Registered by Australia Post:
No PP 242028/00004

NEWSLETTER

VOLUME 24: NUMBER 3, 2009

The sheep and wool situation in Australia has changed dramatically in the last few years. The sheep population in 2009 is expected to be about 80 million – the lowest figure since the early 1920s. Shorn wool production is expected to be about 355 million kilograms. No rebound is expected in 2010.

It is sad to note that despite some welcome rain in some area the drought declares area in the state still 66%.

On a positive note it is a pleasure to note that lamb prices are at an all-time high, there are good prices for cattle and wool prices are at least firm.

Another problem facing members of our society still running Merinos is that from 2010 the practice of mulesing is to be discontinued or at least discouraged. Unfortunately no acceptable alternative has yet emerged. The heritability of skin folds in Merinos is reasonably high so that selection for reduced skin folds may be part of a long term solution to breech strike.

Dr Suzanne Boschma has been investigating the incorporation of Lucerne into pasture mixtures in Northern New South Wales. Early results have suggested, among other findings, that Lucerne is more competitive in a mixture when sown during Spring rather than Autumn. Establishment of Lucerne could benefit from sowing in alternate rows with a pasture mix. For further information contact on e-mail: suzanne.boschma@dpi.nsw.gov.au.

CONTENTS

Trade names are sometimes mentioned in this Newsletter in refereed papers. No endorsement or criticism of these products by the publisher is intended, nor is any endorsement or criticism implied of similar products not mentioned.

An issue that members should be aware of is the "Carbon Pollution Reduction Scheme" (CPRS). A decision on whether or not to include agriculture in CPRS will not be made until 2013. If Agriculture is included it could be very costly to producers particularly if methane (a product of ruminant digestion) is included. Techniques for accurately measuring methane emission are not yet available.

With regret I have decided not to continue as editor of the NSW Grassland Society. I wish the new editor, Carol Harris, every success and enjoyment of the work. I wish the NSW Grassland Society every continued success. There is no Society I have enjoyed membership more. The Society's committee is the best and most positive with which I have ever worked. Thank you all.

Haydn Lloyd Davies
Editor

The Grassland Society gratefully acknowledges the following premier sponsors for 2009/2010

PlantTech

Bringing seed technology to life

Australian Farm Journal

THE NATION'S FARM BUSINESS MAGAZINE

NSW DPI primefacts
PROFITABLE & SUSTAINABLE PRIMARY INDUSTRIES www.dpi.nsw.gov.au
June 2009 Primefact 921

Cycling of phosphorus in grazing systems

Fiona Leech, District Agronomist, NSW DPI, Yass

Introduction

Phosphorus (P) is commonly one of the most limiting nutrients to pasture production in New South Wales. Before addressing soil phosphorus levels under pastures it is important to gain a better understanding of the phosphorus cycle operating in our soils supporting pasture which is grazed by livestock.

In the soil there are a number of different phosphorus pools constantly interacting. These pools include:

- plant-available inorganic P (water soluble P)

- organic P (P associated with living and dead organic matter)
- less available inorganic P (poorly soluble mineral P tightly bound to clay particles).

Plant-available inorganic P

Inorganic P is phosphorus associated with non-living material, e.g. soil, mineral compounds, fertiliser. Inorganic P is present in forms that range from being sparingly soluble and consequently poorly available to plants through to more soluble forms that are potentially available for plants to use. Most of the plant-available P is adsorbed to clay minerals in the soil.

The amount of inorganic P that is found in soil solution is usually very small (about 1% of the total P present in the soil) and as plants use this P for their growth it must be replenished by P released from the clay minerals. If the soil has a low P status and the rate of supply to the plants is slower than it needs for its growth, the rate of pasture growth will be restricted. This may be the case if inadequate fertiliser has been applied or if fertiliser applications have been suspended.

Organic P

Organic P is phosphorus in the soil that is chemically bound in organic matter. Biological activity by micro-organisms, worms, beetles, etc. in soil results in organic matter being broken down and this releases P into the plant-available inorganic form. Rumen gut bacteria also digest organic materials, releasing P from the organic form into the plant-available inorganic P form.

The decaying of plant material and the addition of dung and urine to the soil increase the amount of P cycling through the organic P pool. However, the only way that the total amount of P in the paddock system can increase is by importing feed, fertiliser or other forms of organic matter to the paddock.

Less available inorganic P

Some of the P associated with non-living material can be very tightly bound to soil particles or in very sparingly soluble compounds. P may be released from this pool to the plant-available inorganic P pool but this usually happens very slowly.

Figure 1 shows the pathway that P takes in a grazed pasture system. The following points describe the detail of the system.

- Pasture growth each year needs P and this is taken up by the plant from the plant-available inorganic P pool. Typically pasture growth may use 3–4 times more P than that supplied as fertiliser P. This is because a large amount of P is always supplied from the P cycling in the soil and the fertiliser input is only intended to top up usage and losses from the system.

- Animals eat a proportion of the pasture. In Figure 1 it is assumed that the utilisation rate of pasture by grazing animals is in the order of 50%. The remaining proportion of the pasture ultimately decays and returns organic P and inorganic P to the soil.

Phosphorus pathway under a grazed pasture system

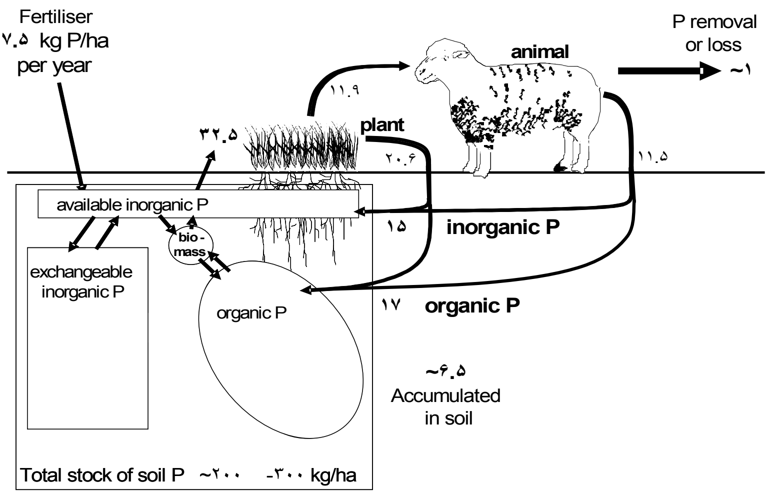

Figure 1. The cycling of phosphorus under a grazed pasture scenario. Units are kg P/ha/year.

