This is a Grain & Graze 2 project, funded by GRDC & the Australian Government's Caring for our Country initiative

Grain & Graze 2
You've filled the feed gap – now what?

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It wasn't too many weeks ago that Grain & Graze 2 encouraged farmers experiencing a feed gap for their livestock, who also had appropriate early weed free crop resources, to begin grazing those crops. For those who were able to take advantage of that opportunity, we hope it's made it a bit easier for the sheep to get a good feed and for you to get a good night's sleep!

Although grazing crops may have been valuable from a livestock perspective, the last few weeks (this is written in the first week of August) would have seen crops approach or pass Growth Stage 30 and force decisions about what to do next.

Of course, if stock are grazing relatively small areas or livestock business is the mainstay of your operation you might just continue to graze crops and trade off grain yield for some non-selective weed control, perhaps while setting up other pasture paddocks for later in the year. However, if your situation is more one of concern about how long to continue grazing crops and still maximise yield, it's time for some information to assist with decision-making.

It is important to understand that taking stock out of a paddock at the right time can result in surprisingly rapid recovery which in some crops can be as much as 1-2cm per day. If conditions are ideal, paddocks can look virtually ungrazed ten days after stock removal.

Why is GS30 a critical stage?

After crops reach GS30, the growing point, which becomes the head, moves above ground level and is therefore prone to being eaten. The longer you graze past GS30, the more (potential) heads will be eaten as stock graze emerging tillers. If tiller number two is only a week behind tiller number one and grazing continues, you rapidly get to the point where you have nothing left for grain production except possibly the miracle of re-shooting after a big rain.

With the aim to get as close as possible or even exceed the yield of ungrazed crops, getting stock out by GS30 is the best way to reduce the risk of missing that target.

Canola can recover after grazing with no seed yield penalty if grazing is completed when the plant is in a vegetative stage. Like cereals, grazing later in the season (early reproductive stage) will delay flowering and may cause a reduction in seed yield, especially if the season finishes early. Oil content was similar between grazed and ungrazed crops. So the message for canola grazers is to get the stock out as soon as the crop starts to bolt upwards.

Photo 1: Grazed vs ungrazed at Tarlee 6 days after 2nd graze (MNHRZ trial site)

Identifying Growth Stage is critical

It is important to understand that the GS30 we are talking about is that of the ungrazed cereal crop. You must have an exclusion cage in the paddock to gauge this or the same variety sown at the same time in an ungrazed adjoining paddock. That's because grazing itself will delay maturity so you need to be looking at an area that your stock have not had access to.

An easy way to monitor the growth stage of the crop your sheep are grazing is to establish this stock exclusion area in a paddock with weldmesh or portable sheep yards. Grazing delays the transition from tillering to stem elongation by a few days so when the main stem on these ungrazed plants begins to elongate as GS30 approaches, the rest of the grazed paddock will not be far behind.

Photo 2: Exclusion cage

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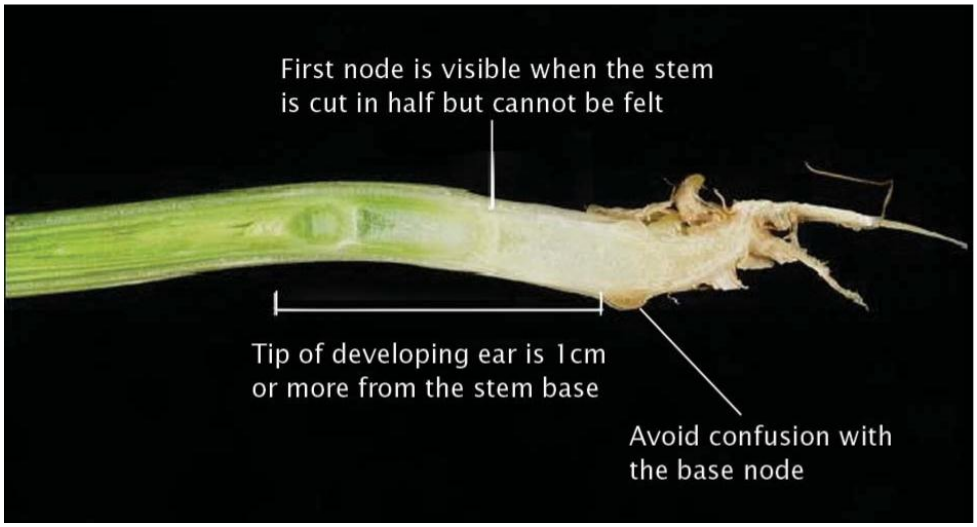
How to dissect a cereal plant to determine growth stage

