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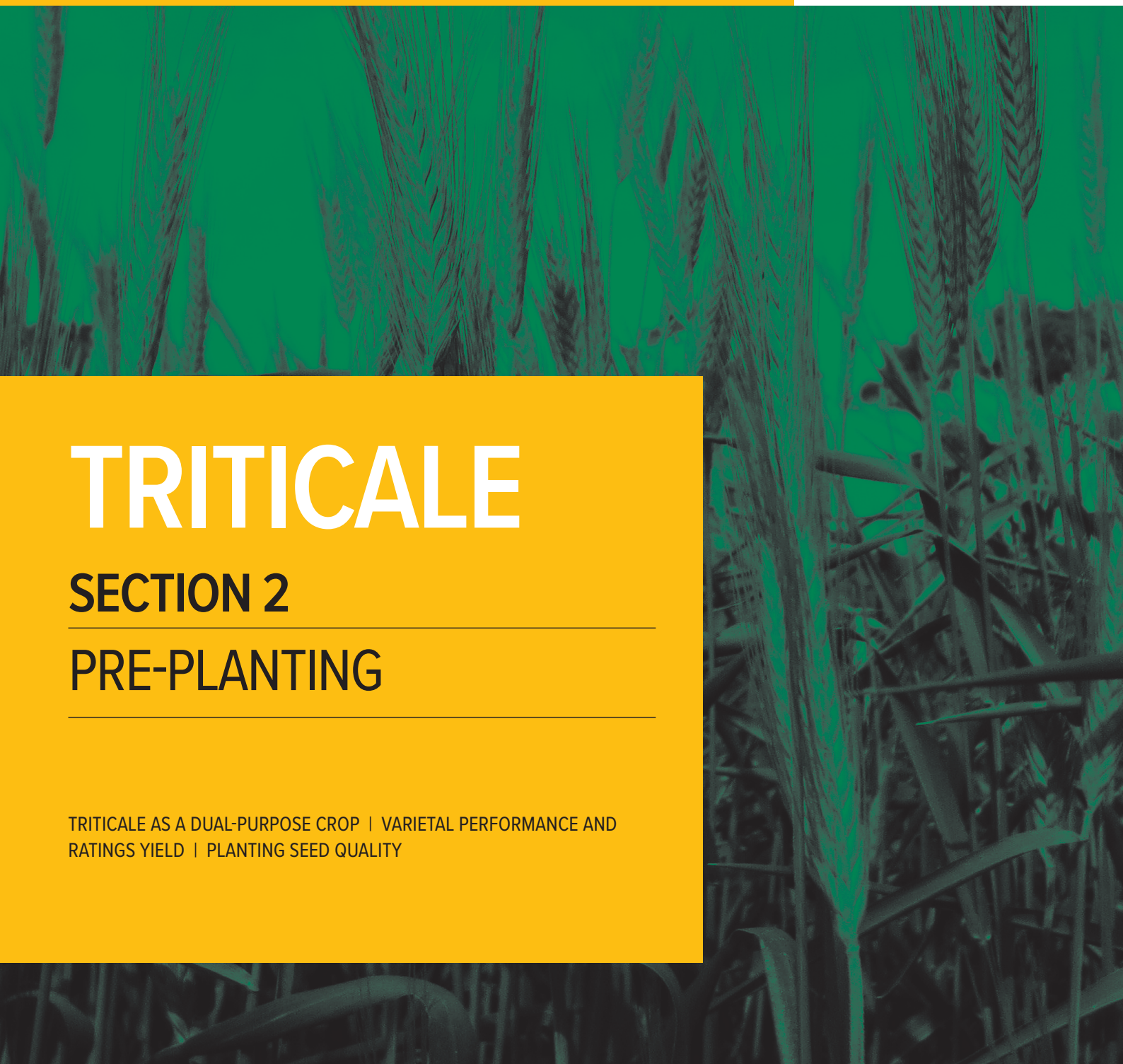

