Pasture Productivity in Central West NSW

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Overview:
Pastures has two roles in a farming system; in cropping and livestock.
Pastures are valuable to cropping enterprises as they improve soil structure, fix nitrogen (legume based), reduce risk of herbicide resistance in weeds and provide a disease break in the rotation. Soil structure benefits are mainly in the topsoil so direct drilling into sprayed out pasture is the best way of maintaining soil structure benefits. Plant density of lucerne stands is the key to optimising N fixation and undersowing is a compromise in this respect. Annual grass species can be spray topped with different chemicals to those used in the cropping phase to reduce the risk of herbicide resistance and spraying out grasses is important to prevent them carrying cereal diseases.
Grazing pastures based on native and/or naturalised species should be managed to maintain a useful balance of these species. The Pasture Productivity Survey, a new project for CWFS and NSW Agriculture will improve pasture assessment skills of those involved, quantify pasture quality and identify factors which determine productivity.

The Role of Pastures

Pastures have a role to play in 2 major parts of your whole farming system - in the livestock enterprise and/or in the cropping enterprise.

Pastures In The Cropping System

1. Benefit to soil structure

The majority of dryland farming in central west NSW is carried out on hardsetting red soils. These soils are inherently low in organic matter and prone to structural degradation, including crusting and hardsetting. Work funded by GRDC and carried out by NSW Agriculture over the past 6 years at Trangie, Narromine and Nyngan has investigated the role different types of pasture leys can play in ameliorating these problems.

The study found that the rate of soil structural improvement under the pasture leys was slow in this environment and in general confined to the topsoil. There were significant increases in organic carbon and this correlated to increased available nitrogen (N) levels. There was also a significant relationship between increasing organic carbon and increasing aggregate stability of the soil. Larger soil aggregate size means the soil is less likely to crust and hardset and that infiltration is improved. This change in aggregate stability was effective to a depth of 20cm under perennial pastures.

Because the improvements are however mainly in the surface layers one cultivation event at an inappropriate time could significantly reduce the benefit of the leys. A direct drilling system to get cereal seed into sprayed out pasture would be the most appropriate system to maintain any soil structural benefits into the cereal phase.

2. N fixation

In conjunction with the work described above we have also been studying, with Dr Mark

Peoples from CSIRO, N inputs from dryland lucerne stands in the Trangie district.

Plant density has been found to be the key to optimising N fixation from the pasture phase for the following crop. If plant density of a lucerne stand is maintained at 8 plants/m^2 and above you can expect to grow 3 to 3.5 t/ha of above ground dry matter per year.

We have measured fixation levels of 20 kg of N for every tonne of above ground dry matter grown. Estimates tell us that you get almost that much again from below ground growth. Therefore for 3 tonnes of lucerne drymatter you are getting around 120kg of N being fixed per year. By knowing how much N you will need at the start of the cropping cycle to grow a crop of a certain yield and protein you can quickly calculate how many years of pasture are required to meet that N need.

The key point from the work is that it is not the age of the lucerne stand that is important but the plant density. So if a newly sown stand establishes poorly (8 plants/m^2 or below) then it is unlikely to be of much benefit in optimising N input for the following crops. The same applies if plant density drops rapidly during a drought period. In both cases if the primary reason for the pasture is to fix biological N for the next crop then the farmer is better off the resow the pasture and manage it appropriately to maintain it at a higher density.

Remember if you have an annual legume in the mixture it will also produce a bulk of dry matter in spring that will add an extra pulse of N. The same rule of thumb, 20 kg N for every tonne of above ground dry matter, could then be used to work out the benefit from the annual legume growth. Data from these experiments shows we can expect around 0.5 t/ha of drymatter per year from medics such as Sephi for example.

3. Wheat Crop Response To Pasture Leys

The response of two years of wheat following 5 year pasture leys (removed in July 1996) at Trangie and Nyngan is shown in Table 1. This data shows that using a lucerne based pasture is still the optimum in terms of maximising wheat yield and protein. So although some significant benefits were found in terms of soil structure improvements by using a perennial grass in the pasture phase, these benefits were not reflected in the following wheat crop response.

At both sites wheat yields and protein following lucerne or a lucerne based mix were high. Yields and protein following lovegrass alone or lovegrass and medic mixtures were the lowest. The fallow plots (which were actually fallowed for the whole 5 years of the pasture phase) maintained reasonable yields and protein for 2 years, despite 1998 being a very wet year where nitrate leaching probably occurred.

It is important to note that at both sites the lucerne + lovegrass mix produced much higher yields in the second year, relatively to the other leys, than in the first. It is likely that two things occurred here, one that lucerne fixes N to depth and often a cereal response is picked up in the second year following lucerne when this resource is tapped into, secondly the lovegrass probably used up N being fixed by the lucerne during the pasture phase but this was not available until the lovegrass material started to break down, which would occur much more slowly than for the annual grasses or legume species.

