Canola hay: reducing the risk of canola production

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Take home messages

- *Canola can produce excellent quality hay (and silage).*
- *Cutting at late flowering is a good compromise between quality and quantity.*
- *Cutting after late flowering reduced hay quality but had little effect on hay quantity.*
- *The hybrid IT varieties produced higher hay and grain yield than the triazine tolerant varieties.*
- *The option of hay reduces the risk of growing canola and enables the rotational benefits (weed control, disease break) of canola to be achieved at a lower financial risk.*

Background

Canola yields have been variable in North Central and North Western Victoria in the past ten seasons due to the run of below average rainfall years and a lack of early sowing opportunities. In some of these years, particularly 2002 and 2006 and now 2007, cutting canola crops for hay has provided an alternative risk management strategy for some growers and significantly improved the income from that crop compared to running it through to grain.

The demand for hay from the dairy industry and the gradual acceptance of canola hay or silage as a feed source for dairy cows creates a new fallback option for canola and reduces the risk associated with taking canola to grain. In years where grain yields are likely to be low, hay demand is likely to be strong. This was the case again in 2007.

This option could encourage growers who have removed canola from the rotation to re-introduce this valuable rotational tool. Canola is an excellent weed and disease management tool.

The value of a canola hay crop is driven by demand, quality and dry matter. To maximise potential returns, it is essential to understand the management requirements for maximising quality and dry matter. There are several factors that may influence this end result and some of these were investigated as of part of an Australian Oilseed Federation and GRDC-funded Better Canola project. The specific aims were to investigate:

- The effect of time of cutting on canola dry matter, quality and profitability
- The effect of variety selection on canola dry matter, quality and profitability
- The profitability of hay compared to grain production.

Method

A replicated variety by timing trial was conducted at BCG's Wimmera Research and Demonstration site at Longerenong College. In addition, a commercial canola crop at the same location but sown six weeks earlier, was utilised to repeat the time of cutting aspect of the trial.

Trial Design

Four varieties (two Clearfield IT hybrids and two triazine tolerant varieties) were sown in a fully replicated trial. The Clearfield Hybrid varieties, 45Y77 (mid maturity) and 46Y78 (mid-late) were sown at 3kg/ha and the Triazine tolerant varieties, ATR Barra (early mid) and Tornado (mid) were sown at 4kg/ha.

Management Details

Sowing date:	22/5/2007. Re-sown 12/6/2007 due to poor emergence.
Fertiliser:	Urea 100kg/ha pre-drilled, 110 kg/ha Supreme Z15S. (Total nutrient application 60 N, 14 P, 14 S, 0.8 Zn)
Herbicide + insecticide:	1.2L/ha Trifluralin 480, 0.5L/ha Endosulphan post-sowing pre-emergent (PSPE) on all plots.
	1L/ha Atrazine 500 + 1L/ha Simazine 500 PSPE on TT Plots only.
	Grass weeds were removed by hand.

Assessment details

Plots were assessed for early vigour, plant density and ground cover six weeks after emergence.

To simulate hay production, dry matter was determined at late flowering (17 Oct 2007) and mid pod fill (1 Nov 2007). Due to its earlier maturity, 44Y77 was closer to late pod fill at the second time of cutting.

Plant height, plant density and ground cover were assessed at the first hay cut and plant height was assessed again at the second hay cut. At each time of cutting, samples were analysed for feed quality using the Feed Test service. Grain was harvested on 20 Nov 2007 and oil and protein were determined.

Commercial Paddock

The time of cutting and grain versus hay comparison was repeated in a portion of a Tornado TT canola crop on the Longerenong College farm using a randomised complete block design with four replications. The crop had been sown on 1 May at 4 kg/ha with 65 kg/ha MAP. A very high level of stored nitrogen negated the need to apply urea. Pre-emergent chemical applications were 1.5 L/ha TriflurX + 1.0 L/ha Lorsban. Post-emergent chemical application consisted of 250 ml/ha Select + 20 ml/ha Verdict + 1.0 L/ha Atrazine + 120 ml/ha Lontrel + 1% Uptake + 80 ml/ha Dimethoate. All measurements were the same as described above except an additional hay cut was taken at mid flowering (6 September) as well as late flowering (27 September) and mid pod fill (17 October).

Results

Time of cutting

In the paddock trial, cutting at mid flowering produced significantly higher quality (higher protein, digestibility and energy and lower fibre) than cutting at late flowering but the earlier cutting time produced significantly less hay yield (Table 1). The hay cut at late flowering produced higher yields and good quality feed, with high energy and protein levels. Cutting at mid pod fill produced similar dry matter to the late flowering timing but quality had deteriorated significantly. This detected change in quality is consistent with previous results (Phillips 2007).

