PERENNIAL PASTURES ON CERTIFIED ORGANIC PROPERTIES IN SOUTH EAST AUSTRALIA – A SURVEY OF FARMER PRACTICES AND AWARENESS

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Abstract

A survey of 166 organic producers located in Victoria, New South Wales and South Australia was conducted during 2005-2006 to determine the status of perennial pastures on their farms. A response rate of 71% was achieved. Survey respondents were experienced with an average of 16 years organic farming experience. Respondents had a high level of awareness of native grass species; and some had used management strategies to encourage them. Over half (55%) of respondents had established a perennial pasture since they had been farming organically, with lucerne and perennial ryegrass the most common species sown; lucerne and phalaris were the most common perennial species currently growing. These species, together with fertiliser (and legume inoculum) were typically broadcast into seed-beds, which had been cultivated to control weeds. More demonstration and evaluation of perennial species is required so that producers can make informed choices about species selection and management for their particular conditions.

Key words: Perennial pastures, organic production, establishment, management, native pastures

Introduction

Perennial pasture species are an essential part of dryland farming systems to assist in controlling salinity, reducing nitrate leaching that contributes to soil acidification, and reducing annual species invasion. Significant research has been conducted into the status of perennial pastures within conventional farming systems, but there is a paucity of credible information with regard to the status of perennial pastures within organic farming systems. Broadacre farming systems require perennial pasture species to achieve environmental and economic sustainability (Kemp and Dowling 2000). For example, phalaris (*Phalaris aquatica* L.), lucerne (*Medicago sativa* L.) and many perennial native grass species can remove excess water from soil down to 1-3 m during spring, summer and autumn (Sandral *et al*. 2006). Also, their roots can slow down the movement of rainwater through the profile, using it where and when it falls, thereby reducing the risk of leakage to ground water and the possible onset of salinity (Williamson 1998). Perennial grasses, such as phalaris and cocksfoot, can also be effective in reducing nitrate leaching, which can contribute to soil acidification (Helyar and Porter 1989; Ridley *et al.* 1990). Once established, perennial pastures are competitive and productive and, with appropriate management, can reduce annual species invasion (Campbell and McDonald 1979), thereby assisting in chemical-free weed management.

There has been significant research and development investment into the study of perennial pasture systems within conventional agriculture in south east Australia through programs such as the Temperate Pasture Sustainability Key Program (TPSKP) (Mason and Kay, 2000). The TPSKP program investigated perennial pasture systems in the high rainfall zone (> 600mm) in New South Wales, Victoria, South Australia and Tasmania, focusing primarily on grazing management, but also studying soil factors and producer

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perceptions of pasture decline (Lodge and Orchard 2000, Virgona *et al*. 2000, Avery *et al*. 2000, Graham *et al*. 2000, Garden *et al*. 2000a, White *et al*. 2000, Reeve *et al*. 2000). There have also been reviews of the suitability of perennial species in lower rainfall mixed farming environments (Dear *et al*, 2003), and a significant amount of information has been collected relating to pasture establishment and management methodology (Kemp and Michalk 1994). Only some of this is directly relevant to organic farming systems. Certified organic farms exist in both high and low rainfall regions, and in all states, yet there is a paucity of scientifically credible information available on the status of perennial pastures on these properties. Information is also lacking as to how organic producers establish and manage perennial pastures as part of their farming systems, given the constraints of no herbicides, no soluble artificial fertilisers and a requirement to use certified organic seed. Organic conversion case studies (Wynen 1992, Patterson 2002) provide some general information about organic farming systems, but in terms of pasture establishment and management on organic farms, there is presently insufficient specific information.

Given the critical importance of perennial pastures to the long-term economic and environmental sustainability of dryland farms, and the need for accurate information for new entrants to certified organic production, a survey of certified organic producers in south east Australia was conducted to assess the status of perennial pastures, both exotic and native, and the methods of establishment and grazing management used by these producers. The survey also aimed to find out whether there were novel 'organic methods' of pasture establishment and management that could be communicated to others in the industry. Our survey results, based on organic conversion history, pasture establishment and management trends, and awareness and management of native pastures within the certified organic farming community, are reported and discussed in this paper.

