Pastures to increase nitrogen in crop rotations

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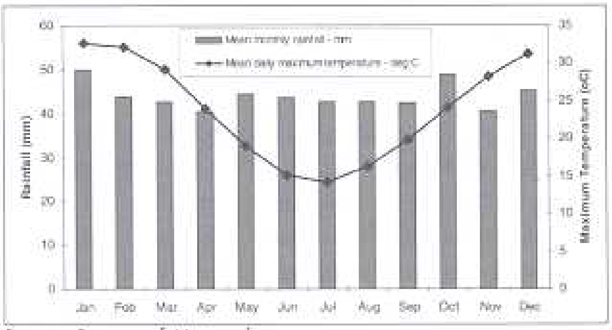
BACKGROUND

Our family business operates a total land holding of some 2,520 hectares, located between Forbes and Parkes (annual rainfall approx. 560 mm). A summary of the local climate is presented in Figure 1, based on long term climatic averages for Forbes (123 years data).

Figure 1. Forbes average maximum daily temperatures & monthly rainfall - Camp St (all years)



Source: Bureau of Meteorology

Until recently, our business operated a traditional enterprise mix consisting of winter cropping (1,300 to 1,600 hectares) and Merino breeding (21 micron – Uardry ewe base and Uardry rams with a recent infusion of Hazeldean rams in the ram breeding flock).

Stocking rates for our sheep enterprise over the last two years analysed (1999/00 and 2000/01) have been 8.0 and 10.8 DSE per hectare, respectively. This has equated to a 'grazing water use efficiency' of 1.71 and 1.71 DSE per hectare per 100 mm of rainfall, respectively.

In a decision based on detailed farm performance analyses over the last 10 years or so, we are currently in the process of winding up our Merino breeding operation. Based on our benchmarking figures, Merino breeding simply does not stack up against the profitability of our cropping enterprises. As an indication of the relative differences in profitability (full cost allocation), in 2000/01 the average profit generated by our crop enterprises was $205 per hectare higher than that of our Merino breeding enterprise.

Whilst our farm performance analysis have confirmed a significant difference in profitability, the decision to discontinue the sheep enterprise was not easy to make. This was especially so given the devotion to our Merino breeding enterprise and our historical involvement in the sheep industry.

However, we still strongly believe in the need for persisting with a pasture legume phase in the crop rotation to maximise long term cropping profitability. Whilst in our opinion the primary benefit from pastures is the supply of organic nitrogen, they also have a crucial role to play in our herbicide resistance strategy. As such, we now treat pastures as another crop, with livestock grazing as the harvesting and value adding process.

We believe that the dynamics of the nitrogen supplied to our crops in the form of organic nitrogen (compared to fertiliser nitrogen) assists in meeting our aim of maximising grain yield and quality. Organic matter (OM) appears to supply nitrogen in a pattern that better matches crop requirements. This is as a result of both the controlled release of nitrogen throughout the growing season with the mineralisation of OM and the superior distribution of organic nitrogen throughout the soil profile.

Despite the increasing focus on our cropping enterprises, pastures will remain an integral component of our farm business. However, our dilemma is how to profitability utilise the pasture areas during the pasture phase within the crop rotation. We believe that pastures are essential to maintaining long term crop profitability, however pastures need to be profitably utilised in their own right.

As yet we do not have the definitive answer to this dilemma. However we feel that the most profitable option for our business is likely to be based on grazing pastures with a livestock finishing enterprise. This would achieve our aim of maximising livestock profits per hectare of pasture from both high growth rates and opportunistic livestock trading. The livestock enterprise would be based on sheep primarily due to:

- the generally lower capital investment per livestock unit ($/DSE) to fully utilise our carrying capacity,
- existing management expertise and
- less damage to pastures with grazing during wet periods.

CROP ROTATION

Most producers would appreciate the difficulty in defining the 'standard crop rotation' for their property given the differing land capability and production constraints for individual paddocks. However the most common rotation practised on our properties is shown overleaf.

