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PASTURES IN THE CROPPING ZONE:

Twenty years of lucerne management

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"Waerawi", Old Junee

Summary: Lucerne has a central role in increasing productivity, profitability and sustainability on our 1,888 ha property near Junee in southern NSW. The farm, run as a family partnership, comprises a number of enterprises, namely: cropping (cereals, canola and grain legumes), livestock (self replacing merino flock), hay (lucerne) and seed (registered cereal, canola and grain legume seed). The adoption of lucerne has meant changes in the rotations that require constant monitoring and changes to the whole farm plan. The practices and principles of the agronomy and management of the rotation are described. Lucerne underpins a more profitable farming system *e.g.* double the stocking rates over comparable annual-based pasture systems. The benefits of lucerne, when combined with liming, go beyond pasture production and effect crop choice, crop yield and sustainability.

Our farm is a family partnership of Hart Brothers situated 60 km north of Wagga in the Junee shire in southern NSW. The long term annual average rainfall is 525 mm. The property is made up of what were originally six smaller holdings and is currently 1888 ha in two blocks of 880 ha ("Carinya") and 1008 ha ("Waerawi") separated by 13 km. Soils are principally red-brown earths that had acidified during the middle part of this century. The farm was subdivided into large paddocks (100-200 ha) but is now made up of 84 paddocks (each 20-30 ha in size).

The farm currently runs four enterprises:

Cropping -	wheat, tritcale, canola, lupin, fieldpea, chickpeas
Livestock -	self replacing merino flock with 25% wether component
Hay	lucerne bales sold off farm
Seed	registered seed of above crops

We view and monitor each of these enterprises separately in order to maximise whole farm profitability. For example the present mix of commodity prices has meant that in 1996 we are cropping approximately 72% of our country. In former years when the wool price was high relative to that of wheat, only 40% of the land area would have been in crop. However, we take into account more than short-term shifts in commodity prices in determining the ratio of crop to pastures. Other major issue taken into account relate to the benefits of the pasture phase to the whole system. These benefits include improvements to soil structure, erosion control and weed management, increased nitrogen carryover and efficient use of water. We have found that only a pasture system based on lucerne can achieve both high levels of production as well as the benefits mentioned.

The lucerne system we have developed originated on "Carinya" in the early seventies on advice from Roger Southwood and Des Fitzgerald from the Department of Agriculture. At this time we found ourselves on a steep learning curve getting lucerne established in our cropping system particularly with regard to the use of lime. We were further hampered by the arrival of the aphids in 1978. Hence, real gains were not apparent for the first 6 or so years. In contrast, for the more recent development of "Waerawi", we have found that by using a checklist developed on the farm, paying attention to detail, adopting current varieties and latest management techniques, we have been able to achieve the same levels (stocking rates and wool cuts/ha) as on "Carinya" from the first year.

There are four planks that underpin the role of lucerne in the farming system:

- Lucerne drives the rotation;
- Lucerne systems require monitoring;
- Lucerne changes the whole farm plan; and
- Lucerne underpins a more profitable farming system.

Lucerne drives the rotation

In order to adopt lucerne an attitude change needs to take place. Simply put, wherever crop can grow so too must lucerne. A typical rotation is. Wheat - Canola - Wheat -Grain legume - Wheat - Canola (undersown with lucerne) followed by three years of pasture. By sowing wheat as the first crop this allows a lower cost canola crop in the 2nd year and better weed management as both fumitory and lucerne removal can be a problem in canola.

Establishment

We view lucerne as another crop with its own specific needs and have developed a check list to help us make sure we do the job right (Table 1). Careful planning of weed control in the previous crops allows easy management of undersown lucerne pastures. As a precaution against wireweed, treflan from 1.5-2.5 L/ha plus 175 g Mo are applied presowing. Pasture is established under cover crops. We have found that the selection of cover crop is not critical *i.e.* lupin, triticale, wheat and canola have all been successfully used. At present it is more convenient and profitable to establish under canola. Cover crop rates depend on the crop type eg. 1.5 - 2 kg/ha canola, 12-15/kg/ha for cereal but the golden rule is the cover crop rate must be must conservative. Under these crops we sow 1.5-2 kg/ha lucerne (highly winter active varieties eg. Sceptre, Pioneer 5929) and 5 kg/ha sub clover (2.5 Dalkeith and 2.5 Junee) all inoculated, lime pelleted and lucerne is apron treated.

