



SOUTHERN

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# GRDC™ GROWNOTES™



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GRAINS RESEARCH  
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CORPORATION

# DURUM

## SECTION 2

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## PRE-PLANTING

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VARIETAL PERFORMANCE AND RATINGS YIELD | PLANTING SEED QUALITY

# Pre-planting

## Key messages:

- Take the time to carefully choose a variety best suited to your goals and conditions.
- Consult the Australian Durum Growers Association and/or State crop variety sowing guides for most updated information on varietal characteristics.
- Good seedling establishment is more likely if seed is undamaged, stored correctly and from a plant that had adequate nutrition.
- The main factors that affect the viability or germ of the seed are moisture levels and temperature, so these factors should be considered in storing seed.
- The safest application method for high rates of high ammonium content fertilisers is to place them away from the seed by physical separation or by pre- or post-plant application by broadcasting onto the soil surface before seeding or in crop application after seeding.

## 2.1 Varietal performance and ratings yield

Seasonal, environmental and management conditions all influence durum wheat yield and quality, but often variety is the predominate influence (Photo 1).<sup>1</sup> The commercial release of several new durum varieties in South Australia (SA) has set a yield performance benchmark of up to ~10% above Tamaroi(d) which was the previous standard.<sup>2</sup>



**Photo 1:** Durum in the paddock.

## VIDEOS

WATCH: [Over The Fence Revisited: Research investment pays dividends with new durum varieties](#)



<sup>1</sup> M Sissons, B Ovenden, D Adorada, A Milgate (2014). Durum wheat quality in high-input irrigation systems in south-eastern Australia. *Crop and Pasture Science*, 65(5), 411–422. <http://dx.doi.org/10.1071/CP13431>

<sup>2</sup> GRDC (2012) Durum expansion in SA through improved Agronomy – DGA00001. Grains Research and Development Corporation, <http://finalreports.grdc.com.au/DGA00001>

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Improved varietal choice and management options for existing and potential new durum growers within the Southern region has provided a viable alternative crop choice for grain growers. Durum has excellent rust resistance relative to most wheat varieties. This reduces the need for fungicides and the potential environmental risk issues associated with their use. In offering an alternative crop choice, durum may also provide break crop opportunities for diseases, such as cereal cyst nematode (though all varieties are moderately susceptible) and rusts. Susceptibility is defined as multiplying the disease and hence durum is not a good break crop for CCN although are better than some bread wheat varieties.<sup>3</sup>

Table 1 provides a comparison of the yield, quality, maturity and other characteristics of the most common durum varieties grown in the southern region. Table 2 lists the agronomic characteristics of some of these varieties.

**Table 1: Durum varietal performance and ratings yield.**

Variety	Yielding ability	Quality traits	Maturity	Other varietal traits	Coleoptile length (cm)
DBA-Aurora(Δ), 2014	Grain yield slightly lower than Yawa(Δ).	Improved grain size and lower screenings more similar to Hyperno(Δ) and Saintly(Δ).	Mid maturing.	Good disease resistance profile. Good early vigour and grass weed competitiveness.	7.5
Tjilkuri(Δ), 2010	Greater yields than Tamaroi(Δ).	Improved semolina colour.	Mid maturing; similar maturity to Tamaroi(Δ).	Similar adaptation and disease resistance profile to Tamaroi(Δ). A mid-season fully-awned variety. Tolerant to boron.	7.6
Saintly(Δ), 2008		High quality semolina with higher yellow pigment colour.	Early maturing line suited to both short and medium season production environments.	Awnless, earlier flowering than Kalka(Δ) and Tamaroi(Δ). Performed very well in dry finishing conditions in SA. Slightly less stem and leaf rust resistance compared to Hyperno(Δ). Australian Premium Durum (ADR) classification in SA. High levels of resistance to stem, stripe and leaf rust.	7.2
Hyperno(Δ), 2008	High yield potential.	Improved semolina colour and better sprouting and black point tolerance than Kalka(Δ) and Tamaroi(Δ).	Mid maturing; similar maturity to Kalka(Δ) and Tamaroi(Δ).	An awned mid-season white chaffed variety adapted to medium rainfall zones. Similar adaptation and disease resistance profile to Kalka(Δ) and Tamaroi(Δ). Intolerant of boron.	7.8

<sup>3</sup> GRDC (2012) Durum expansion in SA through improved Agronomy – DGA00001. Grains Research and Development Corporation, <http://finalreports.grdc.com.au/DGA00001>