Materials and Methods

A telephone survey of certified organic producers in New South Wales (NSW), Victoria (VIC) and South Australia (SA) was conducted between January 2005 and March 2006 to investigate perennial pastures on organic farms, their establishment and management, and producers' awareness of native grass pastures. A list of 291 potential respondents was compiled from organic certification websites (NASAA 2004, ACO 2003: (*www.nasaa.com.au* and *www.bfa.com.au*). Because our focus was dryland agriculture, we included beef, dairy, sheep/lamb and cropping systems, but not intensive horticulture. To enable comparisons between states and agencies, a stratified sampling method was used to select representative populations from each organisation and state. This resulted in a survey population of 166 producers (numbers in parentheses in Table 1).

Table 1. Number of surveyed organic producers by state, with sample size (*)

State/Agency	BFA	NASAA	Total
NSW	141 (57)	22 (18)	**163 (75)**
SA	16 (13)	25 (20)	**41 (33)**
VIC	25 (20)	62 (38)	**87 (58)**
Total	**182 (90)**	**109 (76)**	**291 (166)**

In a 'pilot study', with eight representative organic producers, survey questions were tested and subsequently fine-tuned (Table 2). Based on their preferences, producers were contacted by telephone (most) or were provided with a facsimile copy of the survey for completion. Producers who could not be contacted during four attempts (at different times and on different days), were recorded as a non-response. Of the selected 166 producers, 141 were contacted, 119 completed the survey, and 22 declined to participate.

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Table 2. Survey questions and answer possibilities

Survey section **Question**	**Alternative answers**
A. Property size, conversion history and demographic information 1. What is the size of your farm?	(acres or hectares)
2. When did you start farming organically (prior to certification)?	Year
3. When did you first apply for organic certification?	Year
4. When did you achieve conversion certification?	Year
5. When did you achieve full organic/biodynamic certification?	Year
6. Can you tell me your age?	Less than 20 years; 20 - 29 years; 30 - 39 years; 40 - 49 years; 50 - 59 years; 60 - 69 years; 70 years or over
B. Perennial pasture information 7. What area of your farm is under pasture this year (2005)?	(acres or hectares)
8. What proportion of the area under pasture is perennial pasture?	(acres or hectares)
9. Can you list the pasture plants on your farm?	List of species
C. Pasture establishment information 10. Have you tried to sow/establish a perennial pasture on your farm since you have farmed organically?	Yes/No
11. Think about the most recent time you sowed a perennial pasture. What year was this?	Year
12. Did you take a soil test before sowing the perennial pasture you just described?	Yes/No
13. What perennial species or species mix did you sow?	List of species
14. Why did you select these species?	Please explain your choice
15. How did you sow it? - Soil preparation	Cultivated/Direct drilled
16. How did you sow it? - Sowing method	Row sown/Broadcast/Undersown
17. How did you sow it? - Fertiliser	Yes/No
18. How did you sow it? - Inoculate legumes	Yes/No
19. When did you manage competition from other plants/weeds in the establishment process?	Before sowing and after sowing
20. What do you think would be the major difficulties that you would face when sowing a perennial pasture?	Please describe
D. Native grass species information 21. Are you aware that there are native perennial grass species on most farms?	Yes/No
22. Have you observed native grass species on your farm?	Yes/No
23. Do you manage native grass pastures differently or the same as introduced pastures?	Differently/Same as introduced species
24. How do you manage native grass pastures on your farm?	Please describe
E. General perennial pasture management 25. With regard to grazing management, how important are the following factors in your decision to move stock out of a paddock? Please rank your choices with '5' indicating most important and '1' least important	Leaf/growth stage of the pasture species? Height of the pasture? Time on the pasture? Paddock has run out of feed? Stock is ready to be sold? Other?
26. Do you lock up (exclude from grazing) perennial pastures to allow them to set seed?	Yes/No
27. Is there any other reason that you might lock up (exclude from grazing) perennial pastures?	Please specify

Statistical analysis

Survey data were analysed using Genstat Version 8™ to produce state, certification agency or combined means with standard errors. Because not all questions were answered, the data are presented as numbers of observations obtained. To best reveal the main trends in pasture establishment and management on certified organic farms, the quantitative data are presented in tabular form and the qualitative data are presented graphically. An overall response rate of 71% was achieved on the survey.

