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Sheep Updates 2003 - Pastures

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Sheep Updates 2003

Pastures for saline land

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KEY MESSAGES

Sheep need metabolisable energy and crude protein in the diet. Saltland pastures can be designed to deliver these with decreased salt (ash) concentrations in the diet.

INTRODUCTION

Saltland pastures have had a bad press in WA over the last 10 years but this is about to change. About ten years ago, information became available suggesting that the economic return from saltland pastures did not justify the cost of establishment. This information largely ended public interest in such pastures. Today however, through a better understanding of animal nutrition, the saltland pasture has a new lease of life.

REVIEW

Researchers in WA are developing improved knowledge of how pasture components interact to benefit grazing animals. In particular, it is recognised that good animal production requires a diet that contains sources of metabolisable energy and crude protein which are consumed at the same time. Compared with other saltland plant species, saltbushes have the disadvantage of low metabolisable energy concentrations (Figure 1) and high leaf salt concentrations (ash - Figure 2). However, they do have high crude protein concentrations (Figure 3). It is clear that when grazing saltland pastures, the challenge is to mix the fodders to ensure that the sheep access energy (from the fermentation of grass, straw, hay, etc.) and crude protein from the saltbush leaf, and that the salt in the diet from saltbush is diluted by other fodders.

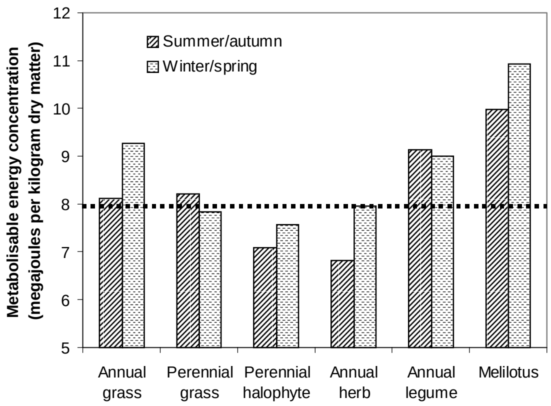

Figure 1. The concentration of metabolisable energy in a range of plant species found on saltland in southern Australia [1]. The dotted line indicates the approximate critical level for the maintenance of a 50 kg sheep.

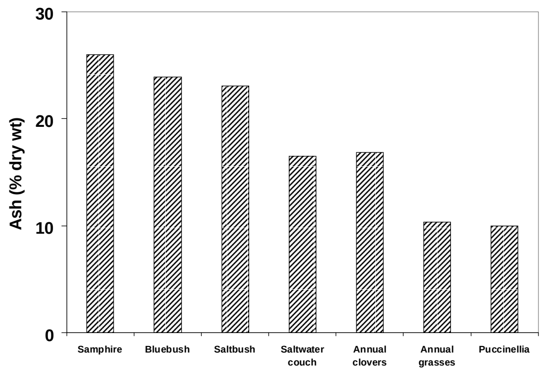

Figure 2. **Typical ash concentrations in the leaves of a range of saltland plant species [2].**

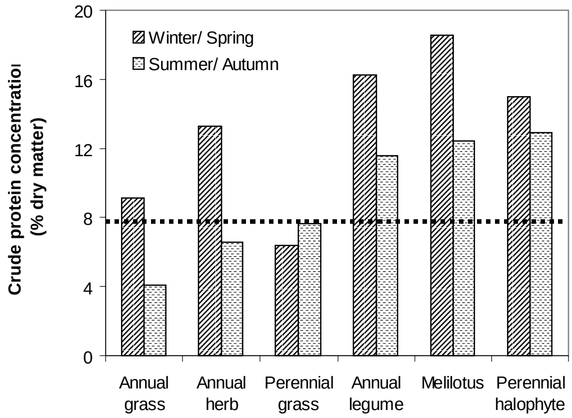

Figure 3. **Crude protein concentrations in a range of plant species found on saltland in southern Australia [1]. The dotted line indicates the critical level for the maintenance of a 50 kg sheep.**

CONCLUSION

The Land, Water and Wool Sustainable Grazing from Saline Land (SGSL) initiative is conducting new research to 'lock in' this improved understanding. A new ($2 million) dollar project will conduct research to:

- examine the effects of grazing management and energy supplementation on the nutritive value and profitability of saltbush-based saltland pastures;
- locate the perennial and annual elements of saltland pastures in the optimal parts of the landscape;
- examine the effects of saltbush spacing on the productivity of pasture components, soil moisture and water-table drawdown.