This 9 to 10 year rotation has been implemented for the last 7 years. After some forgettable experiences with grain legume crops in past years, we are trialing chickpeas

Canola[1] - Wheat[2] - Wheat[2] - Canola[1] - Wheat[2] - Triticale[3] - Pasture[4]

1 – Conventional varieties predominantly. Only limited areas of Triazine Tolerant (TT) and Clearfield tolerant varieties trialed to date.

2 – Spring wheat varieties, predominantly – Strzelecki, Sunmist, Cunningham and H45.

3 – Triticale variety: Tahara.

4 – Legume based pasture phase (3 to 4 years), established without a cover crop.

this year. If this trial is successful, we will seek to replace at least 20% of the area in year 4 of the rotation (currently sown to canola) with chickpeas.

The inclusion of a profitable legume mid way through the crop phase of the rotation will provide some nitrogen saving, an opportunity for herbicide rotation and increased enterprise diversity. . Another concern we have is the potential disease risk associated with canola grown in a close rotation (ie. 2 canola crops in 4 years). Grain legumes are therefore being revisited, albeit with great trepidation.

However, we feel that grain legumes do not offer a replacement for a productive pasture phase in our crop rotation. Furthermore, our farm benchmarking figures reveals that wheat is by far our most profitable crop. Whilst we feel that we can grow grain legume crops successfully, the profitability of this crop does not come close to that of wheat, canola and triticale.

TREATING PASTURES AS A CROP-

Whilst our ongoing aim is to have pastures being grazed by livestock, we strongly believe that pastures still need to be treated as a crop. We seek to apply equal attention to the sowing and maintenance of pastures as to that of our crop enterprises. This is because if pastures are to represent a profitable phase of the overall crop rotation and fix maximum levels of organic nitrogen, a high level of management needs to be applied.

The following general management program is applied to the establishment of our pastures.

- Summer fallow spray(s) – as required.
- Stubble from the final crop in the cropping phase (triticale) is burnt late.
- Cultivation with Bourgalt cultivator (2" points on 8" centres).
- Application of Stomp herbicide (incorporated by sowing).
- Sowing: lucerne - L69 (4 kg/ha), subclover – Dalkeith and Seaton Park (2 kg/ha) and arrowleaf clover – Zulu (0.5 kg/ha), sown with 300 kg/ha single superphoshate (26 P: 33 S kg/ha).

Our target density for lucerne, as the key component of the pasture, is 50 plants per square metre. Based on our experience, sowing 4 kg/ha of lucerne normally results in around 50 plants per square metre established entering into the pasture's first summer. Following the second summer, densities have generally been reduced to around 20 to 30 plants per square metre.

The total cost of the above program is estimated as $210 per hectare (before labour costs). This is comparable to the establishment costs for our winter grain crops.

Our pasture maintenance program comprises annual applications of 80 kg per hectare of single super superphoshate (supplying 7 P: 9 S kg/ha). Herbicides are used for weed control as required. Average annual pasture maintenance costs are around $30 per hectare (before labour costs). This gives a total costs for establishment and maintenance of $210 + ($30 x 3) = $300 per hectare for the 4 year pasture phase.

As a strict policy, no grass selective herbicides (Group A) are utilised during the pasture phase. Where grass weed control is required, grazing management and spray topping with paraquat is used. We have found that by using the broad grazing strategies recommended by the Sustainable Grazing Systems (SGS) initiative, we have been able to successfully suppress annual grass weeds in our relatively short pasture phases.

CROP AND PASTURE NUTRITION BENCHMARKS

Phosphorus (P) inputs at sowing for pastures are based on results of shallow soil tests (0-10 cm). In paddocks with low P levels (ie. less than 20 mg/kg Colwell P) up to 300 kg/ha of SuPerfect (supplying 27 P: 33 S kg/ha) are applied by banding under the seed. With the high P rates applied at sowing, the P rates for annual top-dressing have been reduced. This reflects our belief that banding is a more efficient method of supplying P requirements, compared to topdressing.