Results

A. Conversion history, property size and demography

Among our surveyed population, producers had been farming organically longest in VIC (average 18 yrs or more), followed by SA producers (16 yrs) and NSW producers (nearly 14 yrs) (Table 3). Producers took just over one year to achieve the first level of certification (conversion). The time taken to achieve full organic certification was longest in VIC (at almost three years) and properties had been fully certified organic the longest in VIC (average almost 9 yrs). Property size in VIC (229 ha) was less than half that in NSW (596 ha) and SA (515 ha). This contrasted with shorter time periods for full certification in NSW and SA of 2.2 and 2.3 years respectively, shorter time periods for full certification (8.1 and 6.5 years respectively), and larger property sizes in NSW and SA (596 and 515 ha respectively). In each state the age-bracket with the highest number of producers was 40-49 years (42 respondents), followed by the 50-59 year cohort (36), then the 60-69 year cohort (23), the 30-39 year cohort (10), the 70-79 year cohort (5) and the 20-29 year cohort (1),

Table 3. Conversion history and farm size (ha) of survey respondents

State	No. of observations	Mean	Standard Error
	Years farming organically		
NSW	42	13.7	± 1.4
SA	23	16.1	± 3.2
VIC	45	18.3	± 2.0
	Years to achieve conversion certification		
NSW	40	1.10	± 0.15
SA	23	1.26	± 0.17
VIC	46	1.02	± 0.11
	Years to achieve full organic certification		
NSW	38	2.24	± 0.21
SA	19	2.32	± 0.32
VIC	46	2.94	± 0.48
	Years farm has been fully certified		
NSW	39	8.10	± 0.92
SA	22	6.50	± 1.32
VIC	46	8.96	± 1.06
	Size of the property (ha)		
NSW	42	596.1	± 128.6
SA	23	515.2	± 135.0
VIC	46	229.3	± 45.0

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B. Pasture status and perennial species frequency

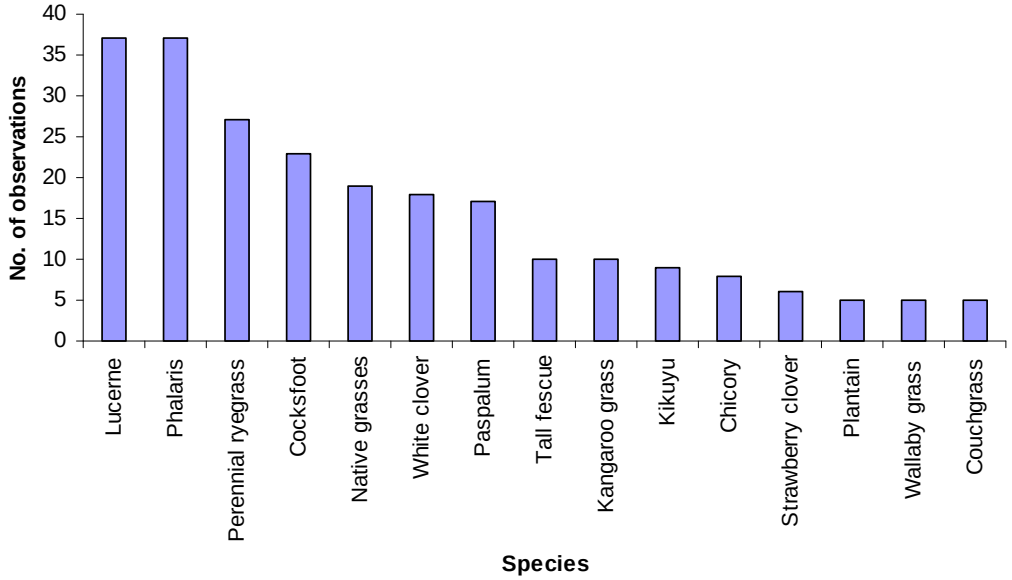
An average of 74% and 72% of the organic farms were under pasture in 2005 in NSW and VIC respectively, compared with the much lower percentage of 52% in SA (Table 4). Of this area under pasture, NSW respondents indicated that an average of 73% consisted of perennial pasture, whereas in VIC perennial pasture was estimated at 43% and in SA at 48% of farm pasture area.