The research is being done in collaboration with farmers from Pingaring, Yealering, Meckering and Wubin. This project will enable farmers to develop strategies to optimise the use of pastures within saline landscapes and maximise their economic value.

KEY WORDS

saltland, pasture, saltbush, nutritive-value

ACKNOWLEDGMENTS

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Paper reviewed by: Dr David Henry and Dr Yvette Williams, CSIRO Livestock Industries

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Feeding value - the essential link between pastures and animals

Robyn Dynes, David Henry, Hayley Norman and **David Masters,** CSIRO Livestock Industries, Centre for Environmental and Life Sciences

KEY MESSAGES

The feeding value of pastures determines animal performance, as it is a function of the nutritive value of forage and voluntary feed intake by animals.

INTRODUCTION

Profitability of both extensive and intensive animal industries is determined by the value of the output of meat, milk and wool per unit of feed and the cost of and efficiency with which the feed resource is utilised. Traditionally, the key driver of profit has focused on the quantity produced per hectare or per head. Today farmers face increasing pressures from the community and government to meet social, animal welfare, food safety and environmental requirements.

Management strategies to maximise profit from pastures are a feature of our current research. The drivers for profitable pastures are the nutritive value of the feed available and the voluntary feed intake by the animals. Considerable work over the past decade by the Department of Agriculture Western Australia has clearly established the strong linkage between feed on offer (up to ~ 2 tonnes per hectare) and animal performance.

REVIEW

Feeding value and nutritive value are the two terms commonly used to describe the quality or value of a forage for animal production [1]. Feeding value is a function of voluntary feed intake and nutritive value. Variation in voluntary feed intake accounts for at least 50% of the variation that is observed in feeding value of forages [1]. Nutritive value refers to the responses in animal production per unit of intake and is a function of digestibility of nutrients and the efficiency with which the nutrients are used for maintenance or production [2].

Feeding value is hard to predict, because we cannot reliably predict voluntary feed intake. Nevertheless, it is clearly driven by such factors as amount of feed on offer, and the physiological status of the animal, e.g. growing, lactating. In contrast, we can objectively measure components of nutritive value in the laboratory. Nutritive value remains a valuable and underused indicator of feeding value.

Nutritive value is influenced by plant species attributes, management and the environment [3]. These differences in nutritive value can be very large between species but also within species under different conditions. Table 1 demonstrates variation in digestibility and crude protein of a range of grasses and legumes sampled in September 2001 (D. Henry, unpublished).

Table 1. Components of nutritive value for a range of pasture species in September 2001. Values are average (and range in parentheses)

Pasture type	*In vitro* dry matter digestibility (%)	Crude protein (%)
Annual ryegrass	67.0 (57-79)	13.0 (6-21)
Paspalum	74.0 (67-80)	9.4 (7-11)
Rhodes grass	36.1 (33-40)	7.7 (7-10)
Setaria	55.7 (53-58)	10.9 (8-15)
Subterranean clover	69.5 (63-80)	26.0 (20-30)
Balansa clover	74.7 (71-77)	29.5 (28-32)
French serradella	67.8 (61-74)	19.6 (18-22)
Capeweed	70.9 (68-73)	11.7 (8-15)

Relative feeding value can be estimated from the liveweight/wool production responses of sheep grazing on a single species where voluntary feed intake is not restricted by availability. This approach is increasingly important with the evaluation of new and novel plant species, which may have compounds present which change animal performance and are not detected by standard testing for nutritive value. Using this approach, Masters *et al.* [4] evaluated Prima gland clover against Dalkeith sub. clover and found no significant differences in live weight gain (Prima 274 $\pm$ 16 vs Dalkeith 251 $\pm$ 16 g/d) or clean wool growth (Prima 0.16 $\pm$ 0.01 vs Dalkeith 0.16 $\pm$ 0.01 g/100 cm^2/d).

Saltland pastures provide a significant challenge, where nutritive value based selection of plant species could provide substantial gains in animal performance. Digestibility (DMD) and crude protein content (CP) are measures that are frequently used to describe salt tolerant species, but they are often used incorrectly. The error stems from the common calculation of DMD, in not adjusting for the high soluble ash content of plants growing in saline soils [5]. The ash in forage has no energy value, but depending on the solubility will contribute to the apparent DMD. For example, saltbush with an apparent DMD of 60% would be calculated to have a metabolisable energy of 8.4 MJ/kg DM with an assumed ash content of 10%, leading to the conclusion that it would be a forage suitable for growing animals. If the ash content of the forage is actually 30% of which 24% is soluble (ash content of many saltbush samples analysed in our laboratory), the metabolisable energy content is 5.4MJ/kg DM [5] and sheep could not eat enough to maintain liveweight.

