Dual-purpose crops, forage crops or oversowing pastures – how to manage feed supply post drought

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Keywords

- Dual-purpose crops, forage crops, pasture lucerne, subterranean clover, density, post drought.

Take home messages

- Using dual purpose crops increases management options to allow post drought recovery.
- Assess pastures on density before the start of season.
- Determine the area of pasture and crops required.

Introduction

Grain producers have become more proficient alt is critical that a whole farm feed budget be created to determine the requirement of feed for the year. This should include dual-purpose crops as they can supply livestock requirements from May to mid-August depending on the season. Environmental stresses such as drought can significantly decrease the density and forage production from existing pasture stands. Assessing a pastures density and its ability to recover from drought is essential for the forage production and long-term viability of the pasture stand. If pastures are degraded dual-purpose crops can provide a good source of feed allowing the existing pastures to recover post drought.

The primary species used in pastures in the mixed farming zone is lucerne and subterranean clover. Lucerne is a perennial legume species that does not recruit seedlings in the field and the population tends to decline over time. Persistence of a lucerne pasture is related to the density of lucerne plants. Environmental stresses such as drought can significantly decrease the density of a lucerne stand. Therefore, a critical density measurement of lucerne can be used to determine if management is required.

In comparison, annual legume species such as subterranean clover rely on the development of a seed bank. As part of the annual cycle, seeds are set each year and the maintenance of the seed bank is essential for maintaining the productivity of the pasture. Determining seed bank levels is difficult but it is likely that following two dry springs that there will have been a severe reduction in the pasture legume seed bank.

Determining a benchmark for lucerne density.

When sufficient soil water is available, lucerne production is limited by the amount of light that is intercepted. These conditions can occur in many dryland areas in spring and it is lucerne density that will limit the amount of light intercepted by the crop, and therefore, limit production. Maximum production under irrigation can be achieved with a lucerne density of 30 plants/m^2 (Palmer and Wynn-Williams 1976). Within the mixed farming zone densities between 20-40 plants/m^2 are sufficient for maximum production (Dear et al 2007; Dolling et al

2011). This may seem low particularly in comparison to the number of plants sown but the population of lucerne declines over time and does not recruit seedlings. When lower lucerne densities occur a companion species such as subterranean clover can intercept light thereby increasing pasture production during periods of adequate soil water. Wolfe and Southwood (1980) suggested that at Wagga Wagga, NSW that 10 lucerne plants/m^2 was adequate when lucerne was sown with a companion species such as subterranean clover.

Under low rainfall conditions the plant density required for maximum production is likely to be lower. Virgona (2003) demonstrated that lucerne density of 12 plants/m^2 could deplete the soil water to equivalent levels as higher densities. Presuming that water use is strongly related to lucerne growth that may indicate that 12 plants/m^2 could produce similar levels of biomass under water limited conditions as that produced with sufficient water. Similarly, at a low rainfall site at Trangie and Condobolin, Bowman et al (2002) demonstrated that 8 plants/m^2 was the critical value for maximum production below which lucerne biomass production decreased.

Mccormick (2017) conducted a paddock survey in the Temora region and measured species' frequency. This was conducted using a 50cm x 50cm quad across a paddock 50 times and a species was observed to be present or absent. This quick assessment demonstrated that a species frequency of 50% limited that species to producing a maximum of 20% of the pasture biomass. The species frequency would need to be at 80% to be able to produce 50% of the biomass. Converting frequency data to density is problematic but if it was assumed there was 1-2 plants at a frequency of 80% (50cm x 50cm quad) that would lead to densities of approximately 3 plants/m^2 to 6.5 plants/m^2. Under this situation companion species would be required to contribute to biomass to meet livestock feed requirements but in degraded pastures it is likely to be weeds.

Companion species in lucerne pastures

Subterranean clover or other annual clovers are the most useful companion species due to the quality of feed produced and their nitrogen fixation ability. Research has indicated that 1000 seedlings/m^2 is sufficient for maximum pasture production from subterranean clover (Silsbury and Fukai, 1977). Environmental conditions and perennial density influence seed production. Drought can lower the seed bank level of companion species. Other species can also be important in lucerne pastures. For example, barley grass can provide important feed early in the season but in spring quality will decrease and animals may be injured due to grass seeds. Consequently, barley grass should be controlled in the winter which will reduce its contribution to pasture production. Annual ryegrass can also be a very useful pasture species in a lucerne stand due to high growth rate and high quality. If the pasture is likely to be returned to annual crops in the next two years, the annual ryegrass should be spray-topped in the spring time to reduce seed set.

