Inspecting grain for defects and impurities

**Diseases**

**Smell**
When inspecting grain, note any unusual smells. A sweet or minty smell indicates mites, and fishy smells indicate moulds, chemical smells, eg cleaning fluids and diesel, can also occur.

**Screenings**
- **Physical damage**
  - **Broken grains**
    - Exposed endosperm, usually due to aggressive handling, provides potential sites for mould infections.
    - Broken grains are removed during the cleaning process and hence milling potential is reduced due to a lower yield of clean, white flour from each tonne purchased.
  - **Sprouted grains**
    - Germinated grains, caused by wet harvest conditions, will have very high levels of alpha-amylase. Even a few in a bulk can reduce Hagberg Falling Number to white flour from each tonne purchased.
  - **Lost embryos**
    - Insects may be damaged mechanically or by enzymes (as shown) or insects.
    - Damage to seeds or insects may indicate poor storage.
  - **Burnt grains/heat damage**
    - Heat damage arises from localised ‘hot spots’ or excessive temperatures during drying.
    - Grains can range in colour from bronze to dark brown (charred).
    - wrists will have inedibly damaged gluten.
  - **Insect damage**
    - This type shows internal damage. Flips are left within the grain. Endosperm is eaten by the larvae inside the kernels.
    - Evidence of insects indicates poor storage and possibly local hot spots.
    - The presence of live insect pests is unacceptable; the risk of mycotoxin formation.
  - **Rodent droppings**
    - Rodents directly damage grain and carry infection.
    - Rodent droppings distinguish it from rodent droppings.
    - Rodent droppings can also be harmful and cause respiratory problems.

**Smell**
- Broken grains, shrivelled grains, chaff, weed seeds, small screenings.

**Fusarium**
- Pale moulds indicate possible Fusarium infection.
- Some Fusarium fungi can produce mycotoxins that are toxic to humans and animals. Permitted mycotoxin levels are governed by legislation or trading specifications.

**Mouldy grains**
- Dark mouldy grains indicate poor harvest conditions and may impair quality, eg white or brown colour.
- Dried grains or sowers or moulds which are unacceptable to all users due to the risk of mycotoxin formation.
- Spores present possible health hazards and must not be inhaled.

**Ergot**
- The feeding body of the fungus Claviceps purpurea affects grasses as well as rye, wheat and barley.
- The inside of an ergot is greyish white, which distinguishes it from rodent droppings.
- Ergot is toxic to humans and animals and is unacceptable to any processor.

**Bunt (Tilletia tritici)**
- Fragile grains, dark in colour. Part of the grain may have eroded.
- Surface cracks may reveal black powdery spots within the endosperm. Bunt balls occur occasionally and spores give grains a full bush.
- Infected grains have a pungent fishy smell, making it unacceptable for cereal products.

**Blackpoint**
- As a response to infection the plant produces chemicals in the bran which vary from brown to black over the germ area.
- Blackpoint is often associated with Alternaria infection but is not the only cause. Some varieties are more prone to blackpoint than others.
- Black bran specks in flour can affect flour quality.

**Dullness**
- M ay be due to spores or moulds giving a dull look.
- M ay have eroded.

**Screenings**
- Unthreshed material (ie grain, stalks, stones) that has no value to the miller and must be removed before milling. Stones can damage machinery; metal objects may cause sparks.

**Weed seeds**
- Brome
- Wheat and barley.
- Orange blossom midge
- Brachybrachy latus is fusiform, long, rigid in empty florets.
- The larva attacks immature grain, pierces the bran and inject enzymes into the grain. This can lead to water ingress and low Hagberg Falling Numbers.
- Black spots indicate additional fungal infection.

**Small screenings**
- Broken, shrivelled grains, straw and small straw pieces.

**Mud and stones**
- Mud balls are a particular problem during wet harvests.
- Stones can be picked up during combining, particularly when harvesting conditions are difficult.

**Dust, chaff and fine soil**
- Grain dust can be harmful if inhaled and can cause respiratory problems.

**Fusarium**
- Fusarium is a cereal disease which attacks the endosperm and is spread by conidia or spores, with some species producing mycotoxins.
- Fusarium head blight is a disease that affects cereals and can be very destructive.
- Fusarium head blight is caused by the fungal species **Fusarium graminearum**.
- Infection occurs when the fungus infects the growing grain head (spike) during wet conditions.
- Fusarium head blight is a complex disease and can be caused by several different species of Fusarium.
- The symptoms of fusarium head blight include: rice, wheat and barley.
- The symptoms of fusarium head blight include:
  - White or pink mycelium growth on the head surface.
  - Brown or black discoloration of the grain.
  - Reduced grain yield and quality.

**For best practice grain**
- **Sampling and storage**
  - Consult the HGCA Grain sampling guide and the HGCA Grain storage guide, or go to:
    - **www.hgca.com/grainsampling**

For additional copies of this poster, contact
hgca@cambertown.com or 0845 245 0009

HGCA is the cereals and oilseeds division of the Agriculture and Horticulture Development Board.
Inspecting grain for defects and impurities

Smell

When inspecting grain, note any unusual smells. A sweet or minty smell indicates mites; musty and fishy smells indicate moulds; chemical smells, eg cleaning fluids and diesel, can also occur. If the grain is visibly mouldy or dusty, do not smell it. Moulds and grain dust can be harmful and cause respiratory problems.

Physical damage

Broken grains

These grains are usually caused by aggressive handling, providing potential sites for mould infections. Can cause processing problems. These include excessive water uptake and mushy steep with starch leaching into steep water.

