MANAGING AND DEVELOPING NATIVE GRASS PASTURES FOR SUSTAINED PRODUCTION AND PROFITABILITY

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Pasture improvement is a great adventure which can hold tremendous rewards for the thoughtful grazier. We may start with low producing, thin, erosion-liable native pastures and end up with high producing, dense, erosion-safe and highly profitable improved pastures.

But pasture improvement is not a single-path adventure. We can travel with it on many different paths from the path of killing all native vegetation and replacing it in one fell swoop, to the path of using the native species we have, but slowly and gently modifying them towards greater production and profitability.

Nor is pasture improvement a mere physical adventure into the area of producing more and better livestock products from the same piece of land. It is also a financial adventure in putting more money into improvements and livestock in the hope of higher profits and a better total way of life.

Like all adventures, pasture improvement can be quite hazardous, but these hazards can be greatly reduced if we take with us a good map which indicates where we are heading and good equipment in the form of knowledge and understanding to use when we move into new and unfamiliar situations.

My effort this morning is directed towards providing some kind of a map for pasture improvement adventurers in the form of a development plan and some equipment, in the form of basic principles, which may help them on their way.

BASIC PRINCIPLES OF PROFITABLE PASTURE IMPROVEMENT

Making good profits from pasture improvement depends on growing additional usable feed at the minimum cost and efficiently converting it through grazing animals as quickly as possible to high value products like milk, meat and wool.

PROFIT = EXTRA LIVESTOCK INCOME FROM PASTURE IMPROVEMENT − TOTAL COST OF IMPROVEMENT (CAPITAL COST & MAINTENANCE COST)

For Australian pastures, except where nitrogen fertilisers are used, increased profits are almost entirely dependent on increased legume production, increased protein production and increased production of protein based products like milk, meat and wool. Legume nitrogen fixation is the basis of the whole system. If I had to choose, from an animal production viewpoint, between a legume-dominant pasture with a few thistles and a grossly grass-dominant pasture, I would opt for the legumes and thistles!

The costs associated with pasture improvement can be many and varied ranging from clearing, fencing, watering, cultivation, herbicide

treatments, fertilising, spelling from stock, rabbit and kangaroo control, providing additional livestock and losing livestock from improved pasture toxins. But of all these costs, and others, the only two which are essential over most of our tablelands and slopes are fertilisers (containing mainly phosphorus, sulphur, molybdenum and calcium) and legume seed.

When stripped of all its complexities, PROFIT from pasture improvement will come from investing mainly in FERTILISER, LEGUME SEED AND LIVESTOCK and making these investments at the right time and in the right proportions.

THE PRINCIPLES OF MANAGING NATIVE PASTURES IN THE DEVELOPMENT PHASE

If we could, during the development phase, add clover, superphosphate and stock in the right proportions so that we constantly ate the additional food produced, then we should have no nitrophilous weed problems because the additional feed produced by the clover and superphosphate would be eaten by the additional stock purchased or bred each spring. Thistles and other nitrophilous weeds come in only when clovers or winter annual grasses remain ungrazed in spring and prevent the native summer growing grasses such as redgrass (Bothriochloa macra) from growing through the spring residues of annual clover and grasses.

But what are the right proportions of superphosphate, sub-clover and livestock?

THE DEVELOPMENT PLAN

To answer this question, a review was made of the literature up to 1966 on the response of pastures and livestock to different additions of superphosphate applied to non-phosphate fixing soils on the NSW tablelands. The two papers which most strongly influenced our final decisions were:

(1) The residual effects of phosphorus on soil fertility and pasture development on acid soils (Anderson and McLachlan, 1951)

(2) The effect of superphosphate on the carrying capacity of pastures of the southern tablelands (Kinsman and McLennan, 1961).

These two papers showed that, at least in the pasture development phase, pasture production and annual carrying capacity is closely related to the accumulated total superphosphate applied over the years of pasture development.