1. Pull up a plant and shake the dirt off the roots
2. Pass your hand around the plant and draw upwards to identify the tallest leaf (this will usually be attached to the main stem of the plant)
3. Peel off any dying leaves
4. Cut the roots from the plant at the base
5. Cut the stem lengthwise along the stem to expose the embryonic ear. Want more information? Refer to the Cereal Growth Stages booklet available from the GRDC. It can be ordered from the GRDC website www.grdc.com.au in the publications section.

Photo 3: Cross section through cereal plant



What do we mean by risk of recovery from grazing?

Because a variety of factors influence the actual ability of a crop to recover from grazing, it is the risk of recovery we try to influence by removing stock at a particular time. Farmers with high water capacity soils and a long growing season can actually graze longer because the main head of the plant may be eaten but others will continue to emerge.

As you graze longer, the risk of the crop not recovering to produce a satisfactory amount of grain increases. The decision to continue or end grazing or define what 'satisfactory amount of grain' means is up to the individual farmer. Soil moisture and spring rains can have a significant impact.

In short, if you want minimal reduction in grain yield then don't graze past GS 30 to avoid eating off reproductive parts of the plant and becoming reliant on later order tillers and spring rainfall unless you are confident of soil moisture supply.

In long growing season areas, the completion of grazing before GS30 should ensure no grain yield loss unless periods of moisture stress are encountered. In shorter growing season environments, grain yield losses will occur due to grazing but may be reduced by limiting that grazing to an early crop stage.

Photo 4: Ungrazed left, grazed right – recovery after 5.5 days (MNHRZ Trial Site)

Recovery from grazing and crop type / variety

Another interesting facet to this story is that even if we removed stock from all the varieties at GS30 there would still be a difference in their ability to recover. Part of the Grain &Graze project is to try to find out if those varietal differences are just due to their phenology (the variation in developmental stages of different varieties) or whether there are other drivers. At this point in time we do know there are differences but we don't know what the drivers are.

Because of the different sensitivities to grazing recovery exhibited by different crops and varieties there can be implications for when to remove stock. For example, if we graze beyond GS 30 with barley we might only take out one tiller. But because barley produces more tillers (heads) than wheat, its recovery is usually better under the same conditions.

Within the wheat varieties there are groups that respond differently. Winter wheats don't produce as much dry matter as spring wheat varieties but they reach GS 30 later so can provide an extended period of grazing. Naparoo is an example of a winter wheat studied in SA trials but there are very few commonly grown here. Because of the long vegetative period, winter wheat also tends to have more tillers and that means more potential heads.

Most of our varieties are spring wheats, so named because they develop very rapidly in spring. Mace, for example, runs through its lifecycle so quickly that it does not get that chance to produce four or five heads per plant. We need to be more cautious when grazing rapidly developing spring wheats.

Mace is largely replacing Wyalkatchem in SA as a major high yielding grain crop. Mid-North growers who were grazing Wyalkatchem sometimes experienced no yield loss whatsoever. Mace is proving a less robust variety in terms of grazing recovery so it is wise to remove sheep earlier.

The wheat varieties shown in trials to have poor recovery from grazing are those such as Coral, Scout, Yitpi and Frame. Similar performance in this regard may indicate a common link in their lineage. So, if you're grazing a wheat variety with a poorer response to grazing then get the stock out earlier to give yourself more opportunity in the grain stakes. If you need to leave stock longer on a crop then barley may be the safest option.