Bunt grains/heat damage

Heat damage arises from localised ‘hot spots’, usually due to aggressive handling, providing potential sites for mould infections. Grains can range in colour from brown to dark brown (charred). Overdried grains are unlikely to germinate and may affect beer or malt flavour.

Splitting

Cracks through outer grain tissues may arise from excessive expansion or mechanical weakness. Splits often occur along the ventral plane but can also occur on the side lateral to the grain and can also be caused by endosperm injury. Grain is susceptible to mould attack. Processing problems include excessive water uptake and mushy steep with starch leaching into steep water.

Skinning

A separation and loss of lemma and palea (hull). Causes include development factors, weather conditions, rough harvest and post-harvest handling. May lead to filtration problems due to loss of hull and hence malting efficiency is likely to be reduced. Dust problems during handling may arise. More prevalent in spring varieties.

Gape

A gap between husk tissues (lemma and palea) due to poor development and/or excessive expansion. Endosperm remains intact. Gape – a function of variety and environment – is not necessary a defect unless associated with lateral splitting.

Lost embryos

Commonly caused by mechanical damage. Of no use for malting as the grain will not germinate.

Pre-germination (light)

Receptive by a xylem and xylem-germ area. Pre-germinated grains may not malt and hence will reduce malt yield. Pre-germinated grains can be detected by laboratory testing.

Pre-germination (heavy)

Moist, fully-grown grains with viable nutrients will not malt and hence will reduce malt yield.

Discoloured grain

Dull looking, weathered grains indicate poor harvest conditions and may lead to quality problems. Duriness can be due to spores or moulds.

Diseases

Fusarium

Pile mounds indicate possible Fusarium infection.

Some Fusarium fungi can produce mycotoxins that are toxic to humans and animals. Permitted mycotoxin levels are governed by legislation or trading specifications. May cause gushing of bottled beers.

Mouldy grains

May result from adverse growing, harvest or storage conditions. Qualities may be impaired. Dustless may be due to spores or moulds, which are unacceptable to all users due to the risk of mycotoxin forming.

Sprouted grains with visible rootlets will not malt and hence will reduce malt yield.

Ergot

The fleshy body of the fungus Claviceps purpurea, which affects grasses as well as rye, wheat and barley. The inside of an ergot is grey/white, which distinguishes it from rodent droppings. Ergot is toxic to humans and animals and is unacceptable to any processor.

Mouldy grains

Moulds include excessive water uptake and mushy steep with starch leaching into steep water.

Weed seeds

Brome

2-3.5mm

Actual size

Black-grass

6mm

Actual size

Couch

1-3.5mm

Actual size

Wild oats

2-30mm

Actual size

Bindweed

4-6mm

Actual size

Cleavers

2-3.5mm

Actual size

Brassica

2-5mm

Actual size

Weed seeds

Brome

2-3.5mm

Actual size

Black-grass

6mm

Actual size

Couch

1-3.5mm

Actual size

Wild oats

2-30mm

Actual size

Bindweed

4-6mm

Actual size

Cleavers

2-3.5mm

Actual size

Brassica

2-5mm

Actual size

For best practice grain sampling and storage, consult the HGCA Grain sampling guide and the HGCA Grain storage guide, or go to: www.hgca.com/grainsampling

Dust, chaff and fine soil

Dust, chaff and fine soil on grain dust can be harmful if inhaled and can cause respiratory problems.

Screenings

Large screenings

Stones, brassica, contaminated grain, sticks, stones, etc.

Small screenings

Broken grains, chaff, weed seeds and small straw pieces.

Mud and stones

Mud balls are a particular problem during wet harvests. Stones can be picked up during combining, particularly when harvesting conditions are difficult.

Dullness

Dullness may be due to spores or moulds, which are unacceptable to all users due to the risk of mycotoxin forming.

Lost embryos

Commonly caused by mechanical damage. Of no use for malting as the grain will not germinate.

Pests

A gap between husk tissues (lemma and palea) due to poor development and/or excessive expansion. Endosperm remains intact. Gape – a function of variety and environment – is not necessary a defect unless associated with lateral splitting.

Roondroppings

Rodents directly damage grain and carry infection. Rodents urinate on grain, posing a food safety risk. Contaminated grain is unacceptable.

Insect damage

Insect damage is usually caused by mould damage. Eggs are laid within the grain and the endosperm is eaten by the larva. Evidence of insects indicates poor storage and possibly local hot spots. Severe infestations (as in this example) are unacceptable to processors.

For best practice grain sampling and storage, consult the HGCA Grain sampling guide and the HGCA Grain storage guide, or go to: www.hgca.com/grainsampling

Screenings

Large screenings

Stones, brassica, contaminated grain, sticks, stones, etc.

Small screenings

Broken grains, chaff, weed seeds and small straw pieces.

Mud and stones

Mud balls are a particular problem during wet harvests. Stones can be picked up during combining, particularly when harvesting conditions are difficult.

Dullness

Dullness may be due to spores or moulds, which are unacceptable to all users due to the risk of mycotoxin forming.

Lost embryos

Commonly caused by mechanical damage. Of no use for malting as the grain will not germinate.

Pests

A gap between husk tissues (lemma and palea) due to poor development and/or excessive expansion. Endosperm remains intact. Gape – a function of variety and environment – is not necessary a defect unless associated with lateral splitting.

Roondroppings

Rodents directly damage grain and carry infection. Rodents urinate on grain, posing a food safety risk. Contaminated grain is unacceptable.

Insect damage

Insect damage is usually caused by mould damage. Eggs are laid within the grain and the endosperm is eaten by the larva. Evidence of insects indicates poor storage and possibly local hot spots. Severe infestations (as in this example) are unacceptable to processors.