Saving weather damaged grain for seed

By the Grains Research & Development Corporation

AT A GLANCE

- Ideally retain seed from grain harvested before rain.
- Weather damaged grain is more susceptible to poor germination, low vigour and degradation during storage and handling, so extra care is needed.
- Harvest at low moisture and cool temperatures. Storage temperature and moisture must be monitored and controlled.
- Germination percentage should be checked at harvest, during storage and before seeding. Low germination seed should not be used.
- Do not retain seed from hybrid canola.
- Correct seeding depth, conditions and agronomy are essential when sowing weather damaged seed.

GRAIN retained for seed that is harvested following wet conditions requires attentive management if a healthy crop is to be established next season. This management starts at harvest and continues through storage, handling and seeding.

All crops are susceptible to deterioration in seed quality during wet harvests. Mild symptoms can be a loose and wrinkled seed coat. Severe symptoms can be seed staining and fully germinated seed. It is essential to recognise whether the damage is cosmetic or the symptom of a seedborne disease and if it will impact on germination.

Due to the vulnerability of canola's small seed it is recommended that unless it is harvested before any weather damage it should not be retained for sowing. Irrespective of availability, hybrid canola seed should never be retained for seed as the crop will not be true to the original first generation (F1) seed.

Any retained seed should be graded and tested for germination and vigour. Testing for seed-borne disease is also recommended, especially with saved pulse seed.

Knowing the germination percentage at harvest will help determine how much extra seed may be required.

Assessing germination during storage will indicate potential problems, while a germination test prior to seeding will allow sowing rates to be adjusted.

Front and back images of wheat grains that are affected by pre-harvest sprouting. They have absorbed water and have started to germinate. Those showing embryo development – shoot and/or roots – will not be viable as seed.
(PHOTO: Dr J Barrero, CSIRO)

Wet seed at harvest

Weather damage occurs when grain is subjected to wetting at harvest. Generally, grain will absorb moisture and start the chemical process that eventuates in germination; this may be indicated by discolouration or wrinkled and loose seed coats, especially in pulses.

When pre-harvest moisture is significant the seed will swell, often splitting the skin covering the growing point. This seed is referred to as being 'sprung'. Once this has occurred the chemical reactions in the seed have greater access to oxygen and proceed at a faster rate.

If sufficient and prolonged moisture is available the embryo will grow and shoot, completing the germination process. But if moisture is lacking and the seed dries the process will be incomplete.

Provided the seed dries out before the embryo starts to grow this seed could still be viable for sowing.

Much of a sprung seed's energy store will have been used, greatly reducing the seed's ability to complete the germination process. Seeds will often be lighter and seedling vigour is often markedly reduced.

Germination causes an increase in alpha-amylase – an enzyme that breaks down starch. The longer the grain sprouts, the greater the amount of alpha-amylase formed. This is measured indirectly using the falling number test.

The falling number of badly sprouted wheat is about 62 seconds. High quality wheat gives a thicker paste, and the test then takes between 300 to 600 seconds.

Conditions that favour sprouting are also conducive to fungal growth.

Sprung seed is more susceptible to fungal attack and physical damage by handling. It is also more vulnerable to disease and rotting once sown.

Harvest management

In wet harvests, when weather damage is occurring, it is important that retained seed is harvested as a priority but only at low moisture content. This is especially important where there is no aeration drying on-farm. If heat drying is used extreme care should be taken not to further damage seed quality.

Generally, harvesting at a moisture content of about one per cent below receival standard is considered appropriate.

Some pulse grains, particularly lupins, are very susceptible to damage if harvested at very low moisture content.

Where grain has swollen and then shrunk, seed coats will have been stretched and can become wrinkled and loose. The kernel of pulses can also become very brittle and break during handling.

Harvester settings and handling processes must ensure that seed coats and kernels are not damaged. Damaged seeds will deteriorate rapidly.

Seed quality can also decline during storage. Testing seeds' germination capacity should occur before and during storage, and before seeding.

Generally, a germination percentage of 80 per cent at seeding is considered acceptable. When testing at harvest the germination percentage should be higher.

With many weedy pulse and cereal crops in a wet season, desiccation or crop topping often becomes necessary. Depending on timing and chemicals used, this could affect seed quality for sowing.

Grain must not be retained for seed when glyphosate has been used in pre-harvest applications.

Storage

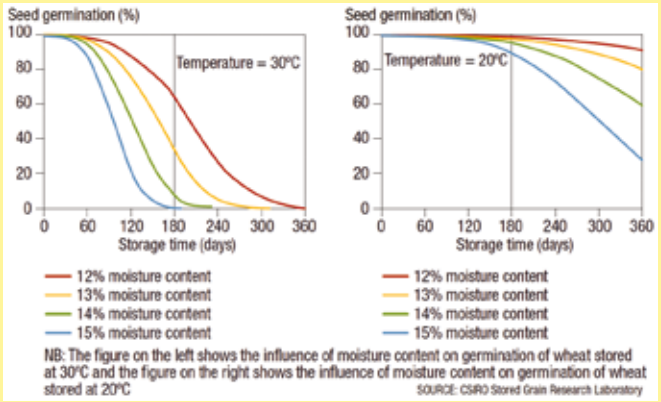
Achieving and maintaining low temperature, humidity and grain moisture content for stored grain is critical if grain has been weather damaged (Table 1). As weather damaged seed deteriorates faster than sound seed it should not be stored for more than 12 months (Figure 1).