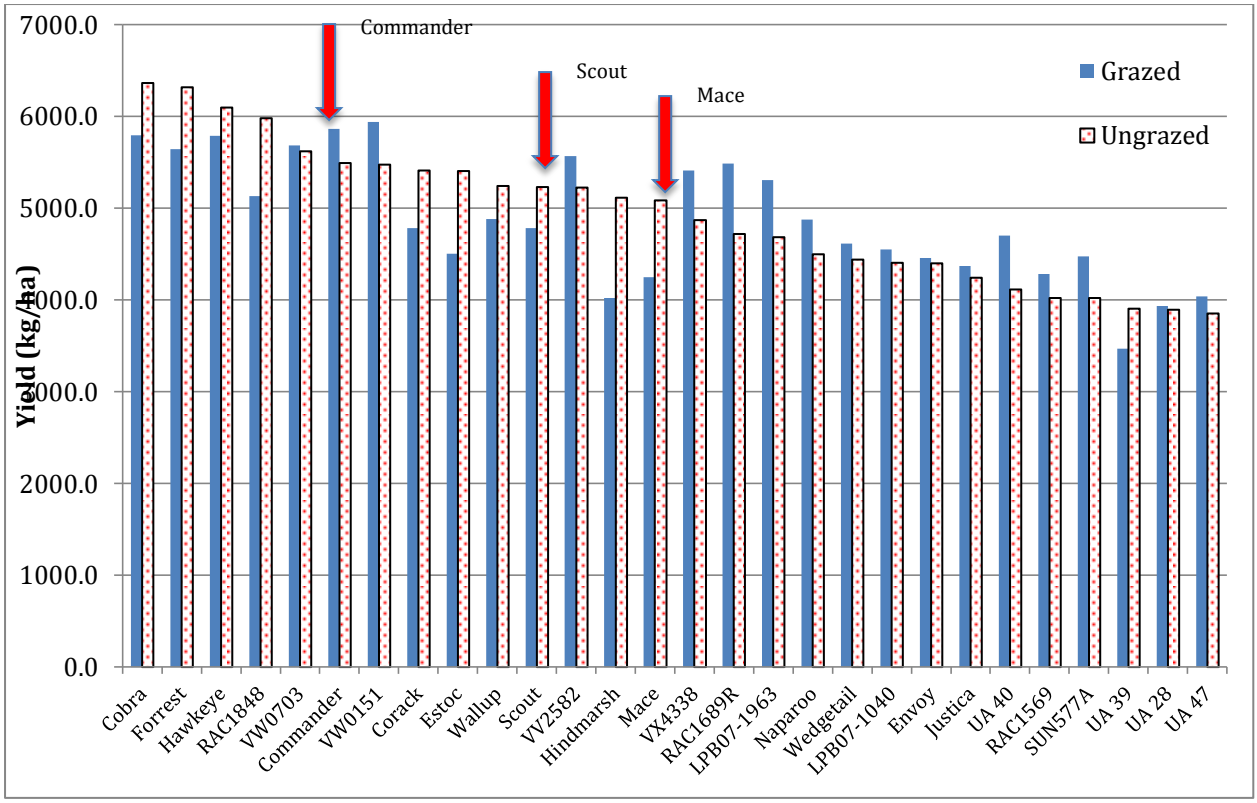
Grazing doesn't always reduce yield!

Grazing sheep on crops doesn't always reduce yield. In some cases it actually increases yield. Grain & Graze 2 trials at Tarlee show this to be more common in barley than wheat. Anecdotal evidence from trials at Minlaton support this.

The positive increase in grain yield has been attributed to less disease, reduced lodging, more efficient photosynthesis, avoidance of late frost events and possibly the use of moisture at grain fill that was conserved earlier in the year because of the reduction in leaf area of the crop. Other varietal characteristics may also help explain the positive benefits seen with grazing.

Tarlee trials in 2010 and 2011 saw Commander barley produce yields which, in some cases, were more than 20% higher when subject to grazing.

Figure 1: Grain Yield (kg/ha) vs. Variety and Grazing Treatment at Tarlee 2010 and 2011(MNHRZ Grain & Graze 2 Trial Site)



Generally, in these good years, the 27 varieties tested at Tarlee did not show significant yield reduction through grazing. Grain protein levels were acceptable due to generous application of nitrogen although they did vary between varieties. Protein was generally higher where treatments were grazed. This is most likely due to the slight drop in yields associated with grazing (grain protein dilution effect lessened). It could also be related to the potential delay in maturity experienced by some varieties when grazed. Filling grain under warmer conditions could also cause increased protein levels.