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Variety	Yielding ability	Quality traits	Maturity	Other varietal traits	Coleoptile length (cm)
Caparoi(Δ), 2008	High yielding (similar to Jandaroi(Δ)).	Good semolina colour, excellent physical grain quality and high grain protein. Grain quality is similar to EGA Jandaroi(Δ) and superior to Wollaroi(Δ).	Mid maturing; slightly earlier flowering than Tamaroi(Δ),	Semi-dwarf variety. High level of resistance to stem rust, stripe rust and yellow leaf spot. Moderately tolerant to root lesion nematodes. Good resistance to lodging and shattering. Strong seedling vigour, strong straw and shedding resistance.	7.5
WID802(Δ), 2012 (targeted for the south east of SA [Tatiara districts])	High yields.	Sometimes small grain size. may have low protein if nitrogen is limiting.	Early to mid maturing; similar maturity to Tamaroi(Δ).	Similar adaptation and disease resistance profile to Tamaroi(Δ). Likely to produce high screenings in short finishes.	7.7
Gundaroi(Δ), 1999 (adapted to SA environments)	Slightly better yielding than Yallaroi(Δ).	Pasta quality similar to Yallaroi(Δ) and Tamaroi(Δ).		Superior site adaptation in SA, with disease resistance characteristics of Yallaroi(Δ) and Tamaroi(Δ).	
Tamaroi(Δ), 1998 (adapted to SA environments)	Yields around 15% higher than Yallaroi(Δ)	Higher protein levels than Wollaroi(Δ) and Yallaroi(Δ).	Quicker in maturity than Yallaroi(Δ).		7.9
Wollaroi(Δ), 1993		Grain protein content is about 0.5% higher than Yallaroi(Δ). Superior bright, clean yellow appearance.		Medium height. Strong straw with good lodging resistance.	7.2
Yallaroi(Δ), 1987	Consistently out-yields Kamilaroi(Δ).	Protein content may be lower than Kamilaroi(Δ). Excellent colour and dough strength		Excellent resistance to black point. Slightly less tolerant of weather damage than Kamilaroi(Δ).	
Kamilaroi(Δ), 1982		Good dough properties, high protein.		Good tolerances to all of the then current rust strains.	

Source: [Department of Economic Development, Jobs, Transport and Resources](#)

**Table 2:** Agronomic guide to common durum varieties.

	Maximum quality southern zone	Rainfall			Screenings	Maturity	Height	Lodging	Sprouting	Head type		Soil tolerance	
		Low <400 mm	Med 4–500 mm	High >500 mm						Colour	Awn	Boron	Acid
Caparoi(Δ)	ADR		✓			M	S–M	MR	M				I
DBA Aurora(Δ)	ADR		✓	✓	R	M	M	MR	MR	W	A		MT
Hyperno(Δ)	ADR		✓			M	M	MR	MR	W	A		I
Tjilkuri(Δ)	ADR				MS	M	M		S	W/B	A		T
WID802(Δ)	ADR				MS	E–M			MR				

Source: [Department of Economic Development, Jobs, Transport and Resources](#)

## IN FOCUS

### DBA-Aurora

Durum production in Australia has halved since 2002. With reasons for the decline including unfavourable seasons, disease, and lower prices, the University of Adelaide released a new durum wheat variety called DBA-Aurora which promises a step-change in potential durum production in southern Australia (Photo 2). DBA-Aurora heralds a new beginning for the Australian durum industry with many superior attributes over current commercial grown varieties including Hyperno, Saintly, Tjilkuri, Yawa and WID802 in the southern region (SA and Victoria). Its most notable features are an improved disease resistance package, larger grain size, good test weight, early vigour and weed competitiveness when compared to the other high yielding durum varieties. DBA-Aurora is a more robust durum that is better suited to an integrated weed management system, and less likely to be downgraded for small grain under a tight spring finish with minimal rainfall.<sup>4</sup>



**Photo 2:** Dr Jason Able, from the University of Adelaide, led the durum breeding program to develop the durum wheat variety DBA-Aurora.

