Current and future use of pasture legumes in central and southern NSW – results of a farmer and advisor survey

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Abstract

A survey of 300 farmers and 33 advisors in central and southern NSW found subterranean clover (ssp. *subterraneum*) and lucerne were sown by 79% and 65% of farmers, and recommended by 91% and 81% of advisors, respectively. Subterranean clover (ssp. *yanninicum*), arrowleaf clover, balansa clover and white clover were used by less than 20 % of farmers. Other legumes were sown by less than 5% of farmers and recommended by less than 1% of advisors. Differences were found between regions with farmers in high rainfall zones using less lucerne (17%) and more white clover (43%) compared to farmers in medium and low rainfall areas (70 % lucerne, 10% white clover). Less than 40% of farmers rated currently used legumes as highly successful. Seventy-eight percent of farmers indicated they would increase or maintain the area of their farm sown to pasture in the future. Farmers mainly intended to use pasture legumes in the future for short-term pastures in cropping rotations or for fodder conservation. Farmers were most interested in using arrowleaf clover, balansa clover, lucerne, biserrula, subterranean clover (ssp. *subterraneum*), purple clover, gland clover and French serradella for these purposes. The majority of farmers (79%) and advisors (71%) indicated they needed more technical information on the growth and management of recently developed legume species before they would be prepared to grow them or recommend their use.

Keywords

adoption, knowledge, management packages, annual legumes

Introduction

Subterranean clover has traditionally been the most widely used pasture legume in New South Wales (NSW) in medium and higher rainfall regions. Lucerne has been used successfully in low, medium and high rainfall regions where soil acidity is not problematic or can be easily ameliorated while various annual medic species have been used in the lower rainfall regions with neutral to alkaline soils (Dear *et al*. 2003, Dear *et al*. 2008). White clover has been used widely, particularly in the higher rainfall zone (Blair 1997,). In recent years a range of new species of annual pasture legumes has been developed for use in Australian farming systems (Nichols *et al.* 2007). Many of these new species have significant agronomic advantages compared to traditionally used species specifically in terms of herbage production, increased water use efficiency (WUE), suitability to difficult soils, improved pest and disease tolerance and/or superior ability to cope with difficult or unpredictable seasonal conditions as a result of having higher hard seed levels and/or ability to set more seed in adverse seasons (Nichols *et al*. 2007, Hackney *et al*. 2008, Hayes *et al*. 2008). Several studies have also shown that these pasture legumes have comparable or superior capacity to fix large quantities of atmospheric nitrogen (N) compared to traditional pasture legumes (Dear *et al*. 2003, Hackney *et al*. 2008), resulting in reduced reliance on inorganic N for crops and pastures. This attribute is particularly important as inorganic N fertiliser prices continue to rise. The majority of these newly developed annual legume species set seed aerially and seed can be harvested using a conventional cereal harvester. In contrast, annual medics and subterranean clover require suction harvesting which can create considerable negative environmental consequences including reduced ground cover on harvested paddocks leaving them more susceptible to wind and water erosion. Many of the recently developed aerial seeding legumes were developed in direct response to this problem (Nichols *et al.* 2007).

While recently developed annual legumes have significant agronomic potential, little information is available on the level of use of these species in farming systems in NSW. The aim of this study was to determine, i) the current level of use of traditional and recently developed pasture legumes in central and southern NSW farming systems, ii) the intended future use of pasture legumes in farming systems, and iii) information required by farmers and advisors to successfully use traditional and recently developed pasture legumes in farming systems.

Materials and methods

Thirty workshops involving 300 farmers and 33 advisors were held in central and southern NSW from August to October 2007. Of the farmers, 64 were from the low rainfall zone (<450 mm average annual rainfall (AAR)), 199 from the medium rainfall zone (450-650 mm AAR) and 37 from the high rainfall zone (>650 mm AAR). Respondents were supplied with individual surveys to complete (survey available on request from authors). The participants were asked to complete questions on the following:

- The species and varieties of pasture legumes currently grown, or in the case of advisors the species and varieties they recommend to farmers
- How successful farmers believed currently used pasture legumes are in their farming systems. The definition of highly successful was that species met farmer production and/or persistence expectations on >95% of occasions .
- The level of knowledge farmers and advisors have of pasture legume species – there were four ratings used. These were “nil”- never heard of the species and had no knowledge of how to grow and manage it, “little”- minimal knowledge of the species and had not previously grown it/or recommended its use, “moderate”- basic knowledge of the species and its management and “good”- possess the necessary skills to successfully grow and manage (or provide high quality information on growth and management requirements) the species
- Indicate whether they would require more information on how to grow and manage (or recommend) the currently used and recently developed pasture legumes
- Identify the information needed before growing (or recommending) a new pasture species
- Farmers were asked how the area sown to pasture on their farm may change in the future
- Farmers were asked the role pasture legumes would play in future pasture systems on their farm
- Farmers were asked which pasture legumes they would most like to use and advisors which they would recommend to fulfil these roles.

