

## THE ROLE OF NATIVE PASTURES IN THE SYSTEM:

# HOW TO MAINTAIN OR IMPROVE THE PRODUCTIVITY OF NATIVE GRASS-BASED PASTURES IN THE TABLELANDS?

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**Abstract:** Native grass based pastures still dominate NSW Tablelands, occupying over sixty percent of the total area. Research and commercial experience has shown they can be developed to carry between 80 to 95% of the stocking rates achieved when compared to a sown pasture based on introduced species. In the non-arable class 3 to 5 land in particular or on acid soils, they have a vital future role to play in any sustainable pasture development program. A range of management strategies are available to modify most native pastures.

## INTRODUCTION

With the new century only seven years away, let me throw this observation into the ring. If we are to have any chance of a sustainable agriculture after the year 2000, the protection of existing perennial grass species in non-arable areas will be paramount for the future of Tableland pastures.

I say this because many pastures based on introduced species have simply not proven to be sustainable over time without regular fertiliser inputs and/or resowing. Under the current economic pressures, there is a high likelihood that many pastures based on exotic species will be invaded and eventually dominated by native grasses. The only possible exception to these changes will be pastures based on Australian phalaris and subterranean clover which, for most landholders, have stood the test of time. There are several reasons that support this conclusion including: decline in soil fertility, increase in soil acidity, and local problems with salinity.

In New England area widespread interest in year-long green native perennial grasses goes back at least to the early 1900s. In fact at that stage wallaby grass (*Danthonia* spp.) was recommended as worthy of domestication. It is sobering to realise that for the next 50 years the dominant philosophy and practice of most researchers, advisers and farmers was to move away from natural species. Unfortunately, this ig-

nored the fact that while natural grasslands were initially unproductive, some native grass species are capable of developing into a far more productive pasture over time with increasing levels of soil fertility, and careful management.

Fortunately, from the 1960s onwards, a small but increasing number of landholders and researchers recognised the worth of native pastures. Wal Whalley (University of New England) and Greg Lodge (NSW Agriculture, Tamworth), have been preaching for years about trying to obtain a more balanced approach to pasture improvement. Commercial farmers including Ed Wyndham, Ernie Stephenson and John Flemming have been supporting them.

## VALUE OF NATIVE GRASSES - EXAMPLES

### Northern Tablelands

Research in the New England area has shown that fertilised native grass pastures plus oversown legumes have a potential carrying capacity of about 90% of that expected on pastures sown with introduced species. Recent surveys and current research on the Central and Southern Tablelands suggests that on average fertilised native pastures oversown with subterranean clover are carrying about 80% of the stocking rates of fertilised pastures sown with introduced grasses and legumes. This success of native species is attributed to greater tolerance to a wide range of soil



Table 1: Seasonal and total yield (t/ha) of native and introduced grasses at Glen Innes (Archer and Robinson, 1988).

Season	Introduced		Native			
	Phalaris	Fescue	<i>Danthonia</i>	<i>Microlaena</i>	<i>Poa</i>	<i>Bothriochloa</i>
Spring	3.1	3.1	3.5	3.0	3.3	3.4
Summer	2.3	1.7	2.7	2.6	3.0	5.1
Autumn	2.1	2.0	1.4	1.6	2.3	2.1
Winter	0.5	0.1	0.2	0.2	0.6	-0.1
Total	8.1	6.9	7.8	7.4	9.2	10.6

types, acidity, drought and grazing pressure, as well as possessing the ability to adapt to increased soil fertility.

Research work at Glen Innes (Archer and Robinson 1988) over a three year period under comparable management conditions resulted in the following yields (Table 1). Snow grass (*Poa sieberana*), a native grass, was the highest yielding grass at most times of the year.

### Beef cattle demonstration

During 1981-1985, an 80 ha block of native pasture (including kangaroo grass and weeping grass) was split up into four paddocks and the following treatments imposed: pure native pasture; native pasture plus superphosphate; native pasture plus superphosphate plus subterranean and white clovers; and a sown pasture based on phalaris, cocksfoot and clover. The results (Table 2) show that native pasture with fertiliser and clover carried nearly as many stock as the sown pasture and resulted in the highest net profit over the five year period.

