype (PHM+); and 5) low phenotype individuals with markers associated with low phenotype (PLM-). Progeny from the within selection polycrosses were evaluated for NN in a pot experiment along with members of the breeding population. There were significant (P<0.05) differences among the selection groups for NN. Mean NN for the selection groups PH, M+ and PHM+ were significantly (P<0.05) higher than the M- and PLM- selection groups. These preliminary results demonstrate the applicability of QTL-linked SSR markers to select for increase in stolon NN in white clover breeding pools, and these selections are currently being validated by assessing the polycross progeny in a perennial ryegrass (*Lolium perenne* L.) sward under sheep grazing.

Introduction

White clover is a significant perennial forage legume in temperate pasture systems (Frame and Newbould 1986) providing key attributes such as high nutritive value, palatability and fixation of atmospheric nitrogen. The perennial behaviour of white clover and its ability to spread horizontally and colonise pasture ecosystems (Harris and Thomas 1973) is determined by the stolon, often referred to as its structural/vegetative unit (Thomas 1987).

The stolon, a surface creeping stem, is made up of a series of nodes separated by internodes. Each node has the ability to form the basis of a new plant unit as it can develop nodal roots, carries a trifoliate leaf and has an axillary bud which, during vegetative growth, may produce a lateral stolon branch (Thomas 1987). Rooted nodes, therefore, provide a mechanism to enhance the viability and persistence of stolon sections.

Unreliable vegetative persistence of white clover in the sward is a common problem in New Zealand and Australia, especially under summer moisture stress conditions (Barbour *et al*. 1996; Archer and Robinson 1989). Improving the ability of white clover populations to persist through stolon survival is a significant breeding objective, particularly as white clover plant regeneration based on stolon survival results in more productive swards in comparison to those based on annual seedling regeneration (Archer and Robinson 1989). Genotypic selection based on key morphological traits associated with stolon growth and development is fundamental to the success of improving vegetative persistence. However, measurement of stolon traits under sward conditions is laborious and is also associated with large experimental error and genotype-by-environment interaction effects (Jahufer *et al*. 1999).

Molecular marker technology provides plant breeders with a new set of diagnostic tools to track genetic variation. Application of marker-assisted selection (MAS) enables indirect estimation of trait expression independent of environmental effects and also increases precision of selection (Collard *et al*. 2005). Identification of molecular markers associated with quantitative trait loci (QTL) with significant influence on the expression of key stolon traits will enhance the selection process in white clover breeding programs. QTL discovery and development within the Pastoral Genomics program at AgResearch has successfully identified QTL for a range of above and below ground morphological traits in white clover (Jones *et al*. 2006).

Our paper is focused on part of a preliminary proof of concept study to evaluate MAS for a key stolon trait, node number (NN), within a random mating breeding population using SSR markers subtending QTL for NN identified in a biparental QTL discovery population.

The approach taken in our study is based on previous work on white clover seed yield (Barrett *et al*. 2008) which showed that markers associated with QTL may be used to screen unrelated populations and identify new marker alleles that have a significant effect on population performance for that trait.

Methods

Our study consisted of the following phases:

a) Phenotyping for NN in a breeding population: A random sample of 450 seedlings, from an early generation breeding population of cultivar Kopu II, was established under glasshouse conditions in July 2008, then transplanted into 15 cm diameter pots containing potting mix and placed outdoors in mid October 2008. In early November 2008, a phenotyping experiment was established using a row-column spatial experimental design with repeated clonal checks. In March 2009, two stolons, with the apical ends intact, of minimum 15 cm length, were sampled from each of the 450 plants and repeated clonal checks. The number of nodes were counted along from the apex of each 15 cm stolon sample. Analysis of the phenotype data was conducted using the variance component analysis procedure, Residual Maximum Likelihood (REML) option, in GenStat 7.1 (2003). A completely random linear model was used in the analysis using the REML algorithm. The final adjusted phenotypic means, Best Linear Unbiased Predictors (BLUPs), were based on adjustment for random error across columns, rows and repeated clonal checks.

