Productivity of oldman saltbush in relation to rainfall and economic considerations

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Summary. Oldman saltbush, A *triplex nummularia,* is a native plant with a C4 photosynthetic pathway, a halophytic shrub with a deep and wide spreading root system, and other physiological and biochemical attributes. These enable a productivity, under heavy intermittent grazing, of some eight times better than native pastures under equivalent rainfall. The returns from grazing plantations of oldman saltbush provide a better gross margin cost per ha than most pasture, forage or grain crops for equivalent rainfall; and a lower cost per sheep area of additional carrying capacity rather than acquiring additional land. The plant possesses the ability to lower water-table levels and convert salt affected country to high productivity.

Introduction

A major problem for most grazing properties is providing for fodder shortfalls. This ties up both the financial and labour resources required for the production of hay and silage. In spite of an apparently high cost of establishment, oldman saltbush will provide green forage at a cost per sheep much cheaper than hay, grain or silage from the second year after planting.

Oldman saltbush has a long standing reputation as an extremely drought resistant native shrub in the low rainfall regions of Australia. It was nearly wiped out in earlier times by mismanagement, and a lack of appreciation of its management needs. Alternative approaches to grazing management, based on heavy grazing (complete defoliation) over a period of one to three months, followed by resting for five to seven months, have made possible productivity levels some eight times that of natural pastures.

Extensive trials by Narromine Transplants (unpublished data) have shown that degraded areas, whether they be from scald, from salt or suffering from high water-table, can be rehabilitated by planting oldman saltbush, which will then provide a grazing alternative to once unproductive country.

Establishment and management

We have found that, in rainfall areas of 500 mm or below, fallowing for at least six months prior to a spring planting is essential. This removes competition from both weed and pasture growth which significantly increases moisture conservation. In addition, deep ripping in lines 3 m apart several months before planting is also essential to encourage deep penetration of moisture and early deep rooting of young plants. To provide the highest possible plant survival rate, establishment is best effected by using spring-planted seedlings which have been grown in a nursery for at least six months.The newly established plantation will normally be ready for a light grazing in the following autumn. This encourages proliferation of stems for subsequent growth. The plants will then be ready for a heavy grazing in the second summer or autumn after planting, but this needs to be soon enough to keep the tops within the reach of sheep.

From trials by Narromine Transplants (unpublished data), the optimum grazing period on a mature bush has been established as being four to six weeks. This allows the plants to begin refoliation swiftly and be ready for further grazing in five to seven months, regardless of season,. The shortened grazing period has proved to be less detrimental to accompanying pastures, and allows for three grazings of the saltbush in any period of two years. It is necessary to defoliate the bush at least once in any 12 month period to prevent the plant from becoming woody.

Carrying capacity

De Kock (4) has reported grazing rates ranging from four dry sheep equivalent/hectare (dse/ha) at 300 mm average annual rainfall (AAR) to 12 dse/ha year-long equivalent (YLE) at 500 mm AAR. There are now sizable plantations of oldman saltbush throughout western NSW (unpublished data). From these grazing results it has been possible to determine the total sheep grazing days, which can be converted to dse/ha YLE. For example, the 8.9 dse/ha YLE at `Cooinbil' was derived from a total of 3375 sheep grazing days (sgd) per ha, less 125 sgd per ha from the ground cover of very dry barley grass, most of which was left uneaten. 3250 divided by 365 (days per year) = 8.9 dse/ha YLE. The forage in one paddock of oldman saltbush is available for only two to four months. But if four paddocks are available, each grazed in turn for three months, the result would be 8.9 dse/ha/yr. These plantations range from `Tupra' station on the Lower Lachlan near Oxley (6 dse/ha YLE at 300 mm AAR) to 'Cooinbil' near Darlington Point on the Murrumbidgee (8.9 dse/ha YLE at 375 mm AAR) to Gulargambone on the middle Castlereagh north of Dubbo (18 dse/ha YLE at 550 mm AAR), with other stations beyond and between this range of locations. The grazing rate for Gulargambone has been repeated in a second series of grazings over 18 months in which grazing periods were shortened and the rest periods were reduced to four months. Each of these plantations have been subjected to heavy grazing for two to four months at a time.

Special features

High productivity from oldman saltbush over a wide range of soil types and climates is achieved because it is a C4 plant (8). This means a very high productivity potential exists under conditions of high temperature and high moisture. It also has a level of water-use efficiency enabling it to produce two and a half times more plant matter on a dry weight basis per unit of water used than lucerne (4,10).

As well as being highly efficient in the use of water when this commodity is limited, oldman saltbush has a capacity for high water use when soil moisture is non-limiting. Extrapolation from the rates of water use (6) by the much smaller bladder sal tbush, A *triplex vesicaria,* suggests a rate of water use of 1000 mm per annum. This extrapolation has been necessary because of the lack of research with *Atriplex nummularia.* The resultant figure is not considered unusual for a plant able to develop a leaf index area of three (8).

Research on water use under conditions of high water table is urgently needed to determine the ability of oldman saltbush to pump water as well as produce usable forage in large quantities. An ability to use shallow groundwater, along with this affinity for salt, would make oldman saltbush a useful plant for using up saline groundwaters which are presently causing problems in irrigation areas, in wheatbelts and in tableland regions.

