

Turning sowing times on their head with spring-sown canola and wheat

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Key messages

- Winter habit canola has been successfully sown in spring, grazed over summer and harvested for grain in 2012, 2013 and 2014.
- Establishing canola in spring means larger, more resilient plants in autumn with less impact from slugs and waterlogging.
- Forage value comparable to commercially available dedicated forage rapes over summer and autumn with added benefit of oil seed production.
- Grazing management and timing of stock removal is proving to have an impact on grain yield.
- Vernalisation means winter wheats have the potential to be used in the same way.

The spring sown canola story

Grazing cereals has proven to be a major opportunity for mixed livestock and cropping farmers in Southern Victoria. If managed correctly, the crop can provide ample amounts of forage over winter and go on to produce grain without a penalty on yield. With more and more land sown to canola in the HRZ, finding the fit of canola in a mixed farming system has been the focus of more recent research. Over the last four years, SFS trials have shown that grazing of canola over winter hasn't supplied much feed and has usually been at the expense of yield.

Conventional grazing of canola in the HRZ provides valuable winter fodder, yet often at the expense of grain yield come harvest. With the introduction of varieties with a vernalisation requirement, such as Taurus and Hyola 971 CL, spring sowing and grazing over the summer/autumn period can fill the feed gap with potentially little impact on subsequent grain yield, as well as provide other options for management of problem paddocks.

Sowing in October or November means that the crop is in the ground for over 12 months. The vernalisation requirement of winter canola varieties dictates that a plant will not flower until it has endured a certain period of cold weather (over winter). In order to make a comparison, in 2010 some Hyola 50 (spring canola variety) was sown alongside Taurus and was attempting to flower over summer.

What have we learnt in the last 12 months?

The earlier you sow, the better: paddocks sown mid-late September 2014 were ready for grazing at the start of November, establishing on very little rainfall. Having the seed in the ground, rather than waiting for a big rain and sowing afterward would be the best approach but could also be considered more risky. Establishing on a few separate rainfall events isn't going to hurt the crop provided the youngest plants are established well enough before the first grazing. There is very little risk of the vernalisation requirement being fulfilled in the late spring, however sowing before mid-September would be pushing it.

Refining grazing management: deciding how hard to push the crop is going to depend on the preference of the farmer and the seasonal opportunities (sheep prices, weather conditions etc.). Grazing the plants hard is not an issue, but set stocking a paddock and grazing lightly for an extended time seems to result in poorer recovery than a short heavy graze with high stocking numbers. Smaller paddocks or strip grazing if stock numbers are low may be a way to manage this better.

Remove stock when sowing canola in autumn: the timing of locking the paddock up for grain seems to be crucial and needs to be stressed to growers grazing spring-sown canola. As a rule of thumb, for optimal grain yield, animals should be taken off the crop around the same time canola is being sown in the autumn. The later this 'lock up' date is pushed back, the harder the crop has to work to recover from grazing before cold and wet conditions in late autumn and winter cause stress to the crop.

Don't be scared by low plant numbers: we yearn for good, even germination in a canola crop, aiming for around 60-70 plants/m² in an autumn grain crop. Whilst aiming for these numbers in spring (around 3 kg/ha sowing rate) we have often failed to get even half that in the spring/early summer due to weather conditions. It's daunting, but soon goes unnoticed once the plants start growing and covering ground. Plant numbers in the autumn, after a summer of grazing, seem to be closer to the 15 plants/m² mark, yielding the same, if not better than an autumn sown crop with a plant stand of over 50 plants/m². Plant numbers have dropped over summer whether grazed or not.

Sheep prefer the taste of canola over rape: the advantage of using real sheep to graze trial areas is what gives

us this insight. In February 2014, the rape plots were left virtually untouched by the sheep, with the rest of the trial area eaten down to bare earth. This is thought to be due to the higher glucosinolates in rape, to ward off pest damage over the summer, which has been bred out of canola and seems to make the taste less bitter. In 2014, Brazzil was the preferred variety over any others, with four plots clearly bared out in the trial area, before any of the others were touched. Other industry research is suggesting that grazing ewe lambs on spring-sown canola compared to other traditional pasture or forage crops increases conception rates.



Figure 1. Sheep preferred spring sown canola over forage rape as a summer feed. This is thought to be due to higher glucosinolate levels in rape which can cause bitterness.

