

Conserving Cereals

*When and how to conserve cereals on dairy
farms*

Information sessions and farm walks

25th - 29th August 2008

- **Finley**
- **Merrigum**
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Making Cereal Silage

(Frank Mickan & Tom Farran, DPI Victoria)

Introduction

Many farmers across the district have sown cereal crops this season and are wondering how best to make them into silage. Many cereals such as oats, barley, wheat, triticale and rye-corn are suitable for making silage. Cereal crops which have been affected by frost or unfavourable weather conditions resulting in unsatisfactory grain yields can also be ensiled. If considering cutting a cereal crop for silage, there are two recommended stages to cut them at:

- Flag leaf/boot – early ear emergence if desiring a higher quality silage or
- Soft dough stage if a higher yield but not as high protein and energy content is required.

When to cut for silage

The timing of harvest should take into consideration the following:

- end use of the silage i.e. for animal production vs maintenance rations
- weather conditions at harvest
- soil types and soil moisture conditions at harvest
- if double cropping, when the following crop needs to be sown
- availability of suitable harvesting machinery

Stage of growth recommended for ensiling

Cereals can be harvested at the flag leaf/boot to early ear emergence stages or the soft dough stage.

Flag leaf/boot - early ear emergence stage (Figure 1)

- The flag leaf is usually the widest leaf and is the last leaf to appear before the head emerges.
- The flag leaf sheath contains the “boot”, a swelling in which the ear will emerge.
- Once the ear has emerged, flowering commences.
- The plant has vegetative leaves up to this stage.
- All cereals can be harvested before or at this stage and should produce higher energy and protein silage (over 10 MJ ME) than cutting later.
- There will be lower yields compared to their potential if harvested in the grain formation stages.
- DM content will usually be well below 30% DM, thus requiring wilting before harvesting.

Soft dough stage (Figure 2)

- As the plant reaches maturity, sugars in the stems and leaves are moved to the grain and converted to starch.
- Plant changes in colour from an all-green plant to an all-yellow plant when it's fully mature at the hard grain stage.
- As the grains form they pass through the clear liquid stage, then become milky, followed by the soft dough stage. This is then followed by the hard dough stage and finally to a dry grain.
- Harvesting at this later soft dough stage results in much higher DM yields but silage of lower energy and much lower crude protein levels than earlier at the vegetative stage. (refer to figures 3, 4 & 5)
- The grains may reach the hard dough stage within days after soft dough if the weather is hot and dry, or several weeks in cool moist conditions. In the event that the crop reaches hard dough it is important to make sure the crop is chopped finely (see dry matter content) and consider using additives to help prevent aerobic spoilage (see silage additives).
- **Warning - Cereals should not be harvested at the clear liquid - early milk stages.** At this stage the soluble sugars in the plant are being converted into starch in the heads. The nutritive value at this stage is often reduced and palatability of fodder made at this stage is sometimes greatly reduced.