TRITICALE

SECTION 2

PRE-PLANTING

TRITICALE AS A DUAL-PURPOSE CROP | VARIETAL PERFORMANCE AND RATINGS YIELD | PLANTING SEED QUALITY

Pre-planting

Key messages

- Triticale breeding programs have produced a number of new varieties designed for particular uses and regions.
- Breeding programs have aimed at improving grain yield and dry matter production. This has produced winter triticales with a wider range of sowing dates, improved grazing habit (having the growing point closer to the ground), and new sources of rust resistance.
- Triticale is extensively used in dual-purpose cropping systems, with specifically bred varieties.
- Ensure that seed quality is of a high standard. Check for damage and discolouration as affected seeds may have poor germination and emergence.
- The larger seed size of triticale means that emergence is consistently good, as long as seed is of high quality.
- Consult local variety sowing guides for the best practices for your region.

There are two types of triticale to choose from—grain only and dual purpose (Photo 1). Grain only varieties perform best in long-season environments rather than lower rainfall regions with unreliable springs. Dual purpose varieties can be sown very early, grazed during winter then shut up for forage conservation or grain recovery. [1]

Photo 1: *Triticale combines the high yield potential and good grain quality of wheat with the disease and environmental tolerance (including soil conditions) of rye.*

Source: SeedTech

1 Waratah see Co. Ltd. (2010). Triticale: planting guide. http://www.porkcrc.com.au/1A-102_Triticale_Guide_Final_Fact_Sheets.pdf

IN FOCUS

Triticale testing, Northam WA.

In 2006, triticale trials were conducted in Northam, WA (Table 1 and 2). [2]

Table 1: *Triticale trial details, Northam, WA 2006.*

Soil group	Soil pH ($CaCl_2$) 6.1 at 10 cm and 4.2 at 30 cm.
Sowing date	28/06/06
Seeding rate	76 kg/ha
Rotation	2005: Medic and grass pasture, 2004: Wheat. 2003: Medic and grass pasture.
Fertiliser (kg/ha)	28/06/06: Agras #1 80 kg/ha 28/06/06: Treflan 1.6 L/ha; Sprayseed 1.6 L/ha
Pesticides	15/09/06: Dominex 200 mL/ha 26/09/06: Wipeout 450 1.6 L/ha

Source: DAFWA and Liebe Group

Table 2: *Results of triticale trials, Northam, WA, 2006.*

Variety	Yield (kg/ha)	% of Tahara	Growth scores	% of Tahara
Tickit	612	121*	5.0	116
Everest	524	104	4.3	100
Prime-322	520	103	5.0	116
Credit	507	100	5.0	116
Speedee	507	100	5.3	123
Tahara	505	100	4.3	100
Muir	465	92	5.0	116
Mean	514	-	5	-
Av. SED	37	-	-	-
CV	8.8	-	16.8	-

* = Significant (0.05). Adjusted yield data. Obs dates: 21/11/06. Growth Scores: 5/09/06
Source: DAFWA and Liebe Group

2.1.1 Triticale as a dual-purpose crop

Key points:

- Advantages of dual purpose crops include minimising risks, capitalising on early rainfall events, flexibility in enterprise mix, and improved cash-flow
- Dual purpose crops require a high standard of management
- Ideal grazing facilities would allow for an excellent water supply, shelter belts, rotational grazing, and drafting cattle into similar weight ranges before being

2 Garlinge J (2006). Triticale testing- Stage 3. DAFWA, Liebe Group. http://www.farmtrials.com.au/trial/10443

placed onto grazing crops. Try to minimise handling and ensure that all animal health issues are addressed. [3]

- When a dual-purpose triticale is grown with the intention of providing winter grazing and then optimising grain production the time of stock removal or lock-up is important.