Table 4. Perennial pasture area as a proportion of total pasture area (hectares and %).

State	No. of observations	Mean	Standard Error
	Area of the farm under pasture		
NSW	42	442.2 (74%)	± 118.0
SA	23	266.6 (52%)	± 71.4
VIC	46	164.8 (72%)	± 36.8
	Proportion pasture that is perennial		
NSW	41	324.2 (73%)	± 95.7
SA	23	128.3 (48%)	± 53.1
VIC	45	70.3 (43%)	± 17.7

Producers were asked what pasture species were present on their farms (B 9); and species mentioned were sorted into annuals and perennials, with the perennial species observations sorted from most to least frequently mentioned (Figure 1). Lucerne (*Medicago sativa* L.) and phalaris (*Phalaris aquatica* L.) were the species most frequently mentioned by producers (37 observations each). The next most popular species included perennial ryegrass (*Lolium perenne* L.) (27), cocksfoot (*Dactylis glomerata* L.) (23), white clover (*Trifolium repens* L.) (18) and paspalum (*Paspalum dilatatum* L.) (17). A total of 19 responses were recorded for the category of native grasses. It is not known whether these are actually native grass species or introduced grasses; but some producers did mention specific native grass species such as kangaroo grass (*Themeda triandra*) (10) and wallaby grass (*Austrodanthonia spp*.) (5).

Fig 1. Frequency of perennial species as identified by organic producers in VIC, NSW and SA



C. Pasture establishment

Over half (55%) of survey respondents indicated that they had attempted to establish a perennial pasture since they had been farming organically. Perennial pasture establishment had occurred more frequently since 2003 than in the previous nine years (1994-2002), with very low levels of establishment activity during the mid- to late-1990s (Figure 2). Lucerne and perennial ryegrass were the most common perennial species sown, with 33 and 19 observations respectively (Figure 3). Producers sowed lucerne primarily for stock

feed, especially over summer, and for its N benefits. Perennial ryegrass was sown because it was considered a proven performer in a range of environments; it provides good stock feed and is drought tolerant.

Fig 2. Number of respondents sowing perennial pasture since 1994.