Crude protein content may also be misleading due to forages having different proportions of protein to non-protein nitrogen. We do not currently have sufficient understanding of the composition of the non-protein nitrogen content of many plant species present in saltland pastures or for more widely used new and novel plant species, to be able to predict.

CONCLUSION

Feeding value is essential to understanding animal performance in farming systems. When improving the characterisation of forages, we must maintain focus on identifying the factors that are important for sheep production and the levels of precision needed for practical application.

KEY WORDS

feeding value, nutritive value, sheep performance

ACKNOWLEDGMENTS

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Paper reviewed by: Dr R. Kelly, Program Manager, Dr Y. Williams Post Doctoral Fellow, CSIRO Livestock Industries

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Sheep Updates 2003

'Pastures from space' - how do we do it, how well do we do it and what do producers think about it?

Stephen Gherardi[A], **Graham Donald**[B], **Asoka Edirisinghe**[B], **Dave Henry**[B], **Chris Oldham**[A], **Richard Smith**[C] and **Joanne Sneddon**[D]

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KEY MESSAGES

Satellite-based pasture information (feed on offer and pasture growth rate) is sufficiently accurate for producers to make management decisions but there are still questions about its reliability, timeliness and cost effectiveness.

INTRODUCTION

Sheep producers have long recognised the need for reliable, accurate and timely pasture measurements to enable them to make on-farm management decisions. Over the past decade it is estimated that around 10,000 producers Australia wide have undertaken training programs designed to provide them with skills and tools to improve their grazing management decisions. However, a recent survey found that only 45 per cent have utilised these skills and tools on their farms. The slow adoption of pasture management techniques is attributable to the lack of producer confidence in quantifying pasture biomass and the lack of time available to assess pastures across the whole farm [1]

AIM

Our vision is to provide cheap, reliable, timely and accurate satellite-based pasture information at the paddock level directly to livestock producers across southern Australia.

METHODS

The estimation of feed on offer (FOO) and pasture growth rate (PGR) using satellite measurements from space has been developed and calibrated from pasture data collected in the south-west of Western Australia [2]. Paddock estimates of pasture biomass were related to normalised difference vegetation index (NDVI) or index of greenness determined from satellite (Landsat TM and SPOT XS) images and these were used to develop a predictive FOO relationship at 30 m resolution. Regional PGR predictions were developed using NDVI from another satellite (NOAA AVHR), solar radiation, estimated soil moisture and temperature at 1 km resolution. Soil type was then used to interpolate regional scale estimates of PGR to paddock scale PGR.

In 2002, the accuracy of the FOO predictions was assessed by comparing the averages of the satellite values with those observed in the paddock by trained technicians over two parallel transects 30 m apart and either 500 or 1,000 m long, on farms in south-west Western Australia. The technicians assessed FOO every 10 m along transects within 5 days of the satellite pass for each month of the six month growing season.

The assessment of the accuracy of the PGR predictions was undertaken by comparing the averages of the satellite values with the monthly paddock averages derived from 1 m^2 exclosure cages at 100 m intervals on the 1,000 m transects.

Precision Sheep Production Producer Groups were set up to pilot test the delivery of the satellite based FOOs and PGRs for paddocks on individual farms. The FOO product was delivered monthly and the PGR (for the previous 7 days) via a website (http://spatial.agric.wa.gov.au/foo). FOO was delivered as a map displaying the spatial distribution of and average FOO for an individual paddock, whereas the average paddock PGR was delivered as a report. The average paddock PGR forecasted seven days forward was also included in the report from August 2002. At the end of the 2002 growing season, 63 of the producers from the Precision Sheep Production Groups were surveyed to determine the value of the remotely sensed pasture technology to their farming enterprises.

RESULTS AND DISCUSSION

FOO and PGR

The validation studies showed that the satellite-based predictions of FOO had an accuracy of ±10 per cent for paddock averages. The effective range for prediction is between 400 and 5,000 kg DM/ha which covers the important changes in feed availability over growing seasons. From studies undertaken in 2002, satellite-based predictions of FOO explained 97 per cent of the variance in ground measurements covering the range from 500 to 3,500 kg DM/ha. In some of the regions the delivery of FOO was unreliable due to cloud cover. Cloud limits the availability of Landsat TM and SPOT XS imagery such that monthly data can not be guaranteed. Current research is investigating the use of MODIS (a new satellite) imagery (available daily) to provide Landsat TM (16 day cycle) like information for calculating paddock FOO when the Landsat TM data are unavailable.