Dual-purpose crops hold great potential to utilise early-season sowing opportunities to provide extra grazing for livestock and maintain grain yield. With good management, the period of grazing can increase net crop returns by up to $600/ha and have a range of system benefits including widening sowing windows, reducing crop height, filling critical feed gaps and spelling pastures. Over ten years of experiments, simulation studies and collaborative on-farm validation across Australia has demonstrated that a wide range of cereal and canola varieties can be successfully grazed and recover to produce combined livestock and crop gross margins that exceed grain-only crops, and increase whole-farm profitability. [4]

The Australian dual-purpose cereal crop (including triticale, wheat, oats, barley and cereal rye) is increasing in importance because of factors such as higher-value animal industries. The ability of several recent variety releases to provide valuable winter grazing, as well as a grain yield similar to grain-only crops, helps farmers to improve winter feed supply after pastures have been affected by drought. [5]

Dual purpose cropping in WA

Increasingly in WA, paddocks are earmarked for grazing and are sown earlier to provide early plant growth - knowing that grazing will retard maturity - and spread frost risk. Research is finding that there is a high correlation between total crop biomass at harvest and yield. The best yield results are from crops with the greatest total crop biomass at harvest. The implication is that the best crop biomass recovery comes from grazing heavily for short intervals early, or leaving more residual after later grazing. More severe grazing (e.g. higher stocking rates for longer), which may have some yield impact, is better in severe frost-prone areas. In a dry year, dual purpose crops can provide an important 'fall back' position for winter dry matter production, allow pastures to get away and reduce costly supplementary feeding for livestock enterprises. In dry years and in years when grain prices are high, the economics of the amount of grazing value provided by the crop needs to be weighed-up against the impact on returns of even a small yield penalty from grazing the crop outside the preferred window. This impact must be tempered by the value the grazing has had to the livestock system. Benefits to the livestock enterprise may include improved animal performance, young animals able to be finished prior to sale, stock to be retained rather than forced to be sold, increased lamb survival and reduced ewe mortalities. [6]

Benefits of growing dual purpose or winter forage crops

1. *Minimises risks*

- Floods close to grain harvest have caused or can cause severe damage to ripening crops
- Floods during the growing period of grazing crops can provide irrigation-type benefits
- Floods in November/December on grazing crops are not so critical as benefits are already banked
- Minimises the risks associated with dry periods late winter/spring such as 2013/2014/2015.

3 Harris K. (2016). GRDC Update Papers: Dual purpose crops. https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2016/02/dual-purpose-crops

4 Kirkegaard J, Sprague S, Lilley J, Bell L. (2016). GRDC Update Papers: Managing dual purpose crops to optimise profit from grazing and grain yield north. https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2016/02/Managing-dual-purpose-crops-to-optimise-profit-from-grazing-and-grain-yield-north

5 GRDC Ground Cover Issue 66 – Jan-Feb 2007. Dual-purpose crops: Adaptable triticale steps up. https://grdc.com.au/Media-Centre/Ground-Cover/Ground-Cover-Issue-66-January-February-2007/Dualpurpose-crops-Adaptable-triticale-steps-up

6 GRDC. (2014). Grazing dual purpose crops in Western Australia. https://grdc.com.au/Media-Centre/Hot-Topics/Grazing-dual-purpose-crops-in-Western-Australia

2. Capitalises on early rainfall events

- Grazing or dual-purpose crops can be planted in late February & late March thus capitalising on late summer rainfall events. It also spreads workloads!
- Early sown crops will provide quality feed from mid-May most seasons.

3. Flexibility in Enterprise Mix

- It isn't totally reliant on grain prices/export markets/grain quality issues/ downgrading weather damage etc.
- Buying and selling trading cattle - there are budget profits from weight gains
- There is the opportunity to background cattle for feedlots and the potential to lock in sale price at purchase
- In most cases cattle prices at feedlots are higher when grain prices are down. Grain is a major input cost for feedlots and therefore it has a major impact on feedlot margins
- The decision to lock up dual-purpose crops does not need to be made until late July. During a normal average season when late winter/early spring feed reserves (pastures) are looking good dual-purpose crops can be locked up/top dressed/weed controlled if necessary and kept for grain production.
- Growers could also elect to continue to graze their crop, taking into account cattle & grain prices/stored soil moisture levels/seasonal outlook etc.