b) Determining marker:trait association: To identify SSR marker allele:trait associations, DNA was extracted from leaf material of the 450 plants (Red Extract-N-Amp Plant Kit, Sigma) and screened with a set of six SSR markers selected using a priori knowledge, such as subtending NN QTLs or markers that had exhibited trait association in previous pot experiments. SSR amplification was performed as described (Barrett *et al.* 2008). Marker:trait associations were identified using both a Kruskal-Wallis non-parametric one way analysis of variance, implemented in MapQTL® 4.0 software (Van Ooijen *et al*. 2002) and a linear regression analysis (Genstat 7.1, 2003) on a data set comprising the genotype and BLUP phenotype data. Five SSR alleles with significant ($P<0.0001$) trait associations were used to develop divergent selection indices for increased and reduced NN.

c) Phenotype and genotype-directed crosses: Using phenotype and marker indices, a series of five contrasting polycross combinations, each comprising 22 individuals, was developed based on: 1) high phenotype value (PH); 2) markers associated with high phenotype (M+); 3) markers associated with low phenotype (M-); 4) high phenotype individuals with markers associated with high phenotype (PHM+); and 5) low phenotype individuals with markers associated with low phenotype (PLM-). High and low phenotype refer to the high 5% and low 5% of individuals in the random sample for NN expression, respectively. The selected 22 genotypes within each phenotype/marker combination were polycrossed using pollen-free bumble bees during summer 2009/2010, and seed from the half-sib (HS) families was harvested within each of the crossing categories.

d) Evaluation of half-sib (HS) phenotypes: In November 2010, 10 random progeny from each of the HS families within each selection category were established in a pot experiment. A random sample of 50 individuals from the Kopu II breeding population was also included. All seedling and experiment establishment procedures including NN counts were similar to those described above. NN was counted in March 2011. The experimental design was a row-column design with repeated checks and data analysis performed as described above.

Results and discussion

Phenotypic and genotypic characterization of the Kopu II breeding pool:

There was significant ($P<0.05$) genotypic variation ($\sigma^2 g = 189\pm31$) for the trait NN, among the 450 white clover plants in the random sample. This was also evident from the range (46 to 123 nodes m-1: l.s.d.0.05 = 23) of expression for NN among the 450 plants. The BLUP adjusted phenotypic means were used to select the high and low 5% groups of 22 individuals each.

Marker selection and crossings:

The number of alleles present in the population of 448 early generation Kopu II genotypes for each of the six SSRs ranged from 7 to 63 with an average of 26.3±8.84 alleles/SSR and a total of 158 alleles. As to be expected, single-locus SSRs had fewer alleles in the population than those which amplify from with multiple loci. The allele information was used to generate a matrix combined with BLUP phenotype data for marker:trait association analysis. Using both Kruskal-Wallis and regression analysis, highly significant ($P<0.0005 – 0.0001$) allele:trait associations were identified. Both methods generated very similar results with only slight changes in the order of significance for lower ranked allele:trait associations. Five SSR alleles with significant ($P<0.0001$) trait associations were used to develop divergent selection indices for increased and reduced NN. Plants carrying beneficial marker alleles exhibited a 19% increase in trait mean for NN compared with those without the beneficial marker alleles. These indices, along with the phenotype indices, were used to develop five contrasting polycrosses as described above. The HS progeny of these were assessed for NN in a pot experiment.

Half sib family progeny response to phenotypic and marker aided selection:

There were significant ($P<0.05$) differences observed among the selection groups for NN (Table 1). Mean NN for HS family progeny from polycrosses based on phenotype or markers associated with increased NN (PH, M+ and PHM+) were significantly ($P<0.05$) higher than those from polycrosses based on reduced NN (M- and PLM- selection groups). Furthermore, progeny from PH and PHM+ had a mean NN significantly ($P<0.05$) higher than the M+ based selection offspring, highlighting that selections made in combination with phenotype indices had greater genetic gain. The M+ and M- selections, however, performed as predicted and provide an opportunity for making additional crossing cycles before needing to re-phenotype to select individuals for crossing. The selection groups PH, M+ and PHM+ also had a mean NN significantly ($P<0.05$) higher than the genotypes representing the original breeding population, early generation Kopu II. This indicates potential genetic improvement for increased expression of NN relative to the original base population. The mean NN of the PLM- selection combination HS progeny was lowest and similar to the original Kopu II population.

A key step towards application of MAS in breeding programs is identification of effective marker:trait associations in complex multi parent breeding pools. Results from progeny assessment in this preliminary proof of concept MAS experiment indicate the marker effects are heritable in complex elite populations, evidence that QTL-informed MAS in forage populations is a viable option. To further assess the gains shown by MAS, this experiment has been transferred to a sward-based field environment with a companion grass under grazing to represent more typical agronomic conditions.