Figure 1. Targa oats at boot stage



Figure 2. Crackerjack triticale at soft dough stage

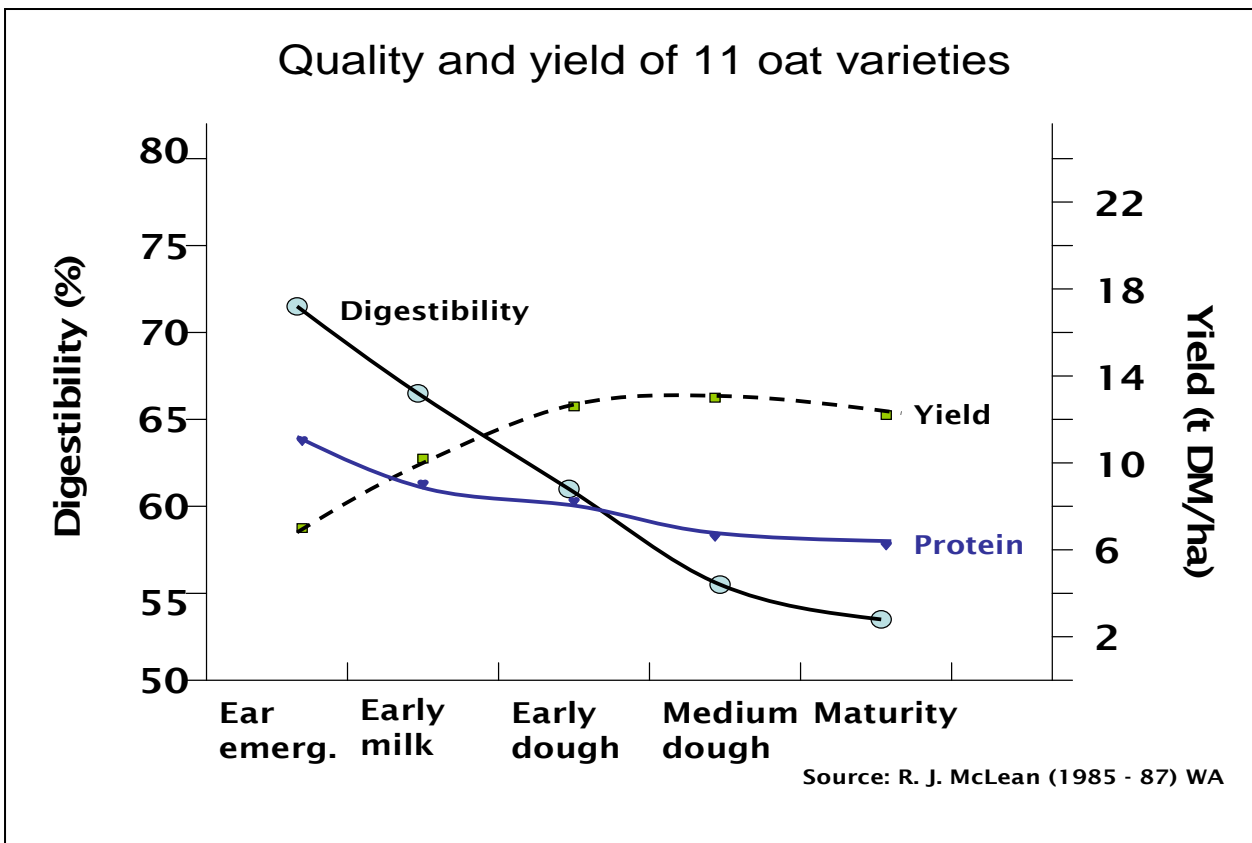


Figure 3. Grain and feed oats: Quality declines as crops become more mature while yield continues to increase up to the medium dough stage. If chasing a higher quality crop, cut at boot-ear emergence. If after higher yields cut at the late milk-soft dough stage. Forage oats are slightly better quality at the later growth stage.