Table 1. Summary of Harvest Data - 1997 and 1998
Wheat yield and protein following 5 years of pasture leys (sprayed out from July 1996) at 2 sites

1. "Gordon Park " - Trangie

		Love grass	Lucerne + Love grass	Medic + Love grass	Rye grass	Medic + Rye grass	Lucerne + Rye grass	Fallow
Yield (t/ha)	**1997**	1.23	1.39	1.22	1.45	1.55	1.60	1.33
Yield (t/ha)	**1998**	1.90	2.58	2.16	2.38	2.52	3.24	2.44
Protein (%)	**1997**	11.5	**14.7**	12.0	14.0	14.3	14.3	14.8
Protein (%)	**1998**	9.8	10.2	9.8	**9.7**	10.2	11.1	10.2

2. "Tyrone" - Nyngan

		Lucerne	Medic	Lucerne + Medics	Love grass	Lucerne + Love grass	Medic + Love grass	Fallow
Yield (t/ha)	**1997**	2.09	1.84	1.40	1.08	1.76	1.20	1.24
Yield (t/ha)	**1998**	3.45	2.33	3.09	1.78	3.26	2.13	2.38
Protein (%)	**1997**	14.5	13.0	15.3	13.2	13.8	12.9	14.3
Protein (%)	**1998**	11.8	11.4	11.0	10.9	11.4	11.0	11.1

3. Herbicide Resistance - A Problem For The Future

Herbicide resistant weeds, particularly annual grasses, are an increasing problem in farming regions. The incorporation of a pasture phase into the cropping system allows the opportunity to spray top to control seeding of annual species with a different combination of herbicides to those used in the crop component of the system. The example from SA below shows the benefit of this system where such weeds are problem.

Table 2 - Reduction in the ryegrass seed bank with the use of a pasture phase in combination with spray-topping from a paddock in SA.

1995 autumn - 12,000 ryegrass seeds/m in continuously cropped paddock

1996 - 20,000 seeds/m^2 (despite four grass herbicide applications) **1996**

to 1998 - two years of pasture, with 3 spray-topping applications **1998** -

1,300 ryegrass seeds/m^2

The cost/benefit of using pastures in this system needs to be considered in the light of depressed livestock prices but there would also be the benefit of increased soil N in the pasture phase as well as a decreased chemical cost with time. Evaluation of this system therefore needs to be on the complete rotation not a single crop in the rotation.

4. Disease Break In The Rotation

Pastures are one rotation option, as are canola, grain legumes etc, that can be used to lower levels of disease inoculum carried over by continuous cropping. However remember annual grasses in a pasture phase can carry cereal diseases too so they need to be sprayed out early (eg) winter clean lucerne pastures the year before going back to crop.

5. Grazing Value

It is important to note that even in times of depressed livestock prices the grazing value gained from pasture sown in a cropping system is still of economic benefit to the landholder.

***6. Pasture Establishment** Issues*

High density plant populations with good early ground cover are often the key to successful pasture establishment. In this region it is typical to use a cover crop when sowing pasture however this can often have a negative impact on pasture establishment. An example of this is shown in Table 3 where not only pasture plant populations were suppressed with the use of a cover crop but also dry matter production in the first year after sowing.

A lucerne/medic mix was sown at 4kg/ha with and without a cover crop of Yarran oats at 20 kg/ha on the 11.5.98.

Table 3 Results of pasture establishment work at Trangie

	with cover crop			**no cover crop**	
	lucerne	**medic**		**lucerne**	**medic**
Plants/m^2 at 3.7.98	**12**	**18**		**16**	**29**
Pasture yield by 5.1.99	**1.29** t/ha			3.48 t/ha	

Pastures In The Livestock System

Most extensive livestock grazing in the region is carried out on pasture based on native and/or naturalised species - mainly native perennial grasslands that have a large component of naturalised medics, sub clover, other forbs and annual grasses. The benefit of each of these components needs to be understood if grazing management strategies are to be applied appropriately.

1. Perennial Species/Annual Species

Perennial species, in this case perennial grasses, maintain the system. They provide feed and ground cover over dry periods. The feed value of most of these grasses is not high except at certain times, for example when there are fresh green shoots. Summer growing perennial grasses in particular are not high protein or highly digestible feed, but they do provide maintenance rations. The annual species in the mix provide the feed quality and are the basis of fattening stock or supporting lactating stock.

Grazing to maintain a useful balance of these species is the key.

2. How Do We Manage This System?

There is very little information to provide the basis for developing- grazing strategies for native species based pastures in this region. It is known that spelling or resting summer growing grasses in some years to allow seed set is important. There also needs to be a period where new grass seedlings can establish without being removed by grazing animals.

If pastures are already in good condition, with a base of desirable perennial species that will maintain ground cover during dry periods, management needs to aim at keeping them there and minimising the invasion by annual and perennial weeds. Maintaining perennial grasses often depends on utilisation levels of those grasses, around 30% utilisation per annum is a figure often quoted for some species. This might seem low but most of the weight in perennial grass species is at the base of the plant so they can be eaten quite low but still not over utilised.

3. Indicator Species And Their Response

Knowing which are the important species in the pasture is the key. Being able to recognise desirable and undesirable species and know whether they are increasing or decreasing in the paddock is important. The value of annual species should also be accounted for and the desirable and undesirable ones know to the landholder. The response of different species to grazing is also important and is gained mainly through landholder observation.