## MANAGEMENT TO CHANGE COMPOSITION OF NATIVE PASTURES

Native perennial grass-based pastures can be changed significantly in three main ways:

- Fertilisation and introduction of legumes;
- Grazing management - species;
- Use of herbicides.

The impact of any one (or combination) of these practices can alter pasture performance in terms of production, quality and seasonal growth distribution.

### Fertilisation - legumes

Top-dressing (mainly with superphosphate) and

introducing a suitable legume (eg. white and/or subterranean clover) is probably the most common method used to increase the carrying capacity of native grass country. To maintain the year-long green species (wallaby grass and weeping grass), most farmers have developed these areas over a long period (up to 15 years), avoiding clover dominance by applying low fertiliser rates (ie. change is based on evolution, not revolution).

This is the reverse of the system recommended for pastures where introduced grasses and legumes are the dominant species. The Goulburn native grass survey showed a steady increase in stocking rates up to 7.5 DSE/ha in paddocks where legumes were introduced and soil fertility was built up by applying 1 t/ha of superphosphate over an 8 to 15 year period.

Prediction of the fertiliser needs of any pasture is difficult at any time, but particularly so when it comes to acid soils. We know that most native grasses and subterranean clover are extremely acid soil tolerant. Weeping grass is probably the most acid soil tolerant of our native grasses, and its frequency in pastures increases as soils become more acid. I have observed wallaby grass, tussocky poa, spear grass and kangaroo grass growing on strongly acid soils. The average pH of native grass paddocks in the Goulburn survey was 4.1, whereas the sown pasture paddocks was 4.9 (CaCl<sub>2</sub> test).

At this stage, there is no evidence to show that these native grasses will respond to lime. In a current trial located on very acid soil at Goulburn (pH 3.9 CaCl<sub>2</sub> test, aluminium saturation >50%), neither cocksfoot or wallaby grass have shown any response to lime over the last two years.

Fertilisation requirements are paddock and pasture specific. Consult your local agronomist for advice, but make sure he/she clearly understands your pasture, enterprise goals, and cash flow situation. Also, know your soil acidity (soil tests are useful), your pasture composition and whether your country can, in fact, be safely cultivated.

### Grass/clover balance

Wallaby grass and red grass are particularly sus-



Table 2: Comparison of production and profitability of native and improved pastures.

Production parameter	Pasture type and improvement strategy			
	Native pasture	Supered native pasture	Supered native pasture plus clover	Fully improved pasture
Stock sold (number)	22	34	79	83
Liveweight gain (kg)	6436	8125	15592	16322
Pasture costs (\$)	0	2353	4492	7007
Value of production (\$)¹	7852	9913	19022	19913
Net margin (\$)²	7852	7560	14531	12907

Notes: ¹Gross value of production @ \$1.22/kg/ha liveweight; ²Net margin after deducting pasture costs.

ceptible to clover dominance in spring. One year of heavy clover growth in the spring will reduce their population densities, and two consecutive years can almost wipe them out. It may take several years for them to recover, if at all. The ideal grass:clover ratio to maintain desirable perennials is about one third of the dry matter/ha contributed by the clover.

Clover composition of a pasture is generally affected by three factors:

(1) Amount and distribution of rainfall (eg. a good autumn break followed by a good spring rainfall can lead to clover dominance);

(2) The amount and frequency of fertiliser increases/decreases the proportion of clover (eg. for country that responds to phosphorus and sulphur the following fertiliser strategies may apply - (a) *Strategy to increase clover content*: Apply superphosphate at 250 kg/ha in Years 1 and 2 followed by an annual top-dressing of 125 kg/ha/year; (b) *Strategy to decrease clover content*: Apply superphosphate applied at 125 kg/ha in Years 1, 2 and 3 followed by application of 125 kg/ha at two or three year intervals. With a good autumn break, reduce the amount of superphosphate to avoid clover dominance if there was a good spring the year before.)

