Farmers’ experiences with the companion cropping of lucerne in North Central Victoria

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Abstract

Companion cropping (also known as inter-cropping) of lucerne involves sowing an annual crop into an existing lucerne stand. A sample of eight farmers from north central Victoria, who currently companion crop, were interviewed to document the impact of this practice on grain production, and to determine why and how they used this approach in their farming system.

All eight farmers companion cropped lucerne to produce grain for either human or livestock consumption. Wheat, barley, oat and triticale were most commonly sown into lucerne stands, with canola less frequently companion cropped. Most companion-cropped stands of lucerne were either winter-active or highly winter-active cultivars and most had densities of 10-30 plants/m^2. They were commonly 9-12 months old, although some stands up to 10 years old were successfully companion cropped. Sowing rates of the annual crop were generally greater than those used in conventional monoculture cropping, and most farmers sowed diagonally across existing lucerne rows.

Most interviewed farmers adopted companion cropping because of perceived better economic returns from cropping rather than grazing their second-year stands of lucerne, which then became more persistent and productive stands for future grazing. Farmers who companion cropped into mature stands aimed to maintain year-round plant transpiration to minimise the impact of their cropping practices on local groundwater systems, through a better hydrologic balance between the rainfall and their vegetation.

Decreased grain yields from companion-cropped crops were common, and were estimated to be 10 to 80 % of those obtained in the absence of lucerne. The magnitude of the yield decreases appeared to be most strongly influenced by seasonal conditions. The use of herbicides for in-crop lucerne suppression was perceived to enhance grain quality by slowing lucerne growth over the late winter-spring period, thereby reducing lucerne seed and herbage contamination at harvest. As seasonal and soil water conditions critically influenced the success of herbicide applications, specialist advice was often sought.

Key words

inter-cropping, grain yield penalty, water balance, grain crop seeding rates, in-crop lucerne suppression

Introduction

Field experiments conducted across Australia have shown that lucerne can dry the soil profile to depth and reduce the threat of dryland salinity in cropping regions (1, 2). The challenge now facing agronomists is to design economically-viable farming systems that integrate lucerne into annual cropping systems.

Presently, phase farming with lucerne is one recommended option in which 3-5 years of lucerne are followed by a 3-5 year sequence of annual crops (3). This approach restricts the proportion of farm under lucerne in a given season, and includes the added costs and risks of successful lucerne removal and re-establishment. Lucerne companion cropping is an alternative approach in which annual crops are sown into existing lucerne stands. Cropping into permanent lucerne stands continues to reduce the potential of excessive recharge by maintaining active lucerne roots in the soil profile during cropping, and eliminates the cost of lucerne removal and re-establishment. Whilst this approach sounds plausible, the practice is performed by only a small number of Victorian dryland grain farmers.

Very little published information exists in the literature on companion cropping with lucerne under Australian conditions. Due to the lack of experimental data to guide researchers and advisers, the experiences of farmers who currently companion crop lucerne are valuable sources of information that can help address some knowledge gaps, and more importantly provide a clearer focus for future research efforts. This paper summarises the main findings of a series of one-on-one interviews with farmers who have companion cropped lucerne stands.

Methods

Eight Victorian farmers who currently companion crop with lucerne in the Natte Yallock, Raywood, Wedderburn, Bridgewater and Kamarooka districts in North Central Victoria (Figure 1) were interviewed.