Use grazing as an integrated pest management (IPM) strategy: Loss of leaf due to grubs over the summer is something we have seen each year (in varying degrees depending on location). Whilst an early spray for grubs may be inevitable in some situations, the IPM approach suggests that the damage caused by the grubs to the plant is going to be superseded by the impact of stock grazing. Manage pest burdens by grazing as soon as possible to remove the green leaf and feed source, but consider high nitrate levels if grazing early. Slug pressure in autumn hasn't been a problem for established spring-sown plants.

Dry matter production and yield 2012

In spring 2011 we set out to answer some key questions relating to grazing spring-sown canola. How many times can it be grazed before a yield penalty is suffered? Should I graze it lightly or can I graze it as heavily as my cereals? Does nitrogen application following grazing enable better recovery?

Quality of feed on offer was high throughout the grazing period. Metabolisable energy (ME) averaged 13.5 MJ/kg dry matter and protein was up around 22%. Nitrate poisoning was not of concern, with levels well under the toxic threshold of 1000 mg/kg for lambs. In saying that, introducing stock to forage brassicas needs to be done gradually – it is important that stock are not put out on canola with an empty stomach and they perhaps should be supplied with some roughage when grazing.

Table 1. Dry matter production and grain yield for spring sown Taurus canola at Dunkeld, Victoria in 2012.

Grazing (no).	Intensity of grazing	Grazing times	Days grazed	Dry matter consumed - cumulative (kg DM/ha)	Grain yield (t/ha)
1	Light	31 Jan - 22 Feb	22	494	2.8
	Heavy	31 - Jan - 5 Mar	34	2316	2.5
2	Light	31 Jan - 22 Feb	29	2763	2.9
		29 Mar - 5 Apr			
	Heavy	31 - Jan - 5 Mar	46	2944	2.5
		29 Mar - 10 Apr			
3	Light	31 Jan - 22 Feb	36	3488	2.7
		29 Mar - 5 Apr			
		26 Apr - 3 May			
	Heavy	31 - Jan - 5 Mar	55	4031	2.4
		29 Mar - 10 Apr			
		26 Apr - 7 May			
		LSD (<i>p</i> =0.05)			NS*
		Sown in Spring, ungrazed			1.9
		Sown in Autumn, ungrazed			2.3

*Not Significant.

In 2012, grazing over summer increased grain yield compared to no grazing as shown in Table 1. Spring sown and ungrazed yielded 1.9 t/ha with optimal grazing going 2.7 t/ha. Taurus sown at the conventional time (April) yielded 2.3 t/ha. Observations were that plants that were grazed had branched more and produced a denser canopy with stems producing pods for grain.

The number of times the crop was grazed had a small effect on yield. Grazing twice produced the best result, yielding 0.1 t/ha more than grazing once and 0.2 t/ha more than grazing three times. Although there was a yield penalty by grazing three times compared to two times, the third grazing supplied an additional 1 t/ha of high quality feed at the beginning of May.

Heavy grazing reduced yield compared to light grazing irrespective of the number of times it was grazed. However the reduction in yield was small and the heavy grazing produced 4 t/ha of feed compared to 1.4 t/ha when lightly grazed. When deciding on stocking rate and grazing intensity, it can be a trade-off between the value of the feed over summer and autumn and final grain yield suggesting that attitude and preference will vary between growers.

Applying nitrogen over summer has no yield benefits except for multiple (three) heavy grazings. In this case yield increased from 2.0 t/ha to 2.7 t/ha when 150 kg/ha of urea was spread after each grazing. This would suggest that an application of fertiliser purely to boost crop performance is not necessary.

Dry matter production and yield 2013

The 2013 season was almost completely opposite to 2012, with extremely dry and hot conditions from sowing until the break in May 2013. Table 2 shows that dry matter production was down on 2012 (over a tonne less feed) however the value of the green feed in 2013 would most likely outweigh the extra tonne in the favourable 2012 season. It is difficult to put a price on almost three tonne of high quality green feed when there is nothing else around!

Resilience of the canola was well and truly tested, with three very heavy grazings occurring between the end of January and the end of April. There were plants lost and for a while it looked like nothing was going to grow back, however the thick starchy stem and root system of the established canola allowed the plants to hang on, and begin to grow leaves back once the break finally came. The recovery of the plants was just astounding – in winter 2013 you wouldn't have believed what the area looked like only three months before.