(3) Intensity and frequency of grazing, ie. increasing or decreasing grazing pressure at critical times (eg. (a) *Strategy to increase clover* - heavily graze over summer to control grass and encourage clover regeneration. Reduce stocking rate for 4-6 weeks after the autumn break to allow clover seedlings to develop. Reduce sheep grazing pressure when clover is flowering and seeding (mid September-October) or graze with cattle or goats; (b) *Strategy to increase grass content* - do not fertilise regularly. Increase

stocking rate for 4 to 6 weeks after the autumn break to check clover seedlings. Understock over summer-autumn and allow the grass to seed. Graze heavily with sheep in September/October when clover is flowering).

## GRAZING EFFECTS ON NATIVE PASTURES

Research has shown that varying the timing and length of grazing pressure can favour some pasture species

over others. This is especially true where there are significant differences in seasonal growth patterns, flowering and seeding. The phenology of common, but important native grasses reviewed here provides the building blocks for development of grazing strategies to improve perennial grass vigour.

### Wallaby grass (*Danthonia* spp).

A range of types is usually present. All are year-long green ecotypes (given rainfall) and generally widespread in the Tablelands, particularly where use of cultivation and herbicides has been minimal.

New England research showed that some Wallaby grass species are very adaptable, generally increasing in frequency with rising stocking rates and fertility. However, wallaby grass cannot handle clover dominance, particularly dense shading in spring. When this occurs short bursts of sheep grazing (sheep prefer clover) in the early- to mid-flowering period (usually September - October) will reduce shading and allow wallaby grass to develop and seed down later on. Wallaby grass species can also produce seed heads in autumn, particularly with an early autumn break.

### Weeping grass (*Microlaena stipoides*).

This is also a year-long green prostrate perennial grass which responds to increasing soil fertility. It has been observed to develop seed heads from November to May, provided rainfall is adequate. Little is known about how weeping grass responds to management. In most cases its productivity and frequency increase with rising soil fertility and rainfall. It is often abundant on acid soils, but is rarely significant where rainfall is less than 625 mm/year.

Farmer observations suggest that it may take 10 or more years of top-dressing and clover before condi-



tions are sufficiently improved to allow weeping grass to take off. Weeping grass loves a wet summer, making prolific growth and seeding. It is usually eaten into the ground over summer/autumn period when green feed is in short supply. Initially it seems to prefer semi-shaded situations or wet valley floor areas. Perhaps the best way to encourage the spread of this grass is to capitalise on a wet summer by allowing it to run to seed, and then mob stock in late autumn to spread the ripe seed slowly through the grazing animal. Where soil fertility and moisture are adequate, it should spread naturally over time. Weeping grass seems very tolerant to annual legumes. In fact, undergrazed, it can reduce clover density.

### Red grass (*Bothriochloa* spp).

Red grass occurs sporadically in the Southern Tablelands but is more frequent in the Central Tablelands (eg. Freemantle, Hill End, Mudgee and Rylstone areas). Grows actively over summer (October - March) and is dormant in winter.

Winter production of redgrass pastures can be increased by heavy summer/autumn grazing and oversowing with subterranean clover and superphosphate. Stocking rates up to 10 DSE/ha have been reported where this practice has been followed. Like wallaby grass, redgrass is also sensitive to clover dominance in the spring.

### Tussocky Poa.

These yearlong green grasses are widespread and variable throughout eastern NSW. Two major types of tussocky poa are present on the Central and Southern Tablelands.

*Poa labillardieri* tends to dominate the wet fertile valley floors and is widespread in higher rainfall areas (eg. Braidwood, Oberon, Moss Vale). When soil fertility is built up (ie. by fertilising and introducing a legume) and set stocking is practised, *P. labillardieri* can become a highly invasive grass which dominates other pasture species. Poa has low palatability and when it becomes rank and mature, pasture quality and productivity declines rapidly. On the positive side, it is tall clumpy grass (up to 1.2m high) and can provide excellent shelter for newborn lambs.

Snow grass (*Poa sieberiana*) is a smaller finer leafed grass that grows up to 50 cm in height and

prefers the better drained areas on the mid-slopes and ridges. It is not as invasive as *Poa labillardieri*, and prefers areas where annual rainfall exceeds 600 mm. When tested at Glen Innes under similar conditions to phalaris and fescue, *Poa sieberiana* equalled or out-yielded these introduced species throughout the year. However, under set stocked grazing, it has lower palatability than legumes and introduced grasses (particularly rye grass) and surplus mature spring growth is usually of poor quality.

