Proc. Seventh Ann. Conf. Grassld. Soc. NSW, 1992, pp 27-29.

MANAGING PASTURES FOR BETTER SOILS:

USING SUMMER AND WINTER PERENNIAL PASTURES FOR SOIL IMPROVEMENT AND PROFIT

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Abstract: *Continuous cropping for 20 years in the Curlewis area has reduced soil fertility, soil structure and soil organic matter. To reverse this trend, a pasture phase was introduced into the cropping program. Requirements for pasture establishment were: complete weed control; sowing dry into a well-prepared seedbed; treating seed to prevent ant theft; and sowing into the top 2 cm of soil. To achieve year-round production from cattle fattening, separate paddocks were sown to summer and winter pastures. This allows one pasture to be spelled whilst the other is being grazed. An advantage of sowing pasture has been to control the depth of the water table and thus reduce the threat of dryland salinity. The introduction of pastures into the cropping program has stopped soil degradation and allowed the development of a sustainable crop/pasture system.*

INTRODUCTION

".....a kind of resurrection by which dead soil rose from the dead and became alive once more." - The Business of a Plowman's Folly -

I have no doubt that today most farmers and graziers are very familiar with the problems associated with the soil degradation which includes declines in fertility, structure and productivity. These effects are becoming increasingly evident, particularly in the cropping industry where they are linked with declining yields and falling protein levels. This indicates that we are rapidly consuming the natural fertility of our soils and are becoming increasingly reliant on artificial fertilisers to maintain productivity. The more the natural fertility is used up, the more fertiliser is required to replace it. Regardless of the ever increasing cost it places on the industry I believe that we must not upset the natural ecology of our region. The consequences of nutrient losses and imbalances are evident in outbreaks of blue-green algae in the river systems, soil acidification and salinity problems in dryland areas.

The severe economic circumstances presently faced by most producers poses a significant constraint to the development of a sustainable system of agriculture. I believe that most farm planning decisions are forced to be made on economic grounds rather than on a desirable balance between economics and sustainability. The farmer's primary concern is for short-term economic survival rather than long -term sustainability.

The realisation that I could not continue to farm my property the way I had been doing for 20 years led me to explore other ways to maintain the soil and rebuild its natural fertility. My comments on pasture establishment are solely in relation to converting existing farming country into pasture.

PROPERTY DETAILS

My property, "Stafford", is located 42 kilometres south east of Gunnedah on the Liverpool Plains. The property comprises 1081 hectares of which 60% is flat, self-mulching, black earths and the remaining 40% undulating red soils. The average rainfall for "Stafford" is between 500-600 mm.

The property has been in our family for over 60 years. Over that period, many changes in enterprises have been made in response to seasonal conditions, commodity prices and economic circumstances. In recent years, however, these determinants have been overshadowed by another major objective - the need to develop a form of sustainable agriculture to arrest soil degradation.

Traditionally the Liverpool Plains supported predominantly sheep and cattle grazing enterprises. However, during the 1960's and early 70's cropping replaced grazing as the major enterprise when vast areas were sown to wheat, sorghum and sunflowers. More recently farmers have begun growing legume crops to help replace some of the fertility removed during this recent cropping phase.

On "Stafford" the course of events has followed this pattern. We were led to believe that the natural fertility of the black soils was virtually limitless. However, after a very short period of time in relation to the history of world agriculture, a marked decrease in the yield of our crops was evident. The signs of structural change and general soil degradation of which most farmers are aware today were becoming very obvious. Paddocks which had been cropped for 20 years consistently yielded 50% less than paddocks cropped for only 10 years, provided no fertilisers were applied. It was apparent that major changes to my farm program were needed otherwise the soil would eventually end up like plasticine in a completely unproductive state. I

was mining my soil without considering its long-term viability.