Table 1. Dry matter and quality of canola hay cut at early and late flowering in the commercial paddock trial.

Time of cutting	Date	Dry matter (t/ha)	Residual dry matter (%)	Crude protein (%)*	Neutral detergent fibre (%)*	Dry matter digestibility (%)*	Metabolisable energy (MJ/kg)
Mid flowering	6 Sep	3.1	87	28	24	86	13
Late flowering	27 Sep	3.9	91	18	33	74	11
Mid pod fill	17 Oct	4.0	91	15	38	68	10
LSD (P<0.05)		**0.62**		**2.7**	**3.43**	**4.4**	**0.73**

** adjusted to dry matter basis*

Variety and time of cutting

The Clearfield hybrid IT varieties, 45Y77 and 46Y78, produced more hay at both timings than the TT varieties Tornado and Barra (Table 2). The hybrid IT varieties also produced more grain than the triazine varieties but there was no significant difference in oil content. Within each canola type, there was no difference among the varieties for biomass at either hay timing or for grain yield. 45Y77 and 46Y78 exhibited greater ground cover at late flowering (82 and 85% respectively) than Barra (66%) and Tornado (69%). They were also taller and had greater depth of pod.

Table 2. Hay and grain yield for four canola varieties at Longerenong 2007.

Measurement	Harvest date	IT Hybrid 45Y77	IT Hybrid 46Y78	TT ATR-Barra	TT Tornado	LSD (P<0.05)
Hay						
Late flowering hay (t/ha)	17 Oct 2007	4.4	3.9	3.2	2.9	0.59
Mid pod fill hay (t/ha)	1 Nov 2007	3.8	3.7	3.1	2.8	0.71
Grain						
Seed yield (t/ha)	20 Nov 2007	1.10	1.07	0.66	0.66	0.16
Seed oil (%)		35.5	36.5	37.1	36.1	NS*

**Not significant*

Hay quality was not affected by variety (Table 3) but was affected by time of cutting (Table 4), although there were no significant differences in protein for the two times of cutting. There was no significant interaction between variety and time of cutting, but 45Y77 displayed poorer quality than the other varieties at the second time of cutting. This was most likely due to its earlier maturity, therefore being closer to ripeness than the other varieties. Table 4 illustrates the drop in quality resulting from the later time of cutting which is consistent with the findings from the commercial paddock trial.

Table 3. Effect of variety on hay quality (mean of two times of cutting).

Quality measurement	IT Hybrid		TT		LSD
	45Y77	46Y78	ATR-Barra	Tornado	(P<0.05)
Crude protein %*	15.0	17.3	16.8	16.6	**NS**
Neutral detergent fibre %*	45.0	41.6	41.0	41.0	**NS**
Dry matter digestibility %*	63.2	66.8	66.5	66.9	**NS**
Metabolisable energy (MJ/kg dry matter)	9.3	9.8	9.8	9.9	**NS**

**Dry matter basis*

Table 4. Effect of timing of hay cutting on quality (mean of four varieties).

Timing	Harvest date	Yield (t/ha)	Residual dry matter (%)	Crude protein (%)	Neutral detergent fibre (%)	Dry matter digestibility (%)	Metabolisable energy (MJ/kg)
Late flowering hay	17 Oct 2007	3.6	91.4	17.1	35.8	71.6	10.7
Mid pod fill hay	1 Nov 2007	3.4	94.6	15.8	48.5	60.10	8.7
LSD (P<0.05)		**NS**	**0.5**	**NS**	**3.0**	**3.8**	**0.6**

**Dry matter basis*

Economic analysis

Table 5. Gross margin for grain compared to canola hay cut at early or late flowering using two hay prices.

End product	Yield (t/ha)	Oil (%)	Commodity price ($/t)	Gross income ($/ha)	Total costs ($/ha)	Gross margin ($/ha)
Grain	0.4	35.3	535	214	240	-26
Early flowering hay	3.1	*	270	837	362	476
" "	*	200	620	360	260	
Late flowering hay	3.9	*	270	1053	392	661
" "	*	200	780	390	390	

Costs include $162/ha for hay making at 3.1t/ha and $192/ha at 3.9t/ha;$200/ha production costs (no N applied in this paddock due to high stored N) $40/ha harvesting and windrowing costs. Grain price Marma Lake Dec 07.