The overall problem with the *Poa* species is not their ability to produce year-long growth, but their palatability and ability to dominate sown pastures over time where set stocking is practised. Under these conditions over- and under-grazing occur together. The more palatable species are over-grazed, and the less palatable *Poa* species undergrazed. Unless this management cycle is changed, resowing pastures is not a long term solution to invasion by poa.

CSIRO research at Krawaree demonstrated that fertilised *Poa* with a legume can carry heavy stocking rates (up to 30 DSE/ha). Other research has clearly shown the benefits of a protein rich supplement that enables animals to utilise the fibre present in the mature tussocks present in spring.

Some landholders have successfully used this strategy to maintain adult sheep and cattle in periods of feed shortage in the Southern Tablelands. The long-term benefit is that they are successfully altering *Poa* dominant pastures and obtaining a broader mix of legumes and grasses.

In early 1991 when semi-drought to drought conditions prevailed on the Southern Tablelands, over 400 landholders attended seven public meetings on feeding and management strategies. No complaints were made about poa tussock, only questions as to how to utilise it better!

The lesson here is to learn how to better utilise its growth. Possible strategies could include:

- controlled grazing to non-selectively defoliate pastures (mob stocking);
- slashing or periodic burning in late winter. The young regrowth is more palatable and much higher quality (up to 12% protein). Graze to control growth in spring aiming to delay seed set and maturity of the poa;



- burning in autumn can significantly increase the quality of poa tussock for winter feed. However, this should only be used in seasons when there is a good early autumn break with little or no likely feed shortage coming into winter and the fire risk is minimal. Poa has one of the highest winter growth rates of the year-long green perennial grasses in NSW and is, perhaps, only exceeded by ryegrass.
- providing autumn/winter supplementation with high protein supplements (eg. lupins, linseed meal, to allow animals to utilise the mature poa);
- doing nothing and treating the poa areas as a drought reserve (useful if only small areas are involved); and
- lambing in poa paddocks so that lambs can shelter amongst the tussocks. This is particularly useful in areas where there is no natural shelter and where other winter growing species are still present.

In broad terms the same principles apply to some spear grass species (*Stipa*). These grasses do not seem to be as productive or as invasive as poa.

### Kangaroo Grass (*Themeda* spp).

Kangaroo grass was probably widespread years ago but is one of the first native perennial grasses to disappear under increasing stocking rates and/or soil fertility. *Themeda* spp. are erect, summer growing, winter dormant grasses of low to fair quality only. However, kangaroo grass can have a valuable role to play in class 3 to 5 steep stony areas because of its vigorous growth after summer storms and adaptability to a wide range of soil conditions.

I am fairly certain that kangaroo grass would tolerate quite high stocking rates for short periods in the summer period, particularly after storms, but would probably thin out and disappear if high stocking rates were continued for a long time. The introduction of subterranean clover and superphosphate would increase the late autumn-winter-spring carrying capacity of kangaroo grass dominant pastures, but this could result in a decline in its density over time.

Implementing strategies to avoid clover domi-

nance and restricting the frequency of top-dressing with superphosphate would help maintain kangaroo grass if this was the desired goal.

In arable areas where resowing by direct drilling or on a prepared seed bed can be undertaken to readily establish more productive and sustainable pastures, the loss of kangaroo grass would not present a significant problem. This would be a preferred result, particularly in areas which have natural shelter and long growing seasons suitable for introduced pastures. Kangaroo grass would not make best use of such areas.

### Wire grass (*Aristida* spp).

Wire grass is an undesirable perennial with seed-heads which are capable of penetrating the pelts of sheep. In most instances, management aims to remove or minimise the impacts of this grass.

When heavily grazed over late spring-summer by rotating mobs of mature wethers to maintain pressure wire grass will be weakened. Light grazing after the autumn break through winter and spring will encourage the establishment of winter green annual and perennial grasses.