The numbers shown are based on an annual P budget for a fertilised native based pasture system at Bookham, NSW over the period 1997-2002 when soil P fertility was maintained near the optimum for pasture growth. The pasture was grazed continuously by 14.6 Merino wethers/ha (average) (Graham 2007). See Table 2 for details of P balance shown in Figure 1.

Source: Simpson, R. et al. (2007). 'Soil biology – some good and bad impacts on pasture production'. Victorian Grasslands Society Conference, Murray Bridge, South Australia.

- The plant material eaten by the animal is digested and some of the organic P in the plant is broken down by microbes in the rumen and converted to the plant-available inorganic P form. There is also P that remains in the organic P form during digestion. A growing animal will use a small amount of P for its own requirements and excrete excess P in the form of faeces and urine back into the soil to add to the soil organic and inorganic P pools.

- The amount of P removed from a pasture system depends on the amount of animal product sold off the farm because P losses in leaching and soil erosion should (if the system is well managed) be very small. Table 1 shows some typical P losses in animal products as well as grain.
- The activity of soil micro-organisms and earthworms, etc. interacting with the organic P pool will release P into the plant-available inorganic P pool.
- As more pasture is grown, more plant material is returned to the soil via faeces and urine through the animal or directly through decaying pasture plants, hence building the organic and inorganic P pools. As these two P pools increase in size, so too does the amount of micro-organisms present in the soil. The higher level of microbial activity will result in higher levels of P moving into the plant-available inorganic P pool.
- When applying fertiliser at maintenance or above maintenance rates there is a slow accumulation of P to the total soil P pool. Due to the higher levels of pasture grown under increased soil fertility, more plant material is returned to the soil, not only building the amount of P that cycles in the system but also building the soil organic carbon levels.
- Using fertiliser consequently gives an immediate benefit to the current year's pasture growth but also builds the potential fertility level of the soil.

Table 1. Phosphorus removed by various livestock enterprises per year at a stocking rate of 10 dse/ha as well as P removal rates in hay and grain.

Enterprise	P Removed
Wethers @ 10 dse/ha Assumptions: Grow out replacement wethers Keep wethers for 4 years	0.6 kg/ha/year
Breeding ewes – wool @ 10 dse/ha Assumptions: Each ewe equivalent to 1.8 dse Stocking rate is 5.5 ewes/ha Weaning percentage is 85%	1.0 kg/ha/year
Breeding ewes – prime lamb @ 10 dse/ha Assumptions: Each ewe equivalent to 2.2 dse Stocking rate is 4.5 ewes/ha Weaning percentage is 115%	1.5 kg/ha/year

Breeding cows @ 10 dse/ha Assumptions: Cow/calf unit equivalent to 14 dse 100 % calving	1.5 kg/ha/year
Steers Assumptions: Each steer putting on 240 kg	1.7 kg/ha/year
1 t (dry matter) cereal hay	2.5 kg
1 t (dry matter) cereal grain	3 kg

Source: The nutrient removal rates calculated for the various livestock categories have been based on figures presented in LANDSCAN® for nutrients removed by various animal and plant products. Calculations were performed by Phil Graham, Technical Specialist – Grazing Systems, NSW DPI.

Take home messages

The main outcome of applying fertiliser P is to feed the soil and nutrient cycles and thus to lift the availability of P for pasture growth. Fertiliser P will build the organic P cycle by increasing the levels of organic matter that is in turn used by soil micro-organisms. Fertiliser P will also build the rate of inorganic P cycling in the soil and this helps to maintain levels of the plant-available inorganic P pool.

Irrespective of the fertiliser form being used in our grazing systems, it is very clear that the release of P for plant growth is highly dependent on organic nutrient cycling. Whether P is applied in the form of a mineral fertiliser (e.g. superphosphate) or an organic fertiliser form, it is fed into the soil P cycle to help raise the availability of P to the plants over time. Soluble mineral fertilisers help to raise plant-available P levels quickly but also increase the organic P cycle. By contrast, organic P fertilisers must enter the organic cycle before mineral P will be released for plant use.

The increase in soil P status and P cycling depends on the amount of P being added to the soil (irrespective of P form) and its ability to promote pasture growth. It is the production of more pasture that most effectively increases the size of the organic P pool. This in turn raises the level of soil micro-organisms and hence the level of P in the plant-available inorganic P pool. The objective of applying a P fertiliser is therefore to build the availability of P for plants and the cycling of P to maintain this availability. Fertilising in excess of the point where the needs of pasture growth are met will be a waste of money. At this point fertiliser inputs may be reduced to maintenance P applications addressing P losses and holding soil P fertility at the ideal level.

Table 2. An example of an annual P budget

Average annual P budget for the fertilised pasture system at Bookham, NSW over the period 1997–2002 when soil P fertility was maintained near the optimum for pasture growth. The pasture was grazed continuously by 14.6 Merino wethers/ha (average) (Graham 2007).

	kg P/ha/year
Fertiliser P input (soil fertility maintenance phase) [1]	7.5
P uptake into herbage during pasture growth (1997-2002) [2a]	26
Likely amount of P uptake into pasture root growth [2b]	6.5
Likely total amount required for average pasture growth per year [2c]	32.5
P consumed as pasture intake by 14.6 wethers/ha [3]	11.9
P retained in sheep liveweight gain (20% replacement policy) [4]	0.44
P returned to soil in faeces and urine [5]	11.5
P returning to soil by death and decay of pasture [6]	20.6
Net amount of P sold off the farm (20% replacement policy) [7]	0.44
P loss in runoff or erosion [8]	<0.04
P excreted and retained in sheep camps [9]	0.5
P accumulating in the grazing system [10]	6.5

Assumptions used in calculating P-balance of this grazing system.

1. Average maintenance fertiliser input = 83 kg superphosphate/ha/year.

2. Average amount of pasture grown per year = 9.3 t (estimated using the GrassGro grazing systems model). The average P concentration of herbage was assumed to be 0.28% of DM (Fulkerson et al. 1998), shoot: root ratio is assumed to be 2 and root P concentration to be half that of the herbage.
3. Average intake of 0.8 kg DM/day is assumed (~45% pasture utilisation)
4. Culls sold at 50 kg LW and replaced with 25 kg weaners. Liveweight gain assumed to be 25 kg/ha/year with a P concentration of 6 g P/kg LW (SCA 1990).
5. Only growing sheep show net retention of P in their bones and tissues; mature sheep excrete the same amount of P in dung and urine that they have consumed.
6. P used in pasture growth less P consumed by sheep.
7. Culls sold at 50 kg LW and replaced with 25 kg weaners. Net removal is 73 kg LW/ha with P concentration of 6 g P/kg LW (SCA 1990).
8. The upper limit for loss in runoff is estimated from data in McCaskill and Cayley (2000) by assuming that P concentration of surface water is linearly related to the annual rate of P application. Soil erosion loss was assumed to be close to zero for a well managed system and because this not a sandy soil there is unlikely to be loss of P due to leaching.
9. 30% of dung is estimated to be deposited in 5% of the paddock area due to the camping behaviour of sheep (Hilder 1964). On face value this could amount to as much as 3.5 kg P/ha deposited in sheep camps. However, P released from dung will also be redistributed from these areas. A recent audit of P in a fertilised pasture system continuously grazed by sheep for 18 years, McCaskill and Cayley (2000) found only 6.5% of applied P had actually accumulated in soil under sheep camps.
10. The soil P fertility of this system was maintained by the amount of P being applied, implying that all losses and accumulations were balanced by the amount of P being added. Consequently the accumulation of P in the soil can be estimated as P input less P retained in camps and P exported or lost from the paddock.

