Pasture cropping – winter grain yield with high quality summer feed

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Take home messages

- Commercially acceptable grain yields can be achieved from pasture cropping systems in Southern Victoria
- At this stage, traditional winter crops sown into a lucerne stand has the best fit for our environment.
- Lontrel can be successfully used to inhibit lucerne growth during the crop phase.
- Barley returned the best grain yield averaging 5.5 t/ha and topping at 6.3 t/ha
- Wheat averaged 4.3 t/ha and canola averaged 1.7 t/ha
- Lucerne on wide row spacings (30 cm) can help to improve yield and grain quality.

Background to the trial

Pasture cropping involves an annual cycle of sowing crops into a perennial pasture base with the aim of harvesting the crop as grain or fodder and then using the pasture for grazing. The technique was pioneered in the 1960s and refined by Colin Seis in Northern NSW in the mid-1990s, where winter crops were sown into dormant stands of C4 (summer growing) native grasses. The match of summer dominant rainfall combined with summer active perennial species and an ability to grow a winter crop aligned well with the goals of pasture cropping; that is, that pasture and crop don't directly compete with each other and year round production is achieved. The resulting benefits of greater groundcover levels year round, higher plant and animal production and better nutrient cycling give positive benefits to the environment and farm profitability.

Southern Victoria poses some challenges to adopting the above system. Growing season rainfall is winter and not summer dominant and there are very few remaining native pastures. Most pasture paddocks comprise of winter active perennial species such as perennial ryegrass, phalaris and tall fescue. Highly competitive annual weeds including annual ryegrass, sub clover, barley grass, capeweed and soft brome also feature in our pastures. Rather than being complementary, our existing pasture base is competitive with the winter crop. A further complication to the story is that when our pastures aren't growing – in summer – our unreliable summer rains and cool climate make summer grain production difficult and risky. This makes the northern system challenging and not applicable to our region.

Consequently, lucerne is being touted as the perennial pasture base for our pasture cropping system. It was chosen because of its potential fit into our current winter cropping programs, its ability to use stored winter soil moisture over summer and its proven ability to tolerate a cereal being sown into it (refer to boosting winter lucerne production by sowing a cereal in winter from Grain and Graze 1).

This trial is designed to demonstrate that is possible to grow a viable winter crop and still maintain a productive lucerne stand over summer.

Designing pasture cropping trials to achieve commercially acceptable yield

This trial was designed to demonstrate whether or not commercially acceptable grain yields can be achieved using an established lucerne pasture as the base of a pasture cropping system. Traditionally grown winter crops were sown into an established lucerne pasture (see Table 1 below) and managed in such a way to achieve maximum grain yield.

Table 1. Details of winter crops and lucerne cultivars sown as part of the pasture cropping trial. WA = winter activity rating.

Winter crops		
Wheat	Axe	100 kg/ha
Barley	Westminster	100 kg/ha
Canola	44Y84CL	5 kg/ha
Lucerne		
WA4	WL342	8 kg/ha
WA3	King Island Creeper	8 kg/ha

In the setting up of the trial we choose to use two lucerne varieties, WL242 and King Island Creeper, which show a strong winter dormancy. In the case of King Island Creeper it has a prostrate growing habit that may work to minimize crop competition and harvest difficulties (Figure 1).

Figure 1. KI Creeper (left) showing more prostrate growth habit allowing for quicker crop canopy closure and reduced harvest difficulties and WL 342 showing its more upright growth habit (right).

Taking the lead from previous Grain and Graze work (Watson, 2012), chemical suppression of the lucerne with Lontrel (active ingredient Clopyralid) was also undertaken in spring to reduce the competition from lucerne. Lontrel was applied at 75 ml/ha and 150 ml/ha. Good levels of suppression were achieved at the higher rate which allowed good crop growth. Figure 2 shows suppressed lucerne with good canola growth compared to unsuppressed lucerne.

Figure 2. The suppressing effects of 150 ml/ha of Lontrel on lucerne (left) compared to untreated lucerne (right).