In the commercial paddock trial, hay production regardless of the time of cutting was more profitable than harvesting the crop for grain. A frost in mid October caused significant damage to the seed formation and reduced yield potential. Cutting at late flowering produced a more profitable result than early flowering at a given hay price. Canola cut at early flowering, was better quality, but produced lower hay yields, requiring a $60/t premium to compensate for this. Although not presented in Table 5, the gross margin for the mid pod fill cut was similar to the late flowering cut (as dry matter production was similar) assuming the same price could be achieved for the hay given the drop in quality.

In the variety by timing trial, the profitability of hay compared to grain was dependent on variety and hay price (Table 6). For 45Y77 and 46Y78, hay was more profitable than grain at the higher hay price of $270/t (which was achievable in mid October) but it was not as clear cut at the lower hay price of $200/t. Conversely, for the lower yielding Tornado and Barra, hay was a more profitable option, with the grain yield required to exceed the gross margin from hay being greater than the achieved grain yield for each time of cutting and for both hay prices.

Table 6. Gross margin for grain compared to canola hay cut late flowering or mid pod fill using two hay prices for four varieties.

Clearfield IT hybrids							
		45Y77			46Y78		
	Price ($/t)	Yield ($/ha)	Gross margin	Grain yield required to match hay gross margin (t/ha)	Yield ($/ha)	Gross margin	Grain yield required to match hay gross margin (t/ha)
Grain*	545	1.10	287		1.1	272	
LF Hay	200	4.4	391	1.3	3.9	309	1.1
	270	"	696	1.8	"	579	1.6
MP Hay	200	3.8	291	1.1	3.7	281	1.1
	270	"	553	1.6	"	538	1.6
Triazine Tolerant							
		Barra			Tornado		
	Price ($/t)	Yield ($/ha)	Gross margin	Grain yield required to match hay gross margin (t/ha)	Yield ($/ha)	Gross margin	Grain yield required to match hay gross margin (t/ha)
Grain*	545	0.66	70		0.66	70	
LF Hay	200	3.2	227	0.9	2.9	181	0.9
	270		452	1.4		385	1.2
MP Hay	200	3.1	215	1.0	2.8	158	0.9
	270		433	1.4		353	1.2

Production costs for IT hybrids $270/ha, TT $250/ha. Harvest costs $40/ha, Hay costs $50/t

Grain price based on 36 % oil mid December Graincorp Marma Lake.

Commercial practice

Hay production is not without risk (weather damage, volatile markets) but does provide a great salvage option in some seasons, as was the case in 2007. Greater nutrient removal in hay should be considered when planning the following season's crop.

Cutting at late flowering is a good compromise between quality and quantity for maximising hay income, but later salvage cuts at mid pod fill (eg. after a frost event) can still prove profitable (as was the case in these trials), as long as the reduction in quality does not hinder the sale of the hay.

In these trials, the commercial paddock was clearly better off cut for hay as were the two TT varieties in the variety by timing trial. The decision to cut the IT hybrids was borderline if the price was low, but favourable if a price above $200/t was achievable.

This illustrates that cutting crops for hay is a complex decision making process involving seasonal outlook, soil moisture reserves and the likely price for both hay and grain, as well as considering the logistics of hay making.

Biomass estimation prior to cutting assists decision making. In the commercial paddock trial, dry matter yields were 18, 23 and 27% of fresh weight at mid flowering, late flowering and mid-pod fill respectively. In the variety trial, dry matter yields were 26% and 36% of fresh weight at late flowering and mid-pod fill respectively. These ratios are useful for assessing potential hay yield without drying down plant material. Suggested rules of thumb for estimating dry matter are 20% of fresh weight for early flowering, 25% fresh weight for late flowering and 30-35% of fresh weight for mid-pod fill.

Paying attention to detail in the hay making process is essential to produce a high quality saleable product. Chemical records and withholding periods of chemical applied in that season should be checked before cutting for hay. Canola hay should be conditioned to reduce curing time and increase palatability. This ensures a higher quality product. The reduction in curing time reduces the chance of weather damage and also reduces the chances of baling hay too wet which can lead to hayshed fires. Patience is indeed a virtue in hay making but is essential to ensure that high moisture hay is not baled prematurely.

Proactive marketing and the use of contracts for hay sales can also reduce some of the uncertainty associated with hay marketing. This trial also illustrates how variable hay quality can be, so analysis of hay using FEEDTEST is suggested to aid in selling canola hay and is required by most dairy farmers.

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References

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