Utilising dual-purpose crops in the farming system

Dual-purpose crops are a critical component for feed supply on mixed farms. Dual-purpose crops can support approximately 20-30 dry sheep equivalent (DSE)/ha during the winter period provided there is sufficient soil water. Dove et al (2015) demonstrated in a trial near Canberra that deferred grazing of pasture due to the grazing of dual-purpose crops led to increased pasture production. Not using dual-purpose crops will increase grazing pressure on degraded pastures increasing the requirement for supplementary feed. To offset the requirements for pastures during autumn and winter and also to maximise growth for dual-purpose crops it is essential to follow the best management practices including:

1. Select a paddock with a history of low weed pressure.
2. Ensure paddock has had strict weed control during the fallow period as to ensure greatest soil water storage.
3. Plan to sow early. Earlier sowing increases biomass accumulation. Canola can be sown from late February to April. Wheat can be sown from March to May. Early sowing does increase risk of moisture stress.
4. Select a true winter type cultivar to enable early sowing.
5. Provide sufficient nitrogen.
6. Provide mineral supplements with dual-purpose wheat. Not for canola

Decision making for the year ahead

As sowing time approaches growers will be trying to determine how much pasture to sow as well as what management strategies can be used in existing pastures. Pasture removal should be for those pastures that have degraded over the last season and that are unlikely to be productive in the year ahead. Firstly all pastures should be assessed for lucerne density. This can be done by using a 50cm x 50cm quad randomly placed 30 times across the paddock. Determining actual plant numbers can be difficult in higher density stands as individual plants that are close together cannot be distinguished other than by digging up and counting tap roots. Paddocks should be ranked depending on density.

Companion species can also be assessed. This could be done using residue from last year i.e. grass seed heads or sub clover burrs. Very small areas (<1m^2) could also be wet up from March to determine the number of seedlings that emerge. It is difficult to determine a critical value for subterranean clover seedling density. After the previous two dry springs it is unlikely that any paddocks will reach the critical number of 1000 plants/m^2. Comparing a density to that achieved after a low sowing rate of subterranean clover would result in a critical value of 75 plants/m^2. There would be no point re-sowing subterranean clover if the existing density was already greater than that which could be achieved by re-sowing.

In discussion with the grower determine the area of pasture required. At the most basic level discuss with the manager how many hectares of pasture they normally have to supply sufficient feed for livestock. McCormick et al (2012) calculated an average stocking rate for pasture areas on mixed farms from a survey to be 11 DSE/ha. A simple feed budget could be constructed to determine the livestock requirement for different periods in the season. This could be done with simple online tools such as the Evergraze Feed Calculator (https://www.evergraze.com.au/library-content/feedbase-planning-and-budgeting-tool/) or simple estimation using 3-4% of body weight for growing/lactating animals. Ascertaining the time of season when pasture growth will be most limiting will aid in choosing the most appropriate management strategy. If dual-purpose crops are used extensively on-farm, then animal requirement could be met by these crops from May to mid-August depending on the break of season. Calculate the area required to be sown for dual-purpose crops using the number of ewes on farm and an estimated stocking rate of 20 DSE/ha. Be aware that the DSE rating of a pregnant or lactating ewe can vary from 1.5 – 4 DSE depending on breed and weight of animal. The area required for dual-purpose crops also depends on the timing of the break. An early rainfall event with early sowing accumulates more biomass, and therefore, less area is needed. In comparison a late break would require larger areas of dual-purpose crops to be sown to have the same effect. With the use of dual-purpose crops, it is likely that degraded pastures will be limiting production immediately after the break in season (late autumn) and from August to September after grazing has ceased on the dual-purpose crops. Identifying production limitations will help with selection of the best management option.

The decision tree (Figure 1) outlines different options that are available for paddocks depending on the density of lucerne determined.

Options for pasture renovation

There are a number of options in response to pastures that have a low density of lucerne. It is recommended not to re-sow lucerne back into old lucerne stands due to disease and autotoxicity (Kehr 1983). Pastures could be over sown with subterranean clover or a cereal to increase forage production. Alternatively the pasture could be removed to sow an annual crop.

Using the decision support tree (Figure 1) will lead to the following various options:

- Option 1 - Remove pasture and sow crop for current year.

  If there is no requirement for the pasture, or forage can be supplemented elsewhere with sown cereals (Option 2) then this paddock should be brought back into the cropping phase.

  Opportunities – Moves the paddock into the cropping phase.

  Limitations – If pasture is still present in autumn it is likely that the soil has not stored summer rainfall and the lucerne will be difficult to remove. Crop yield maybe reduced. Does not provide any extra pasture.

- Option 2 - Keep pasture and sow cereal for grazing, hay or grain.