For PGR, 66 per cent of the variance in the on-ground measurements was explained by those estimated from the combination of satellite, climate and soil data. In the future by using higher resolution MODIS imagery (250 m^2) it will be possible to increase the variance explained to 76 per cent (G. Donald, personal communication).

Precision sheep producer groups

Eighty two per cent of the producers interviewed felt that the satellite based FOO and PGR information increased their confidence in making pasture and stock management decisions. Sixty one per cent of the producers felt that the FOO and PGR information helped them to better manage risk and over 50 per cent felt that the technology contributed to both an increase in the profitability of their wool enterprise and farm business (58 and 59 per cent, respectively).

CONCLUSION

The provision of reliable, timely and accurate FOO and PGR information provides producers in the Pastures from Space project with the opportunity to improve the profitability of their sheep enterprise. The plan in 2003 is to undertake an economic analysis of the technology in order to quantify the resultant increase in profit that is achieved though its use.

KEY WORDS

satellite, pasture biomass, feed on offer, pasture growth rate, sheep

ACKNOWLEDGMENTS

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Paper reviewed by: Dr Keith Croker, Department of Agriculture Western Australia

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Agronomic implications of intensive grazing systems

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[B]Department of Primary Industries, Hamilton Victoria

KEY MESSAGES

Intensive grazing tactics in winter and spring can be used to manage periods of pasture deficit and surplus that characterise the typical growing season in Mediterranean environments. These tactics can have profound effects on both pasture and animal production.

INTRODUCTION

The large *within*-and-*between*-seasonal variation in pasture growth that characterises Mediterranean environments results in periods of deficit and surplus pasture for the grazing animal. Under continuous set-stocking regimes, season not only dictates the quantity and quality of wool produced, but also the type of pastures that persist.

This paper discusses results from small-scale grazing management research conducted to investigate the effect of intensive grazing tactics [strip grazing and intensive spring grazing] on annual pastures.

REVIEW

In general terms, management for the long-term viability of annual pastures should take into account three distinct periods of growth: ‘establishment’, ‘vegetative’ and ‘reproductive’ (1). Grazing management decisions should be based on feed on offer (FOO), and be matched to objectives for the pastures which:

- **allow pastures to establish in Autumn** (by defer grazing until FOO reaches 500-800 kg DM/ha);
- **maximise pasture growth through the vegetative ‘winter’ phase** (by maintaining FOO above 1000 kg DM/ha);
- **manage grazing pressure during the reproductive ‘flowering’ period** in spring to meet seed production and composition objectives.

Slow winter pasture growth rates (PGRs) are the limiting factor controlling stocking rate (SR). Since SR is an important profit driver, tactics that can increase PGR through winter have the potential to significantly increase profitability of grazing enterprises.

Strip grazing (SG) is one management tactic that can be used to increase FOO and PGR during winter (2). PGRs increase because, while recently grazed strips have low FOO, most of the area has levels exceeding 1500 kg DM/ha. Hence, leaf area index is improved over most of the strip-grazed area, resulting in increased PGR and extra FOO (300-500 kg DM/ha). This means higher sheep numbers can be carried through winter without supplementary feeding. In addition, large amounts of readily available nutrients (N, P, K, S) are recycled uniformly across the strips, while under set stocking, nutrients are returned unevenly with much going into stock camps (2). If continued into spring, it is likely SG will result in dominance by grasses and broad leaf plants. SG may be a valuable tool for specialist woolgrowers that want to improve the quality of wool produced, maintain above-average stocking rates or increase SRs.

Intensive spring grazing (ISG) is a tactic that requires regular changes of grazing pressure to maintain FOO at target amounts. The targets will depend on the objective for pastures and animals. Listed below are some of the effects of ISG to 1400 kg DM/ha, compared to set-stocking at district average rates, in Mt Barker, South Stirlings and Keysbrook.

Pasture growth rate: ISG had minimal effect on PGR in late-winter/early-spring. The higher PGR measured on set-stocked treatments in late spring is due to the inclusion of grass seed in the FOO measurements. Under ISG, little grass seed is present.

Pasture utilisation (PU%): ISG more than doubled PU% to about 70%.

Composition: ISG had a profound effect on maintaining clover composition of pastures between 50-70%. Under set-stocking, clover per cent was halved, due to dominance of grasses in spring.

