**Match flowering, sowing date for dual-purpose crop success**  
By Deanna Lush

While growers have long been growing dual-purpose canola and cereals in the high rainfall zone, taking the guess work out of when to sow the right variety to achieve optimum flowering time and knowing how much biomass will be produced is the focus of GRDC-funded research.

The CSIRO is focusing on using climate data to breakdown the links between sowing dates and flowering times using actual data to indicate to growers the likelihood of early-sowing being an option for them. CSIRO’s John Kirkegaard said the organisation matched the different crop development timing of wheat and canola varieties to a sowing time that achieves optimum flowering for maximum dual-purpose crop benefits.

The project has focused on 13 sites across Australia’s high rainfall zone. It involved using the APSIM wheat and canola models with long-term weather records to:

- Pinpoint the optimum flowering window that minimised the risk of damage from frost and heat stress;
- Identify the sowing dates that would have the crops flowering in the optimum window;
- Calculate the historic likelihood of a sowing opportunity in the window;
- Predict average forage production and grazing value.

- Estimate average seed yield of a crop after grazing assuming safe lock-up timing; and to,
- Investigate impacts of agronomic management such as nitrogen application and plant density.

John said all sowing dates generated by the model were ‘laugh-tested’ with local advisers and growers to see whether the CSIRO was on track. They were also cross-checked with experimental data from CSIRO field experiments.

He said the model was designed to answer questions on the benefits specific crops would deliver and their on-farm impacts, such as the best variety to sow, the amount of biomass production for grazing, whether increasing nitrogen or plant

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**GRAZING CROPS ADDS PROFIT**

If research pointed to a new way for high rainfall zone farmers to add $100–$200 per hectare to their farm profits, there would be plenty of interest. Recent GRDC-funded research by the CSIRO has done exactly that through the integration of dual-purpose crops.

CSIRO’s John Kirkegaard says research and leading grower experience is showing farms that are animal enterprises only (all pasture) that are able to introduce about 15 to 20 per cent of their total farm area to grazing crops could increase farm profits by $100–$200 per farm hectare. That is potentially a total increase on a 1000 hectare farm of an extra $100,000 to $200,000 for the farm.

For mixed farming properties, grazing crop paddocks that would have previously been grown for grain-only can increase the gross margin on the paddock by $100–$400 per hectare, assuming best management practices are followed and there are no yield penalties due to grazing.

“Successfully grazing crops is all about sowing early. Grazing gives another option for those early-sown crops to make extra money without losing yield. If you sow on-time or early, crops will usually produce more biomass than is really needed for yield and this can be exploited by the animal enterprise in winter,” John said.
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Density would increase feed supply, stocking rates and grazing times that would optimise feed use, and whether yield would be affected by grazing.

Varieties assessed fell into four maturity categories for wheat: Winter (eg Revenue); Mid-winter (eg Wedgetail); Mid-spring (eg Gregory); and, Fast-spring (eg Suntop).

For canola, the categories were: Winter (eg CB Taurus); Winter/spring (eg CBI406); Late spring (eg 46Y83); and, Mid-spring (eg Hyola 50).

Flowering window

In identifying the optimum flowering window, John’s team used historic weather data to find out the number and timing of frosts and high temperature days in a season. These were optimised to find a window when the chances of both frost risk and heat stress were lowest.

For example for canola at Young, in NSW, the optimum flowering window was between August 24 and September 19 (Figure 1), but the window will be specific to each site. For canola at Inverleigh, Victoria, the safe flowering window was August 8 to September 10 (Figure 2).