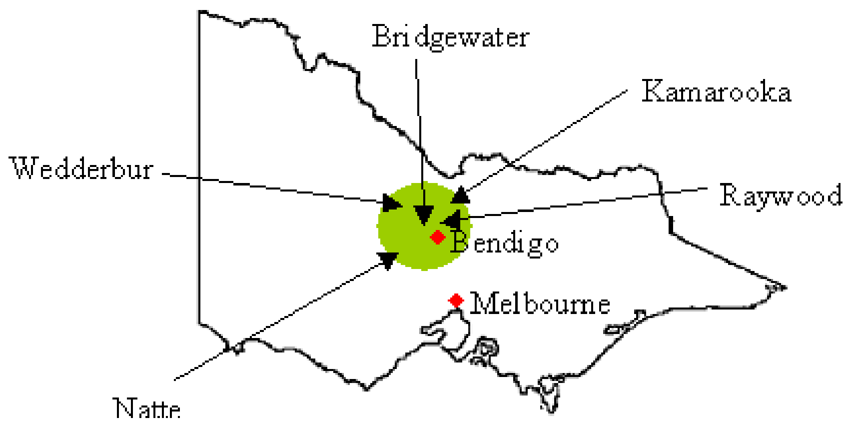

Figure 1. Location of farmers interviewed.

The interview commenced with general questions about the property size, the main farming enterprises and the climatic environment in which the farmers were operating. More specific questions followed about how companion cropping fitted into existing crop rotations, why and how farmers companion cropped, what were the advantages and disadvantages of companion cropping, and whether they saw a viable future in companion cropping. All eight farmers were asked the same questions.

Results and Discussion

This paper reports the major findings from the farmer interviews. Although farmer responses to the interview questions were partly quantitative, they were also based on their perceptions. Therefore the data collected in this study is more qualitative than quantitative and no quantitative analyses have been performed on them. Kieran Ransom (NRE Bendigo, personal communication) estimates that at least 40 of the approximately 700 farmers in the districts where the interviewed farmers live have companion cropped lucerne in the last 10 years.

Each of the interviewed farmers ran mixed livestock and cropping enterprises in the 400-450 mm annual rainfall zone of North Central Victoria. Farms varied in size from 570 to 4600 ha, with 25-38% of farms under lucerne and 15-88% under grain crops in any given season. Two of the farmers companion cropped most of their lucerne each year, while the remainder companion cropped either 5-30% of their lucerne stands annually, or sporadically from year to year.

Generally, the interviewed farmers companion cropped to produce grain for either human or livestock consumption. Wheat, barley, oats and triticale were often sown into lucerne, with canola less frequently sown. Six farmers grew 3-4 annual crops, followed by lucerne established either under a pulse cover-crop, or sown alone in the spring of the fourth or fifth year (Table 1). In the year following lucerne establishment, a cereal companion crop was grown, before returning to a lucerne pasture. The two farmers who companion cropped mature lucerne stands used a sequence of crops similar to those used in conventional cropping rotations.

Table 1. Crop rotations used by farmers who companion crop lucerne.

Location/District	Mean annual rainfall (mm)	Crop rotation *
Natte Yallock	472	1. <u>canola, wheat, barley, oat</u>
		2. <u>canola, barley, canola, barley</u>
Natte Yallock	472	1. <u>canola, oats or barley, fababean</u>
		2. <u>canola, oat, oat</u>
Wedderburn	475	wheat, barley, lupin, <u>barley or wheat or oat</u>
Wedderburn	475	wheat, canola, wheat, lupin, <u>barley</u>
Bridgewater	435	canola, wheat, wheat, canola, wheat, lupin, <u>wheat or oat</u>
Raywood	431	canola, wheat, barley, lucerne, <u>triticale or oat</u>
Raywood	431	canola, wheat, barley, lucerne, <u>triticale</u>
Kamarooka	435	canola, wheat, wheat or barley, safflower, <u>oat or wheat</u>

* Underline denotes companion crops

Before sowing grain crops into their lucerne stands the farmers often applied broad-spectrum herbicides to reduce lucerne growth and remove annual weeds. The lucerne stands were mostly winter-active and highly winter-active cultivars and had densities of 2-30 plants/m^2 (Table 2). Cereal sowing rates (80-100 kg/ha) were generally higher than those used in conventional cropping (70-80 kg/ha), whilst canola was sown at 5 kg/ha. Most farmers sowed across the existing lucerne rows at a 45?angle to minimise damage to the lucerne.