THE RATIO OF SUPERPHOSPHATE APPLIED TO LIVESTOCK CARRYING CAPACITY

On the basis of past research, we decided that the superphosphate to livestock carrying capacity in the development phase (typically 10 years of adding 120 kg super per hectare per year) should be:

1. On a per tonne of superphosphate basis;

EVERY TONNE OF SUPER TOPDRESSED IN AUTUMN	GIVES	5 EXTRA DSE OR WETHERS NEXT SPRING, SUMMER AND WINTER

OR

2. In the case of our 500 ha property;

60 TONNE SUPER TOPDRESSED IN AUTUMN	GIVES	300 EXTRA DSE OR WETHERS NEXT SPRING, SUMMER AND WINTER

OR

3. On a per hectare basis;

120 KG/HA SUPER	GIVES	INCREASED CARRYING CAPACITY OF TOPDRESSING IN AUTUMN 0.6 DSE/HA NEXT SPRING, SUMMER AND SUBSEQUENTLY.

If the above ratios of additional superphosphate to pasture production and carrying capacity are correct and if this increased carrying capacity available in spring each year is taken up with additional purchased or bred livestock, then additional spring growth would be controlled by additional livestock grazing and nitrophilous weeds would not become a problem.

In 1966 we decided to test out the above principles on our own native pastured, hilly property near Bathurst.

APPLICATION OF PRINCIPLES TO HILL-FARM DEVELOPMENT ON THE CENTRAL TABLELANDS OF N.S.W.

With the foregoing principles in mind, we set out in 1966 to develop a 500 ha slate-diorite, hilly property on the Bridle Track north west of Bathurst with an elevation of 500 to 700 metres, an average uniform rainfall of 650 mm, an average mean temperature of 7°C for the coldest month and 22°C for the warmest month, a soil pH range from 5.6 to 6.8 and carrying redgrass (Bothriochloa), wallaby-grass (Danthonia) and speargrass (Stipa) native pasture with a trace of naturalised imported clovers (mainly haresfoot, cluster, hop and suckling clovers). The area had been carrying about 1000 medium wool merino wethers on the 500 ha of native pastures - or 2 DSE per hectare.

By the time we made the property operational, our equity in it was only 25%, so it was important for us to choose a pasture development programme that would give us a high and fast return on our investment.

There were, broadly speaking, two avenues of hill-pasture development open to us.

1 The clean-sweep method. A method by which we would aerial spray and kill-out all the existing native pasture species with herbicides and then aerial-seed a mixture of improved pasture species with appropriate fertilisers and then apply appropriate grazing management; or

2. The developmental method. A method by which we would accept the native pastures we had and then slowly improve them by adding fertilisers and subterranean clover seed being always careful to keep our increased pasture production in line with increased stock numbers and grazing pressure.

The **Clean sweep method** had a lot going for it, if we could have afforded it, but it was risky and expensive; risky because it required good rainfall conditions in the establishment year and good aerial-seeding management, and expensive because it required investment in items like herbicides, aerial spraying and additional fencing and watering which did not give an immediate return in increased forage and animal production. It would, however, if successful, greatly reduce the problem of nitrophilous weeds sometime down the track. With the state of our finances and our non-preparedness for further economic and seasonal risks, it was clearly not for us, despite its advantages for people who have the capacity to invest large amounts of money simultaneously in land and pasture improvement.

In 1966 we chose the **Development method**, a simpler method by which we added aerial superphosphate and sheep, as a combined unit, whenever we could afford to do so, but with the already described development plan before us.

This development plan generated the following development record (Table 1) for the first eleven years from 1966 to 1977.

Table 1. **Development record on a whole-farm basis for "Blackfellows Creek"**

	Rabbit control	Subclover seed added (kg)	Super(1) added (tonnes)	Total super (theoretical)	Total DSE(2) (Actual)	Total DSE(3)
1965	some	nil	60	60	1000	1000
1966	1080	1000 (Marrar)	60	120	1300	1248
1967	1080	nil	60	180	1600	1975
1968	1080	500 (Daliak)	60	240	1900	2115
1979	some	nil	60	300	2200	2585
1970	some	nil	60	360	2500	1279
1971	some	nil	nil	360	2500	1863
1972	some	nil	60	420	2800	2796
1973	some	nil	60	480	3100	2721
1974	some	nil	50	530	3350	3870
1975	some	nil	50	580	3600	4109
1976	some	nil	20	600	3700	4073
1977	some	nil	60	665	4000	4106

(1) Superphosphate applied Feb to April and Mo-Super in 1966 and 1971
(2) On basis of 5 DSE per t of superphosphate previously added
(3) Actual from livestock carried at 30 June each year.