Photo 5: Commander barley grazed to GS30 in foreground shows delayed maturity compared to ungrazed plot behind. (MNHRZ Grain & Graze 2 Trial Site)

Stocking rate and recovery

There are Grain & Graze 2 projects currently underway in other states investigating the effect of stocking rate on crop recovery but we can make some general statements here in this regard.

Farmers who stock lightly and run sheep over the top of the plants should find those plants recover more quickly. Light grazing results in more rapid crop recovery than heavy grazing to ground level or continuous grazing.

Therefore, unless you are confident of the season and you have marginal feed shortages you might just do a light grazing over a few paddocks. Rather than heavily grazing a paddock with high stock numbers, you might just walk smaller mobs over a few clean paddocks and nick the top off, just to let the pasture get away. As we move into August, production is lifting in pasture paddocks so stock can probably be shifted to them.

If you graze past GS30 the growth rate of crops can be so rapid that unless stock numbers are very high the sheep won't keep up with it. This can result in uneven grazing and variation in crop maturity across the paddock.

Replace the nitrogen grazing removes

By grazing you reduce the nitrogen status of your crop. It is important to remember that the nitrogen sheep consume from the growing plant goes into their bodies and mostly is excreted but not available to the plant for some time. Sheep that are growing (eg lambs) actually retain more of the plant nitrogen as protein in their meat. Animals that are not putting on weight excrete most of the nitrogen they consume. It is estimated that the nitrogen consumed from 10 square metres of grazed crop is excreted onto less than 1/10th of a square metre. The fertility of this 1/10th of a square metre increases substantially but the remaining 9.9 square metres has lower fertility as a result. Therefore, one of the important messages is that when you take the stock out you need more nitrogen and the amount may be substantial.

To get a handle on how much N is needed it is worth looking at the dry matter produced (and removed by grazing) by some commonly grown varieties and their performance in the Tarlee trials.

In a typical year, on a site like Tarlee, Mace wheat might produce 1200kg/ha of dry matter to GS30. There is variation of 50% up or down from this figure, at this site for different cereal crops. For example, Moby barley might produce as much as 1800kg/ha, Naparoo wheat 720kg/ha and Commander barley around 1400kg/ha.

If we use Mace @1200kg/ha DM removed by grazing to GS30 as our benchmark, then approximately 20kg/ha of nitrogen needs to be applied when the stock are removed. A barley variety like Commander will require slightly more. As a rule of thumb, if you have grazed hard to GS30 apply 20-25kg/ha of nitrogen afterwards.
Of course there are some situations where grazing of the crop was initiated because the crop was too lush or the soil had extremely high nitrogen. This form of canopy management of the crop does not need nitrogen top up.

Nitrate poisoning

A word of caution is necessary for those farmers who apply nitrogen to the crop before GS30 while sheep are grazing it. Urea application has the potential to cause stock losses. This can happen through direct ingestion (from piles of spilt urea) but also through increased nitrogen levels in plants that sheep are grazing.

When nitrate and protein levels are very high it is difficult for the animals to get enough energy to actually digest the protein and scouring with loss of condition results. Managers with a good eye for their stock will spot this quickly. Good quality supplemental hay and 5 in 1 vaccine prior to introduction to crops are recommended. Spreading urea after stock are removed means that there won't be a sudden boost of plant nitrate during grazing.

Recovery and seasonal / soil conditions

Crop recovery post grazing is heavily dependent on seasonal and soil conditions and when grazing is completed. Commander barley is a variety that can normally be grazed

safely up to GS30 without yield reduction (and possibly yield increase) in an average year. However, if it becomes very dry later in the season or there is weed competition, recovery may not be as good.

With an El Nino event predicted to develop, it may be wise to consider removing stock earlier than GS30. However, in many areas farmers have sufficient soil water available to make that unnecessary. Be careful on shallow soils that don't have plenty of water in the profile.

Soils that will hold 100mm or more of Plant Available Water (PAW) and are 80mm+ at the moment are probably safe to exploit through extended grazing. They are likely to offer buffering capacity for an average or slightly below average spring. Soils not that full (holding less than 60mms PAW) or with less capacity require caution in case recovery is restricted by a dry spring.

Table 1: Characteristics of the growing season and implications for grazing winter crops. It is critical to appreciate the differences in regional characteristics so the opportunities and risks of grazing winter crops are understood before decisions are made.