Acknowledgments

The authors wish to acknowledge Pastoral Genomics for financial support for this research project. Pastoral Genomics is a joint venture co-funded by DairyNZ, Beef+Lamb New Zealand, Fonterra, AgResearch, DEEResearch, and New Zealand's Ministry of Science and Innovation.

Table 1. Genotypic variance ($\sigma^2 g$) among the half-sib (HS) family parental selection classes and their means for the trait NN (number/meter of stolon).

Selection category	NN
$\sigma^2 g$	209±97
Top Phenotypic (PH)	$85.4^{a,b}$
Top Phenotypic and Marker + (PHM+)	$76.5^{a,b}$
Marker + (M+)	72.7^{b}
Marker - (M-)	61.2^{c}
Low phenotypic and marker - (PLM-)	48.9d
Early generation Kopu II	46.4^{d}
l.s.d.(P=0.05)	10.0

Means with identical superscript letters are not significantly ($P<0.05$) different.

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Research Update

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.

Volume 63(8 and 9) 2012 of Crop and Pasture Science is a collection of scientific papers from the Australian Grasslands Association - Australian Legume Symposium held in February 2012.

Contents include:-

- Temperate pasture legumes in Australia—their history, current use, and future prospects. P. G. H. Nichols, C. K. Revell, A. W. Humphries, J. H. Howie, E. J. Hall, G. A. Sandral, K. Ghamkhar and C. A. Harris
- An overview of dryland legume research in New Zealand. D. J. Moot
- An overview of the role of lucerne (Medicago sativa L.) in pastoral agriculture. J. H. Bouton
- Improving white clover for Australasia. M. Z. Z. Jahufer, J. L. Ford, K. H. Widdup, C. Harris, G. Cousins, J. F. Ayres, L. A. Lane, R. W. Hofmann, W. L. Ballizany, C. F. Mercer, J. R. Crush, W. M. Williams, D. R. Woodfield and B. A. Barrett
- Nitrogen from Australian dryland pastures. J. F. Angus and M. B. Peoples
- Factors affecting the potential contributions of N2 fixation by legumes in Australian pasture systems. M. B. Peoples, J. Brockwell, J. R. Hunt, A. D. Swan, L. Watson, R. C. Hayes, G. D. Li, B. Hackney, J. G. Nuttall, S. L. Davies and I. R. P. Fillery
- Nitrogen fixation in Australian dairy systems: review and prospect. Murray Unkovich
- Nutrient surpluses in Australian grazing systems: management practices, policy approaches, and difficult choices to improve water quality. C. J. P. Gourley and D. M. Weaver
- Exploring short-term ley legumes in subtropical grain systems: production, water-use, water-use efficiency and economics of tropical and temperate options. Lindsay W. Bell, John Lawrence, Brian Johnson and Anthony Whitbread
- *Biserrula pelecinus* L. – genetic diversity in a promising pasture legume for the future. K. Ghamkhar, C. Revell and W. Erskine
- Breeding and farming system opportunities for pasture legumes facing increasing climate variability in the south-west of Western Australia. C. K. Revell, M. A. Ewing and B. J. Nutt
- Breeding of an early-flowering and drought-tolerant *Lotus corniculatus* L. variety for the high-rainfall zone of southern Australia. D. Real, G. A. Sandral, M. Rebuffo, S. J. Hughes, W. M. Kelman, J. M. Mieres, K. Dods and J. Crossa
- Some factors that contribute to poor survival of rhizobia on preinoculated legume seed. E. J. Hartley, L. G. Gemell and R. Deaker
- Development of an early season barrel medic (*Medicago truncatula* Gaertn.) with tolerance to sulfonylurea herbicide residues. D. M. Peck and J. H. Howie
- Spatial and temporal variation in soil Mn2+ concentrations and the impact of manganese toxicity on lucerne and subterranean clover seedlings. R. C. Hayes, M. K. Conyers, G. D. Li, G. J. Poile, A. Price, B. J. McVittie, M. J. Gardner, G. A. Sandral and J. I. McCormick
- Boron tolerance in annual medics (*Medicago* spp.). J. H. Howie
- A new biotype of bluegreen aphid (*Acyrthosiphon kondoi* Shinji) found in south-eastern Australia overcomes resistance in a broad range of pasture legumes. A. W. Humphries, D. M. Peck, S. S. Robinson, T. Rowe and K. Oldach
- Bean leafroll virus is widespread in subterranean clover (*Trifolium subterraneum* L.) seed crops and can be persistently transmitted by bluegreen aphid (*Acyrthosiphon kondoi* Shinji). D. M. Peck, N. Habili, R. M. Nair, J. W. Randles, C. T. de Koning and G. C. Auricht
- Future applications of lucerne for efficient livestock production in southern Australia. A. W. Humphries
- Australian Legume Research – synthesis and future directions . J. M. Virgona, C. Harris, S. Kemp, J. Evans and R. Salmon