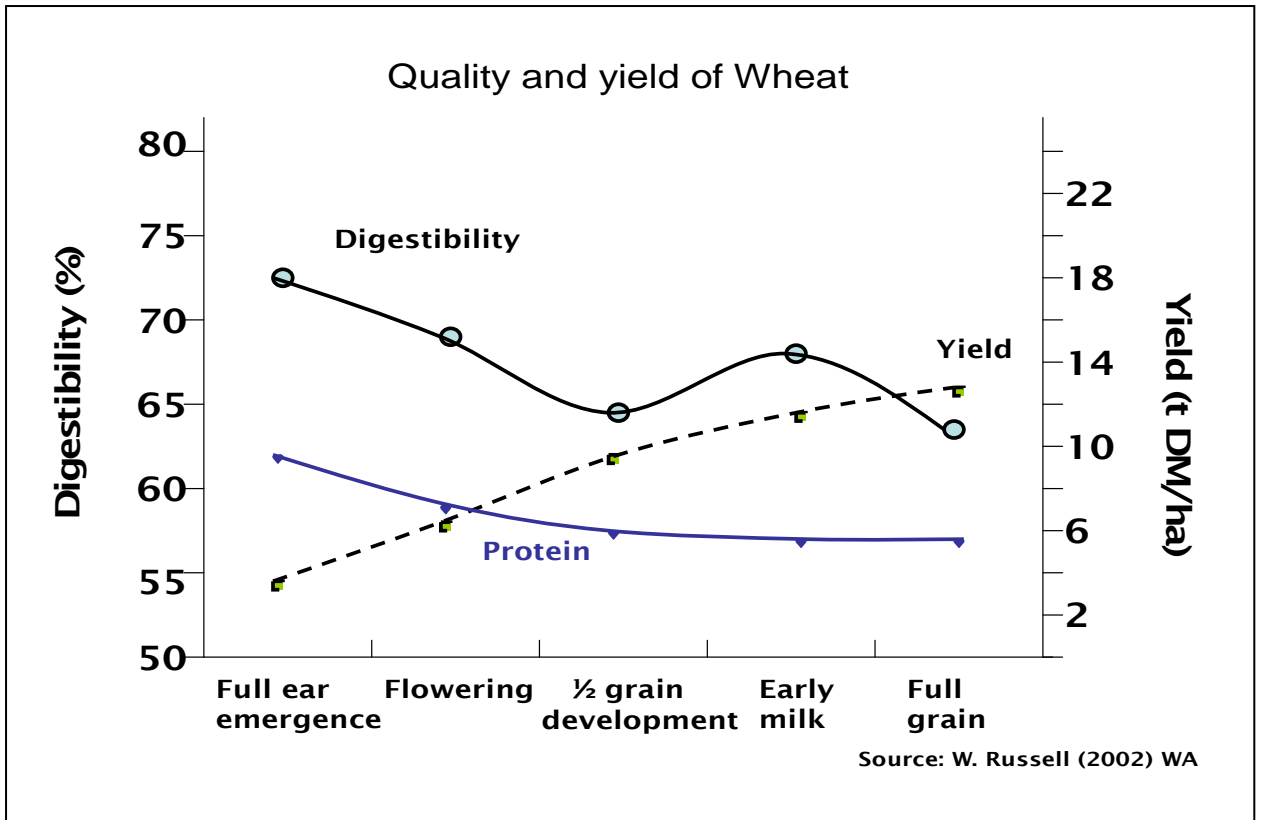


Figure 4. Quality is highest at boot-ear emergence (full ear emergence) and slightly lower at soft dough (between early milk & full grain). Yield increases up until the soft dough stage. Avoid harvesting at the clear liquid (1/2 grain development)-early milk stage.

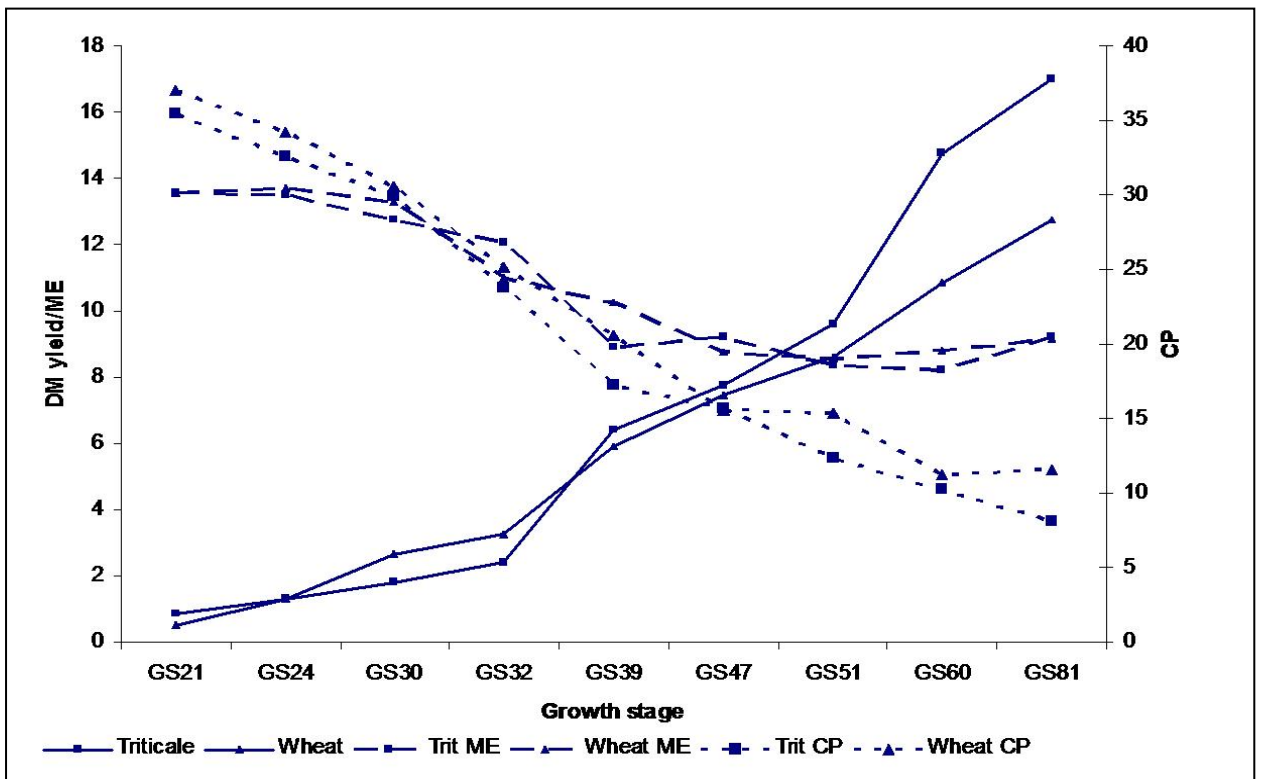


Figure 5. Forage triticale and winter wheat. The more mature the crop becomes the higher the yield but lower the quality becomes. Source: Joe Jacobs, DPI Warrnambool, 2007.

Mowing & Cutting Height

- The stage of growth of the crop at harvest affects the DM and will therefore determine whether it is mown and wilted before harvesting or direct cut and ensiled as a “standing” crop.
- Cutting height is usually 7 – 10 cm above ground level.
- Cutting higher will result in a slight increase in nutritive value but will also reduce yields accordingly.
- If mown and wilted, a higher cutting height will also keep the mown swath higher off the ground thereby allowing more airflow under the crop and a slightly faster wilting rate.
- A higher cutting height will also reduce the risk of soil contamination from other equipment operations such as raking.
- Cutting at greater heights will leave behind increased levels of stubble which creates a problem of removal in the future and preparation for the next forage.

