



Making Cereal Silage

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September 2008

Introduction

Many farmers across the south west have sown cereal crops this season to fill feed gaps and to restock their fodder reserves. However, there are some “must do’s” to ensure they are ensiled successfully. This article outlines some of the key decisions to ensure that a satisfactory fermentation in bales and stacks occurs.

Cereals (Forage, dual purpose and winter sown) suitable for ensiling are oats, barley, wheat, triticale and rye-corn. Cereal crops which have been affected by frost or unfavourable weather conditions resulting in unsatisfactory grain yields can also be ensiled.

When to cut cereals 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 to boot stages or the late milk to soft dough stage.

Flag leaf - boot 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 from which the head (or ears) will emerge.
- Once the head has emerged, flowering commences. Some cereals start flowering just before head emergence.
- The plant has vegetative leaves up to this stage.
- All cereals can be harvested before or at this stage and will usually produce high energy silage (over approx. 10 MJ ME) and higher protein (over 105 CP) than if cut later.
- Dry matter yields will be lower compared to their potential if harvested later, in the grain formation stages.
- DM content of the standing crop will usually be well below 30% DM, thus requiring wilting to the recommended contents before harvesting (See Table 1).

Soft dough stage (Figure 2)

- As the plant reaches maturity, sugars in the stems and leaves are translocated to the newly forming grains, converting to starch in the process.
- The crop changes in colour from an all-green plant up to the boot stage to a mix of green and yellow at the soft dough stage and to all-yellow when it’s a fully mature at the hard grain stage.
- As the grains form they pass through the clear liquid stage, then become milky, followed by soft and hard dough stages, finally to hard dough and eventually as a very hard dry grain.
- Harvesting at soft dough results in much higher DM yields but of variable energy levels (approx. 8 – 10 MJ ME) being influenced by grain yield and weight compared to stem and leaf. Crude protein levels are much lower (less than 10% CP) than at the vegetative stage.
- The grains may reach the hard dough stage within days after soft dough if the weather is hot and dry, or may take several weeks in cool moist conditions.
- **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.

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

Mowing and Cutting height

- The stage of growth of the crop at harvest will 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 reduced yields accordingly.
- “Headage” is a crop where only the heads and small amount of stem is harvested.
- 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 for ensiling

Flag leaf/boot to early ear emergence stage

- Harvesting at this vegetative stage (approx. 18 – 22% DM) will require the crop to be wilted to reach the desired DM content before harvesting. Cereals in the vegetative stage have a high buffering capacity which causes them to have a greater resistance to undergoing a desirable fermentation and becoming silage. Wilting to the above levels (Table 1) overcomes this issue.
- Mowing with a roller-type mower conditioner is recommended to crimp/crack the stems which will encourage quicker wilting. Tyned-type mower conditioners are also suitable, causing some stem cracking, leaf abrasion and leaving a fluffier windrow than roller types. Wilting rate will be increased by 20 – 40% compared to mowing only.
- Conditioned stems allows 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 higher rainfall areas. In all cases, leaving the windrow as wide and thin as possible, and in a “fluffy” state, will increase the wilting rate substantially.
- If using a tedder, and do so soon after mowing, avoid incorporating dirt/dust when raking later.

Soft dough stage

- The DM content of wheat, barley and triticale at the soft dough stage of growth will be in the desired harvesting DM range as a standing crop range.
- 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 in the stack or pit so minimising the amount of air trapped thus 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.
- If the crop DM content at harvest is drier than desirable, chop length must be as short as possible.
- 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 quality 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 also minimises straw stalks protruding from the bales which can puncture the stretchwrap plastic seal, allowing air to enter.
- Vermin control (baits, clear ground, slaked lime around perimeter, spaces between bales, etc.) is essential, especially for cereal crops baled at this later stage.

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. Narrow stack faces (no more than 2 days to remove the stack face) and a daily depth of face removal greater than 0.4m would be required to avoid using 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

Project 3030 is jointly funded by Dairy Australia, Victoria DPI, Gardiner Foundation, the University of Melbourne, GippsDairy, MurrayDairy and WestVic Dairy.



Figure 1. Targa oats at boot stage



Figure 2. Crackerjack triticale at soft dough stage



Figure 3. Grain at soft dough stage