Seed production: ISG significantly reduced clover seed-set. However, 300-400 kg seed was produced which is sufficient to establish pastures in the next season. Near maximum seed-set occurs when FOO exceeds 4000 kg DM/ha (A.N. Thompson *et al.* unpublished data).

Extended growing season: When soil moisture persists after late season rains, intensively grazed pastures continue to grow compared to set-stocked pastures. This extends the growing season and provides higher quality pasture residues into summer.

Insect control: Under continuous set-stocking grazing regimes, populations of pasture pests can reach 47,000 per square meter, and cause up to 80% loss of clover seed if uncontrolled (3). This loss occurs when clover seedlings are killed early in the season, or plants are damaged during the reproductive period in spring. ISG controls RLEM numbers to a similar degree as spraying (3).

Available nitrogen: Plots that were ISG'd for 3 years at Mt Barker had significantly higher levels of soil minerali nitrogen in Autumn. When cropped, this resulted in higher yields of triticale and oats (4).

CONCLUSION

Results from small-scale research show huge potentials for increased productivity by using intensive grazing management tactics. However, adopting this technology into farm-size operations will require the implementation of flexible management systems. Wool producers are unlikely to adopt SG or ISG practices to be used over the whole farm or for all flocks on the farm. The tactics will be used for particular classes of stock, the purpose being to grow a certain type of wool, to increase stocking rate on the whole farm or to manipulate the composition of selected pastures. Their use by woolgrowers will depend on their production objectives, their farm plan and the prevailing economic conditions (2).

Concentrating sheep to increase grazing pressure on selected areas will leave other areas 'undergrazed' unless other management practices are also altered. Some producers will be able to shift from early to late lambing to increase their spring grazing pressure. They may also decide to sow fodder crops into paddocks that are under utilised. Alternatively, pastures may be managed by mechanical topping/windrowing, by conserving excess pasture as silage or hay, or by herbicide treatments (1).

KEY WORDS

intensive spring grazing, strip/ration grazing, feed on offer

Paper reviewed by: Dr Chris Oldham, Department of Agriculture Western Australia

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Sheep production from lucerne

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KEY MESSAGES

In response to late spring and autumn rain lucerne extended the seasonal forage production and increased the returns for a sheep meat and wool enterprise.

INTRODUCTION

Lucerne was continuously grazed with merino ewes from August 2001 to December 2002 and lambs from August to December in both years. Sheep were rotated between three paddocks with movement determined on the basis of feed availability. Ewe and lamb liveweights and ewe wool production were compared with commercially run stock. The persistence and production of the lucerne pasture was also measured. The lambs on lucerne @ 20 weeks were six and three kilogram liveweight heavier than the commercial lambs in 2001 and 2002 respectively. The ewes on lucerne remained at a similar or heavier weight than the commercial ewes throughout study, they produced 0.8 kg/head more clean wool of a similar yield, micron, length and strength. They also had 130% marked lambs compared with an estimated 85% marked lambs from the commercial flock. Rainfall events in November 2001 and autumn 2002 were significant in the comparative performance of the lucerne pasture.

AIMS

To measure and report the production from a merino ewe/prime lamb enterprise grazing lucerne pastures. Benchmark comparative performance with similar commercial animals grazing opportunistically mixed (lucerne, annual, crop stubble) pastures.

METHOD

A six hectare plot of lucerne pasture at Borden, Western Australia was fenced into 3 x 2 hectare sub-plots x 2 replicates and grazed (ewes with lambs at foot) at a rate commensurate to growth rates and food on offer (FOO) through the July to November major growing period. The ewes and lambs were rotated when FOO was less than 600 kg DM/ha, pasture growth rates were lower than disappearance rate and/or animal condition score was less than 1.5. Opportunistic fodder conservation was practised when seasonal conditions allowed on 'saved' paddock/s. The control treatment was farmer managed opportunistic grazing of lucerne, annual pasture and crop stubbles with the same flock age/bloodline of ewes and lambs.

RESULTS

The rainfall during the study was near average, 394 mm in 2001 and below average 322 mm in 2002. The significant features of rainfall in relation to the study were events of near 100 mm in both December 2001 and April 2002. The impact of these rainfall events is reflected in the pasture growth rates presented in Table 1.