Source: Simpson, R. et al. (2007). 'Soil biology – some good and bad impacts on pasture production'. Victorian Grasslands Society Conference, Murray Bridge, South Australia.

References

Clements, B., Keys, M. and Schumann, B. (2005). LANDSCAN® Manual. Second Edition. NSW DPI. Fulkerson, W.J., Slack, K., Hennessey, D.W., and Hough, G.M. (1998). 'Nutrients in ryegrass (Lolium spp.), white clover (Trifolium repens) and kikuyu (Pennisetum clandestinum) pastures in relation to season and stage of regrowth in a subtropical environment'. *Australian Journal of Experimental Agriculture* 38, 227-240.

Graham, P. (2007). Bookham grazing demonstration results. NSW Department of Primary Industries, Yass 9 pp.

Hilder, E.J. (1964). 'The distribution of plant nutrients by sheep at pasture'. Proceedings of the Australian Society of Animal Production 5, 241-247.

McCaskill, M.R. and Cayley, J.W.D. (2000). Soil audit of a long-term phosphate experiment in south-west Victoria: total phosphorus, sulphur, nitrogen, and major cations. *Australian Journal of Agricultural Research* 51, 737-748.

SCA, (1990). Feeding Standards for Australian Livestock – ruminants. Standing Committee on Agriculture and CSIRO, Melbourne, 266 pp.

Simpson, R. et al. (2007). 'Soil biology – some good and bad impacts on pasture production' Victorian Grasslands Society Conference, Murray Bridge, South Australia.

Acknowledgements

The author thanks Richard Simpson (Research Stream Leader Agro-ecosystem Function, CSIRO Agricultural Sustainability Initiative, CSIRO Division of Plant Industry, Canberra) for his technical input into the document. Thanks also go to Phil Graham (Technical Specialist – Grazing Systems) for his technical support in calculating P removal rates under various livestock enterprises, and Mark Conyers, Principal Research Scientist, NSW DPI for additional technical input into the document.

ISSN 1832-6668
Check for updates of this Primefact at: www.dpi.nsw.gov.au/primefacts

---

The Grassland Society gratefully acknowledges the following major sponsor for 2009/2010

MID COAST DAIRY ADVANCEMENT GROUP

SSP: Single superphosphate, a scenario slowly passing

Graeme Blair, Agronomy and Soil Science, School of Environmental and Rural Science, University of New England (gblair2@une.edu.au)

Abstract

The use of single superphosphate (SSP) has declined in world agriculture and Australia is following suit. SSP has formed the backbone of pasture fertilization in Australia since the introduction of topdressing but, with the imminent closure of another of the major SSP production facilities, what is the way forward?

SSP is a historical accident and for most situations the P:S ratio in SSP of approximately 0.8 is too narrow.

In most situations P requirement exceeds the S requirement so a fertiliser with a higher concentration of P and lower concentration of S would be more suitable.

Increasing transport costs also mitigate against the use of SSP as the low analysis means that the transport cost from factory to farm, and spreading costs, are an increasing proportion of the overall on-the-ground cost.

Many alternatives exist to add S to fertilisers such as triple superphosphate and ammonium phosphates. These include coating, inclusion, or as a granular additive to bulk blends.

World supplies of elemental S are increasing as S is removed from fuels and gas deposits with high H_2S concentrations are being exploited. Addition of elemental S to fertilisers allows a tailoring of particle size to match plant S requirements. Such fertilisers have been available in Australia for a number of years and more alternatives are on the way. An impediment to the use of elemental S containing fertilisers to date has been the lack of control and difficulty of managing S particle size and misinformation promulgated by SSP manufacturers that elemental S does not oxidize.
This is all about to change!

Key words

fertiliser, fertilizer, phosphorus, sulphur, sulphur, ammonium phosphate

Introduction

Who would have thought that a fertiliser patented by J.B Lawes in 1843 would still be widely used 165 years later? Such has been the utility of this fertiliser, commonly thought of as a phosphatic fertiliser, but which contains more S than P.

Lawes interest in phosphate was stimulated by the observation that crushed animal bones were not effective in some soils. He experimented with application of sulphuric acid on bones and produced superphosphate, later referred to as single superphosphate (SSP). The addition of approximately 0.3 t H_2SO_4 to 0.7 t rock phosphate produces 1 t of a 50/50 mixture of mono-calcium phosphate and gypsum, which is SSP. This is an extremely simple process which partly accounts for its widespread use. SSP was first manufactured in Australia in 1876, with the pioneers being James Cumming in Victoria and George Shirley in NSW.

SSP has been widely used as a pasture fertiliser in Australia, both in permanent pastures and in the pasture phase in pasture/crop rotations. Application rates have generally been low with 1cwt/ac or 100 kg/ha being widely used. Such low application rates, which deliver approximately 9 kg P/ha, are generally below the widely recognized maintenance application rate of 1 kg P/DSE, so soil P concentrations, measured by extractants, have generally increased only slowly. SSP contains less P than S (0.8:1) and in non-leaching soils extractable S can accumulate at a faster rate than P. Such accumulations of sulphate S can reduce Mo and Se uptake by plants. The widespread occurrence of S deficiencies in pastures and cropping means that in many situations the S in SSP was more valuable than the P.

Usage of SSP in Australia has gradually declined from 2.1 mill t in 1974/75, where it made up 82% of total P usage, down to 1.2 mill t in 2005/06, where it made up only 22% of total P usage. Over this same time period total P usage in Australia increased from 230000 to 454000 t, mainly in ammonium phosphates.

Why the change?