TABLE 1: Storage conditions required to maintain seed quality of key grain crops

	Maximum temperature (°C)	Maximum moisture content (%)
Cereals	20	12
Canola	20	7
Pulses	20	12.5

SOURCE: GRDC Stored Grain Extension Project.

FIGURE 1: Influence of storage temperature and moisture on seed vigour



NB: The figure on the left shows the influence of moisture content on germination of wheat stored at 30°C and the figure on the right shows the influence of moisture content on germination of wheat stored at 20°C

SOURCE: CSIRO Stored Grain Research Laboratory

A germination test should be carried out on stored grain one to two months after storing to reassess its viability.

Sowing

Weather damaged grain is likely to have a lower germination percentage and poorer vigour, so seeding rates will need to be adjusted accordingly.

A laboratory seed test should be used to establish the germination percentage of on-farm retained seed before sowing, especially if it has been weather damaged. A vigour test is also recommended.

Purchased seed will be certified and should include details of germination percentage.

It is essential that nothing makes it harder for the germinating seed to reach the surface and establish.

Sowing too deeply, cold or wet soil, some seed dressings and herbicides and hard setting soil, can all reduce seedling emergence.

The coleoptile is a protective sheath surrounding the first leaf of cereals. This protects and guides the shoot as it grows through the soil. If the seed is sown deeper than the length of the coleoptile the plant can fail to emerge. Coleoptile lengths vary between varieties. For example, the wheat varieties Wyalkatchem and Axe have moderately short coleoptile lengths, while Scout and Correll have moderately long coleoptiles.

The ideal seeding depth for wheat is 30 to 35 mm for semi-dwarf varieties, through to 50 to 70 mm for tall wheat varieties, which have a longer coleoptile length.

Barley has a shorter coleoptile length than wheat and so the ideal sowing depth is 20 to 30 mm.

Canola has small seeds and should be sown 12 to 25 mm deep. Poorer establishment occurs with smaller seed, therefore grade the retained seed and sow only the larger fraction.

Lupins should be sown no deeper than 30 to 50 mm depending on soil type and species. Other pulses tolerate sowing at depths of 50 to 80 mm but must be sown below the depth at which herbicides are incorporated.

Coleoptile lengths are shortened by some seed dressings and also from use of dinotroaniline herbicides (such as trifluralin, pendimethalin and oryzalin).

Seed dressings containing the fungicides fluquinconazole, flutriafol or triadminol, can all reduce coleoptile lengths under certain conditions.

These seed dressings should be avoided on weather damaged seed, particularly when used in conjunction with herbicides such as trifluralin.

Some new seed dressings contain the fungicide ipconazole, which has a reduced impact on coleoptile length, similar to triticonazole.

Care must be taken to sow the seed just below the herbicide layer and to avoid soil containing herbicide to be thrown into the furrow by the seeding implement.

Check with the supplier or manufacturer of seed dressings and chemical treatments to determine if they will reduce the coleoptile length or affect emergence.

FIGURE 2: Seeding rate calculation

$$\text{Seed rate (kg/ha)} = \frac{\text{Target plant density (pl/m}^2\text{)} \times \text{100 seed weight (grams)} \times 1000}{\text{Germination percentage} \times \text{Establishment percentage}}$$

Seed testing

Germination

While a laboratory seed test for germination should be carried out before seeding to calculate seeding rates (Figure 2), a simple on-farm test can be done in soil at harvest and during storage:

- Use a flat, shallow seeding tray (about 5 cm deep). Place a sheet of newspaper on the base to cover drainage holes and fill with clean sand, potting mix or freely draining soil. Ideally the test should be done indoors at a temperature of about 20°C or lower.
- Randomly count out 100 seeds, do not discard damaged ones and sow 10 rows of 10 seeds at the correct seeding depth. This can be achieved by placing the seed on the smoothed soil surface and pushing in with a pencil marked to the required depth. Cover with a little more sand/soil and water gently.
- Keep soil moist but not wet as overwatering will result in fungal growth and possible rotting.
- After seven to 10 days the majority of viable seeds will have emerged. Count only normal, healthy seedlings. If for example you count 78 normal vigorous seedlings the germination percentage is 78 per cent.

IF YOU HAD A WET HARVEST, CHECK THE QUALITY OF RETAINED SEED

Heavy harvest rainfall could impact on the viability of grain that growers are planning to retain for sowing in 2018. Any grain subjected to wetting at harvest is more susceptible to poor germination, low vigour and degradation during storage and handling.