Table 1. Lucerne growth rates (kg DM/ha/day) measured over duration of study

Winter 2001	Spring 2001	Summer 2001/02	Autumn 2002	Winter 2002	Spring 2002
8	7	15	10	15	15

The sheep and lambs, which grazed lucerne for the duration of the study, had similar or higher liveweights than control animals throughout the study. Lambs reached a slaughter weight prior to the senescence of the lucerne pasture in both years (Table 2).

Table 2. Mean lamb and ewe liveweights (kg) in response to lucerne and mixed pastures in 2001 and 2002

	2001 @ 4 DSE/ha			**2002 @ 10 DSE/ha**		
Lambs	26 Sept.	23 Oct.	6 Dec.	12 Sept.	17 Oct.	6 Dec.
Lucerne	20	29	37	20	28	39
Annual pasture	20	27	31	20	27	36
Ewes	26 Sept.	23 Oct.	6 Dec.	March	September	December
Lucerne	48	52	58	65	68	63
Annual pasture	48	55	60	55	57	60

The ewes grazing lucerne for a full 12 months produced 4.8 kg of clean 22 micron wool and 130% marked lambs. The commercial ewes produced 4 kg of 22 micron wool and 85% marked lambs.

CONCLUSION

The average annual gross return from each hectare of lucerne pasture was:

4 tonne of legume pasture biomass (100 kg of N) = $80

75 kg of prime lamb = $150

300 kg of pure lucerne hay = $50

30 kg of clean lucerne seed in February = $150

12 kg of clean 22 wool = $120

Total approximate gross = $550/ha

There were no economic benefits put on the improved soil structure, land protection and weed control opportunities as a result of the lucerne pasture. The comparative benefits from each hectare between the lucerne and commercially grazed sheep were, 2 extra lambs and 0.8 kg of clean 22 wool = $120.

Lucerne is being evaluated by more than 400 WA farmers in both grazing and mixed cropping/livestock farming systems. Information supporting the economic and agronomic viability of lucerne will enhance the uptake of lucerne. The amount and probability of summer/autumn rain events will determine the extent of the financial and environmental benefit.

KEY WORDS

lucerne, grazing, sheep, perennial

ACKNOWLEDGMENTS

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Paper reviewed by: Keith Devenish, Jerramungup

Development of two new cultivars of hardseeded French serradella

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Angelo Loi, Centre for Legumes in Mediterranean Agriculture, UWA

KEY MESSAGES

Two new hardseeded cultivars of French serradella, breeder's codes FHS3 and FHS7, have been developed by mass selection for hardseed from the cultivar Cadiz. They are similar to Cadiz in maturity, ease of harvest and productivity but will ensure persistence through crop rotations or drought affected years. The seed will also be protected from germination on out of season rainfall. The new cultivars will be released to licensed producers for the 2003 growing season.

INTRODUCTION

Cadiz French serradella has been adopted over large areas in the south west of Western Australia since it's release in 1996. The drivers for this success have been a high level of productivity on deep, relatively infertile sands combined with a high level of harvestability and a ready germination without further processing (i.e. no need to dehull as with yellow serradella). However the lack of hardseededness in Cadiz and all other cultivars of French serradella limit the longevity of the seed bank and therefore rotational application of the species. The readily germinable seed is also exposed to out of season rainfall events. In 1995 a selection program was initiated to select a hardseed type of French serradella.

METHODS

Hard seeds were isolated from a basic generation seed lot of Cadiz (produced in 1995) by wetting up 500g of pod and allowing germination to occur over a three-week period. The resulting material was then dried and hand threshed to isolate yellow, ungerminated seed. These seeds were then used as parent populations that were tested for the ability to produce hardseeded progeny. Progeny were combined (and recoded with FHS prefixes) on the basis of the level of hardseed and hardseed breakdown and were field evaluated against Cadiz French serradella, Santorini yellow serradella and Dalkeith subterranean clover. The synthetic lines and commercial cultivars were sown at 7 kg/ha of dehulled, scarified and inoculated seed (15 kg/ha for Dalkeith and Cadiz pod) in three replicate 20 m by 2.5 m plots at a site at Pingelly after germinating rain in 1999. The soil at the site was a red sandy loam with a pH of 4.5 ($CaCl_2$). Dry matter and seed yields were determined by sampling from two 0.2 m x 0.5 m quadrats per plot. Regeneration was estimated by counting established seedlings in five 0.1 m x 0.1 m quadrats per plot. The plots were cultivated after germination in 2000 and were sprayed with knockdown herbicide in spring to prevent seed set. Winter seed reserves in 2001 were estimated by taking five soil cores per plot and collecting any seed present from representative sub samples. The proportion of hardseed was determined by counting germinated and hardseed after 14 days at 20°C on wet filter paper from two replicates of 100 pods each. Winter hardseed levels were determined by exposing the pod samples on the soil surface from January to June in mesh pockets and then sampled for germinability.