It may take 3-5 years before the program has a significant effect on pasture composition. Oversowing a legume (eg. sub clover) and fertilising further increases carrying capacity. This program works better in dry summers.

## MANIPULATING NATIVE GRASS PASTURES BY USING HERBICIDES

While little formal research has been undertaken on other major native perennial grasses in the Tablelands areas, the following experience of landholders and agronomists may help. Native grass-based pastures dominate the Tablelands grazing scene, particularly in the undulating to hilly areas. Traditionally, the approach to utilise these areas has been to:

- do nothing and utilise what feed there is on a seasonal basis, or run adult dry stock on them depending on species present;
- oversow with a legume (either subterranean and/or white clover), fertilise and improve the carrying capacity over time;



- aerial spray with knockdown non-residual herbicides, *eg.*, glyphosate, and replace the existing pasture with one based on introduced species. This option, when successfully applied on non-acid soils, has the highest production potential (up to 20% more than oversowing and top dressing), but has the highest cost and risk and requires more planning and careful management.

Recently research has looked at non-destructive ways of changing pasture composition with herbicides. The aim has been to:

- improve pasture quality and/or quantity by selective removal of annual weeds, *eg.*, barley grass, *Vulpia* or thistles;
- encourage the more useful species in existing pasture;
- reduce the risk and costs of having to resow a new pasture;
- minimise erosion.

The three main ways that native grass pastures can be improved using herbicides are:

- direct drilling;
- pasture topping;
- winter cleaning.

Each strategy has a role and selection will depend on the characteristics of the paddock, the existing pasture and enterprises, and the goals and resources of the landholder.

### Direct drilling

Direct drilling has a major role to play in improving native pastures on steep and stony semi-arable areas. A wide range of herbicides is available for direct drilling and the selection and application rate depend on existing pasture composition and the desire to suppress some species and maintain others.

Figure 1 shows the tolerance of two of our most useful native grasses, *ie.*, wallaby grass (*Danthonia* spp) and weeping grass (*Microlaena stipoides*), to a range of herbicides.

If the existing pasture is dominated by wallaby grass, Roundup® (glyphosate) should not be used as wallaby grass is sensitive to Roundup® even at low

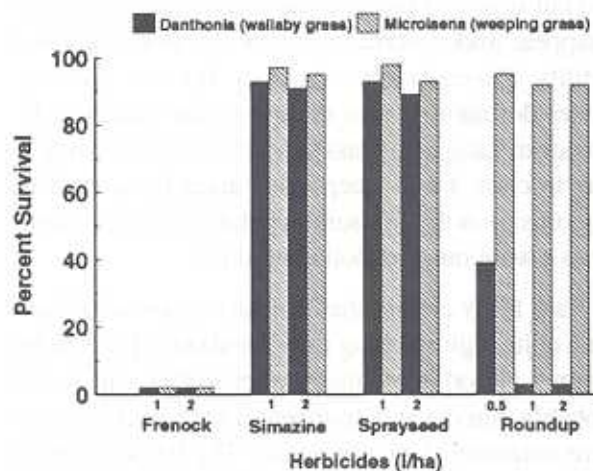
rates. The preferred herbicide is Sprayseed® as it has no permanent effect on wallaby grass.

Care must be taken to assess existing pasture composition as some plants such as sorrel are not controlled by Sprayseed®. Other herbicides will have to be added to Sprayseed® to control this hard to kill species. The use of knockdown defoliant herbicides like Sprayseed® will most likely result in less establishment of sown species than by using herbicides that kill everything. However, Sprayseed® does enable you to maintain existing productive perennial grass species.

### Pasture topping

This technique is designed to reduce the seed production of annual grasses (*eg.* barley grass, *vulpia* and brome) and annual thistles (*eg.* saffron thistle). Where weeping grass is the dominant native grass, all currently registered herbicides for spray topping can be used at their recommended rates with little effect on existing pasture. Where wallaby grass is dominant, Gramoxone® (paraquat) is the most suitable herbicide to use for spray topping.

Work is currently underway to assess the tolerance of native grasses to a tank mix of Ally® (metsulfuron and gramoxone) looks promising when applied to control sorrel/annual grass mixtures.