ASSESSING THE PROBLEM

I considered that I had two options. The first was to increase crop yields by applying artificial fertilisers. In our case nitrogen and zinc were the most limiting nutrients, but sulphur, iron and calcium were also becoming marginally deficient. It worried me that the use of artificial fertilisers did not address the root cause of the problem, which was that the system was not sustainable. With artificial fertilisers I could get a short-term increase in yield, but the more I took out of the soil the more fertiliser I would eventually need to add. My concern related to the continual mining of the soil organic matter which is essential for maintaining soil fertility.

The cropping program we had been using had been continually reducing the amount of organic matter in the soil mainly as a result of the long fallow cropping strategy which was common in the area. Long fallow depletes organic matter because nothing is contributed to the soil reserve for a considerable period yet at the same time existing organic matter is mineralised. The situation is worse in times of drought when the country may go three years without any substantial plant growth. The organic matter level in black earths in their natural state is about 2%, but on "Stafford" the levels have declined to <0 .4% . This alarmingly low level must be increased to achieve sustainable agriculture.

The second option, which was the one I adopted, focused on the use of a pasture phase in my cropping program to maintain or improve soil fertility. This approach was adopted because at the time crop returns were very low whereas cattle returns were acceptable.

I based my cattle operation on a steer fattening enterprise. Weaner steers are purchased and grown into feeder steers suitable for feedlots or trade cattle depending on market prices. This type of operation gave maximum efficiency in feed conversion as well as providing greater flexibility than would have been possible with a breeding enterprise.

PASTURE ESTABLISHMENT

Establishing pasture in crop land is an expensive and risky exercise. To reduce risk of failure, I adopted a program of paddock improvement over several years. This allows the success of establishment to be monitored as you progress. The method I use to establish pastures is the same as I use to establish a crop. The paddock is farmed conventionally with a fallow phase to ensure adequate soil moisture and to reduce weed competition. One of the most important factors in establishing pasture is to know the weed history of each paddock and to make sure that the paddock is clean prior to planting. Poor pasture establishment is often seen in paddocks heavily infested with native phalaris, barley grass or similar weeds.

Most pasture species are slow to develop which makes them vulnerable to competition. Unfortunately, pastures are often established as a "rough it in" exercise which leads to disappointing results. Good pasture establishment requires as much attention and planning as preparing for a 2 tonne sorghum or wheat crop.

Specialised equipment is not needed for sowing pasture in my district. I sow all my pastures through a conventional Gyral combine. However, sowing time is critical. I prefer to sow dry into a well-prepared seedbed which allows sowing at a time when the possibility of rain is considered better. That is, if there has been no rain for the four weeks prior to sowing, the chances of getting rain in the next two weeks should be greater, giving an opportune time to sow. Because the seed may lie in the soil for a long period before rain is received, consideration should be given to treating seed to provide protection against loss from seed harvesting ants.

I work the paddock first to loosen the soil and then drop the seed on the surface with the combine with trailing harrows to lightly incorporate the seeds into the top 1-2 cm. In our warm climate sowing dry is preferred to chasing moisture after rain because the soils tend to dry out too quickly. Germination is far better if the seed is in the soil while it is raining . If the soil surface remains wet for several days, the germination rate is greatly enhanced.

The varieties of pasture species down depends on the paddock and soil type. It is impossible to make blanket recommendations without considering these factors. Unfortunately, many of the species we are sowing on drier plains country are better adapted to the wetter and cooler tablelands area. While there is a great deal of work being done by the various departments on pasture suitability, I feel more is needed, particularly in relation to the use of natural species on the plains.

BLOAT

As with all farm plans, solving one problem often creates another. One of the biggest problems encountered with pasture improvement in northern NSW is cattle bloat. Because the country is low in nitrogen, clovers tend to be dominant in the initial stages. Although bloat incidence varies from property to property, bloat must never be underestimated. Bloat was the reason I replaced lucerne with balanced pastures. Lucerne now constitutes a very small part in my improvement program. Also, I feel lucerne does not contribute greatly to organic matter build up in the soil surface, although it is very beneficial for nitrogen fixation.

Given the extent of the bloat problem, more research is needed to develop bloat control strategies and select non-bloating legumes. The million of dollars lost attributed to bloat are incurred not only through deaths, but through a failure to efficiently use bloating legume-based pastures because farmers are not sufficiently confident to graze cattle on such pastures. Lucerne may look good but it is not making the farmer money.