4. Improved cash-flow

- Dual purpose crops offer the benefit to generate early income from the start of the grazing period. Cattle are often sold after 70 days of grazing in late July and after achieving a weight gain of between 90–120 kg/head (budget 70 days x average 1.6 kg/head/day for a good crop).
- Remember you don't need to finish the cattle, best returns are often obtained from backgrounding cattle for local feedlots. A good idea is to speak with the feedlot before you buy the cattle, or there may be an opportunity to background cattle on their behalf, being paid for the weight gain only.
- A well-managed forage crop can provide sufficient early season feed for up to 5 weaners/ha. Therefore early income potential paid in August should realise well over $1,000/Ha.
- No need to wait until December or January (6–8 months) to realise cash-flow
- Dual-purpose crops grain recovery in northern areas should budget 50% of un-grazed crops. [7]

When to graze

Dual purpose varieties can be sown early for winter grazing (30–90 grazing days) and can then be locked up at spring time. The ideal grazing time is when the canopy is closed (GS21 – GS29) using a continuous grazing system. Do not graze below 5 cm with prostrate varieties and below 10 cm for erect varieties (Photo 2). [8]

The crop must be monitored regularly (at least twice each week) for stem elongation and the appearance of the first node.

This indicates the plant has gone into reproductive mode and grazing from this time onwards will reduce grain yield. Once the crop reaches this stage grazing should cease. [9]

MORE INFORMATION

Dual-purpose crops Factsheet

Optimising grazing and grain yield in dual-purpose crops

Dual purpose crops; do they have a fit in your system and how can they be managed to optimise forage and grain production

7 Harris K. (2016). GRDC Update Papers: Dual purpose crops. https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2016/02/dual-purpose-crops

8 Birchip Cropping Group. (2004). Triticale agronomy – 2004. http://www.farmtrials.com.au/trial/13801

9 Waratah see Co. Ltd. (2010). Triticale: planting guide. http://www.porkcrc.com.au/1A-102_Triticale_Guide_Final_Fact_Sheets.pdf

Photo 2: *Triticale grazed by cattle and used to clean up a paddock.*

Source: EverGraze

The ideal stage to start grazing dual-purpose varieties is when plants are well anchored and the canopy has closed. Continuous grazing is better than rotational grazing for fattening stock. Maintain adequate plant material to give continuous and quick regrowth of the crop (1000–1500 kg DM/ha).

The higher grazing height is particularly important with the erect-growing varieties. Over-grazing greatly reduces the plant's ability to recover. [10]

In southern trials, grain yields were generally reduced by grazing, possibly because the latest "grazing" occurred at or about GS31. This is likely to have resulted in the removal of the growing point of the primary tiller, resulting in fewer productive heads. Varieties that produced the highest grain yield when not grazed actually had the greatest yield loss when grazed. Protein content was reduced by grazing in all cereals while 1000 grain weight was reduced by grazing in triticale and wheat.

So long as farmers graze their cereals before they get to GS30-31 they can get a reasonable amount of grazing from that cereal. Once you get past that stage you are likely to have an impact on grain yield in the end. It is a matter of farmers trying to get some grazing in winter (when dedicated pastures are growing slowly and under pressure due to low dry matter levels) and then removing the stock to harvest a reasonable grain yield. [11]

When to use crop grazing in WA

The timing of the autumn break will heavily influence if and how soon crops can be used for livestock feed in the autumn-winter.

In most years in many grain growing areas of the State, there will be an opportunistic storm or rainfall event in autumn that will allow sowing of some dual purpose crops in March or April.

Grazing crops early, at about four weeks after sowing and for a short period of about 10 days, seems to have the least impact on plant growth and provide the best yield potential in low rainfall southern grain growing areas.

With longer grazing periods, the plant's ability to recover is more limited and yield potential is reduced, especially in low rainfall areas.