There are three major drivers of change in SSP usage. The first is the variation in returns from wool and meat in traditional pasture areas. This, together with the observation that responses to SSP are not as noticeable several years after the initial application lead many producers to believe that SSP was "not what it used to be". This resulted from a failure to recognize the residual value of previous applications. The poor uptake of soil testing in pastures kept the truth of soil build up of P from many producers. Producers are often heard say "My pastures don't need P because I have applied 20 cwt over 30 years" not realizing that the application rates used, and the infrequency of applications, were generally below maintenance.

The second reason is the increased transport and spreading costs. Cartage to the New England region of NSW costs $44/t and ground spreading $40/t so that these costs are lower/unit P from more concentrated P sources.

The third reason is the move from pasture rotations in cropping areas to continuous cropping with the SSP in the pasture phase being replaced by ammonium phosphates in the crops.

Information regarding the S oxidation potential of Australian soils has been clouded by misinterpretation of scientific results and commercial interests. Fertiliser manufactures who do not have products containing elemental S in their range often tell clients that elemental S will not oxidize in Australian soils. This is clearly untrue.

The future

Incitec Pivot have announced the closure of the Cockle Creek SSP plant in Newcastle in the next few years and this will have a major impact on the supply of SSP to Central and Northern NSW, and in Queensland.

Given the trend in the world fertiliser industry of capital investments being made in DAP and MAP plants it is unlikely that substantial capital will be put into the current SSP plants in Victoria, Tasmania and Western Australia as they age, so they are likely to follow the fate of Cockle Creek.

TSP could be used to replace SSP but availability is low and it contains little S.

Although DAP and MAP are widely available, both from domestic production and imports, the lack of value placed on the N it contains for pastures, and the lack of S, means that they are unlikely to substitute for SSP, unless S can be added to them.

The alternatives

Given the ready supply of ammonium phosphate fertilisers it is likely that these will form the basis for an SSP replacement, and it seems likely that MAP will be preferred to DAP because it contains less N and can be made from lower grade phosphate rock. If this occurs then it will be necessary to add S to the MAP. This can be added either as sulphate or elemental S. Modelling of CNPS cycling in grazed pastures by McCaskill and Blair (1988) indicates that a P:S ratio of 2:1 in pasture fertiliser would meet the P and S needs in most situations

This can be done by coating with elemental S or gypsum, incorporation of elemental S into MAP during manufacture or physical mixing with elemental S/bentonite or granulated gypsum prills.

If sulphate S in a form such as gypsum was added to MAP to achieve this 2P:1S ratio the P concentration in the MAPS would be reduced to almost half, thus losing the concentrated nutrient benefits of the MAP. This leaves elemental S as the candidate material to add to the MAP. For the elemental S to become available to the plant soon after application it must be applied in fine particles (<75□), and preparation of this material is difficult because of the potential explosion risk. This has lead to a number of elemental S/Bentonite products, commonly containing 10% bentonite, being developed (eg S bentonite 90 in Figure 1). These are commonly ineffective because the amount and quality of the bentonite used is compromised by the need to avoid it absorbing water and expanding in the bag or pile prior to application.

Another attraction of elemental S is the likely severe reduction in price for this commodity in the not too distant future. Increased recoveries of S from refineries needed to make cleaner petrol and diesel, together with increased recoveries from new gas fields being opened up in the Middle East and Central Europe will likely increase supply dramatically.

Several evaluations of alternative products have been undertaken and results from one such study, conducted in the 1960's on the Northern Tablelands of NSW, are presented in.table 1. In the first 11 months after application plant recovery of S was highest from gypsum, but in the ensuing 11-23 month period the highest recovery was from elemental S with particle size <250 □ resulting in the highest overall S recovery from the E^o<150 □ treatment.

Table 1. Recovery by pasture of S applied as elemental S or gypsum on the Northern Tablelands of NSW (Weir et al 1963)

S source	S recovery in plants (% of applied)		
	0-11 months	11-23 months	Total over 23 months
E^o 250-600 □	1.8	4.2	6.0
E^o 150-250 □	5.5	8.3	13.8
E^o <150 □	13.0	7.0	20.0
Gypsum	18.0	0.4	18.4

In a more recent study, also conducted on the Northern Tablelands of NSW (Blair, unpublished), considerable differences were found between sources which most likely relates to the particle size of the elemental S and/or the mechanism of bonding the S to the fertilizer (Figure 1). Coating S onto finished fertilizer such as in Goldphos 10 (Figure 1) has convenience but the difficulty of grinding elemental S to a fine enough particle size adds to the cost and difficulty of preparing an agronomically acceptable product. In addition, abrasion of the coat during transport and handling can create potentially explosive dust problems.

A process has been developed by Shell Canada which incorporates molten elemental S into MAP and DAP during manufacture. This process has been incorporated into the IncitecPivot ammonium phosphate plant at Phosphate Hill, Queensland and products marketed as S8, MAPSZC and DAPSZC, containing approximately 8% S as a mixture of elemental and sulphate S, have been manufactured. A range of experimental products, with up to 20% elemental S, has also been produced in a pilot plant.

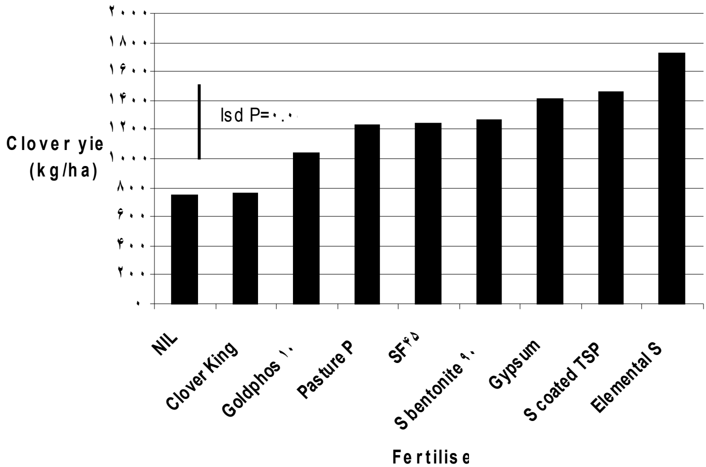

Figure 1. White clover yield (kg/ha) resulting from the application of different S sources applied at 10 kg/ha to a sedimentary soil on the Northern Tablelands of NSW, with N and P balanced between sources.

Elemental S added into TSP, or MAP enhanced with S, are possible new alternatives to SSP. One experimental product that could replace SSP is a MAP containing 12%S which has been developed by Shell Sulphur Solutions and made in a pilot plant at the International Fertilizer Development Center (IFDC), Alabama. This is generically known as MAP-SEF (Sulphur Enhanced Fertiliser). This is currently being evaluated in a field trial on the Northern Tablelands of NSW and the results of the three harvests taken to date are presented in Figure 2. A feature of the results is the superiority of SSP over MAP12 in the first harvest with the reverse being true at the second and third harvests. These results mimic earlier studies that showed that the sulphate S in SSP is immediately available and that it can easily be leached from soil and that the elemental S provides a more sustained release of S to the pasture. Studies with ^{35}S labelled sulphate and elemental S undertaken by Blair et al. (1994) has demonstrated the potential magnitude of S losses from sulphate sources. Losses from gypsum were double that from elemental S over a 1 year period. Manipulation of S particle size can be used to further reduce S losses in extreme leaching situations.