<table>
<thead>
<tr>
<th>Site</th>
<th>Cultivar – phenology type</th>
<th>Sowing window intervals</th>
<th>Mean predicted grazing days (DSE/ha)</th>
<th>Mean potential yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delegate, NSW</td>
<td>Winter</td>
<td>78%</td>
<td>1830</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
<td>Mid-winter</td>
<td>100%</td>
<td>1200</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>Mid-spring</td>
<td>84%</td>
<td>750</td>
<td>5.7</td>
</tr>
<tr>
<td></td>
<td>Fast spring</td>
<td>84%</td>
<td>650</td>
<td>5.7</td>
</tr>
<tr>
<td>Young, NSW</td>
<td>Winter</td>
<td>44%</td>
<td>2050</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>Mid-winter</td>
<td>98%</td>
<td>1500</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>Mid-spring</td>
<td>89%</td>
<td>720</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>Fast spring</td>
<td>89%</td>
<td>600</td>
<td>5.1</td>
</tr>
<tr>
<td>Delegate, NSW</td>
<td>Winter</td>
<td>75%</td>
<td>680</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td>Winter/spring</td>
<td>84%</td>
<td>400</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td>Late-spring</td>
<td>88%</td>
<td>230</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>Mid-spring</td>
<td>62%</td>
<td>380</td>
<td>4.2</td>
</tr>
<tr>
<td>Young, NSW</td>
<td>Winter</td>
<td>44%</td>
<td>1300</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>Winter/spring</td>
<td>65%</td>
<td>1360</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>Late-spring</td>
<td>80%</td>
<td>580</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>Mid-spring</td>
<td>80%</td>
<td>570</td>
<td>3.9</td>
</tr>
</tbody>
</table>

The table outlines the predicted long-term safe sowing window (highlighted in yellow) for four different maturities in wheat and canola. The percentage in each window describes the probability of a sowing opportunity in that window for each region. The simulated potential mean grazing and grain yield outlines the mean grazing and yield potential achieved from each option.
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Sowing dates and probability

Armed with knowledge of the least-risk flowering window, the CSIRO could work back to identify the optimum sowing dates to hit that window with varieties of different maturity. The model was then used to calculate the percentage of years growers could sow at the optimum date, based on actual rainfall and evaporation data for each site.

A grower at Delegate could expect that in 78 per cent of years there would be the opportunity to early-sow a winter wheat from March 8–22 and to have it flower at its optimum time (Table 1). For a grower at Young wanting to early-sow canola, the model predicted there would only be an opportunity to sow a winter canola variety from March 8–22 in 44 per cent of years (Table 1).

Grazing value and yields

Predicted mean grazing days and potential grain yield for each variety was predicted using the model based on 50 years of weather data from 1959–2009 (Table 1, two right hand columns). It predicted a winter wheat variety sown at the optimum time at Young would provide an average of 2050 DSE per hectare grazing days while a fast-spring variety at the same location would only give 600 DSE per hectare grazing days.

John said earlier sowing with later maturing varieties provided the greatest grazing potential across all sites. Generally, wheat provided more grazing than canola.

“There are not large differences in potential grain yield for the different maturity types sown in their optimum windows. But the differences are very large in terms of what each variety can offer for grazing,” he said.

“Overall, growers should be looking at varieties with a high chance of sowing and high combined grazing and grain yield potential.”

Nitrogen, plant density

John says early N application encourages plants to grow rapidly, producing early biomass which is desired for maximum forage. But for grain-only crops, it can lead to excessive growth and water use, and lower starting N with later topdressing are usually advised.

At Young, the model predicted grazing from winter wheats –

FIGURE 3: The effect of nitrogen rate on average grazing for early-sown Wedgetail at Young, NSW

![Graph showing the effect of nitrogen rate on average grazing for early-sown Wedgetail at Young, NSW.]

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such as early-sown Wedgetail at 150 plants per m² – produced most biomass at 150 kg N per hectare of starting N (Figure 3) and up to 100 kg N per hectare for later-sown spring varieties, such as Gregory. For canola at 60 plants per m², required levels were higher at 250 kg N per hectare for winter types and 150 kg N per hectare for spring types.

“As for crop density, the modelling, combined with grower experiences and trial work, shows there is little impact in wheat above 150 plants per m² with respect to grazing value – which is also a reasonable target for grain-only in the medium and high rainfall zones. In canola, densities of 40–50 plants per m² are usually advised to optimise grazing and grain.”

Future research

John said best management practice for grazing stressed the importance of removing stock before growth stage Z30 in cereals and before buds elongated more than 10 cm in canola to avoid significant yield loss.

“But recent experience in cereals in shorter-season areas suggest that grazing can cause yield penalties even when locked up by these dates if grazing management leaves insufficient time or biomass for crop recovery,” he said. “While these phenology-based grazing rules remain sound, they could be improved with additional advice on the residual biomass needed at different lock-up dates to achieve potential yield in specific seasons. This is the goal of ongoing work.”