The other feature of the trial is the use of narrow (15cm) and wide (30cm) lucerne row spacings in a bid to determine whether reduced damage to the lucerne stand, improved establishment of the winter crop and increased grain yield and quality is possible. From previous work (Nicholson et al., 2013) it was found that lucerne dry matter production wasn't compromised over summer in stands established on wide row spacings. Therefore if crop performance is improved there is no downside to sowing the lucerne pasture base on a wider row spacing.

Figure 3. Wide row spacings prior to sowing (left) with canola establishment (right) after sowing. Note the good establishment of dual canola rows between the lucerne rows with very little damage to existing lucerne plants.

How did we go?

If we take the starting point for acceptable commercial yields to be canola 1.8 t/ha, barley 3.5 t/ha and wheat 3.5 t/ha then this year's pasture cropping demonstration almost achieved its goal (Figure 4) with only canola falling slightly short.

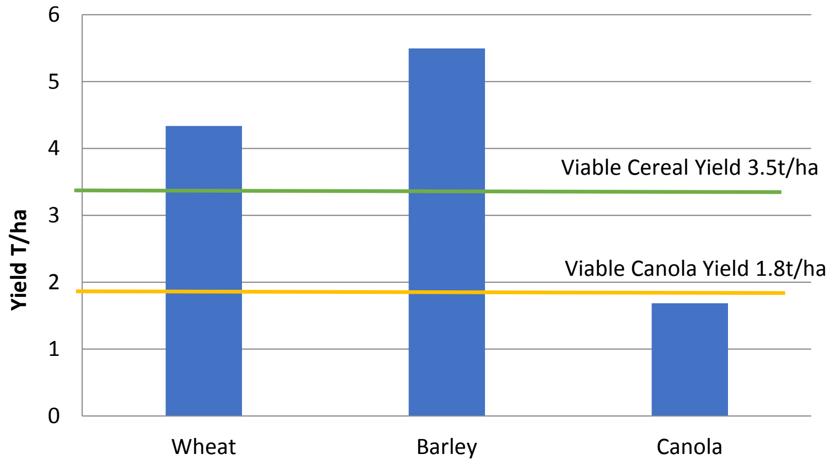

Figure 4. Average winter crop yields under pasture cropping at Inverleigh compared to the acceptable commercial yields of 3.5 t/ha for cereals and 1.8 t/ha for canola.

Barley

Barley with an average yield of 5.5 t/ha stood out as the lead performer. It established well, achieved quick canopy closure which reduced competition from weeds and maintained good suppression of the lucerne.

Wheat

Wheat achieved an average yield of 4.3 t/ha but was handicapped by being less vigorous in its establishment and achieving slower canopy closure which allowed greater competition from weeds (mainly ryegrass) and better recovery of the Lucerne from its Lontrel suppression. The better lucerne recovery necessitated crop desiccation so harvest problems weren't experienced.

Canola

Canola achieved an average yield of 1.7 t/ha which was a little disappointing but may have been impacted on by a marginally late application of Clethodim. Windrowing the canola overcame any problem associated with green lucerne at harvest.

The importance of using a wider lucerne row spacing

The importance of establishing an adequate plant population and using wide row spacings to achieve a good yield is demonstrated below in Figure 5. The research suggests that sowing into the wide (30cm) inter-row space partly allows for better establishment but more importantly increases yield in both wheat and barley, however these differences were not significantly different.