In recent years the addition of cocksfoot (Kara) has proven beneficial in stocking rate and feed composition. In one of our lucerne grazing rotations the inclusion of cocksfoot in 2 out of 4 paddocks has noticeably increased the stocking rate. In future we intend to experiment with chicory in the mix - to provide a more balanced feed supply - sheep tend to get sick of lucerne only! Our reluctance to more widely include cocksfoot is due to not knowing whether it will be an alternative host for take-all reducing first crop choice.

We sow the pasture seed through a small seed box which has been extended beyond the harrows dropping onto a level surface and covered using heavy mesh or jute bags as a trailing blanket. Pastures are undersown with 200 kg/ha of Starter-15 (Granlock 15, N-29, P-24, S-24). This is followed by a bare ground spray for earth mite control.

First grazing - remembering lucerne now drives the rotation a light grazing to help establish the slower plants is essential as soon as practical after harvest. Grazing at this time encourages crown development and removes feed source for Rutherglen bugs.

Management

After the initial grazing, the second grazing should commence when suitable summer rain/thunderstorms occur on a strict 2 weeks on - 6 weeks off rotation. The critical grazing time and management revolves around what you consider to be the autumn break. At this time remove stock off all lucerne pastures being used for winter grazing for at least three weeks or until there are three to four true leaves on the sub clover. Stock are removed to stubbles and supplementary fed if needed. This is when direct drilling and stubble retention also contribute to the whole farm system. The reason why this is absolutely critical is that leaf area index (ratio of leaf are to ground area) sets the rate of winter production.

Table 1. Key checks for getting lucerne established.

Check	Notes
1 Soil Test	Soil testing prior to liming includes 2 cores per ha for CEC, pH and P usually in wettest part of year. Test again at end of pasture
2 Lime	No lime, No Lucerne. Lime if pH below 5.0-5.4. Lime applied 12 months in advance if possible or at least 3 months. Spread F-70 grade incorporate to 10 cm or chisel plough hard pan. Check for hard pan.
3 Protection from weeds	Red earths are the home of fumitory and wireweed, use pre-emergent herbicides, *e.g.* Treflan® yield and Mo (175 g/ha) at the same time.
4 Treat seed	Inoculate all legumes, apron treat lucerne seed, lime coat (Plastaid®) screen for lumps or purchase commercial mixture.
5 Sowing and fertiliser	Seed rates need to suit sowing equipment, where you farm, cover crop, autumn/spring planting. Pasture sowing rates: range 1-4 kg/ha lucerne, 2-6 kg/ha clovers, 0.2-1 kg/ha cocksfoot, phalaris etc. Cover crop rate must be reduced to ensure establishment every year. For cereals sow 1 kg/ha for every 30-40 mm rainfall, canola 1.5-2 kg/ha, lupins aim for about 20 plant/m^2. Apply ample fertiliser but use a compound starter to apply at least 25 unit of P some N and S.
6 Protect from Insects	Ensure survival while you plant the rest of the crop by using a bare ground RLEM spray.

The higher the leaf area the faster the rate of growth. During spring a three paddock system or even 2 is utilised. Hay is cut from the remaining areas to achieve weed control and utilisation of surplus production. As lucerne drives the system, it is most important during that it does not become rank during spring or get swamped by other pasture species in the establishment year.

A method to manage ewe body weight is to advance weaners/hoggets for one week into each paddock followed by one week with ewes. This achieves lower ewe body weight and high growth rates from the hoggets and at the same time weed control is improved as the ewes clean up what the hoggets leave. Mobs are divided into units to fit the grazing unit (made up of four paddocks) size. At present there are four ewe mobs totalling 2065 and two hogget mobs totalling 1944. Other than maiden ewes, there is no age group separation. The need to have flexibility in mob size overrides any advantages in age segregation. Wethers (900) are not allocated to paddocks but are used on hill tops, timber areas and to clean up following other stock.