To allow an extended crop grazing period, a number of paddocks can be grazed for short periods in a series - minimising the impact in any one paddock, but providing a justifiable benefit to the farming system. [12]

MORE INFORMATION

Grazing dual purpose crops in Western Australia

Effect of cutting on early sown Triticale and Wheat

10 Matthews P, McCaffery D, Jenkins L. (2016). Winter crop variety sowing guide 2016. https://www.dpi.nsw.gov.au/agriculture/broadacre-crops/guides/publications/winter-crop-variety-sowing-guide

11 Roberts M. (2013). YP and Mid-north trials highlight benefits of grain and graze. http://www.grainandgraze3.com.au/resources/343_YPandMidNorthtrialshighlightbenefitsofGG.pdf

12 GRDC. (2014). Grazing dual purpose crops in Western Australia. https://grdc.com.au/Media-Centre/Hot-Topics/Grazing-dual-purpose-crops-in-Western-Australia

Trials have found that of four commonly used cereal cover crops (triticale, oats, wheat and barley), triticale produced the highest grain yield following grazing. [13]

IN FOCUS

Evaluation of triticale as dual-purpose forage and grain crops

Two cultivars of triticale, Tiga and Empat, were compared with existing commercial cultivars of triticale, cereal rye and forage oats, for grain yield and dry matter production. Their performance was evaluated in New South Wales, over 3 years with varying defoliation regimes (uncut to grain yield, cut in late autumn, cut in autumn and winter, and cut in winter only). Grain yields (up to 4.0 t/ha) of the highest yielding triticale cultivar (Empat) were equal to, or greater than, the best oats cultivar (Blackbutt). Generally, the highest winter growth rates, dry matter yield at maturity and grain yield were recorded from uncut plots. Cutting only in autumn had small effects (negative) on grain yields, but cutting in both autumn and winter reduced total dry matter yields at maturity by 30% and grain yields by 50%. Cutting only in winter resulted in higher vegetative forage yields than a double cut (autumn and winter), but the single winter cut subsequently produced lowest dry matter yields at maturity. The high grain yields of triticale were linked to rapid spring growth. Harvest indices of triticale cultivars were generally lower than those of the oat cultivars. The results indicate the potential of triticale, especially cv. Empat, as a dual-purpose forage and grain crop. [14]

Breeding dual-purpose Triticale

Grain producers have expressed the importance to of dual-purpose triticale varieties, as they want to graze the crop through autumn and winter, and have a subsequent grain crop, thus increasing the gross margin per hectare and also providing an insurance against harvest failure. Grazing cereals produce two times the amount of dry matter compared to pastures during the autumn and winter, and also allow pastures to be rested over the winter thus allowing for better production in the spring.

Triticale is advantageous in some areas due to its tolerance of acid soils and high exchangeable aluminium present in these soils, especially where the sub-soil is acid and cannot be easily corrected by liming.

With support from the GRDC, the University of Sydney aims to improve the productivity of dual-purpose triticales through plant breeding. Breeding programs have aimed at improving grain yield and dry matter production. This has produced winter triticales with a wider range of sowing dates, improved grazing habit (having the growing point closer to the ground), and new sources of rust resistance. Shorter triticales have also been produced to reduce the amount of stubble after harvest, suiting conservation tillage farming practices, and also to improve grain yield.

Hybrid triticale is also under development to increase yield by exploiting heterosis, the superiority of the F1 hybrid over the highest yielding inbred varieties.

The breeding program addresses grain quality aspects of triticale in relation to the animal industries, with the aim of improving animal productivity when fed triticale. This

13 Serafin L, Gardner M, Fleming J, Pottie D, Harden S. (2013). Dual purpose cereals: varieties and management for the northern slopes and plains. https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2013/02/Dual-Purpose-Cereals-Varieties-and-Management-for-the-Northern-Slopes-and-Plains

14 Andrews, A. C., Wright, R., Simpson, P. G., Jessop, R., Reeves, S., & Wheeler, J. (1991). Evaluation of new cultivars of triticale as dual-purpose forage and grain crops. *Animal Production Science*, *31*(6), 769–775.

MORE INFORMATION

Dual-purpose Triticale Improvement program

Triticale: grazing guide

program concentrates on grain characteristics for ruminants (grain quality for pigs being covered by the Pork CRC).