RESULTS

A total of 40 seeds were isolated after the germination of 500g of pod (100,000 units), however only 19 plants proceeded to seed set in 1996. Of these, 10 plants displayed the ability to produce both high initial levels of hardseed at harvest and residual winter hardseed which would persist as a seed bank for subsequent growing seasons (Table 1). Recombination of the progeny according to hardseed levels resulted in nine synthetic lines that were evaluated in the field against commercial cultivars. All lines performed comparably against each other and favourably against control cultivars in terms of dry matter yield, seed yield and seed reserves in year three (Table 2, only data for FHS3 and FHS7 is presented). Of particular note is the excellent regeneration in both the 2nd and 3rd seasons compared to both Cadiz and Santorini yellow serradella. The relatively low regeneration of Cadiz in the 2nd season was the result of a mild false break in April that resulted in a substantial germination of seed that failed to survive. The hardseeded French serradella lines also maintained adequate seed reserves (over 6000 seeds per m^2 in both lines) to provide good regeneration in the 4th year after sowing without seed production in years two and three. The lines FHS3 and FHS7 were selected for commercial release as these have a narrow parentage and have produced high and stable levels of hardseed over four generations and at a number of locations and seasons. FHS3 also has a unique prostrate growth habit that may be more tolerant of grazing.

Table 1. Level and range of hardseed in progeny from plants mass selected for hardseed in Cadiz

Parent ref.	No. progeny	Initial hardseed %			June hardseed %
		Ave	Min	Max	
Cadiz	19	2	0	8	0
A	24	71	0	100	44
B	3	97	96	98	52
C	20	91	56	100	41
D	13	58	9	94	32
E	8	63	2	99	51
F	14	89	67	100	30
G	12	98	92	100	53
H	13	61	1	99	43
I	14	73	4	96	32
J	3	79	46	98	35

Table 2. Dry matter, regeneration and seed yield of hardseeded French serradella selections compared to commercial cultivars at Pingelly WA. Sown 1999, cropped 2000, self-regenerated pasture 2001

Treatment (parent ref.)	DM 3/11/99 (kg/ha)	Seed yield '99 (kg/ha)	Regen '00 (plt/m^2)	Regen '01 (plt/m^2)	Seed reserve '01 (no./m^2)	Seed reserve '01 (kg/ha)	DM 20/9/01 (kg/ha)	DM 1/10/01 (kg/ha)
FHS-3 (F)	4455	372	594	3733	6996	152	2457	5750
FHS-7 (B & G)	6068	240	1342	4289	6523	118	4002	7370
Cadiz	6472	244	225	700	556	11	3255	5797
Dalkeith	5632	181	506	2778	2428	149	2800	4970
Santorini	6495	565	111	1333	7181	193	3585	6307

CONCLUSION

Mass selection and progeny testing has successfully identified and stabilised a hardseed character in two lines of early maturing French serradella. This character will enable this species, normally considered fully soft seeded, to be used in crop rotations and will also protect the seed reserves from germination on out of season rainfall. The maturity, ease of harvest and productivity of the lines is similar to Cadiz however an extra processing step (dehulling and scarifying) will be required to produce highly germinable material. However this is easier and more efficient than with yellow serradella. A possible end use at the farm level would be to under sow unprocessed (and hardseeded) pod at a high rate with a cereal crop and allowing natural hardseed breakdown to provide spontaneous establishment in the next season. FHS7 is very similar in appearance to Cadiz, with an upright habit that could be useful for conserved fodder production while FHS3 has a prostrate habit that may be more tolerant of grazing. Both lines produce yellow seeds compared to the usually brown seed of Cadiz. The new cultivars will be registered under Plant Breeder's Rights and released to licensed producers for the 2003 growing season, with commercial seed expected to be available in 2004.

KEY WORDS

French serradella, hardseed, pasture legumes

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The potential of sub tropical perennial pasture species in Western Australia

Tim Wiley, Department of Agriculture Western Australia, Jurien

KEY MESSAGES

There is a range of sub tropical (C4) perennial grass species that will grow across many of soil types and climatic conditions of the agricultural region of Western Australia. A number of these sub tropical perennial grasses survived the extreme drought of 2002. Several sub tropical perennial legumes are also showing promise.