Prior to answering question 8, respondents were provided with some information on the attributes and performance of traditional and more recently developed pasture legumes to assist in their decision making process. While provision of this information may have biased the results of this question it, was necessary as the level of knowledge of recently developed pasture legumes was generally very low and an understanding of characteristics of the new species was required to make a more informed decision.

Results

Subterranean clover (ssp. *subterraneum*) was the most widely grown pasture legume across all zones with lucerne the next most widely used (Figure 1). There were, however, some important differences between zones. Lucerne was grown by 70% and 68% of farmers in the low and medium rainfall zone respectively, but by only 17% of farmers in the high rainfall zone. White clover was grown by 43% of farmers in the high rainfall zone, but by less than 10% in the medium and low rainfall zones. Of the more recently developed pasture legumes, arrowleaf clover and balansa clover were the most widely grown. All other legumes were grown by less than 5% of farmers. The diversity of species grown was greatest in the medium (23) as compared to the low (13) and high (12) rainfall zones. While a large number of varieties of subterranean clover (ssp. *subterraneum*) and lucerne were grown by farmers, a few varieties dominated sowings (Table 1). Similarly, a few varieties dominated sowings of less widely grown species.

Figure 1. The percentage of farmers currently growing a range of pasture legumes in low, medium and high rainfall regions and the percentage of advisors recommending these species.

(SC1=subterranean clover ssp. *subterraneum,* SC2= subterranean clover ssp. *brachycalycinum*, SC3=subterranean clover ssp. *yanninicum*, WC=white clover, Lu=lucerne, Vt=vetch, ALC=arrowleaf clover, BC=balansa clover, AvOth=average of all other legumes).

Only 35% of all farmers growing subterranean clover (ssp. *subterraneum*) and 35% of farmers growing lucerne considered these species to be highly successful.. Even fewer farmers rated white clover and arrowleaf clover sowings as highly successful (18% and 26% respectively). Balansa clover was considered highly successful by 40% of farmers. The most common reasons given for high levels of success were suitability to the local climate (including ability to tolerate drought) and/or ability to persist under grazing.

Table 1. Pasture legume varieties most commonly sown by farmers and recommend by advisors (Note figures in this table are the percentage of farmers or advisors indicating they grow or recommend a given species, it is not a percentage of all farmers. For example, 79% of farmers indicated they were growing subterranean clover (ssp. *subterraneum*), of these 27% use Seaton Park)

Species	Variety	% Farmers sowing the variety	% Advisors recommending variety
Subterranean clover (ssp. *subterraneum*)	Seaton Park	27	29
	Goulburn	28	27
Subterranean clover (ssp. *brachycalycinum*)	Antas	67	63
	Clare	33	25
Subterranean clover (ssp. *yanninicum*)	Riverina	57	82
	Trikkala	32	12
Lucerne	Aurora	33	16
	Genesis	17	19
White clover	Haifa	88	45
Arrowleaf clover	Zulu	95	73
Balansa clover	Paradana	55	50

	Frontier	22.5	25
	Bolta	22.5	25

More than half of farmers in all zones indicated they had “good” knowledge of subterranean clover (ssp. *subterraneum*) while the level of knowledge amongst advisors was also very high (Table 2). Level of knowledge of both farmers and advisors of other subterranean clover subspecies was much lower. More than 70% of farmers in the low and medium rainfall zones had good knowledge of lucerne but the percentage was considerably less in the high rainfall zone. Other species for which more than 10% of farmers felt they had a sufficient level of knowledge for successful growth and management of the species were white clover, rose clover, Persian clover, burr medic and barrel medic. Only 3-4% of farmers considered they had good knowledge of any of the more recently developed annual legumes.

Table 2. The percentage of farmers in low medium and high rainfall zones indicating they had a “good” level of knowledge of several pasture legumes.