This program provides benefits to the grains industry through the identification of dual-purpose triticales with improved productivity. [15]

2.1.2 Triticale grain for livestock

The major uses for triticale grain are as a feed supplement in the dairy industry, as a component ingredient in beef feedlots and as a constituent of compound rations for intensive livestock (pigs and poultry) rations. In livestock diets, triticale has a similar role to other cereals (Tables 3 and 4). It is primarily an energy source having moderate protein content with high starch and other carbohydrates, giving it high energy content.

A key physical feature of triticale is that it is a soft grain with a hardness index almost half that observed for wheat and barley. This is an advantage as less mechanical energy is required to mill triticale compared to wheat and barley prior to inclusion in livestock diets.

On farm, triticale can be fed to livestock in the same way wheat or barley would be fed. [16]

Triticale is well suited to feeding dairy cows (Table 5).

Table 3: *Crude protein concentration and yield and percent digestible dry matter IVDDM and yield of four small grain species harvested at the milk stage of maturity.* [17]

Species	Crude protein		IVDDM	
	%	T/A	%	T/A
Spring wheat	15.7	0.43	63.3	1.72
Triticale	15.2	0.45	66.4	1.95
Oat	14.6	0.44	61.5	1.86
Barley	15.7	0.50	68.5	2.20

Source: Cherney and Marten, 1982

15 University of Sydney. (2012). Triticale.

16 Agriculture Victoria. (2012). Growing Triticale. http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/growing-triticale

17 Cherney and Marten, 1982, University of Minnesota and USDA in https://www.hort.purdue.edu/newcrop/afcm/triticale.html

Table 4: *Forage and diet composition (dry matter basis).* [18]

Item	Alfalfa	Triticale	Oat
	%		
Forage			
Dry matter	43.5	37.8	28.0
Crude protein	22.6	17.5	142.0
Neutral detergent fibre	43.8	54.8	52.4
Acid detergent fibre	32.9	32.1	31.1
Calcium	1.69	.56	.42
Phosphorus	.43	.56	.39
Diet			
Dry matter	58.1	52.4	43.7
Crude protein	16.4	17.2	17.3
Neutral detergent fibre	30.3	36.9	36.0
Acid detergent fibre	18.0	19.8	19.3

Source: Cherney and Marten, 1982

Table 5: *Effect of forage on milk yield and milk composition.* [19]

Item	Forage source		
	Alfalfa	Triticale	Oat
No. of cows	15	15	12
Milk yield and composition			
3.5% FCM 2 (lb/cow/day)	64.7ab	71.9a	60.7b
fat, %	3.7	3.7	3.9
protein, %	3.4	3.4	3.4
total solids, %	13.3	13.3	13.4

FCM = Fat-corrected milk.
ab = Means differ (P .05).

Source: Cherney and Marten, 1982

MORE INFORMATION

Triticale: stock feed guide

A guide to the use of Triticale in livestock feeds

Protein content of triticale is thought to depend most on the cultivar, less on the weather conditions of the growth year and least on nitrogen fertiliser application. [20]

2.1.3 Triticale as a cover crop

A cover crop is a crop planted primarily to manage soil erosion, soil fertility, soil quality, water, weeds, pests, diseases, biodiversity and wildlife in an agroecosystem. One approach used in southern cropping regions involves annual crops being sown into lucerne, a practice known as *lucerne inter-cropping* (Figure 1). The benefits of sowing annual crops into established Lucerne include reducing the risk of rainfall leakage during the cropping phase, as well as eliminating the costs of Lucerne removal and re-establishment.