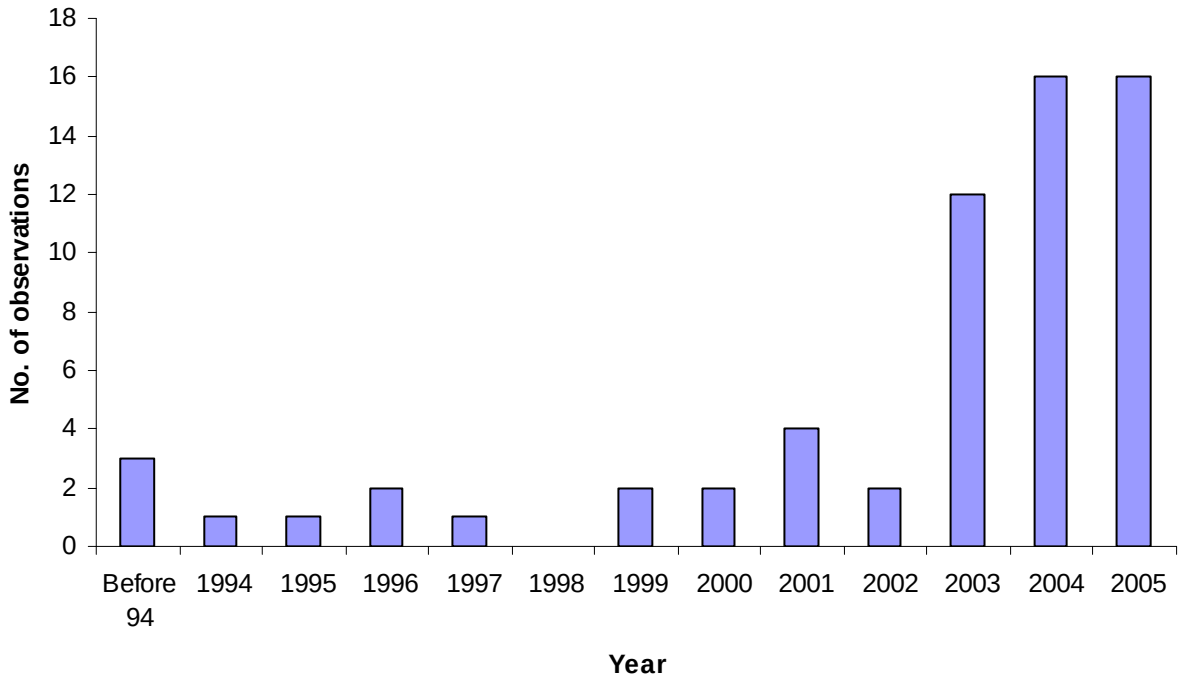
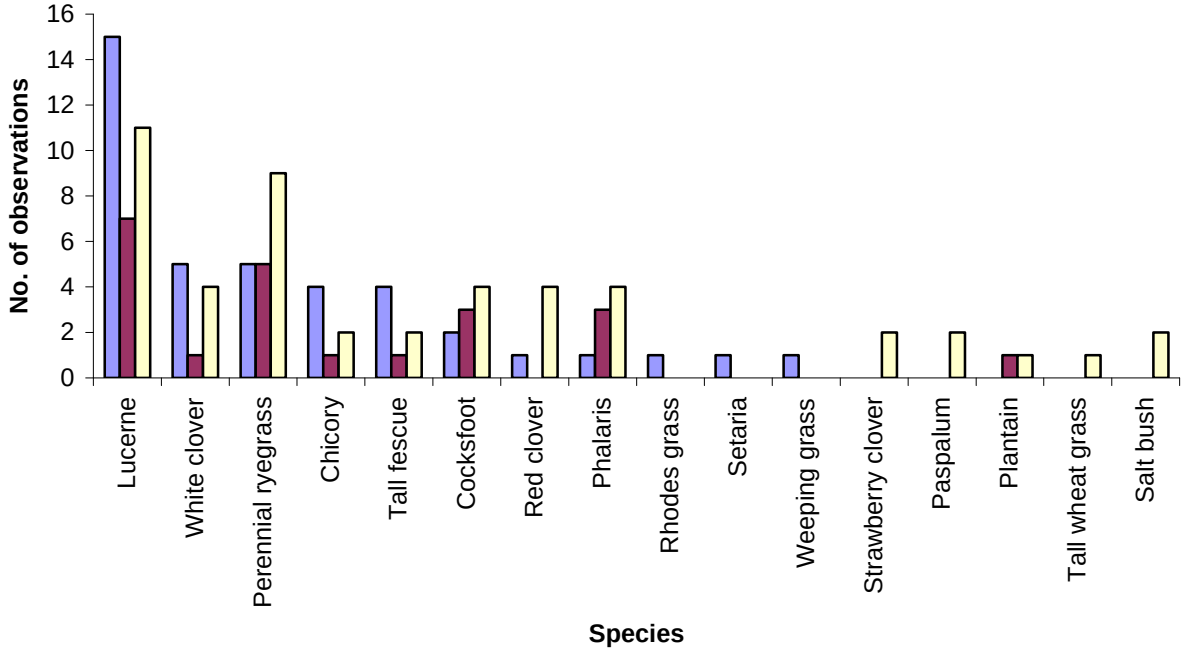


Fig 3. Perennial pasture species sown most recently by organic producers in NSW SA and VIC