For more information contact John Kirkegaard, 0458 354 630, john.kirkegaard@csiro.au

MORE OPTIONS WITH DUAL-PURPOSE CROP PROGRAM

Grazing dual-purpose canola and wheat have opened up options to bridge in the autumn-feed gap for Lameroo (SA) farmer Brenton Pudney. Brenton farms 3560 hectares with wife Beck and parents Des and Vicki, and workman Regan Daniel. About 2000 hectares are cropped to cereals, canola, lupins, peas and export oaten hay.

Brenton says they are mostly croppers but had been looking at new ways to lift the performance of their 1500-head Dorper grazing operation.

In 2006 they experimented with early-sowing and grazing Chebec barley, instead of waiting for the June-July germination of medic pastures. There was only a slight yield penalty in the grazed crop – in what was a very dry year – so they decided to keep experimenting.

From ‘heart-in-mouth’ to ‘this really works’

“The first year there was a bit of heart-in-mouth,” Brenton said. “Our agronomist Mick Faulkner had been involved in the first Grain and Graze project. He picked it up and worked with us to have a go.

“When we put the sheep on the crop, it was more stock per hectare than we were used to and they grazed it off to the ground – the weeds too. We thought, ‘this isn’t going to work’.

“By grazing it to the ground, there wasn’t the leaf on top of the soil surface so plants were not losing moisture to the atmosphere through transpiration, instead they were putting effort in root growth.

“We found grazing was good for weed control too because it delayed development of weeds. If there’s a bit of ryegrass, the sheep run up and down the seed rows and eat the grasses first before they eat the cereal.”

The Pudneys would normally sow a crop at a seeding rate of 65 kg per hectare but for dual-purpose crops, it is up to 100 kg per hectare. At the crop’s three-leaf stage, sheep grazing starts until growth stage 31, or stem elongation.

By late winter or early spring, paddocks have been locked up – any later and yield potential for grain can be lost. Pasture paddocks have been rested and sheep are moved into those paddocks. But staggering cereal plantings can lengthen the grazing period.

Brenton says the concern in a low rainfall environment was getting enough rainfall to start sowing, and the risk of a ‘false break’. “But we haven’t found it to be an issue at all,” he said. “The seed just seems to stay there. If there is an issue, the sowing rate is so high at 100 kg per hectare that if it doesn’t germinate immediately, there is still the seed numbers there for plants to emerge later.”

One of the key benefits for the Pudneys has been the ability to sow early. Originally ‘early’ meant late April/early May, but now early paddocks are April 15 or earlier, if soil moisture allows. For wheat or barley in the ‘grain-only’ seeding program, the optimum is the second or third week in May.

Canola was grazed for the first time last year. In total, 200 hectares was sown on April 14 and 450 ewes were put in on May 1. They had 500 lambs and grazed the canola until July 3. The canola crop went on to average 900 kg per hectare.

Meanwhile wheat was sown on May 5 at 75 kg per hectare. Ewes that had grazed canola were changed to the 130 hectare wheat paddock in July and remained there until late August.

“We probably feel more secure with grazing wheat, only because we have more experience with it. The canola last year was really sown as a pasture. It was a dabble but the germination was so good, we turned it into a crop,” Brenton said.

“The key to dual-purpose crops is topping up with nitrogen once the sheep have been removed. We broadcast 50 kg per hectare of urea so that can be washed-in by rain.

“If in seeding early, the best paddocks to use are the ones that are fairly clean. Weed control is much harder because of chemical management and the need to adhere to stock withholding periods for grazing.”

For more information contact Brenton Pudney, 0428 774 031, brentonandbeck@bigpond.com

Des and Brenton Pudney, Lameroo, SA.
DUAL-PURPOSE CROPS BOOST CARRYING CAPACITY

There is a quiet evolution under way on the Southern Tablelands of New South Wales – a change in traditional lingo of micron, crimp and lustre to new concepts, such as grazing canola, dual-purpose crops and early sowing.

Once rolling hills were dotted with only Merinos but now the landscape is taking on a mosaic pattern of grazed and cropped paddocks.

The interest in cropping coincided with livestock’s meteoric rise in profitability in the 2000s. While stock from the Tablelands were usually shipped out to be finished in warmer climates, there was a push to produce higher quality animals by finishing them on-farm. And it was found more high value, dual-purpose grain and graze crops could do it.