AIM

To determine the climatic and soil type limits for the establishment and growth of subtropical perennial grasses and legumes in the agricultural region of Western Australia.

METHOD

Trials on the West Midlands sand plain in 1991 showed that sub tropical (C4) perennial grasses could survive on the poor sands in that area. In these trials the temperate perennial grasses (Phalaris, Fescue, Cocksfoot) died in summer despite considerable summer rain (up to 300 mL). Over the following ten years a range of sub tropical grasses and legumes have been tested and adopted for use by local farmers in the West Midlands. This stimulated interest from other regions.

In 2001 a project was started to test the limits of where perennial grasses could be grown in the agricultural region of Western Australia. As funds were limited most of the tests were done by farmer groups and farmers conducting paddock scale demonstrations. A small number of trials were established by Department of Agriculture officers (e.g. Geoff Moore, Perth; Paul Sanford, Albany; Ken Angell, Midland; David Rogers, Geraldton; Tim Wiley, Jurien Bay). Department officers from the Moora District Office weighed animals on several large paddocks to gather some production data.

Advice on establishment methods was given to farmers through farm visits, field days, telephone calls and the Evergreen Group's bulletin board. The farmers used a range of sowing methods depending on the sowing and spraying equipment they had available. The demonstrations were sown in the springs of 2001 and 2002.

Resources were not available to take qualitative measurements. However, sites were visited and assessed for the success of establishment, summer growth and survival of the various species.

RESULTS

Not all sites sown established successfully. The most common cause of failure was inadequate weed control. In most cases the dry springs after sowings in 2001 and 2002 did not prevent establishment if the seeding guidelines had been followed. It was only in areas with severe drought that there was not enough conserved soil moisture to get seedlings through their first summer.

The production from the perennial pastures varied considerably from site to site. Summer rainfall and stored soil moisture levels were the main factors affecting growth. Soil type was not a significant factor except for sites with very heavy soils that were the first to show signs of moisture stress. The demonstration at Keith Carter's, Wubin property was in the worst affected region of the 2002 drought. Here the perennial grasses survived with only 120 mm of rainfall in 18 months.

Some of the demonstration sites are listed in the table to give an indication of range of regions in which the perennials were tested. There has been very little testing of these species in the central wheatbelt.

Table 1. Sub tropical perennial pasture demonstrations and trials

Farmer	District	Trial/demo	Grass/legume	Comments
T. Pannel	Balla	Demo	Grass	Productive on yellow sand plain
G. Bain	Mingenew	Demo	Both	5 mm of rain in first summer
D. Brindle	Mingenew	Trial	Grass	Very productive on hill top
C. Forsyth	Dongara	Demo	Grass	10 mm of rain in first summer
I. Broad	Nangetty	Demo	Grass	Productive through two dry summers
K. Carter	Wubin	SGSL demo	Grass	120 mm of rain in first 18 months
G. Palmer	New Norcia	Demo	Grass	Very productive first summer with rain
Carpenter Ag	Bibby Springs	Trial & demo	Both	216 kg/ha beef in 10 months
D. Monks	Bibby Springs	Trail & demo	Both	1,800 sheep on 30 ha
P. Nixon	Gillingarra	Trial	Grass	1,100 kg/ha live weight gain
P. Kelly	Gillingarra	SGSL demo	Grass	Rhodes grass productive on salt scald
P. Barret-Lennard	Gingin	SGS demo	Both	Growing on sands to clays
Dewar & Bellinge	Gingin	Demo	Both	Productivity increasing on very poor sand
D. Melvin	Dowerin	Demo	Grass	Rhodes grass persisted for 10 years
R. Wheatly	Bridgetown	SGS demo	Both	Perennials prevented erosion
R. Thomson	Woodanilling	SGSL trial	Both	Rhodes grass showing salt tolerance
R. Warburton	Kojonup	Demo	Grass	Mixed perennials on sandy slopes
A. Anderson	Wellstead	Trial & demo	Both	Productive grasses and legumes
P. Chalmers	Esperance	SGS demo	Grass	Tagasaste and mixed grasses established

CONCLUSION

A range of sub tropical perennial grasses survived on a range of soil types from deep white sands to heavy clays. There were differences in the performances of the different species at different sites. There was even a significant difference between cultivars of Rhodes grass, with Katambora showing much better salt tolerance than Callide. The Bambatsi panic exhibited the best drought tolerance and Green panic showing the most promise on the poor sands.

KEY WORDS

sub tropical perennial pasture, grass, legume, climate, soil type, farmer groups

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