Beyond the herb layer - shrubs and trees as drought reserves
Mulga and drought

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Introduction and history of use

Mulga (*Acacia aneura* F. Muell. Ex. Benth.) is one of Australia's most important native fodder trees and has been extensively used as drought fodder since at least 1886 (Everist 1949). In that year, according to the 'Charleville Times" of July 1947, Henry Riddell employed axemen to cut mulga for 60,000 sheep in the Charleville of Queensland (Anson and Childs 1972).

Mulga is widely distributed in south west Queensland (19M ha) and across much of arid and semi arid Australia, with Mulga-dominated communities covering 1.5M km^2 or about 20% of the continent (Johnson and Burrows 1981). Mulga is adapted to environments where the soil moisture is almost always limited for growth, but rain can fall at any time of the year (Neldner 1986). However, Nix and Austin (1973) note the absence of Mulga in semi arid regions experiencing regular summer or winter droughts.

Mulga varies considerably in it's growth form and structure. Variation is seen in the size and shape of the phyllode (leaf), the degree of winging in the pod and the height (2-15m) and density (10-8000 stems ha^{-1}) of the community. Neldner (1986) reports the highest development of mulga associations occur as open-forests on deep loamy red earths south east of Charleville in Queensland.

Mulga use and practical limitations

Mulga leaf within reach of grazing animals (up to 2m above ground) and windfall is browsed year round. Mulga leaf can comprise up to 10% of the diet of sheep and cattle in any season (Beale 1978).

During drought, mulga is lopped or pulled to allow provide greater quantities of leaf to the grazing animal. Chainsaws and modified wheeled or crawler tractors have replaced the axemen of earlier years (Anson and Childs 1972, O'Dempsey 1989). Mulga can be the main source of fodder for sheep and cattle during drought.

Anson and Childs (1972) identified four growth forms of mulga in south west Queensland each with characteristics requiring different systems of management;

Umbrella mulga- This form of mulga is most commonly used for drought feeding because of higher leaf yields and lower densities (40-1200 trees ha^{-1}). Utilisation without destruction of the tree is best achieved by breaking the leader branches with tree pusher bars, front end loaders or lopping with a chainsaw.

Whipstick mulga- Generally the leaves on this form of immature mulga are out of the reach of sheep. Due to high densities (2000-6000 trees ha^{-1}) whipstick mulga is commonly utilised by

being either pushed or pulled down with a cable, chain or basher unit. Due to high densities and flexible nature of this form of mulga, individual tree survival rates can be high.

Tall mulga- This form of mulga cannot be lopped as the trees have long bare trunks. Drought feeding of this form commonly involves pushing or pulling trees down with either single tractors or a pair of tractors with chains. Utilisation without destruction is impossible.

Low mulga- This form provides useful browse as it is available to grazing animals without any special treatment. During drought it is a poor source of fodder as leaf yields are low and dense stands (7000-12000 shrubs ha^{-1}) make cutting uneconomical.

The number of sheep fed on individual properties varies. Groups of 10000 to 12000 sheep have been fed at one point, though best results have been obtained with sheep fed in flocks of 5000 to 6000 or less (Anson and Childs 1972). The approximate numbers of sheep which can be fed in a 6 to 8 hour day using wheeled or crawler tractors varies from 3000 to 12000 (Table 1.)

Table 1. Approximate numbers of sheep that can be fed in a 6 to 8 hour day using wheeled or crawler tractors (Anson and Childs 1972).

Tractor Size	**Sheep Fed Daily**
35 h.p to 50 h.p	3000 to 4000
50 h.p. to 70 h.p.	5000 to 6000
70 h.p. to 95 h.p.	6500 to 7000
2 x 95 h.p. (chain rolling)	10000 to 12000

Mulga can also be felled by chainsaws. In selected densities of scrub with tree trunk diameters of 10cm to 20cm yielding 9kg of leaf per tree it is possible for one person to cut enough scrub in 6 to 7 hours actual cutting for 2000 sheep. Refuelling, cleaning and sharpening of the saw involves an extra 1.5 to 2 hours work.

Feeding with tractors involves a large capital outlay which needs to be considered. Chainsaws are cheaper to buy and operate but the risk of accident and breakdown is greater. The risk of breakdown in any feeding operation needs consideration as delays extending beyond two days lead to a serious decline in the condition of mulga fed sheep owing to a shortage of leaf (O'Dempsey 1989).

Value and limitations of mulga as browse and drought fodder

Mulga is browsed by domestic, native and feral grazing animals in all seasons. However, despite a crude protein content of 10-14% it is regarded as only a maintenance ration (Everist *et al*. 1958). The low digestibility of mulga protein (35-40%) (Harvey 1952, McMeniman et al. 1981) is due to high levels of condensed tannins (50-170 g/kg dry matter) present in the leaf. Gartner and Hurwood (1976) suggested that the low digestibility of mulga protein was due to binding of proteins by tannins present in the mulga leaves. Due to the importance of mulga as drought fodder for sheep and cattle in Queensland, considerable research has been directed at examining and overcoming the dietary limitations of mulga (McMeniman and

Little 1974, Hoey *et al*. 1976, McMeniman 1976, Niven and Entwistle 1983, Pritchard *et al.* 1988, Pritchard *et al*. 1992 and Miller 1992 to name a few).