It has been found that oldman saltbush increases productivity with increasing levels of salt probably to about 10,000 mg/L (17 dS/m). From clippings in experimental plots, Aronson *et al.* (1) recorded the equivalent of 28.9 t/ha/yr dry matter from oldman saltbush irrigated with 15% sea water. Glenn and O'Leary (5) report dry matter yields equivalent to 20.8 t/ha/yr from five clippings over a 24-month period. This was from oldman saltbush also irrigated with sea water. O'Leary (11) has reported that 'productivities of halophytes (including oldman saltbush) irrigated with sea water are comparable to those of conventional crops irrigated with fresh water have been achieved'.

Another feature is a three-tiered root system (surface roots, other roots extending horizontally for 10 m out of the plant centre, with strong vertical roots off these to a depth of 4-5 m) (7). These attributes are discussed in greater detail in (3).

Oldman saltbush, when grazed in a rotational program, provides a high protein (20%) forage which has a valuable support role for rangeland situations. This makes it ideal for a number of purposes other than putting unnecessary fat on stock. Crude protein (CP) approximates 20%, with adequate levels of carbohydrates and minerals and a moderate level of fibre (4,9,12). Both Newman (9) and Wilson (12) reported that the intake of A *triplex nummularia* was low (for pen-fed sheep) considering its high CP content and dry matter digestibility. This confirms the senior author's experience that oldman saltbush tends to be ignored in the field until there is only very dry feed only available. This also happens with heavy grazing plantations, the saltbush being ignored for 10 to 14 days by sheep which have never grazed it in this fashion previously. Once the mob begins to graze it then they ignore anything else until all the leaves, and stems down to finger thickness, are consumed. When these sheep are introduced to oldman saltbush again, they begin grazing it from the first day (unpublished data).

Although the low fat content has brought warning about being a poor feed for lactating animals, this has not happened in practice with landholders who have used plantations for lambing. R Webb of `Dappo' Narromine reported successfully lambing 705 ewes on 18 ha plantation of oldman saltbush. This grazing started in February 1991 and continued for 8.2 weeks. This produced an 87% lambing which was a rate considerably above that for properties reliant on handfeeding during the same lambing period. It was also reported by Webb that all animals finished their grazing in a strong healthy condition. This grazing occurred over a hot dry period when normal lucerne-based pastures became depleted. Because of the slow acceptability by the sheep grazing the plantation for the first time, it is advisable to introduce lambing ewes at least three weeks before lambing is due to commence.

Other landholders have found uses for the summer feed reserve created by oldman saltbush by using the plantations *as* a feed lot for turning off prime lambs and growing out weaners. W. Roberts of Collie, NSW, reported successfully grazing 2,500 lambs on 85 ha of oldman saltbush during the summer/autumn period of 1991. This grazing was over a 12-week period and was for the sole purpose of finishing the animals off for sale. R. Gorey, near Moulamein, found weaners on oldman saltbush brought $1.50 per head more in the saleyard than weaners from the same mob on dry native pastures.

Economic assessment

To successfully establish oldman saltbush plantations, nursery grown seedlings must be used. This results in establishment costs being higher than for traditional pasture establishment, but it is a once only cost, with no further fertilizers, herbicides, replants etc. being needed. By the time grazing lucerne needs to be re-established (after running out in five to seven years), the total cost of establishing and maintaining the lucerne will have almost exceeded the establishment cost of oldman saltbush, which can be expected to last at least for another 50 years.

Establishment costs, which are generally $600/ha, are recouped within three to four years of planting. This makes oldman saltbush plantations one of the cheapest suppliers of protein, *as* well as providing the most effective shelter for reducing livestock losses.

The cost of using oldman saltbush as a supplementary feed can be compared with that of feeding hay in a supplementary feeding program. A bale of hay, costing about $5 by the time it is transported to, or stored on the property and feed out, will feed 25 sheep for a day (at a cost of 20 cents per sheep per day. This cost will apply every time that hay is fed to sheep. For oldman saltbush, allowing 35 cents per plant (including land preparation, planting operation, fencing and provision of stock drinking water) and two sheep grazing days per bush, this works out at 17.5 cents per sheep grazing day for the first heavy grazing. After 10 years, the cost will be 1.75 cents per sheep grazing day, and after 20 years it will be less than 0.4 cent per day.

The principle role for oldman saltbush, when areas less than 5% of properties have been planted, will be *as a* seasonal feed-gap filler. This will happen during the late summer-autumn periods over much of southern Australia, in the slow-growth winter period in tableland areas, and during the dry winter season in summer rainfall areas. It also provides excellent off-shears shelter if needed as well as high quality growing out feed for weaners.

The best way of assessing the value of an oldman saltbush plantation is to consider it in terms of cost per sheep area of additional carrying capacity. Whereas the sheep area cost of acquiring additional land normally increases with increasing AAR, the sheep area cost of establishing a plantation of oldman saltbush decreases from about $100 per sheep area at 260 mm AAR (where the two values match) down to $50 at 500 mm AAR where land values for grazing country will be of the order of $200 per sheep area.

These values will be found to be well ahead of gross margin returns per ha of most dryland crops, whether for grain or hay. The same applies to irrigation crops, allowing a carrying capacity of 25 dse/ha of oldman saltbush with only two irrigations per year. With a water-table at two metres or so, *as* applies on most of our irrigation areas and districts, it would be expected that irrigation for oldman saltbush would be hardly necessary.

Conclusion

From the above considerations, it will be apparent that plantations of the native oldman saltbush will be the cheapest and easiest way of providing high quality green feed for the feed gaps which so often limit productivity over much of the Australian continent. The capacity of oldman saltbush for high production on salt effected soils and saline ground waters provides a means of converting non-productive land to profitable use. In medium rainfall areas it can also be used to treat a developing salinity problem at its source by planting in recharge areas *as* well as discharge areas.

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