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

Grassland Society of Southern Australia Inc

GRASSLAND SOCIETY OF NSW

Seasonal production of coloured brome (Bromus coloratus Steud) cv. Exceltas, a new high quality perennial temperate pasture grass

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Abstract: In response to the need to find better adapted and more persistent perennial grasses for pastures in temperate regions, the Tasmanian Institute of Agriculture (TIA) and the Tasmanian Department of Primary Industries, Parks and Environment (DPIPWE) developed a number of new pasture grass cultivars, including Exceltas, a cultivar of *Bromus coloratus* (coloured brome). This paper compares the seasonal herbage production and the persistence of Exceltas with nine commercial cultivars of *Lolium perenne* (perennial ryegrass) under dryland conditions at Cressy, Tasmania. Second year seasonal herbage production measurements showed Exceltas, at 8483 kg DM/ha, to be more productive than all the diploid *L. perenne* cultivars and all the tetraploids, except Bealey, which produced 8041 kg DM/ha. Plant frequency (%) of each line was used as a measure of persistence. Exceltas was the only cultivar whose frequency counts were not significantly reduced by the dry summer experienced in year 2 of the study. The results highlight the potential of *B. coloratus* cv. Exceltas for use as an alternative perennial grass for dryland temperate pastures receiving >650 mm of annual rainfall or pastures receiving summer rainfall or under irrigation.

Introduction

Bromus coloratus Steud, is one of the South American representatives of *Bromus* sect. *Ceratachloa*. This section contains a morphologically diverse group of mostly hexaploid grasses (Massa *et al*. 2004), which includes annual, biennial and perennial grasses native to South America, North America and is represented by one species in Africa (Massa *et al*. 2001). South American representatives of the section Ceratachloa native to the southern Andes of Argentina and Chile have been utilised in the development of a number of commercially important cultivars including *B. catharticus* cv. Matua (Rumball, 1974), *B. stamineus* cv. Grasslands Gala (Stewart, 1992) and *B. valdivianus* cv. Bareno.

Bromus coloratus cv. Exceltas was the first cultivar of the species to be commercially released. Exceltas was bred in Tasmania from germplasm collected in Chile (Hurst and Hall 2006). It is a highly palatable perennial grass selected for late inflorescence emergence, high tiller density and a more prostrate growth habit. Like other members of the section *Ceratachloa, B. coloratus* exhibits a low tolerance to soils which are poorly drained or prone to periods of waterlogging and is best suited to well drained soils of moderate to high fertility. This paper looks at the second year seasonal herbage production and persistence of Exceltas, comparing it with eight commercial cultivars of *Lolium perenne* (perennial ryegrass) and one commercial cultivar of *Lolium multiflorum* x *L. boucheanum* (hybrid ryegrass).

Table 1. Cressy site details

Attribute	
Latitude	41°43'57.76" S
Longitude	147°03'58.80" E
Elevation (m)	147
Long term mean annual rainfall (mm)	628
Mean Maximum temperature (°C)	17.2
Mean Minimum temperature (°C)	5.1
Soil texture	Deep Sand
pH (water)	5.8
Colwell P (mg/kg)	81
Colwell K (mg/kg)	334

Methods

Bromus coloratus cv. Exceltas, two commercial cultivars of tetraploid *L. perenne*; cvv. Banquet II and Bealey and one commercial cultivar of tetraploid *L. multiflorum x L. boucheanum* cv. Ohau, plus six commercial cultivars of diploid *L. perenne* cvv. Arrow, Avalon, Expo, Victoca, Wintas and Wintas II were sown as monocultures into the field at Cressy, Tasmania (Table 1). The site was sown on the 22 April 2010 using a randomised complete block design with 4 replications.