Common name	Botanical name	% of farmers			% of advisors
		Low	Medium	High	
Subterranen clover (ssp. *subterraneum*)	*T. subterraneum* ssp. *subterraneum*	60	68	63	84
Subterranean clover (ssp. *brachycalycinum*)	*T. subterraneum* ssp. *brachycalycinum*	27	27	23	56
Subterranean clover (ssp. *yanninicu*m)	*T. subterraneum* ssp. *yanninicum*	44	31	26	53
Lucerne	*Medicago sativa*	71	73	31	91
White clover	*T. repens*	23	30	57	56
Rose clover	*T. hirtum*	27	9	9	13
Persian clover	*T. resupinatum*. var. *resupinatum* and *majus*	28	8	6	38
Burr medic	*M. polymorpha*	31	15	3	31
Barrel medic	*M. truncatula*	31	16	3	30

Arrowleaf clover	*T. vesiculosum*	16	30	17	50
Balansa clover	*T. michelianum*	55	38	31	59
Other legume species [1]		4	3	3	13

[1] Other legumes were biserrula (*Biserrula pelecinus*), gland clover (*T. glanduliferum*), purple clover (*T. purpureum*), crimson clover (*T. incarnatum*), bladder clover (*T. spumosum*), eastern star clover (*T. dasyurum*), strand medic (*M. littoralis*), murex medic (*M.murex*), French serradella (*Ornithopus sativus*) and yellow serradella (*O. compressus*).

Overall, 79% of farmers and 71% of advisors indicated they would require more technical information to successfully grow/recommend and manage recently developed pasture legume species. Even for the two most widely grown pasture legumes (subterranean clover ssp. *subterraneum* and lucerne), 60% of farmers and 39% of advisors said they would like more technical information on the growth and management of these species. The five areas farmers most frequently indicated they required information on before deciding to grow a new plant species in order of importance are shown in Table 3.

Table 3. The top 5 issues where information is required by farmers and advisors in deciding whether use/recommend a new pasture species in a farming system

	Farmers	Advisors
1	General information on the suitability to their region	See new plant species growing in region before recommending it
2	Information on plant productivity	General information on the suitability to their region
3	Information on animal performance from utilisation of the plant	Information on plant productivity
4	Economic benefit of the new species compared to those currently grown	Information on plant persistence
5	Information on plant persistence	Suitability of new species for use in mixtures

Overall 47% of farmers indicated they would be increasing the area of pasture in their farming systems in the future, 31% would maintain their current pasture area and 10% would decrease their use of pastures. The remaining 12% were undecided. Fodder conservation (42% of farmers) and use as short-term pastures in cropping rotations (36% of farmers) were the main areas of increased pastures use with permanent pasture (22% of farmers) accounting for the remaining increase. A lower percentage of farmers in the high rainfall zone (29%) intended to increase overall pasture area in the future via use of short-term pastures.

Arrowleaf clover, balansa clover and biserrula were the species farmers were most interested in using to fulfil their future pasture goals with more than 25% in each region indicating that they would like to use these species in the future. More than 20% of farmers in each zone indicated that they would use

subterranean clover for future sowings. More than 30% of farmers in the medium and low rainfall zone indicated they would be using lucerne, but less than 5% of those surveyed in the high rainfall zone intended to use lucerne in future sowings. In the medium and high rainfall zone, French serradella, purple clover and gland clover were also species that farmers were interested in using (more than 15% of farmers).

Discussion

Pasture sowings in Central and Southern NSW are dominated by two species, subterranean clover (ssp. *subterraneum*) and lucerne with a relatively narrow range of varieties dominating sowings. The results indicate that should new varieties be developed with superior agronomic characteristics to those currently used, they would have significant potential in the marketplace. While these species/varieties are widely used, the percentage of farmers considering these legumes to be highly successful was relatively small. It is likely that recent drought events have had significant impact on the actual and perceived success of currently used legumes. However it was evident that both farmers and advisors were keen to improve their knowledge of the management of currently used pasture legumes with majority indicating they would like access to more technical information. An important finding was a much lower level of knowledge amongst farmers and advisors of the subterranean subspecies *yanninicum* and *brachycalycinum*. It is important that this knowledge gap be rectified as these subspecies vary considerably in their suitability to different soil types and choice of inappropriate subspecies will likely result in sub-optimal performance (Dear and Sandral 2004).

Despite a much wider range of pasture legumes being available for use in farming systems now compared with 20 years ago (Nichols *et al*. 2007), these have not been widely adopted by farmers. It appears that lack of knowledge (and lack of sound evaluation data), particularly on performance (both plant and animal), persistence and economic benefit are impeding adoption rates. With 75 percent of farmers indicating that they intend to either maintain or increase their use of pastures in the future, particularly with a focus on use of pastures for fodder conservation and to supply nitrogen to crops, it is important that management packages be developed so that the potential benefits of new species and varieties can be captured.

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