More perennial pastures were sown into cultivated seed-beds (75%) than were direct drilled (25%). Two-thirds of producers (66%) conducted a soil test prior to sowing pasture. More producers established

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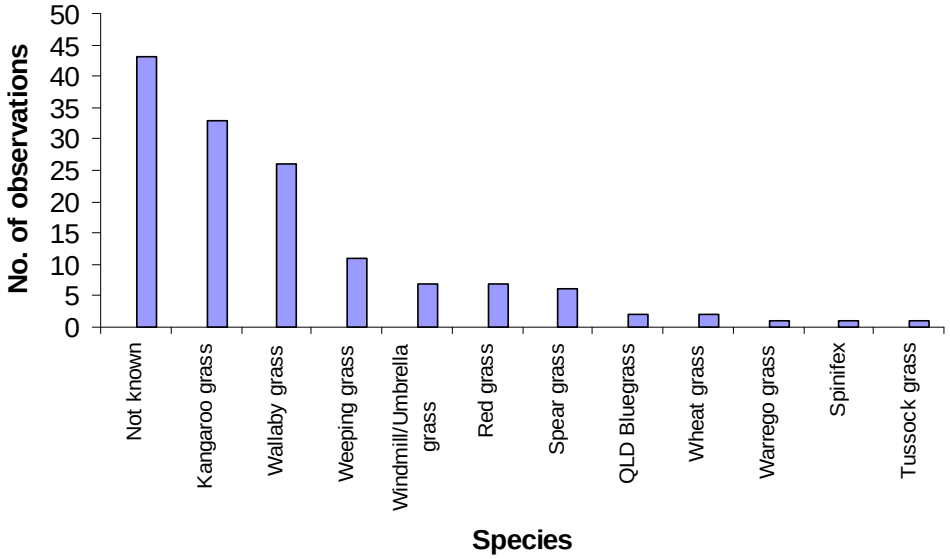
perennial pasture by broadcasting seed on the surface (42%) than by sowing in rows (37%), or by under-sowing with a crop (21%). Most producers applied fertiliser when they established perennial pasture (58%) and inoculated legume seed prior to sowing (64%). Cultivation was the most widely used method (49%) to manage weeds prior to establishment, with heavy grazing being used by 18% of producers. Other methods used to manage weeds included cropping in previous years (8%), increasing the sowing rate (7%), using the crop to provide extra competition in the establishment year (3%), and long fallow (3%). Methods such as cutting hay or green manuring were only used by a small proportion of producers (1%). Most producers (58%) undertook no further weed management after the pasture was sown; however, some (18%) used light grazing pressure to manage weeds in the establishment year. Other methods to manage weed species post sowing included slashing or mulching (5%), topping (5%), cutting hay (5%), hand weeding (3%), further cultivation (3%), or top-dressing with fertiliser (2%) . There was no relationship observed between the number of years farming organically and sowing methodology.

The most common reason for not establishing perennial pasture was the lack of sufficient moisture for sowing and germination (19%). This was closely followed by difficulties with weed management (18%), cost of establishment (15%), and lacking the time to do the work required (11%). Other reasons included having an establishment failure in the past (6%), lack of appropriate machinery (7%), and unfavourable soil conditions (6%).

D. Native grass pastures

Although it is recognised that there was bias in the questions regarding native grasses, most producers indicated a high level of awareness of the existence of native grasses generally, and also indicated that they had observed native grasses on their own farms. Producers were asked whether they had observed native species on their farms (D 22) and many producers offered examples of what they had observed; this was a separate question from perennial species (B 9) indicated in Figure 1. Forty three observations were recorded for the category 'not known', with 33 observations for kangaroo grass, 26 for wallaby grass, and 11 for weeping grass (*Microlaena* spp.) (Figure 5).

Fig 5. Native grass species identified by survey respondents



Most producers (58%) indicated that they managed native and introduced grass species in similar ways. The most frequent responses about the management of native grasses was that there was either no grazing of them (13%) or that they were rotationally grazed (13%). Other popular management strategies included leaving native grasses to set seed (10%), light grazing (8%) and no-overgrazing (8%).