Source: Grains Research and Development Corporation

### VIDEOS

WATCH: [GCTV Extension files: NVT Durum performances SA 2014.](#)



### 2.1.1 Durum variety yield performance update

Across the six central region durum National Variety Trials (NVT) sites in South Australia in 2015, average site yields were 2.17 t/ha (Table 3). These yields are 23–33% below the bread wheat site averages in the SA’s Mid North and Yorke Peninsula sites respectively, clearly demonstrating the lower tolerance in durum to difficult weather conditions for crop growth in 2015.<sup>5</sup>

**Table 3:** Mean grain yield (%) from 2015 NVT in SA’s Yorke Peninsula and Mid North agricultural regions. Yield expressed as a function (%) of trial mean yield is shown for each region.

Variety	SA agricultural region	
	Yorke Peninsula	Mid North

<sup>4</sup> AEGIC (2014) New dawn for pasta wheat in Australia. Australian Export Grains Innovation Centre, October 2014, <http://newsite.aegic.org.au/media/news/2014/10/new-dawn-for-pasta-wheat-in-australia.aspx>

<sup>5</sup> R Wheeler (2016) Wheat variety research update for 2016. Grains Research and Development Corporation, February 2016, <https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2016/02/Wheat-variety-research-update-for-2016>

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Caparoi(ℓ)	93	96
DBA-Aurora(ℓ)	114	110
Hyperno(ℓ)	96	96
Saintly(ℓ)	115	114
Tamaroi(ℓ)	109	99
Tjilkuri(ℓ)	84	80
WID802(ℓ)	101	100
Yawa(ℓ)	96	101
Site mean (t/ha)	2.06	2.29

Source: [Grains Research and Development Corporation](#)

Saintly(ℓ) produced the highest average yields of 2.49 t/ha across all Mid North and Yorke Peninsula trials, but was closely matched by DBA Aurora(ℓ) which produced 2.44 t/ha. At only one site, Paskeville, did Saintly(ℓ) significantly out-yield DBA Aurora(ℓ). All other durum varieties trialled were significantly lower yielding, and surprisingly the formerly high yielding variety Yawa(ℓ), produced very moderate yields in 2015. These results are very encouraging for growers currently adopting the new variety DBA Aurora(ℓ), and when combined with improved grain quality will show the improvements made over Yawa(ℓ) in recent years. <sup>6</sup>

The long term predicted yield of durum wheat in Victoria's Wimmera region is shown in Table 4. The long term yield prediction has been produced using the NVT Long Term MET (Multi Environment Trial) analysis. The analysis produces predictions or "Production Values" for every variety in every NVT trial across all years identified within the dataset. <sup>7</sup>

**Table 4:** Long term predicted yield (2011-2015) of durum wheat in Victoria's Wimmera region, expressed as a percentage of the mean yield. Number of sites years in brackets.

Mean yield (t/ha)	3.76
Caparoi(ℓ)	107 (4)
DBA-Aurora(ℓ)	109 (4)
EGA Bellaroi(ℓ)	96 (4)
Hyperno(ℓ)	107 (4)
Saintly(ℓ)	113 (4)
Tjilkuri(ℓ)	107 (4)
WID802(ℓ)	108 (4)
Yawa(ℓ)	117 (4)

Source: [Department of Economic Development, Jobs, Transport and Resources](#)

### 2.1.2 Varietal maturity

There is currently a relatively small range in maturity length in durum varieties compared with bread wheat varieties. Durum wheats are generally similar in maturity to the quickest bread wheat varieties. This is an important consideration when managing frost risk and can limit opportunities to exploit early planting opportunities. Extended flowering could reduce the risk of pollination failure caused by frost or extended moist weather. Durum is also more sensitive to very cold conditions (near frost conditions) during flowering than bread wheat. The time difference in reaching

<sup>6</sup> R Wheeler (2016) Wheat variety research update for 2016. Grains Research and Development Corporation, February 2016, <https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2016/02/Wheat-variety-research-update-for-2016>

<sup>7</sup> DEDJTR (2016) Victorian winter crop summary 2016. Department of Economic Development, Jobs, Transport and Resources, [http://www.nvtionline.com.au/wp-content/uploads/2016/03/NVT-Victoria-Winter-Crop-Summary-2016\\_for-web.pdf](http://www.nvtionline.com.au/wp-content/uploads/2016/03/NVT-Victoria-Winter-Crop-Summary-2016_for-web.pdf)

full maturity between the early flowering and late flowering tillers is normally fairly small; therefore, the early heads are not likely to be ripe for many days ahead of the later heads. Harvesting should not be delayed significantly. Durum wheats will perform well if sown later, but grain yields will depend on seasonal conditions, especially during the flowering and grain filling stages.<sup>8</sup>

Varietal maturity is important to take into consideration when deciding when to sow (Photo 3).