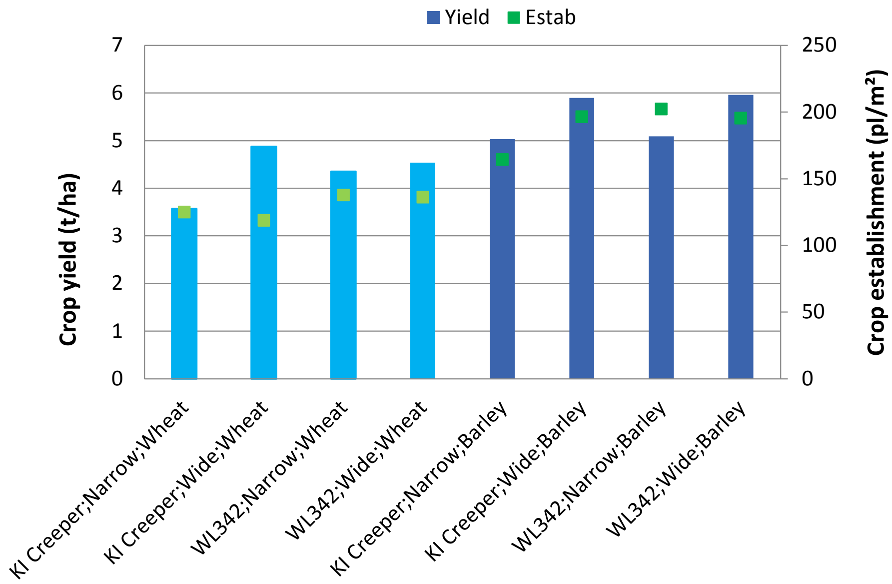

Figure 5. Shows the relationship between lucerne row spacing, crop establishment and yield.

The other positive effect of using wide row spacings was on grain quality (Figure 6). In both wheat and barley, protein levels were significantly higher under a wider row spacing. Wheat proteins increased from 11.3% to 12.3% and barley improves from 10.1% to 11.0%. Improvements were also made to test weight but these were not significant..

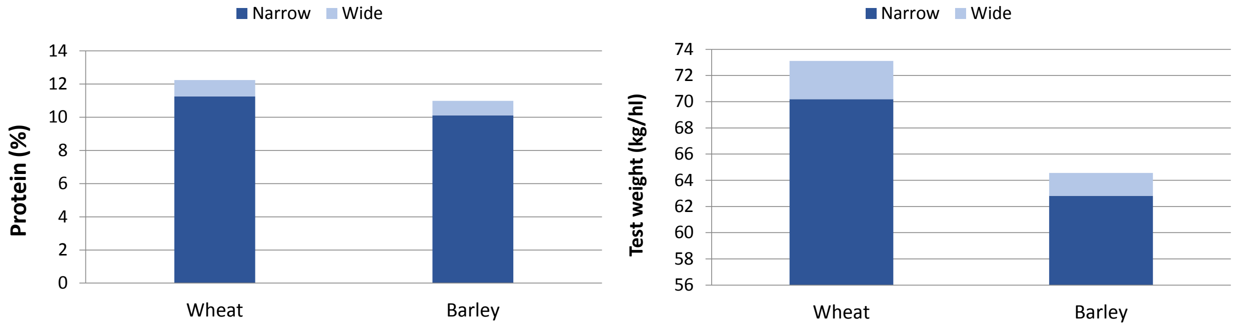

Figure 6. The difference in test weight (left) and protein (right) between wheat and barley due to having lucerne set up on wide row spacings.

Increases in both traits for wheat was beneficial in moving the grain up the quality matrix from AGP1 to AUH2; but it did not reach the top milling grade. Similarly, barley only reached feed grade despite some improvement in quality because the test weight was still too low.

Conclusion

Good yields were achieved in the pasture cropping trials at Inverleigh in 2013. There is a benefit in both yield and grain quality in establishing lucerne on wide row spacings (30cm) in a pasture cropping system. As with all cropping enterprises weed control is paramount to achieving good grain yields. Our observations in some plots noted that a large ryegrass population can be very detrimental to final grain yield. Reducing weed seed set the previous spring to embark on a pasture cropping program is essential.

Figure 7. Believe it or not! There is that much lucerne (left) under that barley plot (right). The barley plot on the right yielded 6.13 t/ha.

References:

Nicholson C, Watson D, Falkiner (2013) Pasture Cropping. P42 Grain and Graze Workshop Notes, GRDC, CFoC, SFS Inverleigh.

Watson D (2013) Pasture Cropping. P40 Grain and Graze Workshop Notes, GRDC, CFoC, SFS Inverleigh.

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