The extremely poor performance of the DAP pastille treatment in Figure 2 highlights the danger of insufficient attention being paid to the S source added. In this instance the pastilles were formed molten S, which has a negligible surface area for oxidizing organisms to colonise.

Trials using this family of S enhanced DAP and MAP fertilisers (Sulphur Enhanced Fertilisers, SEF) have been undertaken with crops and pastures in Brazil, Argentina and China and yield responses to the S contained in them has averaged 14% across 84 S responsive sites.

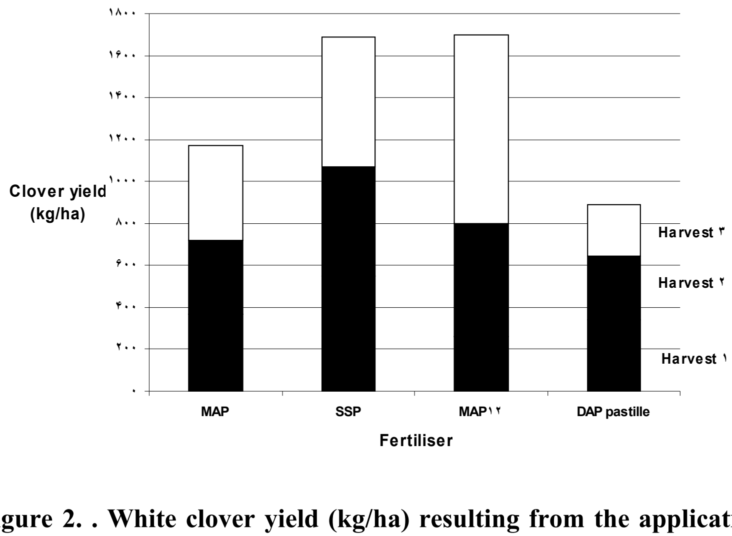

Figure 2. . White clover yield (kg/ha) resulting from the application of different S sources applied at 10 kg/ha to a granitic soil on the Northern Tablelands of NSW, with N and P balanced between sources.

Conclusions

SSP usage in Australia has been in almost continual decline over the past 30 years and with the imminent closure of a significant SSP plant in Newcastle there is a need to find an alternative P and S source.

Addition of elemental S to MAP or DAP appears to offer the best potential and inclusion of the S into the fertilizer granule during manufacture, has been shown to be feasible, and the resulting NPS fertilizer to be agronomically effective.

References

Blair GJ, Dana M and Lefroy RDB (1994). A glasshouse evaluation of sulfur fertiliser sources for crops and pastures. II. A comparison of sulfur coated triple superphosphates and gypsum. Australian Journal of Agricultural Research 45, 1517-23.

McCaskill MR and Blair GJ (1988). Development of a simulation model of sulfur cycling in grazed pastures. Biogeochemistry 5, 165-81.

Weir RG Barkus B and Atkinson WT (1963). The effect of particle size on the availability of brimstone to white clover. Australian Journal of Experimental Agriculture and Animal Husbandry 3, 318-24.

Grassland Society of New South Wales: Travel Grants

Hugh Dove (Travel Grant Sub-Committee
CSIRO Plant Industry, Canberra

With our Taree conference having been held earlier this month, it is timely to remind members that our Society offers Travel Grants to assist members to attend not only its own conferences, but other conferences (including overseas) and other activities that fit within the Society's aims.

Information about the Travel Grants can be found on our web page (see http://grasslandnsw.com.au/blog/?page_id=35), from which point you can also download application forms. If you do not have web access, contact me and I can send forms and information (02 6246 5078). Two important things to note are first, that application will only be accepted if you have been a Society member for at least 2 consecutive years and second, that applications are usually considered at the November meeting of the Management Committee.

There are 2 reasons to think of applying in 2010. The first is if a Travel Grant would help you get to our own 2010 conference and the second, in November 2010, is a joint conference in Christchurch, New Zealand comprising the 15th Australian Agronomy Conference and the conferences of the NZ Agronomy Society and the NZ Grasslands Society. Planning for this is still in progress but essentially, each society will run a conference similar to its previous conferences but the societies will share resources such as registration, venue, social events, tours and some invited speakers. Members of each society would be free to attend sessions of the other societies. This, coupled with joint field tours, should make this an exciting event.

It is also exactly the sort of event for which the Grassland Society of NSW instituted its Travel Grant scheme, so keep it in mind.

Mongolian Tour July 2008

Des and Sally Green

Following on from Mike Keys notes re the International Grasslands Congress, China, we went on the Post Conference tour of Mongolia.

Background:

The local territory of Mongolia encompasses 156.4million hectares of which 72.1% or 112.8 million hectares of land is a pastureland supporting nomadic herding. This renewable and rich "Green Gold" is a basis of Mongolia's socio-economic development.

Two years ago (2007) Mongolian Livestock's numbers reached 40.3 million. This breaks down to 83%goats and sheep, 17% horses, cattle and camel and there are 176 thousand nomadic herding families. The livestock sector is 21% of the GDP, produces 90% of Gross Agricultural Product, employs 1/3rd of work force, and has produced products worth about 1 billion MNT. This includes people who work in various fields of agriculture, like raw material sales, transportation, handling, storing and processing. The sector provides jobs for a majority of the people and plays a vital role for livelihood of the Mongolians.

Since 1958, more than 2 million ha of pastureland were ploughed for crop production in Mongolia. After 1990, when Mongolia shifted to market economy, about 1-2 million ha of that cropland were abandoned.

Trip:

We left our hotel in Hohhot, Inner Mongolia, Sunday 6th July 7am to travel by bus to the Mongolian border where we boarded a train at 7pm for Ulanbaatar, capital of Mongolia. (minus our luggage)

Travelled through the Nei Mongol Autonomous Region across the Gegentala Rangelands to the border at Erenhot City. Rangelands enjoying a reasonable season compared to previous years when there was virtually no rain. Everything covered in green tinge.