Dry matter content

Flag leaf/boot to early ear emergence stage

- Harvesting at this stage (18 – 22% DM) will require the crop to be wilted to reach the desired DM content for ensiling.
- Mowing with a roller type mower conditioner is recommended to crimp/crack the stems which will encourage quicker wilting. This results in a wilting rate 20 – 40% faster compared to mowing only.
- Conditioned stems will also allow a more reliable and easier ‘pick up’ by harvester and baler pick-ups and subsequent feeding into the respective cutting or roller mechanisms.
- Unfortunately high yielding crops will be relatively slow to wilt, even if conditioned. In all cases, leaving the windrow as wide and thin as possible, and in a “fluffy” state will increase the wilting rate substantially.

Soft dough stage

- The DM content of wheat, barley and triticale at the soft dough stage of growth will be in the desired DM range as a standing crop for ensiling without prior wilting.
- They can be either direct harvested with forage harvesters fitted with specifically designed cutting fronts or pre-mown and immediately picked up by the forage harvester.
- Cereals should ideally be harvested using a precision chopping forage harvester to ensure a short chop length (20 – 50 mm actual length). This ensures the material can be well compacted minimising the amount of air trapped, thereby resulting in reduced losses (nutritive value and DM).
- Most other forage harvesting machines such as self-loading wagons cut the material to varying lengths, often over 200 mm, making adequate compaction very difficult.
- The drier the crop DM content at harvest, the shorter the chop length required.
- Grain loss may be slightly higher in pre-mown crops due to the rotary disc action of the mower and, particularly if raked before harvesting, DM yield and nutritive value will also be slightly lower.
- If baling applying netwrap instead of twine will also reduce the amount of air trapped between the plastic and the bale as the twine, especially in slightly loose bales, will “pull” into the bale. Applying netwrap will also minimise straw stalks protruding from the bales which can puncture the stretchwrap plastic seal, allowing air to enter.

Table 1: Target DM content and stage of growth at harvest for ensiling forage cereals

Species	Flag leaf - Boot		Late milk - Soft dough	
	Stack/pit ¹	Baled ²	Stack/pit ¹	Baled ²
Oats/Ryecorn	33 - 40	38 – 50	N R	N R
Triticale	33 - 40	38 – 50	35 - 42	38 - 45 ³
Barley	33 - 40	38 – 50	35 - 42	38 - 45 ³
Wheat	33 - 40	38 – 50	35 - 42	38 - 45 ³

NR Not recommended, ¹ Should be precision chopped, ² Preferably baled with chopper baler,

³ Lower bale DM at harvest suggested to ensure greater compaction

Silage additives for forage cereals

Silage additives (many types of inoculants and others with different modes of action) are available which can improve the fermentation process. These are essential for cereal crops which are being ensiled below the recommended levels (Table 1).

A new class of additives, which will delay and/or reduce aerobic spoilage at the stack face and during feeding out, is recommended for whole crop cereal silages. Large stack faces (which take more than 2 days to remove the stack face) and a daily depth of face removal of less than 0.4m would require the use of spoilage inhibitor type additives. Most additives will improve the fermentation and reduce losses. All additives are applied during harvest at the machine pick up, harvester chute or baler throat to ensure thorough mixing with the forage to be effective.

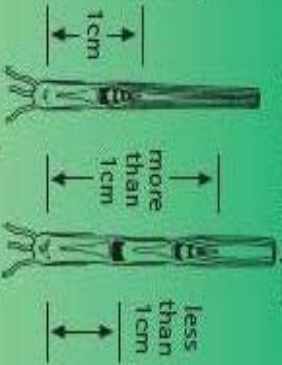
Acknowledgments

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Ravensdown Cereal Growth Stages Guide

Growth Stage 30:
Tip of developing ear is 1cm or more from above the stem base, but first node is less than 1cm from the stem base

Ear at 1cm (30)
(main shoots split)



Growth Stages (Zadoks)

11	12	21	22-29	30	31	32	37	39	45	51-59	61-69	71-79	81-89	91-99
One shoot 1st leaf	2nd leaf	Tillering begins	Leaf sheaths lengthen	Leaf sheaths strongly erect. Start of stem elongation	First node of stem visible	2nd node visible	Last (flag) leaf just visible	Base (ligule) of last leaf just visible	Booting-ear swollen in boot	Heading-ear emergence	Flowering	Milk development	Dough development	Ripening

Foundation phase

0-29

Construction phase

30-59

Grain-filling phase

61-harvest