

Dual-purpose crops – direct and indirect contribution to profit

John Kirkegaard¹, Susie Sprague¹, Lindsay Bell¹, Tony Swan¹ Graeme Sandral²

¹ CSIRO

² NSW DPI

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Take home messages

- Dual-purpose (DP) crops can increase farm profit on the Tablelands, Slopes and Plains of southern NSW
- Higher whole-farm profit relies on attention to detail with crop and livestock management. Establishing the right crop early and correct lock-up time are key to increase profit and reduce risk
- Tough 2017-2019 years (good livestock prices) demonstrate profitable and flexible 'exit' options
- Ongoing refinement to deal with new and emerging issues with DP systems are discussed.

Introduction

In southern NSW, outputs from experimental research and grower experience over two decades has firmly established dual-purpose (DP) crops (both cereals and canola) into mixed farming systems. Experienced growers have undoubtedly increased profit, flexibility and reduced risks in their businesses with appropriate integration of dual-purpose crops. Numerous previous papers have reported on that success across a range of different environments, which I urge readers to revisit for more of the finer detail (see reference list). Some of the main messages are worth repeating here, and more recent experiences and data that reinforce some of those messages are worth reflecting upon. Inevitably new issues have also emerged as the farming system continues to evolve in the face of a changing climate.

In view of the special COVID19 circumstances in 2020, this paper is designed to consider relevant information on dual-purpose crops according to the broad regions represented in southern NSW, from the Tablelands (Feb-March sown winter crops), Slopes (a mix of winter and spring varieties in sown in March and April) and the Plains (opportunistic grazing of April-sown spring crops). The majority of the recent research has been carried out in the medium rainfall Slopes area, where all of the options listed above are possible depending upon seasonal conditions – and indeed many mixed farmers in that area consider that almost all crops are potential grazing options.

First - a few universal guidelines

Early establishment with the right variety is the key to success

Successful establishment in the earliest window with the right variety to flower at the optimum time provides maximum grazing potential. Grazing potential **declines by 200-250 DSE.days/ha for every week's delay after March 1.**

Lock-up time is a crucial decision to maximise profit

Grain yield penalties occur when grazing too late (i.e. removing reproductive parts) and too hard (leaving insufficient biomass to reach target yield). Rules of thumb have been published previously (see reading list). The decision is significantly influenced by the crop yield outlook and the relative prices for livestock and grain. These different 'exit options' depending on circumstances provide significant flexibility.

Tablelands and higher rainfall areas east of the Olympic Way – winter wheat and winter canola

In the higher elevation, eastern areas of southern NSW, the length of season and extended frost windows mean that 'winter types' of both cereals and canola are well-adapted to capitalise on early sowing opportunities, as their vernalisation requirement (need for cold temperatures) delays flowering until after the main frost period. This provides a very long potential vegetative period (increasing grazing potential of 3+ months) for early-sown crops as well as a later and safer flowering window to avoid frost risk (even if crops are not grazed). The longer growth duration of the crops also increases yield potential to take advantage of the higher annual rainfall.

The area spanning Delegate-Canberra-Goulburn provides an excellent case study area where a transformation in farming systems and business profit has been possible in the last decade with the steady integration of both dual-purpose wheat and canola crops into traditional grazing areas.

The system changes

Dual-purpose winter wheats were grown in the area prior to 2010 with some success, and the availability of milling varieties such as Wedgetail® was also popular. Managing grass weeds and diseases became problematic with continuous cereals, and dual-purpose winter canola varieties were first trialled in 2004 and commercialised in 2011. They demonstrated potential for early sowing, very high early (autumn) biomass production and safe grazing with sheep, with some issues for cattle. The dual-purpose canola provided an excellent break crop for the dual-purpose wheat (increasing both early biomass and yield), and when integrated on-farm, the crops extended the sowing and grazing windows providing operational flexibility, and a longer period of winter grazing to spell pastures and increase summer feed. In general, if the DP crops replaced perennial pastures, the autumn and winter feed gaps diminished. The cropping phase also paid for lime, fertiliser, and weed control which provided greater success in establishing perennial pastures. It has also allowed for improvement of native pastures, lifting stocking rates from 4-5 DSE to 12 DSE with associated increases in land value. In order to capitalise on the higher levels of autumn and winter feed, meat enterprises and livestock trading often diversified self-replacing flocks. Rather than sell weaners as store animals, they can be value-added to grow out to prime stock. As a result, some farms that 10 years ago produced only wool, now produce a range of cereals, oilseed, hay and silage as well as cattle or sheep enterprises for meat and wool. Stores of feed, silage, hay or grain provide further insurance in dry times.

