

AWB Wheat Quality Fact Sheet

Frosted Grain

AWB Receival Standards

As frost damaged wheat has a major detrimental effect on the flour milling and end product manufacturing processes, AWB has set tight Receival Standards.

Frosted Grains are included in the definition, 'Dry Green, Sappy or Frost Distorted', for which there is a maximum limit of 1% by count for the total of these. Assessment is conducted on wheat held above a 2mm screen following sieving. Grain containing over 1% but less than 10% Frosted Grain is classified as AGP. Any grain exceeding this will be classified as Feed, where there is no limit, and is only suitable for use as stock feed.

At present there are no objective methods of assessment for Frosted Grain. Classifiers must visually assess the level of Frosted Grains. Photographic standards have been developed to assist classifiers in identifying Frosted Grain.

Nature

The most notable effect of spring frosts is reduced yield often only realised when harvesting an affected paddock. In addition to the yield reduction, frost has a significant effect on quality.

Frosted kernels are recognisable in a grain sample as they often appear shrunken and distorted and can be greyish blue in colour.

Cause

Frost damage occurs between anthesis (flowering) and grain maturity. Plant tissue is frozen, causing ruptured cell walls and membranes. The freezing process can also dehydrate the cells, essentially killing them. Either way, the result is that nutrients cannot be translocated from the plant to the grain effectively, and this affects yield and quality.

If affected during the milk stage of development, the grains may continue to develop, but will be light and shrivelled. They usually have a low Test Weight and at times a low Falling Number.

As development progresses and grains become drier, they become more frost resistant, however a severe frost, even at the

late dough stage can result in wrinkly grains. Again, these may have a low Test Weight and Falling Number.

Impact

The severity of frost damage depends on the stage of maturity of the grain, the temperature and exposure time. Quality defects arising from frost damage include a reduction in flour-milling value due to the combined effects of lower flour yield and poor flour colour. In addition, frost damaged wheat may be extremely hard, needing more energy during the milling process. Finally, flour produced from frosted wheat has unsatisfactory dough properties that results in poor end product quality.

Milling Performance

Flour Yield

The quantity of flour a miller can extract from a tonne of wheat is critical to their profitability. Frosted wheat decreases the flour yield due to the changes in grain morphology such as poor aleurone structure, thicker bran layer and a more compact endosperm structure in which starch granules are tightly held. The middling stocks are more difficult to reduce into flour, which tends to alter the flow characteristics of the mill that in turn can further reduce flour quality and increase power consumption.

Flour Ash

The ash content of flour is a traditional measure of fine bran particle contamination. Millers like to avoid having bran in their flour as it can have an adverse effect on flour colour making it darker and causing specks in some end products. Frosted wheat increases flour ash levels. To try and maintain some flour quality, a commercial mill may compensate by making a few adjustments to the mill set-up, but this amounts to increased milling costs per tonne.

Grain Hardness

The effects of frost damage on flour yield and ash levels can be related to an increase in grain hardness and grain distortion. As grain hardness increases, the natural fracturing of the starch granules also increases during the milling process, resulting in a higher starch damage level. Excessive starch damage results in higher than required water absorption and this has a negative impact on the dough properties and end product quality.

End Product Quality

The effect of frost on end product quality relates to poor dough properties that can be attributed to excessive starch damage and inferior gluten quality. When a frost occurs and the grain is immature, protein synthesis is stopped and consequently its functionality affected. Flours made from such wheat can produce a loaf of bread that has a lower volume due to the poor gluten quality. The same loaf can also have a darker crumb colour as a result of a higher flour ash content. Adding to a fall in quality is the effect of increased grain hardness on water absorption. Poor noodle colour can also occur when frost damaged wheat is used for the production of noodle flours.

Frost causes similar problems when making pasta from durum semolina. In the milling process, frost results in reduced semolina yield. The semolina quality is also poor with high ash, dull colour and specks and in severe cases causes poor gluten quality. Spaghetti made from frost damaged durum is dull and specky.

What can be done?

There are a few measures that a grower can take to avoid unseasonal frosts late in the season.

The most effective way to avoid frost damage or to limit the possibility of it occurring is to adjust planting time and crop variety to suit prevailing frost conditions in the area. Varieties should be sown that will flower after the high risk of frost has finished. Unfortunately, it is impossible to sow late enough to avoid late unseasonal frost, as the crop will be unable to finish grain filling due to a lack of moisture and other factors.

Studies conducted suggest that graded grain may be suitable for producing end products of comparable quality to unfrosted grain. Growers should review their capability and the economic advantages of large scale cleaning of such parcels.