E. General perennial pasture management

Most survey respondents removed stock from perennial pastures during their establishment and for cutting hay (60% and 59% respectively). Other reasons to lock-up perennial pastures included resting the paddock (7%), cleaning the paddock as part of intestinal parasite management (6%), weed management (6%), seed harvest (2%) or because of drought (2%).

Respondents indicated that both pasture leaf stage and pasture height were important in their decision to move livestock out of a paddock. Most respondents indicted either four or five with regard to pasture leaf stage (68%) and pasture height (72%). In contrast, most respondents indicated either one or two for the categories of 'paddock has run out of feed' (66%) and the 'stock is ready to be sold' (75%). Time spent by livestock on the pasture was less clear, with an uneven range of observations, 1 (19%), 2 (8%), 3 (22%), 4 (17%) and 5 (34%).

Discussion

The organic conversion period is difficult for many producers, not just from a farm management and economic viewpoint, but also from a personal and social aspect (Wynen 1992). There is a period when new farming practices have to be learnt and old habits have to be broken, and the perception of changes on farms converting to organic practice can often result in criticism by neighbouring producers. This can result in higher levels of stress amongst organic producers during this period (Wynen 1992). The survey data showed that there was at least ten years of organic farming practice in each state prior to the organic conversion period which included one year to achieve a conversion certification, and at least two years to achieve full certification. This result clearly demonstrates the difficulties encountered by producers in their conversion journey. It is likely that a lengthy 'lead-in' period is required by many producers before the commercial commitment to conversion and full certification is undertaken.

Perennial pastures are most widely established in NSW and VIC and, except for Lucerne, are of lesser importance in SA (Campbell *et al.* 1987). Survey results showed that much of the recent (last 5 years) perennial pasture sowing on organic farms has consisted of lucerne, with all states listing it as the most common perennial species and also the most recently sown species. The popularity of lucerne on organic farms is not surprising as there has been an increasing level of interest in its use in dryland farming systems over the past 15 years, with the area sown steadily increasing since the mid-1980s (Dear *et al.* 2003). Lucerne has many advantages, including a deep root system to manage drought conditions and water use, forage of high nutritive value for livestock, and the ability to fix N for crop production (Stanley *et al*. 2002).

The survey results indicated that there was a period from the mid-1990s through to 2003 when very little perennial pasture was sown by the survey respondents. There are two potential reasons for this result. Firstly, most farmers indicated that the greatest barrier to establishing a perennial pasture was the lack of available moisture at the appropriate time. Although the timing of establishment with regard to season was not explicitly asked in the survey, most producers indicated in discussion that sowing occurred during the autumn months. If the Bureau of Meteorology's rainfall variability index (BOM 2006) is used in the critical period from February through to May, high or very high rainfall variability zones are present in the areas where most of the survey farms are located. This means that the chance of obtaining reliable rainfall for perennial pasture establishment during autumn is generally low, which tends to confirm the farmers' answers. Some perennial species, such as lucerne, can also be established in early spring; in southern Victoria and southern South Australia this may be a common practice. Rainfall variability during the spring period of August to October in these areas is generally lower, which would suggest that spring establishment can be an option there. Secondly, the mid-1990s coincided with the time when the survey respondents had just achieved, or were working towards full certification. This may mean that farmers were initially reluctant to establish perennial pasture because of the perceived risks (weed management, seedbed preparation) of an establishment failure, but as they became more experienced they developed strategies and methods to deal with these issues.