Direct and indirect impacts on profit

Systems experiments, simulation and the early adopters in the district have demonstrated that the benefits to whole-farm businesses can **increase in profit by more than \$100/ farm ha**. The gross margins on individual paddocks which can provide 2500-3,500 DSE.grazing days/ha (3 months) and then yield 3 t/ha of canola and 6 t/ha of cereal, are often in excess of \$2,000/ha and the most profitable enterprises on farm. As the crops are often replacing perennial pastures on some farms where arable areas are low, we have previously estimated that the benefits of DP crops will peak at around 20% of the farm area. Allocating 10-20% of the farm to a combination of dual-purpose wheat and canola could increase whole-farm sheep grazing days by 10-15%, increase farm output by >25% and increase farm profit margin by more than \$150/ha compared to pasture-only livestock systems.

Where DP crops are being used as a tool to improve areas of native pastures, the area may grow to 40% for some farms.

Emerging issues

Sowing just gets earlier....

Improved, longer-season winter wheats (e.g. Revenue[®], Bennett[®]) and canola variety choices along with better summer fallow management has moved sowing dates back into February or even late January. The early availability and amount of feed produced requires serious re-evaluation of stock numbers and approaches to capitalise on the extra feed.

At these livestock prices why risk grain?

At current livestock prices, and where spring rainfall is uncertain, grazing out DP crops and terminating them in October can be cost effective, and can set up the paddock with good weed control and stored water and N for an early sowing opportunity in the subsequent season. Windrow, harvest and storage costs are saved.

Keeping up the N supply

Early-sown and high yielding crops especially down the rotation (several years after a pasture ley) can have substantial N requirements. For example, we recommend that soil N be at least 150kg/ha at sowing to maximise forage production, and the seasonal N requirements for grain yield are 80 kg N/tonne for canola and 40 kg N/tonne for wheat. The fate and recovery of the N in grazed crops is not well understood.

Managing disease

Fungal disease such as Blackleg and *Sclerotinia* in canola, and *Septoria tritici* and leaf and stripe rusts in wheat are more prevalent with higher intensity of cropping, higher rainfall and higher biomass. Resilient disease management plans using resistant varieties, cultural methods (sequence and residue management) as well as targeted fungicide use will be required. Of particular concern is the over-reliance on flutriafol which is applied in both the wheat and canola year, and foliar fungicides which may require at least 2 sprays.

Medium rainfall slopes area – winter and long-season spring varieties (Olympic to Newell Highways)

The medium rainfall area between the Olympic Way and Newell Highway has been the area of the earliest and longest adoption of dual-purpose cropping and the associated research activities of many agencies (Grain'n'Graze, DP wheat and DP canola research). A range of both winter and spring cereal and canola varieties provide potential grazing opportunities across this zone. The opportunity to sow 'true winter types' in March still presents across this region and in the eastern Slopes, the season is often still long enough for successful grain harvests with true winter types. However, as you move west, while early sowing and excellent grazing opportunities persist, flowering and grain filling often falls outside the optimum period limiting grain yield recovery in some seasons. Under those circumstances the faster winter wheat types and slow developing spring canola types tend to provide safer dual-purpose options and may be better suited to farms with a greater focus on grain than livestock, but where autumn and winter feed gaps can still limit whole-farm profit.

The system changes

Dual-purpose winter cereals have been part of the system in this region for decades, with breeding programs devoted to them since the 1960s. During the 1990s when the profitability of crops exceeded livestock, many farms intensified cropping at the expense of pastures and livestock numbers and interest in DP crops waned. The large impetus to further adoption came with the development of the higher protein milling wheat varieties in the late 1990s – early 2000s (Whistler, Wylah and Wedgetail[®]). The combined value of the early-sown grazing forage and higher protein

grain revitalised interest and increased adoption significantly, especially as research outlined grazing strategies that avoided yield penalties. The arrival of dual-purpose canola as an option in the late-2000's was timely as Wheat Streak Mosaic Virus temporarily discouraged early sowing of DP wheat, while early-sown hybrid canola varieties were shown to provide high value grazing potential similar to wheat. By 2010, dual-purpose canola had become an established part of the feed base and together with grazing cereals provided the opportunity to increase livestock production through increased winter carrying capacity, while increasing the cropped area on farm. More recently the move to strict summer fallow management and earlier sowing opportunities offered by DP crops provides indirect benefits to the whole farm by moving the whole sowing program earlier. This together with buoyant livestock prices has meant that dual-purpose crops have become an important adaptation to increasingly unreliable autumn and spring rainfall and increasing spring temperatures. The practice of grazing any crop with excess early biomass is now widely used and whole-farm benefits (spreading workload, resting pastures, increasing winter stocking rates, flexible exit options) apply.