  Cereals can be successfully direct drilled into lucerne stands. Dry sowing can be an option but should not be undertaken too early as lucerne will compete strongly for moisture in

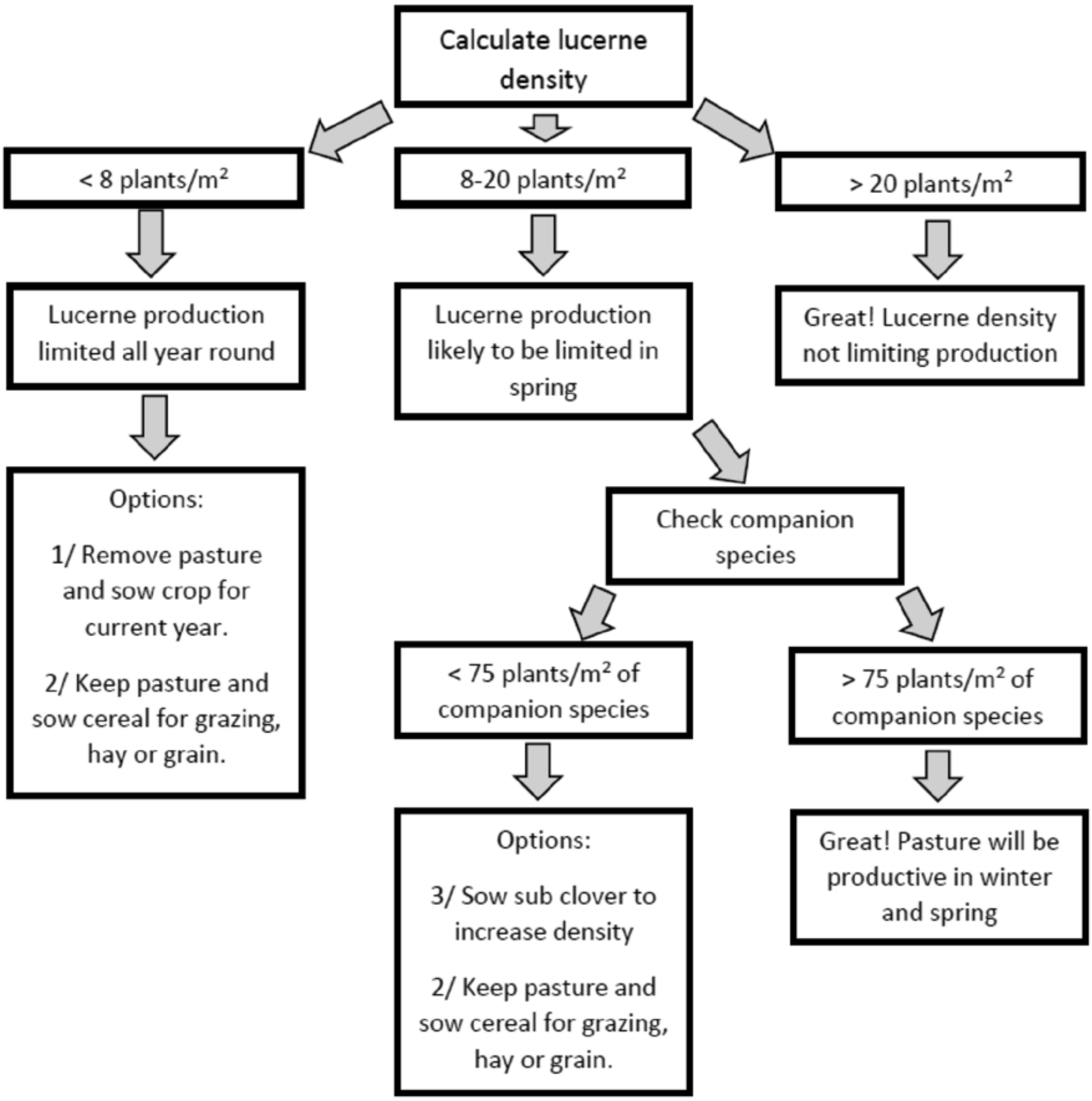

Figure 1. Pasture decision support tree.

the autumn. Cereal species used will depend on what is required. Oats is vigorous and will provide early feed. Barley could be late sown and yet is still vigorous. Winter wheat could be suitable for early sowing with the potential for grain although late grazing may limit significant grain recovery. The opportunity for hay or silage could be high and would enable refilling of haysheds. Decision on cereal species will also depend on seed cost and availability.

Opportunities – High quality forage for autumn, winter and early spring. Potential for hay, silage or grain from dual purpose crops.

Limitations – Cost of sowing operation and seed. One year only. If lucerne density is low, then there is still limited production from the lucerne.

- Option 3 - Oversow sub clover to increase density.

Ideally high sowing rates will ensure a fast establishment for grazing. Seed should be sown rather than broadcast on the soil as broadcasting success rate is low. Pre-sowing herbicides should be used.

Opportunities – Should increase the productivity of the pasture for the next few years.

Limitations – Can be an expensive option. Number of seeds sown is much less than that from an established seed bank, and therefore, growth will be slower.

Conclusion

Pastures on mixed farms will have likely degraded following the drought last year. It is crucial that pastures are assessed to determine their productive potential. Management options can be used to increase forage supply this year to ensure that livestock enterprises are not impacted by poor pastures. Dual-purpose crops can play an important role in filling early season feed gaps giving pastures time to recover and or new pastures to establish.

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