But the road to growing dual-purpose successfully has had its ups and downs.

In the mid-2000s, some farmers on the South West Slopes were sowing canola too early and were using sheep to graze it back to get it under control. Some wheat and triticale sown was ending up with wheat streak mosaic virus (WSMV).

Rural Consulting Company agronomist Tony Good, also a farmer at Cowra, says WSMV put a dampener on cropping in the region for the next few years.

Before 2009, only a handful of growers in the Central and Southern Tablelands were dabbling with early-sown winter cereals, such as wheat and triticale, grown in a loose rotation with oats. The results were variable because there were few break crop options and a tendency to allow summer weeds to grow as sheep feed.

Many growers were not incorporating a two-year break for annual grasses in their rotation planning. Without this break, weed seed banks built-up during cropping and put newly-sown pastures under similar weed pressure than if no crops had been planted.

“Much of the grain produced was feed quality and kept for use on-farm in the livestock side of the business,” Tony said.

But in the past four years, cropping turned professional as contractors were brought in to help.

While difficult-to-control weeds, such as ryegrass, bromegrass and silvergrass, had been hosting cereal root diseases like crown rot and take all, growers were able to use crops to clean-up weeds before reseeding an improved pasture.

“For farmers who have taken up cropping, on most farms dual-purpose varieties have been combined with correct fallow management, through spring and summer weed control and effective break crops, combined with lime application,” Tony said.

“The result has been more certainty in production, fewer weeds and disease issues, and better pasture establishment – all the while carrying more stock on the farm, not less.”

Early sowing advantages

Tony says Tablelands’ growers are proving that early-sown winter or spring varieties that are established before winter will out-yield spring crops sown at the traditional late April/early May sowing time.

The advantages are:

■ Control of invasive weeds, which in turn improves property values for both cropping and grazing.
■ Potential for higher returns from the same land through producing higher grades of milling wheat or higher value oilseeds, as well as prime animals rather than store stock.
■ Ability to push up stocking rates and finish stock in winter. The aim is to recover variable costs of cropping through the sale of the animal, and any grain sold becomes profit.
■ Costs of liming land can be recovered in one year with cropping, rather than as amortised capital over 10 years with grazing.

Pushing up productivity on an existing farm is cheaper than buying a new one; and the extra profit(s) are creating “head-space” to reduce debts or engage in family farm succession.

But Tony says there are risks and many growers have sought professional advice to navigate potential problems.

“Not all parts of the Tablelands are suited to cropping so land choice is critical. Suitable land must not be too shallow or too rocky and must have deep, well-draining soils,” he said.

“It is a new level of expenditure that people aren’t used to and they are putting their cost base up directly and severely. They might misunderstand what the land is capable of, and there are years when stock is expensive and there’s nowhere to trade.

“There are weather risks such as frost but crop maturity is being managed with grazing.

“But is it sending people broke? Not those that are doing it properly. The people that started doing it are making a reasonable return and they are not giving it up.”

Crop choice

Tony says ‘new’ crops being grazed include canola, wheat and barley – replacing triticale and, in some areas, oats.

Canola is palatable to livestock and early-sown crops can be grazed to bridge the historical Tablelands’ mid-winter feed gap. Long-season canola crops sown two to three weeks earlier than normal can produce 1.5–3.0 tonnes per hectare more biomass.

“To guarantee this early biomass, paddocks must be well-prepared and ready for early sowing and have enough stored soil water for good, even crop establishment. High breakout tyres and press wheels can improve crop establishment,” he said.

Cereal grazing can be a major contributor to weed control in the crop in winter and spring. The choice of which cereal cultivar to grow is an agronomic decision (based on locality and sowing time) but long-season or true winter types will be a more flexible fit into the dual-purpose system.

CSIRO research in the region has found grazing of canola and cereals can start as soon as plants are well anchored. Canola must have biomass of more than 1.5 tonnes per hectare and wheat 1.0 tonne DM per hectare. To avoid yield penalties, remove stock before canola buds have elongated more than 10 cm above ground level in mid to late spring.

For wheat, animals must be removed before the crop reaches growth stage 31 – just before stem elongation with one node visible – to ensure there are no impacts from grazing.

More information: Tony Good, The Rural Consulting Company, Cootamundra, NSW, 0488 002 866 or tonynkris@bigpond.com

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