The site was sprayed twice prior to sowing with glyphosate (0.45 kg a.i/ha) + 100 mL/100 L Activator. All lines were direct drilled into 5 x 1.5 m plots using an Oyjord cone seeder. The sowing rates for Exceltas, diploid *L. perenne* and tetraploid *L. perenne* were 15, 20 and 25 kg/ha respectively. The experiment was fertilised with 18 and 51 kg/ha of phosphorous (P) and potassium (K) respectively prior to sowing, with a maintenance dressing of 8, 12, 14, 24 kg/ha respectively of nitrogen (N), P, K and sulphur applied in autumn 2011. The experiment received 50 kg/ha of N as Urea (46% N) in early spring 2011. Fenitrothion (0.5 kg a.i./ha) insecticide was applied annually to control the pasture pests *Oncopera intricata* (corbie) and *Aphodius* spp. (pasture cockchafers).

Broadleaf weeds were controlled with dicamba (0.5 kg a.i./ha) + MCPA

Table 2. Cressy monthly rainfall (mm)

	2010	2011	2012
Jan	7.4	70.7	21.0
Feb	73.0	43.4	24.2
Mar	74.2	118.6	27.4
Apr	57.2	48.5	-
May	42.0	23.4	-
Jun	73.4	98.6	-
Jul	42.4	31.4	-
Aug	68.8	65.0	-
Sep	55.4	35.4	-
Oct	57.4	37.8	-
Nov	80.4	69.4	-
Dec	87.4	16.0	-
TOTAL	717.0	655.2	-

(0.2 kg a.i./ha), applied after the autumn break.

Seedlings were counted in two quadrats (0.25 m^2) per replicate, 4 weeks after sowing. Frequency assessments were made in April 2011 and April 2012 after the autumn break. Two square quadrats of steel mesh with 100 cells (each 0.1 x 0.1 m) were placed in fixed positions 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. The mean of the two quadrats was used as the percent-frequency count. Seasonal herbage production assessments were made in year 2. Dry matter production was assessed by cutting one 0.25 m^2 quadrat per replicate and oven drying the samples at 100°C for 24 hours. Seasonal cuts were only taken from the internal 3 x 1 m area of each plot to eliminate any edge effect. The site was "crash" grazed with sheep after each seasonal herbage production assessment. Plots were then mechanically mown to approximately 2 cm to ensure even plant height after grazing and the herbage removed from the experimental area. Five assessments were made throughout the year to determine seasonal herbage production - the end of summer, at the end of autumn, the end of winter, the end of spring and midsummer.

Results

Sown in April 2010, the site experienced above average rainfall in the year of establishment with 717 mm of rainfall, 14% above the long term average (Table 2). This resulted in the uniform establishment of all *L. perenne* cultivars. Exceltas seedling density was significantly lower than the *L. perenne* cultivars; however, 236 plants/m2 resulted in a uniform sward (Table 3).

Seasonal herbage assessment commenced at the end of summer 2011 on March 16th after the plants had become well established (Table 4). There were no significant differences between the cultivars for this harvest. Autumn dry matter assessment was taken on May 17th. Exceltas produced 1126 kg DM/ha, significantly less than the top five cultivars of *L. perenne*. The tetraploid cultivars of *L. perenne*, Banquet II and Ohau were the highest yielding cultivars with 1905 and 1823 kg DM/ha respectively. The winter assessment was made on August 30th. Exceltas produced significantly more dry matter than all the *L. perenne* cultivars, producing 1810 kg DM/ha. There was no significant difference between the top eight *L. perenne* cultivars at this harvest. Bealey produced 1416 kg DM/ha which was the highest yielding *L. perenne*. Spring production was measured on November 11th and Exceltas produced significantly more dry matter than six of the nine *L. perenne* cultivars with 3136 kg DM/ha. The diploid Victoca was the most productive *L. perenne* cultivar followed by tetraploids Expo and Bealey with 3585, 2594 and 2593 kg DM/ha respectively. Dry conditions resulted in low dry matter production for the early summer period. This is reflected in the assessment cut taken on January 9th 2012. For this period Exceltas was significantly more productive than the *L. perenne* cultivars, producing 1420 kg DM/ha. The most productive *L. perenne* cultivar was the tetraploid Bealey, significantly better than the next cultivar Banquet II with 1069 and 685 kg DM/ha respectively. The total annual production of Exceltas was 8483 kg DM/ha, which was significantly higher than all but the tetraploid *L. perenne* cultivar Bealey with an annual production of 8041 kg DM/ha.