To summarise the Queensland work;
- mature sheep will consume 700-800 g of mulga daily under dry paddock conditions,
- this intake barely provides enough energy for the maintenance of dry sheep (Table 2),
- this intake coupled with the low digestibility of the crude protein results in sheep being unable to meet their protein requirement (Table 2),
- major nutrients identified as deficient in the diet of sheep eating mulga are sulphur, phosphorus, sodium and nitrogen,
- sheep on a predominantly mulga diet for extended periods show lower wool growth rates, loss of liveweight and increasing death rates,
- heavy losses of ewes and lambs can be expected if mulga is the only forage available,
- nutrient supplements are required for sheep consuming a predominantly mulga diet,
- sheep consuming mulga will respond to a daily supplement of;
    - 1-2g of nitrogen
    - 1-1.5g of sulphur
    - 1-2g of phosphorus
    - 2-3g of sodium
- dry licks are a cheap and easy way to provide nutrient supplements (O'Dempsey 1992),
- advice on mulga feeding and dry lick supplementation of sheep is described by O'Dempsey 1989 and 1992,
- polyethylene glycol is effective at binding tannins (Jones and Mangan 1977) and when fed at 24 g/day to sheep on a mulga diet improved nitrogen and sulphur digestibility, and increased wool growth was observed compared to non-supplemented sheep (Pritchard et al. 1992),
- the high cost of polyethylene glycol prohibits it's use and prompted the investigation of alternatives,
- tannin-active bacteria present in the digestive tracts of feral goats, koalas, and camels improve the fermentation of tannin rich diets in these animals and enhance the utilisation of dietary protein (Brooker *et al*. 1994),
- there have not been any reports of micro-organisms from tannin tolerant species being transferred to other animals to enhance their capacity to utilise tannin containing plants (Miller *et al.* unpubl),
- sheep on a mulga diet drenched with feral goat rumen fluid produce as much wool as sheep supplemented with traditional mineral nitrogen, phosphorus and sulphur preparations (Miller 1992),
- single species of tannin-active bacteria are unlikely to elicit responses of the order generated by feral goat rumen fluid inoculations (Miller unpubl),
- an enhanced inoculum, generated by continuous fermentation with mulga, as a substitute for the crude feral goat rumen fluid is currently being evaluated.

Table 2. Mulga dry matter intake required to provide a maintenance level of energy and protein for wethers and dry ewes at different liveweight (O'Dempsey 1995).

Liveweight (kg)	Energy -required Mulga intake (g/day)	Protein - required Mulga intake (g/day)
30	790	1210
40	980	1710

Recommended strategies for feeding mulga

Before starting to feed, the following questions should be considered;
- How long will I have to feed?
- How many can I afford to feed?
- Of these how many should I feed?
- Shall I use new or second-hand machinery?
- Is it necessary to supplement with mineral licks?
- How can I manage the feeding to minimise land degradation to ensure the long term productivity of the property?

The Queensland Department of Primary Industries does not promote regular mulga feeding as a long term sustainable form of stock and land management. An early decision to reduce livestock numbers is often better financially than a decision to feed all the stock just because the mulga is available (O'Dempsey 1989). However, a number of properties 'farm' mulga in selected paddocks on a 15 to 20 year cycle. The Department does provide advice on appropriate methods of feeding and supplementation for maintenance of core flocks or herds during drought periods.

When feeding mulga it is recommended to confine stock to specific areas for feeding mulga. This reduces the distances both stock and machinery have to travel thereby lowering the energy demand on stock and costs of machinery operation.

The feeding of supplements to overcome nutrient, protein and energy deficiencies is recommended (O'Dempsey 1992).

After a break in the season it is important to continue feeding for at least four weeks. During this period livestock should be confined to 'sacrifice' areas to allow growth and seeding of grasses on the remainder of the property. The sacrifice area should then be spelled and any areas of erosion given special attention (O'Dempsey 1989).

Mulga use and ecological implications

Droughts are a characteristic of arid and semi-arid environments world wide and have been defined as a 'period of rainfall deficiency which results in biological or economic loss'. As most of Australia's mulga is restricted to semi-arid areas droughts are common. In Charleville Queensland, a drought (driest 5% of years) can be expected 1 year in every 5. Their frequent occurrence and long duration make droughts the most significant factor affecting land stability in mulga areas (Pritchard and Mills 1986). As mulga is used as a fodder reserve for livestock, management of these areas during droughts differs from that in regions dominated by perennial grasses. Management practises adopted before, during and after droughts have important implications for the stability and productivity of mulga lands (Pritchard and Mills 1986).

The fragility of the mulga lands of Queensland have been documented by a number of authors (Pressland and Cowan 1987, Mills *et al* 1989 and Miles 1994). Dawson and Boyland (1974) identified the maintenance of excessive grazing pressure on sensitive mulga land

types during drought as the main cause of land degradation. Mills *et al*. (1989) suggested the maintenance of grazing pressure immediately following drought was also an important cause of land degradation. The threat of land degradation is primarily a result of the presence of mulga top feed which encourages the maintenance of stock numbers during drought at pre-drought levels. This leads to excessive and prolonged pressure on the remaining ground storey vegetation and can hasten processes such as loss of ground cover and removal of surface soil (Pritchard and Mills 1986).

Conclusions

Mulga is both widespread in its distribution and use as drought fodder. It provides a valuable maintenance diet for livestock during droughts when stock would either die or need to be removed. When mulga is regularly relied upon as part of a 'normal' production system degradation of the fragile mulga landscape results. Prudent and skilful stock and land management is thus required to avoid an over reliance on mulga as a drought reserve.

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