GRDC Southern Regional Panel member Kate Wilson encourages growers to closely scrutinise seed being set aside for planting. Kate, a grain grower and agronomic consultant in Victoria's Mallee, says it is essential that growers determine whether damage to grain caused by rain at harvest is purely cosmetic or the symptom of a seed-borne disease which will impact on germination.

"To ensure establishment of a healthy crop next season, it is important to pay particular attention to the seed that is being saved for sowing. Proper management of the seed starts at harvest and should continue right through to storage, handling and seeding next year," Kate said.

She said growers should also be aware that some cereal varieties are more susceptible to the effects of late season weather damage.

Unless canola seed was harvested before any weather damage it should not be retained for sowing due to the vulnerability of canola's small seed.

Any retained seed should be graded and tested for germination and vigour. Testing for seed-borne disease is also recommended, especially with saved pulse seed.

GRDC Southern Region Panel member, Kate Wilson.
(PHOTO: B Collis)

- While 80 per cent germination is considered acceptable for cereals and pulses, results above 90 per cent are required for canola. Certified canola seed is generally sold with 90 per cent germination.
- The results from a laboratory seed germination test should be used in the seeding rate calculation (Figure 2).

Disease

Grain retained for seed from a wet harvest is more likely to be infected with seed-borne disease. It is also more likely to suffer physical damage during handling, increasing the potential for disease.

Seed-borne disease generally cannot be identified from visual inspection, so requires laboratory testing. This is particularly important for seedborne diseases of pulses, for example blackspot (field peas) and aschochyta and botrytis (lentils, chickpeas, faba beans). Once a satisfactory germination percentage is known, seed should be tested for disease.

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GRDC Factsheet: Retaining Seed – www.grdc.com.au

FREQUENTLY ASKED QUESTIONS

Can I retrieve and sow seed that is warehoused at a central grain receival site?

It is only possible to retrieve grain from your farm if it has been warehoused. Retrieving warehoused grain will depend on each facility, store manager and variety licence owner.

Unless grain is delivered to a specific variety segregation, the grain is likely to have been mixed with multiple varieties of the same quality. It will also be mixed with weed seeds that may not all be present on your farm.

Sowing such a mixture of seed presents multiple agronomic problems, including mixed growing patterns, different disease resistances, different herbicide tolerances and uneven ripening. Marketing may also be a problem and details of market opportunities would need to be confirmed prior to sowing.

Retrieving warehoused grain is highly undesirable.

Is seed retained from previous harvests likely to be of better quality?

The quality of retained seed that has been stored over several seasons will depend on its quality prior to storage and the storage conditions.

A pre-seeding germination test is essential for any seed sown after more than one season in storage. In some cases older seed may be better than seed from the current harvest. It may also be worse – remember that with pulses there were quality issues of low germination, seed size and vigour with seed harvested in 2009–10 due to the sharp seasonal finish. Seed-borne virus levels were also high.

Can I obtain better quality seed of the same variety from another grower?

Growers cannot sell, trade, barter or give away seed of a variety protected by Plant Breeders Rights (PBR) for propagation unless they have an authorisation from the PBR owner of the variety. Any such authorisation is provided through a contract between the PBR owner or commercialising party and the grower.

Preparation key to success with seed treatment

POOR preparation and application are to blame for many grain growers achieving suboptimal results with on-farm seed treatments used to protect seed grain and crops against pest and disease attack.

That is the message from Western Australian-based GRDC Grain Storage Extension team member Ben White, who said that with all grain storage, preparation is the key to optimal results.

Ben White.

"Unfortunately we find that where treatments have failed, seed treatments have not been used well," he said.

"Common mistakes include treating seed that contains too much admix or poor product application methods."

Ben said if growers are considering the use of a seed treatment before on-farm storage, there are some simple steps that can be taken to protect the grain in storage, optimising germination results and crop vigour for next season.

"Most importantly, if growers don't have a gas-tight sealable silo meeting the Australian standard 2628-(2010), then consideration should be given to using a seed treatment with an insecticide component to protect seeds from insect attack while in storage," he said.

"Stand alone insecticide seed treatments compatible to mix with most desired fungicide packages are also available.

"Seed treatments should only be applied to clean seed, as excessive admix, or impurities like chaff and dust, contribute to poor product coverage. There are reputable professional services that will clean and treat your seed for you and, if unsure, it may be best to use these services."

The level of moisture in the seed is another important consideration, according to Ben.

"Monitor moisture content at harvest and plan to stay well below 12 per cent," he said.

"Seed treatments can also add between 0.5 and 1.5 per cent to moisture levels, depending on the application rate and water mix applied."

The method of application is the most important factor in achieving good results from seed treatment use.

"Before starting, measure the grain flow rate through the auger, as well as the flow-rate of the pump applying the seed treatment," Ben said.

"Adjust auger flow rate or seed treatment flow to match the desired application rate.

"Two spray nozzles spaced about one metre apart into the auger barrel typically deliver satisfactory and uniform coverage.

"If unsure, check with seed treatment supplier, as there are often useful resources and tips available to help achieve the best results with the product."

More information about grain storage is also available at the GRDC Stored Grain Information Hub: www.storedgrain.com.au