Frequency measurements after the first summer showed no significant differences between species or cultivars, with all maintaining a strong sward with plant frequency >82%. Rainfall for the period was 91% above the long term summer average with the site receiving 201.5 mm. Rainfall for the second summer was 42% below the long term average with the site receiving 61.2 mm over the 3-month period. The dry summer conditions reduced plant densities. This was reflected in the lower frequency percentage measurements for all cultivars (Table 3). Wintas, Arrow and Avalon had the greatest reduction in frequency falling to 40, 41 and 43% respectively. The frequency of Exceltas fell by 9 units, but the decline was not significant. With a frequency after the second summer of 75%, Exceltas was significantly higher than all *L. perenne* cultivars, with the exception of the tetraploid *L. perenne* cv. Bealey and the diploid *L. perenne* cv. Victoca, with frequency percentages of 67 and 66% respectively.

Conclusion

Under the conditions of this study and for the measurements taken, Exceltas was equally or more productive than the nine cultivars of *L. perenne*. This study has highlighted the potential for using Exceltas to improve the availability of herbage through the winter and early summer periods, times when high quality feed is in short supply. The results have showed that Exceltas has the potential to be an excellent alternative perennial grass for dryland temperate pastures receiving >650 mm or pastures receiving summer rainfall or under irrigation. The higher frequency of Exceltas after the first and second summers indicated it was better adapted than *L. perenne* to the prevailing climatic and site conditions during this study.

Table 3.Establishment counts and frequency counts after the first and second summers.

Cultivar	Species	Establishment (plants/m²)	2011 Frequency (%)	2012 Frequency %)
Exceltas	B. coloratus (H)*	236	84	75
Banquet II	L. perenne (T)*	469	83	52
Bealey	L. perenne (T)	454	86	67
Ohau	L. perenne (T)	406	83	51
Arrow	L. perenne (D)*	464	85	41
Avalon	L. perenne (D)	593	85	43
Expo	L. perenne (D)	512	85	56
Victoca	L. perenne (D)	500	90	66
Wintas	L. perenne (D)	510	85	40
Wintas II	L. perenne (D)	479	89	64
LSD (P=0.05)		82.8	NS	15.3

LSD (P=0.05), Time x Line 12.1

* (H) Hexaploid, (T) Tetraploid, (D) Diploid

Table 4. Seasonal herbage production (kg DM/ha) of Bromus coloratus cv. Exceltas and nine Lolium perenne cultivars

Cultivar	Species	Late summer	Autumn	Winter	Spring	Early summer	Annual Total
Exceltas	B. coloratus (H)*	983	1126	1818	3136	1420	8483
Banquet II	L. perenne (T)*	1282	1905	1258	1995	685	7125
Bealey	L. perenne (T)	1289	1674	1416	2593	1069	8041
Ohau	L. perenne (T)	1220	1823	1250	2240	569	7102
Arrow	L. perenne (D)*	1229	1700	1346	1814	436	6525
Avalon	L. perenne (D)	1069	1470	1344	2155	266	6264
Expo	L. perenne (D)	1170	1522	1361	2594	550	7197
Victoca	L. perenne (D)	1202	1302	1323	3585	535	7947
Wintas	L. perenne (D)	1002	1179	1061	1873	302	5417
Wintas II	L. perenne (D)	834	1456	1300	2340	313	6243
LSD (P=0.05)		NS	380	236	777	289	458

* (H) Hexaploid, (T) Tetraploid, (D) Diploid

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This paper was reprinted from the Australian Society of Agronomy website from the 2012 conference - “Capturing Opportunities and Overcoming Obstacles in Australian Agronomy” held in Armidale in October 2012.

For more papers from the conference go to www.regional.org.au/au/asa/2012/index.htm

Greenhouse gases and liming

Net gains we make from carbon sequestration in acidic soils might be largely offset by carbon releases due to liming.

Mark Conyers, a Department of Primary Industries (DPI) principal research scientist based at Wagga Wagga Agricultural Institute, has just published a paper: Three long term trials end with a quasi-equilibrium between soil C, N and pH: an implication for C sequestration.

Limestone promotes plant growth in acidic soils and therefore increases the potential for organic matter (and carbon) to be added to soil as sequestered carbon.