Region	Time of sowing	Opportunity for grazing	Recovery after grazing
Avon (Sthn WA)	Late April to beginning of June	Limited to about two to four weeks in low rainfall areas, four to six weeks in higher rainfall areas.	Grain yield usually not affected if grazed early. Grazing at late tillering likely to affect yield unless favourable spring finish.
Southern Vic, SE South Aust and Tasmania **(Corangamite / Glenelg Hopkins)**	Usual May sowing. Feb/ March sowing unreliable except with irrigation. Often reliable in Tas.	Limited to about six to eight weeks to avoid grain yield loss. Drymatter for grazing often small. 10 weeks in Tas.	Generally good unless warm dry conditions in early Spring. Silage or hay is possible. Grain fill is generally not affected unless dry late spring.
Upper Eyre Peninsula (SA)	Usually May Early / dry sowing in March / April	Limited to four weeks if targeting grain	Grain yield usually affected, except under very favourable seasons
Lower Eyre Peninsula / Kangaroo Island, (SA	May / June	Four – six weeks if targeting grain	Not affected if grazed early. Grazing at late tillering likely to affect yield unless favourable spring finish.
Mid North & Yorke Peninsula, SA	May / June	Limited to about six to eight weeks to avoid grain yield loss.	Grain fill is generally not affected unless dry late spring.
Mallee (SA, Vic, NSW	Usually May. Rare opportunity for early sowing but success relies on follow up rains.	Limited to about four to six weeks.	Affected in most years. Reduction in grain yield common even if grazing is completed before stem elongation.
Murrumbidgee (NSW)	Often in Feb / March because of adequate autumn rains.	Up to 10 weeks if sown early.	Generally good unless warm dry conditions in early Spring. Silage or hay is possible. Grain fill is generally not affected unless dry late spring.
Northern WA (Northern Ag Region)	Late April to the beginning of June	Limited to about two to four weeks in low rainfall areas, four to six weeks in higher rainfall areas.	One grazing in lower rainfall areas. Grazing twice can substantially reduce grain yields. Stock can selectively graze out weeds in lupins and certain cereal varieties.

Grazing crops vs. opportunity crops

It is common in low rainfall scenarios to sow crops with longer term grazing in mind to maximise returns from stock, intending to reap only if the opportunity arises. In this situation, if substantial rains do occur prior to harvest it is important to remove stock quickly to allow the crop to recover, or even reshoot, especially if good prices for grain are available.

Grazing and disease considerations

Grazing can have different impacts on different crop diseases. Yellow leaf spot, a problem this year, can actually reduce under grazing conditions because the sheep are consuming it. On the other hand, wheat streak mosaic virus can be worse under grazing. Rust spores can not survive ingestion so heavily grazed crops may be infected later by the rust species or sometimes be completely clean. Once stock are removed, however, it is as important to monitor these crops for disease as any crop.

Withholding Periods for crop chemicals

One cautionary note for farmers intending to sell stock after grazing crops is to know the withholding periods for the chemicals they have used. Some of the pre-emergent chemicals have restricted grazing periods when stock, destined for slaughter, feed on the treated crops. This may override the need to consider the crop stage as the only indicator of when put stock in or take them out of a paddock.

Putting it into practice

- Select varieties for grazing and grain recovery based on trial results. Varieties that produce plenty of biomass do not necessarily recover well for grain yield production.
- Maintain adequate nitrogen fertility post grazing to ensure minimal yield decline.
- Follow withholding periods for pre-seeding herbicides and seed/fertiliser treatments. Some products have lengthy withholding periods that may preclude grazing.
- Grass weeds can flourish under cereals that are grazed and intended for grain recovery. Ensure paddocks to be grazed are clean and be prepared to croptop or otherwise manage weed seed set if the paddock develops a grass problem.

More help?

If you need more information to help you take advantage of Grain and Graze 2 opportunities when you are making decisions please contact your advisor. Be aware that Grain and Graze 2 will be publishing important updates and messages throughout the year.

Be sure to sign up for posts from our blog site: www.grainandgraze2.com and our facebook page: https://www.facebook.com/GrainGraze2EastSA.

You can also download the Grazing Cereals Roadshow booklet here: www.grainandgraze2.com.au

Information in this article was also obtained from the [1]Grazing Winter Crops Roadshow Workshop Notes, March 2008.

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