Table 2. Dry matter production and grain yield for several winter canola varieties sown in spring 2012 and harvested in December 2013, Inverleigh, Victoria.

Variety	Time of sowing	Grazing	Spring estab. (pl/m ²)	Autumn survival (pl/m ²)	Reduction in plants (%)	Summer dry matter (t/ha)	Grain yield manual harvest (t/ha)
Taurus	Spring	Grazed	47	26	-43%	2.5	4.0
		Ungrazed	42	30	-29%		5.0
	Autumn	Ungrazed		8			3.6
Hyola 971 CL	Spring	Grazed	41	28	-28%	2.4	4.6
		Ungrazed	42	28	-28%		5.2
	Autumn	Ungrazed		14			4.4
Hyola 930	Spring	Grazed	42	26	-38%	2.2	4.9
		Ungrazed	39	36	-4%		5.2
	Autumn	Ungrazed		11			4.1
CB 143 CL	Spring	Grazed	43	24	-44%	2.3	4.2
		Ungrazed	38	30	-18%		4.5
	Autumn	Ungrazed		17			3.9
CB Sherpa	Spring	Grazed	38	24	-35%	2.8	4.7
		Ungrazed	43	27	-36%		5.2
	Autumn	Ungrazed		Not sown			-
Winfred rape	Spring	Grazed	62	31	-49%	2.8	-
LSD (p=0.05)			12	7	NS*	NS*	0.8

*Not Significant.

Dry matter production and yield 2014

The 2013/2014 season provided a fairly tough start for the canola with another dry and hot summer looking to threaten the success of this relatively new rotation. However as seen the previous summer, once the autumn broke, plants came back and quickly covered the ground, recovering well to yield. An unfortunately late application of clethodim saw the loss of many flowers/pods across the trial, with some varieties (depending on flowering time) being compromised more than others. In terms of having any differences, over the last three years dry matter production has been comparable, as has grain yield. Decisions need to be made on seed costs (OP versus hybrid) and herbicide tolerance (conventional versus Clearfield) rather than looking at the 2014 results too closely (valuable lesson learnt though!). The autumn sown plots were the hardest hit as they flowered a little later and were in full flower at the time of application.

Table 3 outlines the results (though compromised by herbicide damage) in 2014, which paired up a fairly harsh summer with a very hard spring finish. The root system on the plants was not comparable to any autumn sown crops around, the roots establishing deep over the summer and autumn, getting through the winter and more than likely accessing a lot more resources in the dry spring than the shallow roots on the autumn sown plants.

Table 3. Dry matter production and grain yield for several spring sown canola varieties sown in spring 2013 and harvested in December 2014, Lake Bolac, Victoria.

Variety	Time of sowing	Grazing	Summer dry matter (t/ha)	Grain yield (t/ha)
Taurus	Spring	Grazed	3.2	1.18
		Ungrazed		1.68
	Autumn			0.95
Hyola 971 CL	Spring	Grazed	3.2	1.85
		Ungrazed		1.93
	Autumn			1.26
Brazzil	Spring	Grazed	2.4	1.93
		Ungrazed		2.18
	Autumn			0.99
Sensation	Spring	Grazed	3.0	2.46
		Ungrazed		2.18
	Autumn			1.37
LSD ($p=0.05$)			0.7	0.40
Greenland rape	Spring	Grazed	5.0*	-
Winfred rape	Spring	Grazed	4.4*	-

*Results are not replicated.

What about weeds?

Planting a conventional variety can limit weed control from the beginning. Sowing into a paddock that has an existing broadleaf weed burden is likely to exacerbate the problem due to the long rotation and limited control options throughout this time. In 2012, there was no observed difference in weeds when grazed compared to not grazed, nor were there fewer weeds in the April sown crop. Throughout both years of trialling, weed numbers have been of no concern as it appears the rapid closure of the canopy following grazing easily out competed any early weeds and is noticeable throughout the season.



Figure 2. Weed control options after grazing included SpraySeed® on left versus conventional management on right. Yield was not compromised despite the plants being burnt off by the herbicide

In 2014, different herbicide regimes were trialled under spring sown and grazed as well as autumn sown. Some of the grazed plots were sprayed with Sprayseed at 1.2 L/ha or Roundup at 1 L/ha a few weeks after the sheep were removed (onto green leaf) and grew back to yield grain. The autumn sown plots had an autumn knock prior to sowing. Weed counts in spring showed no significance. Yield results are below in Table 4. Plant numbers in autumn sown were much higher than spring sown but this didn't seem to add to yield of the crop.