Travelled overnight in the train across the Gobi Desert to Ulanbaatar where we showered, descended on the ATM for Mongolian money and left about 3.30pm for Kharkhorin, 370klms (arrived 3am). Dinner at Khoyor Zagal camp 11pm. No passable roads, just tracks beside them to travel, very slow going and no trees either! Could see where Russians had planted crops, just carved out of the foothills 1,000's of hectares at a time. The effects of this cropping program can be clearly seen as a line between natural rangeland herbage and the cropped area, which was just left by the Russians, and now the Mongolians are trying to rehabilitate it. Pasture sparse and smelling like herbs. Landscape flat with hills in the background. At Kharkhorin we camped in two Tourist ger villages on outskirts of town. Quite comfortable with amenities block just like our van parks only smaller. Desolate, architecture definitely from Russian days, stark and abandoned. It was so much like the Russian architecture Des saw over 40 years ago, concrete block with square windows. One set of plans does all, just enlarge them if you want a bigger building! Flour Mills, grain storage and abattoirs all just abandoned.

Tuesday 8th Visited Erdenezuu Monastry, still working with monks in residence. Now a tourist place with local markets outside the walls. Left here 11am and arrived Ikh Tamir sum 5pm for lunch!!! (200kms) Again roads leave a lot to be desired! A formed road available but full of potholes and unpassable, just needs a grader! Tracks either side of the formed road are ruining the rangelands pasture, what little there is of it.

Tour of experiment plots at Ikh Tamir in High Mountain Range. Plots were designed to evaluate species and techniques for re-establishing useful varieties into degraded (by grazing) and farmed (by Russians) areas. Three seeding techniques were used, spread on top, same but stocked after seeding to improve ground contact and area raked by hand and seeded. (This was as close to our direct drill method we would see). The results were in the order we would expect here 1 raked 2 hoof contact 3 no action – total failure in Des' eyes. Ants were present in the plots but when Des raised the question of seed harvesting ants and possible treatment none of the researchers had any knowledge of these practices. The heads of the department were very interested when Des pointed out possibilities and we were down on our knees in the usual manner. Whilst Des doesn't know for sure the possible effect, the fact that the temperatures go to –40, one would expect the ants and maybe any other insects present in the small window of summer would be very busy storing food for winter survival!

Dinner party celebration with Mongolian entertainment. Lamb/goat cooked with hot stones inside gave a boiled taste!!!! Coleslaw and pasta salad as well which was a pity as we were expecting more traditional fare. Limited amount of French red wine as well!

Wed 9th. Witnessed the Naadam local festival with horse races, wrestling and a local game of volleyball with our group joining in.

Back to the camp for lunch and then taken to the Mongolian Yak Society's Cashmere shop where we almost bought them out of stock. Beautiful garments made on the premises with money generated used to promote the products and assist with the education of the people.

Attended a meeting of the local community for the "Green Gold" programme and community based pastureland management. Appears to us, too many horses for the pasture, 13 for every man woman and child in Mongolia! Goats seem to be getting the blame for pasture degrading but we raised the question of the horses. Whilst understanding the cultural importance of the horse the reply was "a Mongolian man without a horse is like a bird without wings" Genghis Khan still has a major influence on the cultural ideas of Mongolia. However, the management of the rangelands is now very much taken in hand with strict grazing controls over the areas used and exclusion zones for regeneration. A local committee headed by an elder and experienced members of the community having a lot of the input into management including rotation times dates etc.

Then we were taken to visit local herding families…what an eye-opener! No electricity or running water, but a solar panel, satellite dish and small black and white TV! Women spend their summer (July) preparing the food for the long winter, which reaches –40deg. Nomadic ger very simple and can all be packed on a cart to transport. Timber floor (sometimes) covered in vinyl with hides for warmth in winter. Decoration of the furniture is by hand painting and very colourful with family photos on display. Only two single beds, children sleep on the floor. Nomadic children educated in the towns where they stay during the week in winter in boarding houses or with relatives.

Thurs 10th 5.30am leave for Hustai National Park back towards Ulanbaatar. We passed a lot of direct drill country and stopped to view some of the established crop/pasture that is being done to try and hold the country together. Results look promising and whilst no machinery was seen Des understands they are using some of the old Russian disc units left behind after the withdrawal. One of the main varieties seems to be a cereal rye/Tall Wheat grass type which is simply left to re-establish the next year.

Arrive 8pm just in time to see the P horses running wild there. Some of these horses have returned from breeding programs all over the world, including Dubbo Zoo in Australia. We were disappointed that Australia was not recognised as one of the countries participating in the program during a talk on the horses and the role they play in the park. We saw the horses in Dubbo just before they left there to be returned to Mongolia prior to us leaving on the tour.

Reception at the ger village, with the Minister for Food and Agriculture making a speech. Leave 5.30am Friday for Ulanbaatar and the Opening Ceremony of the 802nd Naadam Games travel 100klms. Just made it in time for 11am Opening Ceremony.

Quite a wild ride, through the park. Apparently we took the short cut and entered the city from the southern side. Only one flat tyre much to the amazement of the group. Australian buses would not have made the journey!

Opening Ceremony of the Naadam Games very colourful and spectacular. Archery and wrestling with the horse racing held outside the arena in the foothills. Mongolians ride like the wind, no matter what the age. Saddles look very uncomfortable in comparison to western saddles, high back and front, usually wooden.

Accommodation in the Erkht Suld Ger Tourist village near the airport, we opted for the Khan Palace Hotel, at least it had running water and hot showers!!!!! We stayed here a further three nights and were taken on a tour of Ulanbaatar by Eamonn Thornton from the Christina Noble Foundation. We donated a ger to an underprivileged family who didn't have one of their own. We were supposed to help erect it but the manufacturer failed to show up at the given time (drunk at the Naadam) so it was given later. We did meet with the family and had tea with her and her two daughters.

Time and distance means nothing to Mongolians - they cannot seem to calculate either.

The next Rangelands Conference is April 5-10th 2011 at Rosario in Argentina website www.IRC2011.com.ar email ifieldman@express.com.ar

We thank the NSW Grasslands Society for their contribution towards our trip and hope you enjoy our account. Many photos are also available on disk. Also the papers from the Congress in book form.

The Grassland Society gratefully acknowledges the following corporate sponsor for 2009/2010

---

103 years of phalaris: Big gains still to come

Bob Freebairn (Agricultural Consultant, (0428 752 149); robert.freebairn@bigpond.com)

Advanced AT and Holdfast GT, released by the CSIRO in 2008, are the latest varieties developed by Australian phalaris research efforts beginning 103 years ago.

These two new varieties represent a continuation in the development of phalaris varieties with improved features that has allowed its expansion across Australia, and especially NSW. Currently it is estimated phalaris is the predominant perennial grass species on 1.6 million/ha of NSW and 2.7 million/ha nationally.