PASTURE SPECIES

My objective is to establish pastures that give all year production so that cattle fattening can continue year round. The other benefit of this is that advantage can be taken of any break in the season. To achieve this I have established certain paddocks as a summer pasture and others as a winter pasture, not together. I do not believe it is a good practise to

Table 1: Winter and summer pasture species sown at "Stafford".

Pasture species	Sowing rate (kg/ha)
1. Winter Pastures	
Perennial Grasses	
Perennial rye grass	4
Sirolan phalaris	2
Demeter fescue	2
Tall wheat grass	3
Currie Cocksfoot	3
Legumes	
Seaton Park subclover	5
Sephi medic	0.25
Strawberry clover	0.25
Haifa white clover	0.25
2. Summer Pastures	
Perennial Grasses	
Bambatsi panic	2
Purple pigeon grass	2
Legumes	
Lucerne	1

include both summer and winter pastures together. As with farming rotations, pasture paddocks also need a rest period. This enables the plants to establish their root systems, to seed and to build up moisture reserves for their respective growing seasons.

The species I have used in my winter and summer pastures are shown in Table 1, along with the sowing rates used.

DRYLAND SALINITY

Another advantage of establishing permanent pastures on our black soil plain, which is a flood plain, has been the improved control of the water table level and reduced potential for dryland salinity problems. Under cropping the water table levels were rising during periods of flooding and during the long fallow periods. The effect of a rising water table, which in one case was at times less than a metre from the surface, is to bring the soil salts into the plant root zone. Although the water table drops again when a crop is planted the salts stay in the root zone, creating possible dryland salinity problems.

Permanent pastures keep the water table at a level of 2 metres from the surface and any surface infiltration tends to flush some of the salts in the upper levels downwards thus, over a period of time, reducing the salt concentrations in the root zone.

The Soil Conservation Service from Gunnedah have been monitoring the effects of pasture on water table levels in relation to cropping country by installing piezometers in strategic locations on my property. These are very cheap to install, and I recommend them to anyone who is concerned about rising water tables.

COMMUNITY COMMITMENT

As already stated, present farm planning is based on economic survival. To develop sustainable agriculture in Australia the problem needs to be addressed by the nation. We need to be aware that we are depleting our most valuable asset - our soil. To people not associated with the land, soil degradation is not an issue because, to them, it is not readily visible unlike surface erosion or the blue-green algae. However, it is the root cause of all these problems.

As a nation we must all contribute towards protecting these resources. Governments must provide policies to assist farmers and graziers in developing sustainable agriculture.

BUDGET COMPARISON - STEER FATTENING - WHEAT

Steer fattening

1. *Assumptions:*
- stocking rate 1.2 ha/steer
- purchase weight 270 kg @ $1.30/kg
- selling weight 420 kg @ $1.25/kg
- average weight gain .7 kg/day
- turn over period 1 steer every 8 months
- no allowances have been made for pasture establishment

2. *Income:*
- Steer 420 kg @ $1.25/kg

GROSS INCOME / STEER: $525

3. *Costs:*
- Purchase price - landed: $350
- Interest 12% on $350: $ 30
- Veterinary costs: $ 5
- Losses 1.5% $ 5
- Selling costs: $ 30

TOTAL VARIABLE COSTS / STEER: $420

GROSS MARGIN / STEER: $105

GROSS MARGIN / HECTARE (1.2 ha / STEER): $ 87.50

GROSS MARGIN / HECTARE / YEAR: $130

Dryland wheat

1. *Income:*
- 3.0 tonnes / hectare @ $140 on farm: $420

GROSS INCOME: $420

2. *Costs:*
- Average costs Gunnedah area including depreciation on plant: $200/hectare

TOTAL COSTS / HECTARE: $200

GROSS MARGIN / HECTARE: $220

- Long fallow cropping allows for 2 crops every 3 years.

GROSS MARGIN/HECTARE/YEAR: $146