Table 4. Grain yield and plant numbers spring vs autumn sowing with different herbicide regimes

Sowing time and herbicide regime	Grain yield (t/ha)	Plant numbers in June 2014 (pl/m ²)
Spring sown, manage as CL	1.68	15.2
Spring sown, manage as conv	1.48	14.5
Autumn sown, manage as CL	1.23	34.5
Autumn sown, manage as conv	1.23	34.3
Spring sown, Sprayseed 1.2 L/ha	1.17	13.5
Spring sown, Roundup 1 L/ha	1.08	11.3
LSD ($p=0.05$)	0.38	5.0



Figure 3. Winter wheat, Revenue, in October 2014. This crop was sown in November 2013 and survived the summer, offering grazing in April 2014.



Figure 4. Spring wheat sown in May 2014 compared to winter wheat sown in November 2013 at flowering. The root mass under the spring sown wheat was visually greater in the dry finish of 2014.

Can we do the same with winter wheat?

What started as a crazy idea in November 2013 has turned into a valuable learning experience as well as perhaps an accidental discovery into the potential of long season crops in the southern HRZ. Winter wheat was sown at the Lake Bolac SFS trial site on November 11, 2013 to see if it would behave like a winter canola, establish and allow summer and autumn grazing before being locked up for grain harvest at the end of 2014.

Disease, weeds, hot temperatures and lack of rain were all flagged as potential risks, as well as the suggestion that the vernalisation may not hold up over the summer and the crop could run to head early. The plants jumped out of the ground well, relishing the soil moisture that was available and the warm temperatures. Things were looking pretty exciting, as the spring wheat 'control' ran up to head by Christmas the winter wheats were tillering well and coping with the summer. So far, so good!

On Australia Day 2014, after five days over 40 degrees Celsius and no real rain since the crop germinated in November, the wheat was pronounced dead. It was literally turning to powder under foot, it looked like it had been accidentally hit with a knockdown spray, that's how dead it was! Research can be like that sometimes, you hold hope in a crazy idea, and sometimes, well, it just isn't meant to work. After seeing what spring sown canola can deal with, we were quietly disappointed in the wheat but admitted defeat, well at least now we know!

Fast forward to the end of March, a bit of rain, and the trial started to green up again. The wheat was grazed, with 800 kg/ha of dry matter eaten by sheep in early April. Management of the crop was very minimal, no in crop fungicide was applied, fertiliser inputs were low and weeds were left to do their thing (we still weren't convinced it was going to eventuate!). As expected, the crop followed the normal growth pattern for the year, flowering about three weeks before autumn sown winter wheat. Root growth over the long growing season allowed the crop to finish surprisingly well in what ended up being a very dry spring. Compared to nearby autumn sown wheat, the root mass would have easily been four times greater. These observations have really made us think about what plants can cope with, and actually that some less than ideal weather conditions at key stages may actually cause the plant to 'try' a little harder.

Table 5. Grain yield, protein and dry matter of spring sown wheat varieties at Lake Bolac, Victoria.

Treatment	Grain yield (t/ha)	Protein (%)	Dry matter (kg/ha)
Revenue, grazed	3.3	11.2	750.0
Manning, ungrazed	3.3	10.5	-
Einstein, grazed	3.3	12.1	793.5
Frelon, ungrazed	3.2	12.3	-
Revenue, ungrazed	3.2	10.8	-
Frelon, grazed	3.1	12.0	810.0
Manning, grazed	3.0	12.4	813.6
Einstein, ungrazed	3.0	11.4	-
LSD ($p=0.05$)	NS*	0.9	-

*Not Significant

At harvest, grain yields of the spring sown wheat averaged 3.2 t/ha. Grazing value, summer cover and low inputs in a marginal finish seems to have paid off and we have continued this work by sowing more in December 2014 at Inverleigh and Lake Bolac which has established and is tillering very well. Sometimes crazy trial ideas can lead to huge lessons, we have seen canola and wheat withstand some of our hottest, driest summers and still perform well. Given these crops can sometimes struggle to establish and grow well in our wet cool autumns, spring sowing has shown just how tough they can be!

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