78 years old Dr Rex Oram, still active in research and with a lifetime's involvement with the CSIRO phalaris breeding and research program, believes there remain large challenges to further improve varieties.

For example he says breeding programs have made good progress in developing varieties with reduced risk of phalaris staggers (reduced tryptamine and tyramine alkaloids) and other research showed cobalt “bullets” also helped minimise staggers. However he says a major remaining need is to identify unknown chemicals that occasionally cause “sudden death” and breed these out of future varieties.

The original variety tested in Australia (known as Australian and still commercially grown today) was first grown commercially in the New England in 1906. Since then 11 varieties have been developed and released in Australia (mainly by CSIRO and one each by New England University and Department of Agriculture Victoria). Gains in new varieties include far better seed retention (therefore cheaper seed), improved seedling vigour, more winter feed, acid soil tolerance and more drought tolerance.

The recently released variety Advanced AT has superior acid soil tolerance (tolerance to aluminium toxicity) even compared to the acid soil tolerant variety Landmaster.

Improved acid soil tolerance is especially advantageous in many tableland and slopes areas where not only surface but also sub soil acidity is an issue and is more difficult to address with liming. Its acid soil tolerance has commonly resulted in far better persistence, probably partly contributed by the plants ability to root more extensively.

Advanced AT (acid tolerant) also has reduced tryptamine and tyrosine alkaloids, good seed retention, good seedling vigour and overall good persistence and productivity.

The second new cultivar, Holdfast GT (grazing tolerant) is a winter active type with improved grazing tolerance on soils with moderate fertility. It has not performed well in north west environments but appears to be especially adaptable in southern NSW and western Victoria. Holdfast GT also has good seed retention, reduced alkaloid levels and some acid soil tolerance.

The history and development of phalaris in Australia and the world is detailed in “The first century of Phalaris aquatica L. cultivation and genetic improvement” written by Rex Oram and colleagues. It is published in Crop and Pasture Science, 2009, 60, 1-15. It is an excellent documentation of the history of phalaris use and research.

The Grassland Society gratefully acknowledges the following major sponsor for 2009/2010

NSW DEPARTMENT OF
PRIMARY INDUSTRIES

What are the implications for fertiliser management practice in grazing enterprises if phosphorus fertiliser prices remain high?

Richard Simpson (CSIRO Sustainable Agriculture Flagship, Canberra), Phil Graham (NSW DPI, Yass) and Lloyd Davies (NSW DPI, Orange)

Currently in the Yass-Canberra district, the price of superphosphate is about $400/tonne, down from a peak of $550/tonne last year, but still well up from the price two years ago of $280/tonne. There is no doubt that price changes such as these have a substantial affect on cash flows and raise significant questions about the continuing use of P-fertilisers.

To illustrate the likely impacts of superphosphate prices (range: $300-$600/tonne) on grazing enterprise profitability and business risk we have calculated cash flows (Fig. 1) for a strategy to apply superphosphate and lift stocking rate in a Merino wether enterprise grazing a previously-unfertilised, native grass and sub clover-based pasture at Bookham, NSW (near Yass). The Colwell extractable-P test before fertiliser application is about 10 mg P/kg soil and the pasture sustains about 6 wethers/ha. The planned soil fertility management objective is to raise Colwell P to about 20 mg P/kg over 5 years whilst concurrently lifting stock numbers by 1.4 DSE/ha/yr (1.4 wethers/ha/yr).

It is expected that superphosphate will need to be applied at about 145 kg/ha/yr to achieve this objective and that after 5 years the enterprise will move to a soil fertility maintenance phase with fertiliser inputs of 110 kg superphosphate/ha. It is assumed that a livestock gross margin (excluding fertiliser costs) of $22/DSE is achieved in this enterprise.

The data used for the cash flow calculations are backed by experience from a fertilised grazing demonstration conducted at Bookham since 2004 (Graham 2006).

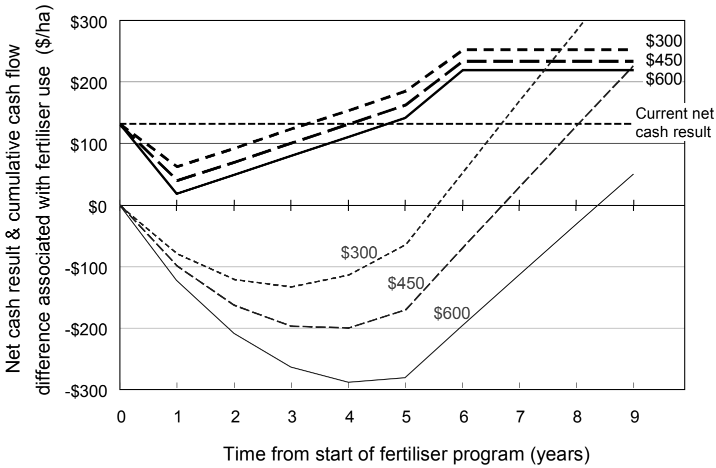

Figure 1: Impact of alternative superphosphate prices ($300/tonne to $600/tonne) on additional profit per hectare (net cash results; upper lines) and pay back periods (cumulative net cash differences which include interest on debt; lower lines) for a strategy to increase soil fertility and stocking rates in a Merino wether enterprise grazing unfertilized pasture at Bookham. Livestock gross margin is $22/DSE.

Terminology used: 'Net cash result' is the livestock gross margin per ha less the cost of extra livestock and the fertiliser and spreading costs where they apply and indicates the likely profit achieved each year of the fertiliser management strategy. 'Cumulative cash flow difference' is the accumulating cash flow position with interest on debt (@ 8%) also being paid.

The annual net cash result and the cumulative cash flow difference of adopting the new management strategy are expected initially to be less favourable or even negative due to outlays on both fertiliser and extra livestock (increasing livestock capital for the business). The time that it takes the cumulative cash flow difference to equal $0 indicates the time it will take to break even. However, the financial performance of the livestock enterprise inevitably improves over time as carrying capacity is increased and the return on investment in this example is ultimately very favourable.

There is no doubt that the increase in P-fertiliser price has a direct negative affect on the profits from enterprises that are using fertiliser. However, such enterprises are typically able to run higher stock numbers per ha than low soil fertility operations and are expected to remain more profitable. In this example, this is the case even if the fertiliser price reaches $600/tonne.

Unfortunately, higher fertiliser prices also mean pay back periods may be substantially longer when increasing soil fertility and this indicates an increase in business risk. It is consequently, more important than ever to assess both the magnitude of the financial gains expected from a fertiliser investment and how long it may take to return to positive cash flows.