Comments: 1. Both grasses nil tolerance to Frenock®; 2. *Danthonia* low tolerance to Roundup®; 3. Both grasses tolerant to Simazine® and Sprayseed®.

Figure 1: Tolerance of native grasses to herbicides at Goulburn 1990-1992.



## Winter cleaning

The aim of winter cleaning is to remove seedling annual grasses from improved pastures in late autumn to late winter. The strategy involves the use of Simazine® at rates between 1 to 1½ litres/ha. Both established wallaby grass and weeping grass are very tolerant to Simazine® at the recommended rates. Winter cleaning can reduce the amount of pasture grown in the following late winter/spring by up to 40% and is not an option under poor seasonal conditions.

Research on the herbicide tolerance of our major year-long green native grasses is continuing and we will have more information over time.

The traditional approach of eliminating all existing vegetation is being questioned and I believe there are an increasing number of options available where we can make best use of our existing pastures and aim to improve them with non-destructive options. For example, scientists at the New England University at Armidale are very concerned at the blanket recommendations being given for both spray topping and winter cleaning. This concern is based on the observation that the consequences may lead to either more of the annual weed problem regenerating from seed reserves in the following years or, alternatively, lead to a situation where annual grasses are the initial target species but they are then replaced by broadleaf weeds like capeweed or thistles in the following year.

I have seen this take place, and I believe that in cropping areas where the majority of existing pastures are based on annual species then there is likely to be more benefit by pasture manipulation and increasing the proportion of legume with herbicides. This benefit can extend into the cropping phase with increased crop yields through such aspects as disease reduction and nitrogen response. We have to be careful in using herbicides on native perennial grass pastures. I have no doubt some species in pasture, which we traditionally regard as weeds, may not be as bad as we think they are.

Dr John Leigh from CSIRO, Canberra, carried out some very interesting work looking at what sheep actually ate in three entirely different types of pasture in three different environments. He found that sheep

were highly selective and showed an uncanny ability to preferentially select the highest quality feed on offer and, this preference only changed with decreased availability over time.

What staggered me was that Flatweed or Catsear (*Hypochoeris radicata*) was preferentially grazed before any grass and was of high digestibility and protein.

At this stage, it would be prudent to contact your local agronomist if in doubt as to the preferred herbicide strategies and tactics to suit you and your pastures.

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## REFERENCES

- Anon. (1992). Boost beef returns with supered pastures. *IN-CITEC publication*.
- Archer K.A. and G.G.Robinson (1988). Agronomic potential of native grass species on the Northern Tablelands. *Australian Journal of Agricultural Research*, 39:425-436.
- Dadd C.P., L.H.McCormick and G.M.Lodge (1989). Wiregrass control. *NSW Agriculture Agfact* - P2.5.28.
- Lodge G.M., G.G.Robinson and P.C.Simpson (1990) Grasses - native and naturalised. *NSW Agriculture Agfact* - P2.5.32.
- Mackay A. (1990). If it grows eat it. *Proceedings of the Fifth Annual Conference of the Grassland Society of NSW*, p 46-47.
- Munnich D.J., P.C.Simpson and A.I.Nicol (1991). A survey of native grasses in the Goulburn district and factors influencing their abundance. *Australian Rangelands Journal*, 13:118-129.
- Simpson P.C. (1992). Herbage quality of two yearlong green native grasses. *Proceedings of the Seventh Annual Conference of the Grasslands Society of NSW*, p 86.
- Whalley R.D.B. (1990). Native pasture grasses in NSW. In "Native Grass Workshop" Edited by P.M.Dowling and D.L.Garden, *Australian Wool Corporation*, p 95-104.
- Wilson A.D. and K.C. Hodgkinson (1990). The response to grazing and its implications for the management of native grasslands. In "Native Grass Workshop" Edited by P.M.Dowling and D.L.Garden, *Australian Wool Corporation*, p 47-57.
- Wyndham, E. and A.Wyndham (1992). Thirty years of phosphate fertiliser application on a New England Tablelands grazing property. *Proceedings of the Seventh Annual Conference Grasslands Society*, p 57-59.