No fertiliser is applied during the pasture phase because there is enough P and S to achieve a Bray P of 50 during the cropping phase using Starter 15. In paddocks that have been heavily cut for hay some fertiliser (100 kg/ha single super) may need to be spread in the following autumn depending on the soil test and usually in the last year before crop.

Over the last 15 years we have not had to use herbicides during the pasture phase for weed management such as capeweed and saffron thistles. However, all paddocks that contain silver grass are either winter cleaned or spring spray-topped the year before going into crop.

While lucerne presents many advantages one difficulty is elimination before resuming the cropping phase. Lucerne must be eliminated before using stored soil water at least by autumn. Our current practice is to set-stock at the highest possible stocking rate, the spring before first crop and manipulate using 2,4-D and other chemicals (*e.g.* Lontrel, Round-up) to further weaken after summer rainfall events. Mechanical cultivation such as disc plowing and off-set discing are satisfactory but are unacceptable because the crown trash interferes with sowing operations, at present other methods are needed. Our experiences with set-stocking during spring are an indication that the current varieties could be adaptable to a less rigid grazing management regime.

Lucerne systems require monitoring

Pasture

In the management package outlined above, development of leaf area after the autumn break was flagged as a key management strategy to maximise winter production. All new pasture paddocks are monitored for clover development, lucerne/clover/cocksfoot density and weed levels during the first autumn and thereafter when considered necessary. If there is a problem, we know what we started with and this helps in decision making. Each grazing unit is monitored for stocking rate and those that are not performing can be put into crop "before time" if required allowing more productive pastures to be maintained.

Livestock

It is quite easy to measure wool cut per ha, stocking rate, fibre diameter and gross returns. Figure 1 details these measurements from 1974-1994. It shows consistent increases in carrying capacity and wool yield while fibre diameter has on average remained at around 22.5 microns. From the late '70's to the mid '80s there was a consistent increase in the value of wool sold but of later times the markets have played havoc with this. The advantage in this monitoring is that it allows you to make adjustments to the system and watch their effects. One example is that in 1995 we moved lambing to August-September when feed is more available, with lucerne it is not difficult to carry lambs over summer as it is with normal pastures. By monitoring we have been able to compare percent-ages with

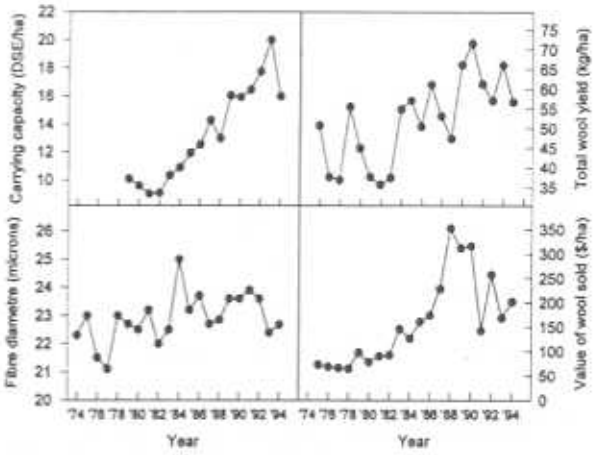

Figure 1. Performance of wool producing enterprises based on lucerne pastures from 1974-1994.

previous years and found that % lambing (June-July) increased form an average of 76% over '92-'94 to 101% in August-September 1995. Sustained high production in this pasture system has allowed investment in lime, fertiliser and subdivision but other pay-offs flow through into the cropping system.

Crops

Lucerne as a nitrogen (N) fixing legume is able to put large quantities of N into the soil. Surface N is tested in the spring before first crop. Deep soil N testing is carried out as close as possible to planting or immediately after to a depth of 60 cm-100 cm. Fertiliser rates for N are then worked out using these figures. We feel that a rotation using wheat first followed by canola is picking up both shallow and deep N as it becomes available.