Getting the best return from a fertiliser investment

It is common to consider soil fertility, livestock genetics, labour efficiency, etc. as separate problems. However, improving all aspects of grazing enterprise management will have a positive impact on returns to a fertiliser investment. To illustrate this, we have calculated the likely cash flows for the same soil fertility management strategy (above) for enterprises that achieve different livestock gross margins. Roughly equivalent farms within districts often achieve substantially different gross margins per DSE. The major factor in these differences is the choice of livestock genotype and productivity. For example, the difference between the top 10% and bottom 10% of high accuracy teams from the Australia-wide Merino bloodline comparison (Atkins *et al*. 2007) was 19% or $6.34/dse. The range across the industry is greater than this because only major bloodlines are evaluated within the trials.

Figure 2 demonstrates the substantial impact that differences in gross margin/DSE have on the net cash result from a fertiliser investment strategy.

Profitability is higher and pay back periods are shorter for enterprises that run productive livestock. Enterprises that achieve high gross margins per DSE have a much greater chance of affording fertiliser that can, in turn, lift overall profitability.

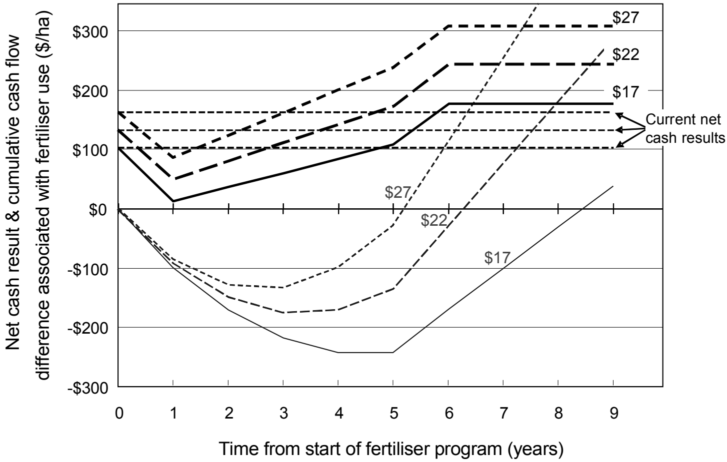

Figure 2: Impact of different livestock gross margins on additional profit per hectare (net cash results; upper lines) and pay back periods (cumulative net cash differences which include interest on debt; lower lines) for the same strategy to increase soil fertility and stocking rates in a Merino wether enterprise grazing previously unfertilized pasture at Bookham. Superphosphate price is assumed to be $400/tonne and spreading costs are $5.70/ha.

Bottom line: *Fertiliser price is set by world markets and cannot be controlled on farm. If things are not looking rosy and you don't want to lie down and be run over by world prices it is necessary to take control of the things you can influence:*
(i) Fertiliser cost can be minimised by ensuring soil fertility management is on target and not over or under where you need to be for your soil type and stock numbers.
(ii) Also focus on the other variables that you can control directly (e.g. livestock gross margin and/or stocking rate), and which also strongly influence the profitability of fertiliser decisions.

References:

Atkins, K.D., Martin, S.J., Casey, A.E., Graham, R.P., Semple, S.J.. Gordon, R.V. (2007) Merino bloodlines: the comparisons (1996 to 2006) *Primefacts 700*, NSW Department of Primary Industries, www.dpi.nsw.gov.au

Graham, R.P., Bookham Grazing Demonstration Results, NSW DPI Sheep Conference, 2006, p 211-216

Acknowledgement: Work contributing to these analyses was funded in part by Pastures Australia Ltd.

From the President's desk

Those of you who attended the recent annual conference at Taree will no doubt agree that it was up there with the best. Just short of 300 people attended the conference sessions and over 200 were at the conference dinner.

The convenor, Ray Johnston of the DPI (now DII) in Taree and his hard working committee are to be congratulated on an outstanding effort. The combination of formal sessions, local farm tours, trade and poster displays and first class weather combined to deliver a great event, the first on the coast since the inception of the Society leading to its first conference at Hawkesbury College in 1986.

Members who attended the conference will already have received their proceedings while others will shortly receive a copy in the mail. It contains plenty of excellent information on various aspects of dairy and beef production systems, soil fertility studies including the use of organic amendments, native pasture performance on the coast and the topical subject of climate change and methane emission reduction strategies.

Our conference next year will take place in Dubbo, where a stimulating program is already in the planning stages. Details will soon appear on the Grassland internet site as well as in the newsletters.

Dry weather is now affecting much of the state after such a wet autumn and winter in the north east and near by areas. Rain before the end of August is urgently needed for crops and pastures. I trust this will have occurred by the time this newsletter is in you hands.

Best wishes,

Mick Duncan

IF YOU HAVE NOT PAID ALREADY, PLEASE NOTE THAT 2009/10 MEMBERSHIP SUBS OF $50 ARE NOW DUE

PAYMENT METHODS: Cheque, Credit Card (Mastercard or Visa) or Electronic*:

Account Name:	**Grassland Society of NSW**		
BSB:	**032 833**		
Account No:	**421690**	**Bank:**	**Westpac**

*If paying by electronic banking, don't forget to email the Secretary (secretary@grasslandnsw.com.au) with your details.

NB: Members please do not forget when paying your membership to indicate whether you would like your conference proceedings posted or you collected at the conference. Thank you.

THE GRASSLAND SOCIETY OF NSW INC.

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 are agricultural scientists, farm advisers, consultants, and 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.

OFFICE BEARERS OF THE GRASSLAND SOCIETY OF NSW – 2009-2010

STATE EXECUTIVE

Mick Duncan (President)
Lester McCormick (Vice President)
Janelle Witschi (Secretary)
Frank McRae (Treasurer)
Committee: Rob Eccles, Linda Ayres, John Ive
John Coughlan, Hugh Dove, Philip Stacy, Carol Harris, Haydn Lloyd Davies, Richard Bloomfield, Keith Garlick, Jeffrey House, Cathy Waters

BRANCH REPRESENTATIVES

North Western Slopes
Loretta Serafin
Central
John Coughlan
Southern Tablelands
Mike Keys
South Western Slopes & Riverina
Vacant
Western Slopes & Plains
Vacant
Northern Tablelands
Mick Duncan

APPLICATION FORM

Name: ....

Address: ....
....
....
.... Postcode.................
Telephone:...................................

Subscription for 12 months (July to June) is $50. This entitles you to copies of the Newsletters and a copy of the Annual Conference Proceedings.

For more information, please contact the Society's Secretary, Janelle Witschi (telephone: 02 6369 0011).

Send membership application to:

The Secretary
Grassland Society of NSW
PO Box 471
Orange NSW 2800

Email: secretary@grasslandnsw.com.au