Total superphosphate added for the twelve year period 1965 to 1976 inclusive was 600 tonnes or 1.2 tonnes/ha and the total livestock added

was 3000 DSE (actual 3073) to give a total carrying capacity of 4000 DSE (actual 4106 in 1977) or 8 DSE/ha, an increase of 6 DSE/ha since 1965. The cost of this development strategy in current prices is outlined in Table 2.

Table 2. Cost of ten year development from 1000 to 4000 DSE at 1989 prices on a 500 hectare property.

Aerial spread super: 600 tonnes @ $220 =	$132,000
Sub clover seed: 3 kg/ha or 1500 kg @ $3	4,500
Total Cost	$136,500
Cost per DSE added (not allowing for income in development phase)	$45-50/DSE
Cost of maintaining 4000 DSE carrying capacity based on applying 60 tonnes super every third year @ $220 per tonne spread	$1-10/DSE/YEAR

MANAGING TOPDRESSED NATIVE PASTURES DURING THE DEVELOPMENT PHASE AND TWENTY YEARS DOWN THE TRACK

During the development phase, the only management required is to keep grazing pressure in line with carrying capacity and in our experience, provided this is done, no nitrophilous weed problems occur for at least ten years.

However, under conditions of set-stocking, nitrophilous weeds inevitably occur on sheep camps and these extend to areas of high fertility which are undergrazed during spring. Such events are indicative of the facts that large amou of plant nutrients are being transported from outlying grazing areas to sheep camps, restricting the overall productivity of the paddock by dividing it into nutrient drained areas and nutrient oversupplied sheep camps. It is at this stage that management in general and grazing management in particular become vitally important in ensuring sustained production at minimal cost.

Sheep for wool production take very few plant nutrients out of the pasture in their wool product but they transport huge quantities of plant nutrients to sheep camps in the form of dung and urine. If we can, through management, reduce their movement of plant nutrients, we can reduce the fertiliser requirements of the pasture. Mob-stocking and rotational grazing, combined with the careful distribution of new fertiliser applications, will do much to keep plant nutrients better spread throughout the whole pasture area, thus reducing nitrophilous weed invasion and ensuring sustained productivity with reduced fertiliser applications.

Our fertiliser management system is based on the principle of applying fertilisers only to the places where they are most needed and not to areas where nitrophilous weeds are present.

Our grazing management system is based on set-stocking merino ewes in groups of about 500 from lambing to weaning but mob-stocking all twelve paddocks the rest of the year with ewes, wethers, weaners or cattle in such a way as to control both edible nitrophilous weeds and internal

parasites of livestock. We may find it necessary to spray-graze bad patches of thistles in autumn or early spring and seed them with ant-protected seed of perennial grasses such as paspalum, Kangaroo Valley ryegrass and phalaris in lush years, if thistles cannot be controlled by heavy grazing.

While we recognize that our pastures have changed a great deal since we began improving them 22 years ago and they are still changing, we see no reason why production and profitability cannot be sustained provided we are prepared to modify our fertiliser and grazing management to fit a changed and changing ecological situation.

CONCLUSION

Our experience suggests that developmental pasture improvement on present-day costs and prices for livestock products, should be a profitable venture for many tableland graziers with non-arable, steep hill country.

In many cases it should be possible for them to:-

1. Increase carrying capacity from two to eight or more DSE/ha;
2. Increase wool production from about 8 kg/ha to over 40 kg/ha;
3. Buy additional carrying capacity for around $45/DSE compared with purchasing land at $120 to $160/DSE;
4. Maintain such improved pastures for an annual fertiliser cost of $1 to $2 per DSE;
5. Obtain a return on investment in pasture improvement of about 30%, and
6. Increase ground cover, reduce or eliminate the risk of soil erosion, and develop a sustainable and profitable production system.

REFERENCES

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