Soil/Soil water

While not closely monitoring soil we have noticed that lucerne based pastures have improved soil water infiltration, soil structure, decreased erosion and run-off and attracted more earthworms. Likewise in one case lucerne had reduced the number of seepages in one paddock from 7 to 1. pH is tested on all paddocks in the spring before first crop. Most paddocks are limed every 5-8 years depending on their place in the rotation. Liming pays by the flexibility of the rotation to include canola and the massive improvements in pasture production, *i.e.* more productive livestock and more N for crops. As mentioned above hay paddocks are monitored for soil P in case further applications of super are required.

Lucerne drives the whole farm plan

We have had to make significant changes to a number of on farm practices to adopt a lucerne-based system:

- **Subdivision** - these are based on soil type and land class. This combined with the need for rotational grazing has meant smaller subdivision.
- **Mob size** - mobs have had to be combined into all age groups to run in separate rotations.
- **Lime** - an initial expense that was required before lucerne could be adopted on all areas and allowed a more diverse number of crops to be grown.
- **Water supply** - reticulated water supply is required to maintain carrying capacity and grazing pressure. Dams in lucerne paddocks have proved inadequate as they catch much less water than in annual pasture systems

Table 2. Grass margins ($/ha) for each of the main the enterprises

Year	Enterprise Gross Margins			
	Wheat ($/ha)	Canola ($/ha)	Field peas ($/ha)	Livestock and hay* ($/ha)
1985	107	218	231	169
1986	169	70	194	228
1987	187	72	92	241
1988	114	163	-32	307
1989	365	404	280	314
1990	150	381	363	293
1991	422	151	51	162
1992	633	474	390	249
1993	392	407	373	169
1994	-18	-205	-32	116

* after 1987 lime costs are debited against the livestock and hay enterprise.

Lucerne drives a more profitable system

The high stocking rates and production levels in Figure 1 result in a more profitable livestock enterprise. This year (1996) is not a good year to analyse returns from crop and livestock systems with wheat at record prices and livestock rock bottom. However, a comparison of the major farm enterprises from 1985-1994 shows that while the returns are variable the livestock enterprises are still comparatively very profitable (Table 2).

The year with the worst return from livestock was 1995 (not shown in Table 2) but this was still viable as gross margins were $84/ha and overheads $89/ha. Without lucerne, *i.e.* half the stocking rate, a loss of over $45/ha would have been the result. Viewing these figures, it should be remembered that pastures make a sizeable contribution to the cropping enterprise but the only exchange is in fertiliser and lime. The hay enterprise often pro-vides small but valuable income yet also contributes in terms of pasture management, crop weed levels and extra income and therefore also contributes to whole-farm profitability. Smaller paddocks allow the stock to manage the pasture rather than the part of a paddock managing the stock. Also smaller paddocks allow treeline planting as part of the system reducing the cost.

Lime may be seen as an expensive input but without it productivity and profitability would quickly decline. In Table 3, I have put in the returns from liming a typical paddock on the property.

Conclusion

Pastures will always remain a poor cousin to crops while ever we fail to measure and monitor.

Table 3. Returns from liming and lucerne.

		Cost/ Return ($/ha)
Costs	F70 lime spread at 2.5 t/ha @$54/t	-135
Returns	***(Comparisons limed v unlimed)***	
Year 1	Canola 2.4 t/ha @$410/t *versus* triticale 4 t/ha @180/t	264
Year 2	Wheat extra 1 t/ha @200/t	200
Year 3	Grain legumes no difference	0
Year 4	Wheat (undersown) extra 0.5 t/ha @200/t	100
Pasture (3 yrs)	Lucerne increases stocking rate 6 DSE/ha/yr @$12/DSE	216
	Net return	645
	Net return per year	92

Lucerne responds to management at the came level as "Canolacheck" or "Topcrop".

A half-hearted wheat crop is easily measured against the best crop that you have and some action will certainly be taken, a poor pasture still carries some stock and generally goes unnoticed. It takes very little time to measure this poor performance. Start now, expect a few false starts, these you will overcome quickly as you monitor. Fine tune your best paddocks and let these generate the income to tackle the next lot. Till the cycle changes 20-25% of crop land under lucerne for total farm sustainability is a small price to pay.

Remember to greet each morning by saying **"I will plant more lucerne"**.