**Photo 3:** These cereal plots show the differences in maturity of varieties grown in trials at Inverleigh, Victoria, in 2013. The plots were all sown on 10 May but maturity ranged from ear emergence (GS51) to milk development (GS71) in October.

Source: Grains Research and Development Corporation

## 2.2 Planting seed quality

Good seedling establishment is more likely if seed is undamaged, stored correctly and from a plant that had adequate nutrition. Early seedling growth relies on stored energy reserves in the seed. Seed should not be kept from paddocks that were rain-affected at harvest. Seed grading is an effective way to separate good quality seed of uniform size from small or damaged seeds and other impurities, such as weed seeds.

Heat damage causes slower germination, delayed emergence of the primary leaf, stunted growth or termination of the germination process. In severe cases, seed death may occur (Photo 4). During bulk storage, areas of excessive moisture can lead to microbial-induced “hot spots” and since moisture moves from hot to cooler areas, further local heating is caused, setting off a chain reaction.<sup>9</sup>

8 R Hare (2006) Agronomy of the durum wheats Kamilaroi®, Yallaro®i, Wollaroi® and EGA Bellaro®i. Primefacts 140, NSW Department of Primary Industries, [http://www.dpi.nsw.gov.au/\\_data/assets/pdf\\_file/0007/63646/Agronomy-of-the-durum-wheats—Primefact-140-final.pdf](http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0007/63646/Agronomy-of-the-durum-wheats—Primefact-140-final.pdf)

9 Hatting H. (2012). Factors affecting wheat seed germination. <http://www.grainsa.co.za/factors-affecting-wheat-seed-germination>

**i** MORE INFORMATION

[GRDC Retaining seed factsheet](#)



**Photo 4:** Normal seed (left) compared to heat-damaged seed (right). Note the distinct colour difference.

Source: [Grain SA](#)

### 2.2.1 Seed size

Seed size is important—the larger the seed, the greater the endosperm and starch reserves. While size does not alter germination, bigger seeds have faster seedling growth, a higher number of fertile tillers per plant and potentially higher grain yield.

Durum seed is, on average, 20% larger than bread wheat seed. The planting rate should be adjusted based on 1000 grain weight data to sow 160-180 seeds/m<sup>2</sup>. However, a higher planting rate may be beneficial in some situations (e.g. seed with a low germination, irrigated crops or early/late sowings). Conventional sowing equipment can be used but the larger seed size may necessitate adjustments.

*In the Southern region, seeding at a lower rate (e.g. 100 seeds/m<sup>2</sup>) could leave a durum crop at risk of being overrun with ryegrass, due to durum's lesser competitive ability against weeds.*

#### Agronomist's view

The coleoptile is the pointed, protective sheath that encases the emerging shoot as it grows from the seed to the soil surface (Photo 5). Coleoptile length is an important characteristic to consider when planting a wheat crop, especially in drier seasons when sowing deep to reach soil moisture. For seed to emerge successfully from the soil, the seed should never be planted deeper than the coleoptile length. Sowing varieties with short coleoptile lengths too deep can cause poor establishment, as the shoot will emerge from the coleoptile underground and it may never reach the soil surface.<sup>10</sup>

Durum varieties have a much narrower spread in coleoptile length than bread wheat varieties. Seed source is a more important determinant of coleoptile length in durum wheats than variety.

<sup>10</sup> J Pumpa, P Martin, F McCrae, N Coombes (2013) Coleoptile length of wheat varieties. NSW Department of Primary Industries, February 2013, [http://www.dpi.nsw.gov.au/\\_data/assets/pdf\\_file/0006/459006/Coleoptile-length-of-wheat-varieties.pdf](http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0006/459006/Coleoptile-length-of-wheat-varieties.pdf)





**Photo 5:** *The coleoptile is the pointed, protective sheath that encases the emerging shoot as it grows from the seed to the soil surface.*

Photo: Nicole Baxter, Source: [GRDC](#)

Small seeds contain less starch reserves than larger seeds. Starch is a form of energy for seeds, so less starch means less energy to get the seedling out of the ground. It also means less energy to fight off seedling stresses such as disease, waterlogging or false breaks.