Table 2. Lucerne densities and age at the time of sowing the annual crop.

Location	Lucerne density (plants/m^2)	Lucerne age
Natte Yallock	5-20	1-10 years
Natte Yallock	10	18 months - 8 years

Wedderburn	10-20	12 months
Wedderburn	10-20	12 months
Bridgewater	10-25	12 months
Raywood	25-30	9-12 months
Raywood	20-30	9-12 months
Kamarooka	2-30	9 months

Some farmers considered that the use of herbicides for in-crop suppression of lucerne was necessary to enhance grain quality by slowing lucerne's growth over the late winter-spring period, and so reducing lucerne seed and herbage contamination at grain harvest. Variable seasonal and soil water conditions heavily influenced the effectiveness of herbicide applications, so specialist advice was often sought. Farmers estimated that with companion cropping, grain yields were 10-80% less than those of conventionally grown crops. Egan and Ransom (4) reported similar yield penalties (6-60%) in field experiments conducted over several seasons in the Bendigo region. They concluded that the magnitude of the yield penalties was influenced by seasonal conditions, with dry conditions during the grain-filling period in particular compromising grain yields. In wetter environments (525 mm, long-term average annual rainfall), Angus *et al*. (5) found no yield penalties in wheat sown into lucerne, but measured a 10% reduction in canola yields in the following season. They concluded that the advantages and disadvantages of lucerne companion cropping depended on soil water availability, with net advantages more likely in wetter (> 500 mm) cropping environments.

The reason most farmers gave for adopting companion cropping was the greater economic return from companion cropping, compared with grazing and that deferring grazing encouraged more persistent and productive stands in the following years. Often, farmers felt that second-year lucerne plants were still too small (often singled stemmed and less than 150 mm in height) for routine grazing. Also, as second-year lucerne stands were largely weed-free following a cropping phase, farmers felt this provided an opportunity to grow another annual crop. Where lucerne had been established under a pulse cover crop, the farmers saw companion cropping in the following year as one way to utilise the increased soil nitrogen provided by the pulse crop. Cropping into second-year lucerne stands provided an income from a paddock that was otherwise thought of as "out of production". Farmers who cropped into mature stands were more concerned about maintaining year-round plant water use to reduce rates of ground water rise, than economic returns.

The farmer interviews identified four key issues on companion cropping with lucerne.

1. The potential magnitude of the grain yield penalties from the companion crop is likely to deter more farmers from adopting the practice.

2. Farmers who did not successfully suppress the lucerne in-crop suffered grain contamination problems at harvest, limiting their capacity to supply grain to markets destined for human consumption.

3. Some farmers have developed effective in-crop methods of lucerne suppression, but were concerned that in some seasons, this might actually kill plants. These farmers felt that there was a role for alternative herbicides that inhibited lucerne growth without killing the plant.

4. All farmers were confident that on mixed farms, companion cropping was a profitable land use that provided a reliable income. However, none of them had completed an economic analysis of their system verses alternative crop−pasture rotations.

Conclusion

Despite the yield penalties associated with lucerne companion cropping, the interviewed farmers plan to continue the practice because the young lucerne stands are relatively weed free and offer limited grazing potential in their second year. Those farmers who cropped into mature stands were more concerned with keeping local ground water levels stable to guard against dryland salinity.

If companion cropping with lucerne is to become a more widely-adopted practice, further research will be needed to identify appropriate management practices for a range of environments and soil types. Furthermore, the grain yield penalties suffered by companion crops need to be reduced if companion cropping with lucerne is to become an economic option for more farmers. Improvements in the grain yields of companion crops can only be achieved if researchers and advisers improve their understanding of the competition between the annual crop and lucerne for water, light and nutrients at critical periods of the growing season. Only then can agronomic strategies be developed that minimise this competition and improve the grain yields of companion crops.

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