The accumulation of C in soils is in turn associated with the lowering of soil pH (increasing acidity), so limestone is needed to maintain agricultural productivity.

“However, limestone contains geologically sequestered carbon,” said Dr Conyers.

“The reaction of limestone with soil acids releases carbon dioxide.

“For every tonne of limestone that reacts with soil, 440 kilograms of CO2 is released, equating to 120kg C.

“Further, liming promotes the activity of a wide range of soil microbes, in turn breaking down soil organic matter and releasing CO2.

“Finally, the C cost of mining, milling, transporting and spreading limestone has to be factored in to the calculations of net carbon benefit,” Dr Conyers said.

Therefore, on one hand liming promotes plant growth and the potential addition of organic C to soil, while on the other it releases large quantities of CO2 to the atmosphere, both directly through its reaction with soil and indirectly via its production and distribution.

For more information contact Mark Conyers, Wagga Wagga, (02) 6938 1830, mark.conyers@dpi.nsw.gov.au

Making more from phosphorus

A Meat and Livestock Australia (MLA) and Australian Wool Innovation (AWI) co-funded research project is aiming to improve the effectiveness of phosphorus fertiliser and reduce producers cost of production in southern Australia.

Phosphorus (P) is a particularly important element for Australian farming. It is often the largest input cost (after labour) in many livestock operations and a driver of food production crops and pastures grown in much of Australia's naturally low-P soils.

Livestock enterprises typically recover 20% of the P applied in farm products (according to the 2010 MLA-funded CSIRO review of P availability and utilisation). In cropping, P efficiency ranges from 45 to 60%.

MLA is aiming to move the P efficiency frontier and reduce costs to producers by co-investing in the four-year Phosphorus Efficient Pasture program.

Project leader Dr Richard Simpson, a senior research scientist with CSIRO Sustainable Agriculture Flagship, said that while low P efficiency is a cost burden for farms today, lifting P efficiency represents a major opportunity.

"Achieving substantial improvement in the P balance of Australian agriculture is not an easy task, despite the clear imperative and obvious potential for production and environmental benefits. If there were easy solutions, change would already have taken place," he said.

While extension efforts will improve efficiency through more targeted P applications, Richard said the research will initially focus on identifying pasture legumes with P-efficient traits. Research into novel fertiliser technologies is also on the cards.

The research will be a joint project of CSIRO, NSW Department of Primary Industries (DPI), University of Adelaide, University of Western Australia (UWA) and the Department of Food and Agriculture Western Australia (DAFWA).

The three research components in the project are:

Theme 1

Sharpen industry best practice management. Research has shown that small changes to on-farm management can deliver immediate efficiency benefits of 10%. The objective is to build innovation capacity and producer and advisory confidence to adopt the most profitable and effective practices when investing in fertiliser.

Theme 2

Alleviate sub-soil constraints to production. Develop and adopt farming systems that can operate productively and profitably at lower available P concentrations in the soil.

Theme 3

Develop innovative fertiliser and application technologies. Novel fertiliser technologies and application strategies may also have a role to play in nutrient use efficiency, especially if better timing and placement of P fertiliser on pastures can modify the "locking up" of P in the soil.

Fast facts

480kt (kilotonnes) of P used in Australia annually (prior to the recent droughts)

450kt used in agriculture

25% average efficiency for P applied as fertiliser across all agriculture in Australia

75% accumulates in soil with a small amount lost to waterways

20–40% P efficiency in grazing

45–60% P efficiency in cropping

Crop production on 30% of the world's soils is limited by low P levels

New lucerne publication

Producing quality lucerne hay: project summary

Mary-Anne Lattimore & Lucy Kealey (Sep 2012)

RIRDC publication: 12–102.
www.rirdc.gov.au

This is an 8-page summary of information on haymaking contained in the RIRDC publication "Producing Quality Lucerne Hay" publication no. 08/101 by Mary-Anne Lattimore, NSW DPI, Yanco.

It was produced for lucerne seed/hay growers attending a Lucerne Australia field day in Keith, SA in October 2012.

Weather conditions, haymaking techniques and skills, and timeliness are among the most important of many factors that influence final hay yield and quality.

Once the lucerne is cut, the highest possible feed value of the hay is set.

The aim of haymaking is to preserve the nutrients in the plant material and make the hay so that it is safe for storage.