Small seed—for example, 1,000 seed weight of less than 30 g—should not be sown deep, and should only be sown where there is ideal moisture. Increase sowing rates by 10–15% to compensate for potentially low vigour.<sup>11</sup>

Coleoptile length is influenced by several factors, including variety, seed size, temperature, low soil water and certain seed dressings, such as those with the active ingredient triadimenol or flutriafol. Trifluralin and several Group B pre-emergent chemicals can also affect coleoptile length. Growers should read the label when using any seed-dressing fungicide, in order to see what affect it may have on coleoptile length.<sup>12</sup>

## 2.2.2 Seed germination and vigour

Seed germination and vigour greatly influence establishment and yield potential. Germination begins when the seed absorbs water and ends with the appearance of the radicle. It has three phases:

- water absorption (imbibition)
- activation

<sup>11</sup> K Condon K (2003) Targeting optimum plant numbers. NSW Agriculture, [http://www.dpi.nsw.gov.au/\\_data/assets/pdf\\_file/0007/168523/targeting-optimum-plant-numbers.pdf](http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0007/168523/targeting-optimum-plant-numbers.pdf)

<sup>12</sup> J Pumpa, P Martin, F McCrae, N Coombes (2013) Coleoptile length of wheat varieties. NSW Department of Primary Industries, February 2013, [http://www.dpi.nsw.gov.au/agriculture/broadacre-crops/winter-crops/wheat\\_barley-and-other-winter-cereals/coleoptile-length](http://www.dpi.nsw.gov.au/agriculture/broadacre-crops/winter-crops/wheat_barley-and-other-winter-cereals/coleoptile-length)

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- visible germination.<sup>13</sup>

Seed vigour affects the level of activity and performance of the seed or seed lot during germination and seedling emergence. Loss of seed vigour is related to a reduction in the ability of the seeds to carry out all of the physiological functions that allow them to perform.

Use sound seed that is true to type (varietal purity), free of diseased seed and weed seeds, cracked and small grain, and barley and bread wheat grain. Ensure that the initial seed of a purchased variety is of high quality, from certified seed stocks, with a germination percentage >85%. Before harvesting seed stocks for the following season, rogue all off-types and contaminant crop and weed plants.

Seed grain kept for sowing in subsequent seasons must be stored in clean silos capable of aeration, sealing for insect control and keeping grain dry and as cool as possible. Such storage conditions will assist the maintenance of high viability seed for the following season. Treat seed with an appropriately registered product just prior to sowing to control smut and bunt. Some chemical constituents can reduce viability and seedling vigour if they remain in contact with the seed for any length of time. Ground preparation is the same as for bread wheat. Spraying to eliminate all volunteer plants of bread wheat, barley and other crop/weed species needs to be carried out.<sup>14</sup>

CropCare have launched a new product, Pontiac®, which is registered to provide broad spectrum control of seed and two soilborne fungi in cereals as well as control of aphids and other stored grain insect pests through the combination of flutriafol, metalaxyl-m and imidacloprid.

Request a copy of the germination and vigour analysis certificate from your supplier for purchased seed. For seed stored on-farm, you can send a sample to a laboratory for analysis, see [Australia Seeds Authority Ltd.](#)

While a laboratory seed test for germination should be carried out before seeding to calculate seeding rates, 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 ~20°C or lower.
- Alternatively, lay a well-rinsed plastic milk container on its side and cut a window in it, place unbleached paper towels or cotton wool in the container, and lay out the seeds. Moisten and place on a window-sill. Keep moist, and count the seeds as outlined below.
- 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 (Photo 6). 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 7–10 days, the majority of viable seeds will have emerged.
- Count only normal, healthy seedlings. If you count 78 normal vigorous seedlings, the germination percentage is 78%.
- Germination of 80% is considered acceptable for cereals.
- The results from a laboratory seed-germination test should be used for calculating seeding rates.<sup>15</sup>

<sup>13</sup> J Pumpa, P Martin, F McCrae, N Coombes (2013) Coleoptile length of wheat varieties. NSW Department of Primary Industries, February 2013, [http://www.dpi.nsw.gov.au/\\_data/assets/pdf\\_file/0006/459006/Coleoptile-length-of-wheat-varieties.pdf](http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0006/459006/Coleoptile-length-of-wheat-varieties.pdf)