In the cropping phase, nitrogen, phosphorus and sulfur rates are based on results from soil testing (both shallow and deep sampling) and target crop yields. As a result, rates of applied nutrients often vary significantly both from paddock to paddock and between years for individual paddocks. Target yields for crops include 4.00 t/ha for wheat (at 11% protein) and 2.0 t/ha for canola.

Both pre-sowing and top dressing is used for the application of nitrogen (N). Topdressing is used as a risk management tool, allowing us to minimise or top up the supply of N to our crops depending on yield potential. Yield potential's are based on predicted crop water use efficiency (WUE) and crop available water. Tools such as the Southern Ocellation Index (SOI) and Australian Rainman have been used to assess likely levels of crop available water.

As cropping rotations lengthen, efficient N management will be crucial.

We have measured up to 250kg/ha total N with deep soil testing (0 – 100 cm) after pasture phases. The amount of N present after a pasture phase depends primarily on dry matter production during the pasture phase, timing of fallow commencement and soil moisture levels during the fallow period. It is hoped the organic N derived from the lucerne component of the pasture will last well into the second or third year of the cropping phase depending on crop N removal.

PASTURE GROWTH

In the management of our pastures we strive to maximise pasture dry matter production.

We were fortunate to be part of the recently completed, Central West Farming Systems (CWFS) pasture survey. This survey was conducted by Dr Alison Bowman over the period spring 1999 to spring 2001. The survey collated data on species composition and dry matter production from pasture cages located in pastures throughout Central West NSW. Figure 2 summarises a comparison of our results (Paddocks 1 & 2) against the average result for the survey.

Lucerne plant counts for our paddocks corresponding to the above survey period are shown below in Table 1. Key soil test results (samples collected January 1997) for each paddock are also shown in Table 1.

Actual rainfall figures corresponding to the period of the survey for our home property are shown below (Figure 3).

Figure 2: CWFS Pasture Survey results for lucerne + sub clover pastures

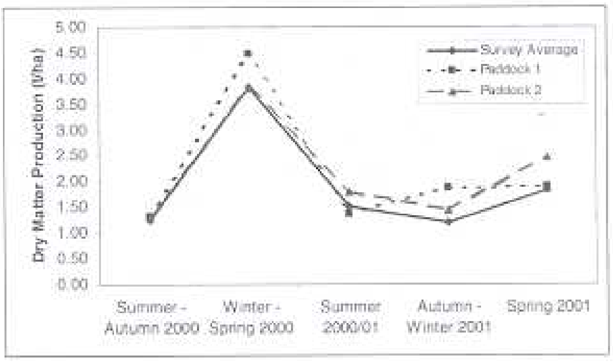


Figure 3: Actual monthly rainfall "Oakleigh" – Jan 2000 to Oct 2001

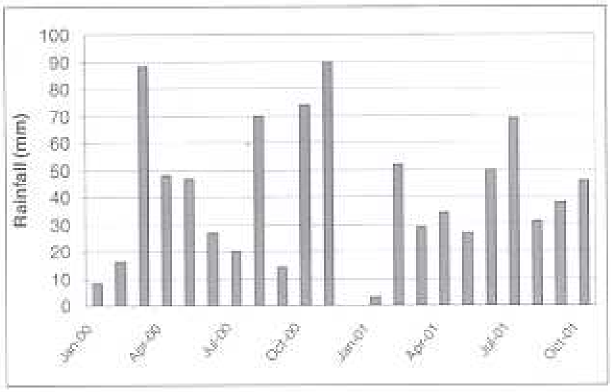


Table 1: Soil test results and lucerne plant counts – "Oakleigh"

Paddock	1997 Soil Test Results					Lucerne Plant Counts (/m²)				
	pH (CaCl2)	CEC	Exch. Al %	P – Colwell (mg/kg)	Ca:Mg Ratio	Summer - autumn 2000	Winter - spring 2000	Summer 2000/01	Autumn - winter 2001	Spring 2001
1	4.5	6.60	5.0%	28	3.35	19	N/a	19	N/a	12
2	4.2	8.4%	4.75	38	3.41	17	N/a	18	N/a	8