This project summary covers when to mow lucerne, curing, conditioning, raking, windrowing, baling and storing lucerne hay. It also provides suggestions to help prevent hayshed fires.

For more information contact:
Mary-Anne Lattimore ph. 02 69512 695
mary-anne.lattimore@dpi.nsw.gov.au

22nd International Grassland Congress

Revitalising grasslands to sustain our communities

Sydney 15-19 September 2013

Join grassland scientists, extension officers, Agri-business professionals, students and leading grassland farmers from all around the world to discuss the current issues facing grasslands around the world and explore the latest industry developments and solutions.

The Congress will be delivered in three streams:

1. Improving the efficiency of production of products derived from grasslands
2. Improving grassland resources
3. People in grasslands – improved policies, practices and processes

Within these streams the following topics will be covered:

- ***Grassland resources and ecology, including***:

  soil fertility
  plant nutrition
  plant physiology
  water resources

- ***Sustainable production from grasslands, including:***

  grassland management and decision support systems
  livestock production systems
  integrated crop/livestock systems
  soil-plant-animal relationships
  pasture, forage and grassland species
  forage quality and conservation
  management of pasture plant pests and diseases
  management of weeds
  applications of IT and remote sensing
  reclamation of degraded grasslands
  pasture seed production
  harmful products in pastures
  turf & amenity grasslands

- ***The impact of climate change on grasslands, and of livestock production on climate***

- **Provision of environmental services, including:**

  clean water
  carbon storage
  reduction of greenhouse gases
  conservation of on-farm biodiversity
  grassland conservation

For more information on the International Grassland Congress & registration details go to

www.igc2013.com

After two good summers and a build up of grass material the threat of bush fire this summer (which is predicted to be hot) is likely to be higher than ever - take time to visit the NSW Rural Fire Service website www.rfs.nsw.gov.au to check out the latest information on how to prepare, act and survive a bush fire. Below is a sample of one of their publications.

BUSH FIRE SAFETY | FIREWISE™ moving towards a FireWise community | 10

Bush Fire Myths

KNOWING THE FACTS MAY SAVE YOUR LIFE

MYTH It won't happen to me
FACT No one can guarantee that it won't happen to you. If you prepare and nothing ever happens then you have lost nothing. If you do not prepare your family and home in order to best protect them from a bush fire you may not live to regret it!

MYTH Filling the bath tub when a fire is approaching is to sit in?
FACT The NSW RFS recommends that you fill your bath and sinks with water in case the water supply to your home is cut off. This water can then be used to put out small spot fires that may start in and around the home.

MYTH Standing on my roof hosing it down with water will help?
FACT During a bush fire more injuries occur from people falling off rooves than from burns! Filling your gutters with water and hosing down your roof will help stop spot fires due to ember attack, but any hosing should be done from the ground.

MYTH A house can explode if it catches on fire?
FACT Houses do not just explode, it's what you have stored under your home that may explode. You should consider what flammable and explosive items you have around/under your home and where you should store them in order to reduce the risk to your home.

MYTH If I know the back streets in my suburb or town really well, it will be ok for me to leave at the very last minute
FACT Smoke from a fire can limit visibility. You may become confused or disorientated. Power lines and fallen trees on roads may be hard to see making driving dangerous. It is always better to leave early before the fire arrives.

MYTH I'll be fine; the bush is a few streets away
FACT Most houses are burnt in bush fires because of ember attacks. Embers can cause fires many kilometres in front of the main fire and can start falling up to an hour before the fire arrives at your home. You need to make sure that your home is properly prepared to withstand ember attack.

MYTH There will always be a fire truck available to fight a bush fire threatening my home
FACT There will never be as many fire trucks as there are houses. Do not depend on a fire truck being available at your home.

PREPARE. ACT. SURVIVE. | **BUSH FIRE INFORMATION LINE** | **1800 679 737**

Merry Christmas
and
a
Happy New Year

to all Grassland Society of NSW members and their families

Disclaimer

While every effort is made to publish accurate information the Grassland Society of NSW does not accept responsibility for statements made or opinion expressed in this newsletter.

Inclusion of an advertisement in this publication does not necessarily imply an endorsement of the company or product of the Grassland Society of NSW.

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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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 February 8 2013.

New Members: The Grassland Society of NSW welcomes our new members - Oliver Cay, Bungarby and Malcolm Green, Laggan

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

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