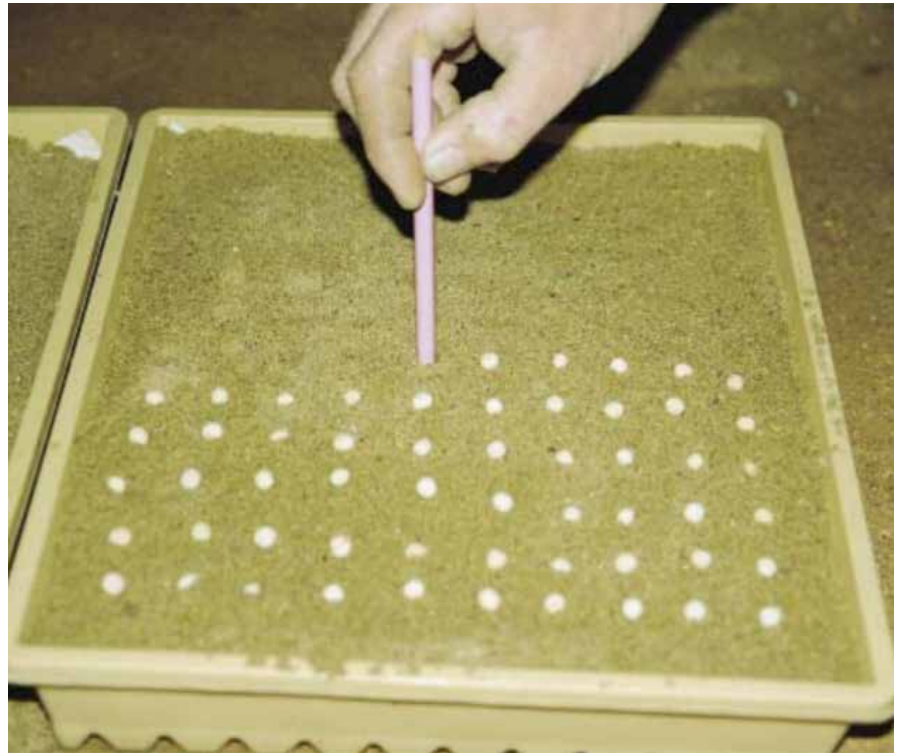
<sup>14</sup> R Hare (2006) Agronomy of the durum wheats Kamilaroi(), Yallaroi(), Wollaroi() and EGA Bellaroi(). Primefacts 140, NSW Department of Primary Industries, [http://www.dpi.nsw.gov.au/\\_data/assets/pdf\\_file/0007/63646/Agronomy-of-the-durum-wheats—Primefact-140-final.pdf](http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0007/63646/Agronomy-of-the-durum-wheats—Primefact-140-final.pdf)

<sup>15</sup> GRDC (2011) Retaining seed. Saving weather damaged grain for seed, northern and southern regions. GRDC Fact Sheet Jan. 2011, [http://storedgrain.com.au/wp-content/uploads/2013/06/GRDC\\_FS\\_RetainingSeed2.pdf](http://storedgrain.com.au/wp-content/uploads/2013/06/GRDC_FS_RetainingSeed2.pdf)

**i MORE INFORMATION**

[Germination testing and seed rate calculation](#)

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.<sup>16</sup>



**Photo 6:** Use a pencil or straw to poke holes in a testing tray.

Source: [NSW DPI](#)

### 2.2.3 Seed storage

The aim of storage is to preserve the viability of the seed for future sowing and maintain its quality for market. Proper storage of any seed begins with the sanitation of storage facilities and reducing or eliminating the respiration of the seed. The main factors that affect the viability or germ of the seed are moisture levels and temperature.<sup>17</sup> By decreasing both factors, the longevity of the seed will increase.

The aim of storage is to preserve the viability of the seed for future sowing and maintain its quality for market. A seed is a living organism that releases moisture as it respire. The ideal storage conditions are listed below:

- Temperature <15°C. High temperatures can quickly reduce seed germination and quality. This is why germination and vigour testing prior to planting are so important.
- Moisture control. Temperature changes cause air movements inside the silo, carrying moisture to the coolest parts of the seed. Moisture is carried upwards by convection currents in the air; these are created by the temperature difference between the warm seed in the centre of the silo and the cool silo walls, or vice versa. Moisture carried into the silo head space may condense and fall back as free water, causing a ring of seed to germinate against the silo wall.
- Aeration slows the rate of deterioration of seed with 12.5–14% moisture. Aeration markedly reduces grain temperature and evens out temperature differences that cause moisture movement.