Direct and indirect impacts on profit

In general, in these medium rainfall areas, dual-purpose crops are likely to be replacing grain-only crops on farms that are more crop-focussed, and this presents a somewhat different picture for whole-farm profit impacts. A summary of over 10 years of experiments, simulation studies and collaborative on-farm validation has demonstrated an increase in net crop returns by up to \$600/ha (Table 1) with a range of other benefits including widening the sowing window, reducing crop height, filling critical feed gaps, spelling pastures and importantly providing flexible options in dry years.

Table 1. Typical examples of forage, grain yield and gross margins achieved from well-managed dual-purpose crops by collaborating growers in southern NSW

Crop type	Grazing achieved (DSE.days/ha)	Grain yield (t/ha)	Paddock \$GM increase above grain only
Winter wheat	1600 - 2700	4.5 – 6.5	+\$600 - \$1000
Spring wheat	400 - 800	3.0 - 5.0	+\$300 - \$500
Winter canola	750 - 2500	2.0 – 4.0	+\$600 - \$1000
Spring canola	300 - 700	1.5 – 2.5	+\$300 - \$500

Emerging issues

Exceptional performance in drought but legacies must be managed Early-sown DP wheat and canola options have been highly profitable at GRDC farming systems sites at Greenethorpe and Wagga in two recent decile 1 seasons in comparison with timely-sown grain only crops (Table 2). However, the success largely depended on deep stored water from either summer rainfall and good fallow management, or sequences with legumes which left legacies of water and N. At Greenethorpe consecutive early-sown dual-purpose crops (phased canola and wheat) were able to capitalise on higher amounts of stored water to produce more than 3 times the profit achieved by a grain-only (or hay) system (**\$1122/ha vs \$334/ha**). At Wagga Wagga under drier conditions, income for the same DP crops declined in the second year in 2019 due to the legacy of drier soil from 2018, but the DP system still had higher profit than the grain-hay system (**\$379/ha vs \$172/ha**). In medium rainfall areas, selecting the paddocks and seasons to go for early-sown winter options can maximise profits.

Companions and forages

Some new options are being used on farms in the area including companion mixes which include a mix of cereal, oilseed and legume options, where after grazing the companions are terminated and

main crop harvested, or all may be grazed out. The mixture can increase the amount and quality of the forage while some benefits (soil improvements, pest or insect repellence, weed competition, N-fixation) is sought. In other cases, winter and summer crops may be sown exclusively for forage.

Managing N budgets in DP crops

Early-sown grazing crops require robust N levels at or near sowing to maximise biomass production (100-150 kg N /ha available in soil or fertiliser). But the uncertain fate of N in the consumed forage that is recycled onto the soil makes top-dressing decisions difficult. Though sheep remove very little N from the paddock (~5%), the timing and availability of the grazed and recycled N is uncertain – our best estimates suggest only 50% of the N taken up by the crop will be recycled and available to current crops, so adjusting topdressing accordingly to yield potential on this basis is advised.

Utilising the feed in good seasons

The large amount of feed made available in autumn especially in seasons like 2020 (following prolonged drought) means that thought must be given to effective and profitable utilisation. How to match the stock with the opportunity? Join more ewes for early autumn lamb? Retain more lambs from previous spring to target export weights? Trade sheep? These all carry risks for overstocking if dry conditions persist.

Table 2. Annual and 2-year profit (earnings before interest or taxes - EBIT) at Greenethorpe and Wagga Wagga for early-sown (March) dual- purpose canola-wheat systems compared with timely sown (April) canola-wheat grain-hay systems in 2018 and 2019. Systems were phased (both crops were grown in each year).

Site/Crop	Dual-purpose system				Grain only system		
	Variety/Sowing date	Graze (t/ha)	Grain (t/ha)	EBIT (\$/ha)	Variety/Sowing date	Grain/ (Hay) (t/ha)	EBIT (\$/ha)
Greenethorpe							
2018 Wheat	Kittyhawk® (5/4)	1.5	1.9	\$862	Coolah® (7/5)	2.7	\$619
2019 Canola	Hyola®970 (23/3)	5.0	0	\$1,414	HyTTec®TT (1/5)	(3.1)	\$96
Ave 2-Yr EBIT				\$1,138			\$358
2018 Canola	Hyola970 (3/4)	3.5	0.9	\$1,251	HyTTecTT (7/5)	1.1	\$79
2019 Wheat	Bennett® (26/3)	3.5	0	\$960	Coolah® (1/5)	(4.8)	\$538
Ave 2-Yr EBIT				\$1106			\$309
Average 2-yr system EBIT				\$1122			\$334
Wagga Wagga							
2018 Wheat	Kittyhawk® (3/4)	2.0	1.9	\$974	Beckom® (2/5)	2.1	\$333
2019 Canola	Hyola970 (8/4)	2.7	0	\$78	43Y92 (26/4)	1.1	\$124
Ave 2-Yr EBIT				\$526			\$229
2018 Canola	Hyola970 (3/4)	3.1	0	\$347	43Y92 (3/4)	1.2	\$34
2019 Wheat	Kittyhawk® (8/4)	2.8	0	\$114	Beckom® (6/5)	(3.5)	\$198
Ave 2-Yr EBIT				\$231			\$116
Average 2-yr system EBIT				\$379			\$172