Another major barrier to perennial pasture establishment was the management of weeds. Although there was some indication that other methods of preparatory weed management were being used (heavy grazing, cutting hay), the survey showed a concentration on the use of cultivation. Whilst excessive cultivation is known to result in soil structure decline on many soil types (Suwardji and Eberbach 1999, Macks *et al*. 1996,

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Gardner *et al*. 1994, Hamblin 1980), successful perennial pasture establishment, irrespective of the sowing method, is highly dependent on achieving a weed-free seed-bed (Watson *et al.* 2002, Stanley *et al.* 2002, Campbell *et al.* 1987). Although successful perennial pasture establishment in conventional farming systems has occurred using a direct drilling technique, this success has been predicated on the use of herbicides to manage the competitive effects of existing plant species (Stanley *et al*. 2002, Watson *et al*. 2002). In organic farming where the competitive effects of weeds cannot be managed using herbicides, there is likely to be a high risk of establishment failure with direct drilling. There is a need to provide targeted extension advice on the range of weed management methods available for farmers to prepare for a successful perennial pasture establishment. These may include such strategies as growing a forage crop in the year prior to pasture establishment to encourage weed germination so that the seed bank can be reduced; cutting silage or hay in the year prior to manage weed seed set; increasing the pasture seeding rate to compete with annual weed species; and, ensuring that fertiliser is used with the pasture seed so that it has a competitive advantage.

A broad indication of what organic producers might consider important when moving livestock around their farms formed part of the survey. Although the choices provided were not exhaustive, and in any one year different choices would need to be made depending on seasonal and other circumstances, the results indicated that organic farmers considered both pasture leaf stage and pasture height are important factors to take into account when moving livestock from a paddock. Of less importance were whether the stock was ready to be sold, or the paddock was out of feed. The result for the amount of time that livestock spent on the pasture was less clear, with some producers considering this as important, whereas others regarded this as not so important. General management of perennial pastures is a complex subject and varies between farms, producers, regions and enterprises. A more comprehensive and thorough assessment of pasture management through on-farm visits would be required to fully understand the management decisions made by organic producers. The survey attempted to glean some information about the motivation for livestock movement, as one indicator of pasture management. It is recognised that there are other motivating factors and issues that need to be considered when trying to draw conclusions from a survey. More research is required to determine whether organic producers access and effectively use the grazing management information that may have relevance to their farming systems.

Although we recognise that the survey questions regarding native grasses may be somewhat biased, most survey respondents indicated a high level of awareness of the presence of native grasses on their farms. This result is consistent with surveys conducted during the 1990s that found 'considerable proportions of native perennial grasses remaining in pastures despite many years of pasture improvement and grazing' (Garden *et al.* 1996). It is not known whether this knowledge is relatively new or has been within the farming community for some time. Knowledge of native grasses and their role in pasture systems, at least in New South Wales, has been evident since the early 1900s (Breakwell 1915), but in a more recent survey Garden *et al.* (2000b) found that farmer knowledge of native grass species on the Central, Southern and Monaro Tablelands in NSW was generally poor and that their management was similar to introduced species. In our survey many producers indicated knowledge of particular species (eg, kangaroo grass) and how these could be managed on their farms. Over half of the organic farmers surveyed indicated that they managed native grass pastures the same way as introduced pastures. This is consistent with the findings of Garden *et al.* (2000b); however, over a third of the organic producers in our survey indicated that they managed native grass pastures differently to introduced species. They either had no grazing, or selective grazing strategies, such as livestock exclusion to promote seed set, or low stocking rates. This result is consistent with comments made by most of the organic producers at a perennial pasture workshop conducted at Rutherglen (Victoria) in March 2006 (unpublished data 2006); 16 of the 29 organic producers indicated that they were actively promoting native grass species on their farms. There is a need for state Departments of Primary Industries to continue to provide information on native grass identification to producers so that they can know what species are present on their farms. Information on the production capability, persistence, palatability and availability of seed, of common native grass species is also required.

Conclusion

The survey has provided a snapshot of perennial pastures on organic farms in south east Australia, their method of establishment, and some indication of current management and producer knowledge. Novel methods of pasture establishment for organic systems were not discovered as a result of the survey. A more sustainable pathway to perennial pasture establishment on organic farms may require improved extension on integrated weed management in preparation for pasture establishment so that cultivation can be reduced.

Knowledge about the role of native grass species within dryland farming systems, their identification and management for long-term persistence needs to be improved and extended. A conscious effort to include organic farmers and their farming systems in current pasture and livestock management extension and communication activities will extend adoption of more sustainable farming practices.

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