<sup>16</sup> GRDC (2011) Retaining seed. Saving weather damaged grain for seed, northern and southern regions. GRDC Fact Sheet Jan. 2011, [http://storedgrain.com.au/wp-content/uploads/2013/06/GRDC\\_FS\\_RetainingSeed2.pdf](http://storedgrain.com.au/wp-content/uploads/2013/06/GRDC_FS_RetainingSeed2.pdf)

<sup>17</sup> EH Roberts (1960) The viability of cereal seed in relation to temperature and moisture. *Annals of Botany*, 24, 12–31, <http://aob.oxfordjournals.org/content/24/1/12.abstract>

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WATCH : [Over the Fence: Insure seed viability with aerated storage.](#)



- No pests. Temperature <15°C stops all major grain insect pests from breeding, slowing down their activity and causing less damage.<sup>18</sup>

#### *Living organisms—insects, rodents, fungi*

Insects, rodents and fungi will infest stored seed and can cause a reduction in quality and quantity. Insect feeding can decrease your grain amount by up to 10%. Bait or insecticide should be set around storage areas to limit these pests.

#### *Temperature*

Maintaining stored seed at cool temperatures is of great importance. When seed must be dried down, do not dry seed above 32°C and do not maintain elevated temperatures any longer than is required to reach 10–12% seed moisture content. When temperatures reach 5–10°C, insects will begin to develop and reproduce.

#### *Humidity*

Humidity should remain in the 20–60% range. Above this, seeds will rapidly gain water increasing the potential to reduce germ levels. In general, for most plant species, seed will maintain its viability and vigour when the sum of air temperature in degrees Fahrenheit and percent relative humidity of the air is 100 or less.

#### *Seed moisture*

Seed moisture should remain below 12% during storage to maintain germination of wheat seed. Under cooler temperatures, grain can be stored at slightly higher moisture contents. Table 5 summarises the effect of various moisture contents on seed viability.<sup>19</sup>

**Table 5:** *Effects of different levels of moisture in seeds.*

Seed moisture content	Condition
4–8%	Little or no insect activity (too dry for most insects).
10–12%	Satisfactory to store most seeds in open storage and in cloth bags or moisture-resistant containers.
14–16%	Molds (fungi) may grow on and in seeds in open storage and on seeds in cloth bags or sealed containers. Harmful to seeds of many plant kinds.
18–20%	Seed may heat because of seed respiration and microbial activity. Seed declines rapidly in viability and vigor.
24–60%	Seeds may rot.

Source: [Syngenta](#)

For more information, see Section 13: Storage.

### 2.2.4 Safe rates of fertiliser sown with the seed

Crop species differ in tolerance to nitrogen (N) fertiliser when applied with the seed at sowing. The safest application method for high rates of high ammonium content fertilisers is to place them away from the seed by physical separation (combined N–phosphorus products) or by pre or post-plant application (straight N products). For the lower ammonium content fertilisers, e.g. mono-ammonium phosphate (MAP), close adherence to the safe rate limits set for the crop species and the soil type is advised. High rates of N fertiliser applied at planting in contact with, or close to, the seed may severely reduce seedling emergence. If a high rate of N is required, then it should be applied pre-planting or applied at planting but not in contact with the seed (i.e.

<sup>18</sup> GRDC (2011) Retaining seed. Saving weather damaged grain for seed, northern and southern regions. GRDC Fact Sheet Jan. 2011, [http://storedgrain.com.au/wp-content/uploads/2013/06/GRDC\\_FS\\_RetainingSeed2.pdf](http://storedgrain.com.au/wp-content/uploads/2013/06/GRDC_FS_RetainingSeed2.pdf)

<sup>19</sup> Syngenta (2012) Storing treated certified seed: cereals. Technical bulletin. Syngenta Crop Protection, <http://www.syngentacropprotection.com/assets/assetlibrary/treatedseedsnov23c.pdf>

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banded between and below sowing rows). Rates should be reduced by 50% for very sandy soil and increased by 30% for heavy-textured soils or if soil moisture conditions at planting are excellent. N rates should be significantly reduced when using narrow points and press wheels or disc seeders. When moisture conditions are marginal for germination, growers need to reduce N rates if fertiliser is to be placed with, or close to, the seed.<sup>20</sup>

20 Incitec Pivot Fertilisers (2014) Nitrogen fertiliser placement and crop establishment. Incitec Pivot Ltd, <http://bign.com.au/Big%20N%20Benefits/Nitrogen%20Fertiliser%20Placement%20and%20Crop%20Establishment>