Lower rainfall plains – opportunistic grazing of early-sown spring crops

The system changes

On mixed, crop-focussed farms in the drier western areas, the swing towards earlier sowing systems with appropriate wheat and canola varieties has trended towards grain-only with the availability of new varieties (e.g. Longsword[®]). Cereals are likely to be a larger focus here than canola due to the greater risks with canola, although in early starts with good soil water, grazing opportunities can still arise. Fewer early sowing opportunities and the higher likelihood of drier conditions during the recovery phase also means that closer attention to lock-up times and residual biomass is necessary, and larger paddock sizes and generally lower stocking rates can provide further challenges for even grazing. These areas may also have a higher frequency of ‘sacrificial grazing’ where value from failed grain crops can be salvaged. As livestock numbers increase, areas prone to frost or otherwise risky for grain are being sown to dedicated vetch or oat crops to be grazed out and fallowed. Smaller areas of these dedicated forages combined with more focussed grain-only crops has become a trend. The dry seasons in 2018 and 2019 highlighted missed potential income from livestock which has encouraged some trading and agistment in order for farms with no livestock to capitalise on good prices and available forage.

Direct and indirect impacts on profit

Much less research work has been conducted in the drier western areas, but some of the research in drier seasons on the eastern edge of the zone near Temora between 2010 and 2014 has suggested around 0.3 to 1.0 t/ha of biomass providing 200-600 DSE grazing days/ha can be achieved with early-sown spring wheat or canola with limited impact on grain yield. In drier areas further north, Bell suggested long-season cultivars could provide grazing value of ~\$400/ha in seasons where early sowing was possible, while opportunistic grazing of spring wheat varieties was generally limited to \$200/ha. Critical yields to trigger sacrificial grazing of wheat are predicted to be around 1.2 to 1.5 t/ha, but this can be difficult to forecast without good information on soil water.

Table 3. Effect of winter grazing on yield of canola and wheat varieties grown at Temora between 2009 and 2014. Crops were grazed with sheep prior to stem elongation.

Crop year	Cultivar type - sowing date	GSR (summer rainfall)	Grazing			Yield (t/ha)	
			Start graze	Start graze dry matter (t/ha)	Sheep grazing days/ha	Ungrazed	Grazed
Canola							
2010	OP-TT – 15 Apr	460	29 June	0.3	240	4.0	4.1
2011	HybridCL – 15 Apr	200	24 June	0.8	1000	3.5	3.1
2013	HybridCL – 1/5	227 (135)	1 Aug	1.3	1470	1.0*	1.3*
2014	TT – 1 May	238 (158)	8 July	0.5	n/a	2.2	1.6
Wheat							
2009	Gregory [®] – 30 Apr	182	18 June + 7 July	0.5	570	1.7	1.3
2010	Bolac [®] – 15 Apr	460	25 June	0.3	140	7.0	7.5
2011	Bolac [®] – 15 Apr	200	22 June	0.8	520	4.3	4.8
2012	Wedgetail [®] – 18 Apr	175 (462)	20 June	0.3	680	4.8	4.8

*Severely affected by frost.

Emerging issues

Even grazing on variable soils

The capacity to apply sufficient stocking rates to utilise the forage on large paddocks evenly in the narrow 'safe' grazing window can be problematic, especially as stock numbers decline. Around 25 DSE or > 8 adult cattle per ha may be required to evenly graze rapidly growing cereals.

Grain-only and forage only crops may provide less risky options

The increasing options in both cereals and canola for earlier grain-only crops are becoming attractive and narrow grazing windows make safe grazing more difficult. Dedicating problematic paddocks that are riskier for grain production (e.g. frost-prone, lighter or variable soils) to dedicated forage crops to graze out (vetch, oats) may provide better options.

Safe early establishment opportunities

At Condobolin, March rainfall in the last decade has tended to be above average while April and May below average. Taking opportunities to get some of the farm sown on opportunities in March improves timeliness for the rest of the farm. Planning for this exposes more possibilities to make money, provided successful establishment can be achieved.

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Further reading

https://grdc.com.au/data/assets/pdf_file/0033/377493/Combined-papers-Coolah-2019-no-adds.pdf

https://www.grdc.com.au/uploads/documents/GRDC_Dual-PurposeCrops.pdf

<http://www.ausgrain.com.au/Back%20Issues/241mjgrn14/Match%20flowering.pdf>

Contact details

John Kirkegaard
CSIRO Agriculture and Food
Canberra
Mb: 0459 354 630
Email: john.kirkegaard@csiro.au

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