Triticale has poor tillering capacity and good tolerance to shattering. This makes triticale a useful cereal as a cover crop to establish undersown lucerne or medic, but

18 Paulson, Ehle, Otterby, and Linn, 1987, University of Minnesota in https://www.hort.purdue.edu/newcrop/afcm/triticale.html

19 Paulson, Ehle, Otterby, and Linn, 1987, University of Minnesota in https://www.hort.purdue.edu/newcrop/afcm/triticale.html

20 Alaru, M., Laur, Ü., & Jaama, E. (2003). Influence of nitrogen and weather conditions on the grain quality of winter triticale. *Agronomy Research*, *1*(1), 3–10.

seeding rates may need to be reduced [21] e.g. reduce seeding rate to approximately 10 to 20% of normal, targeting 15—30 plants per m^2. [22]

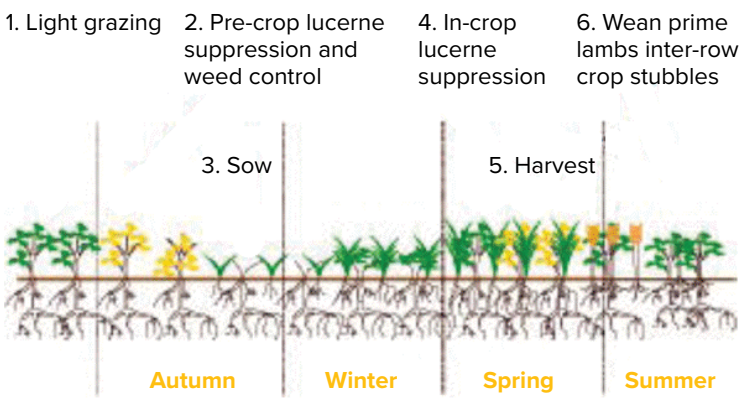

Figure 1: *Lucerne inter-cropping practice.*

Source: AgVic

Use grain only varieties that are early maturing and choose a paddock with a low weed seed bank because of limited options for herbicides with varying species.

Under-sowing lucerne

Triticale has been used to under-sow perennial pasture, in particular lucerne (Photo 3). When under-sowing:

- Use a grain only variety with the earliest available maturity suited to your region
- Sow the triticale at lower seeding rate than used for optimising grain yield
- Choose a paddock with low weed numbers as the combination of species can dramatically reduce herbicide options
- Expect a reduction in grain yield. [23]

Photo 3: *A paddock of cereal under sown with lucerne.*

Source: Andy Howard

As far as amount of growth triticale is very similar to that of a cereal rye plant, growing three to five feet in height. It also has an excellent fibrous root system that makes it an excellent choice for preventing erosion, scavenging for nutrients, and also building soil structure.

MORE INFORMATION

Farmers' experience with Lucerne inter-cropping

21 Agriculture Victoria. (2012). Growing Triticale. http://agriculture.vic.gov.au/agriculture/grains-and-other-crops/crop-production/growing-triticale

22 Waratah see Co. Ltd. (2010). Triticale: planting guide. http://www.porkcrc.com.au/1A-102_Triticale_Guide_Final_Fact_Sheets.pdf

23 Waratah see Co. Ltd. (2010). Triticale: planting guide. http://www.porkcrc.com.au/1A-102_Triticale_Guide_Final_Fact_Sheets.pdf

MORE INFORMATION

Break crop benefits to wheat crops in Western Australia

Break crop – WA's frontline weapon for weeds

Astute(b) - AGT

Berkshire(b) brings home the bacon

Triticale has excellent grazing and forage values. It has a heavy residue on the surface much like that of cereal rye if allowed to reach maturity, thus also making it a good choice for weed suppression. [24]

Triticale is a hardy cover crop that can suppress weeds and produce a moderate to high amount of biomass. Triticale will not produce as much biomass as rye, and may not tie up as much N in the spring.

Triticale is thought to be able reduce soil compaction, loosen topsoil and remove excess soil moisture. [25]

2.2 Varietal performance and ratings yield

New varieties

Astute(b) is a new mid-season triticale that is an alternative to Hawkeye(b). Bison(b), first listed in 2015 and were available in 2016.

New Astute(b)

A mid season fully-awned variety suited to medium-high yielding environments and alternative to Hawkeye(b). Stem rust RMR, stripe rust RMR# and leaf rust RMR. Bred by AGT (as TSA0466) and registered 2015. Astute(b) (TSA0466) was bred with the aim of producing a very high yielding triticale which would be the choice for growers looking to maximise the production from their triticale crops in high potential environments. Astute(b) combines broad adaptation, resistance to rust and CCN, good physical grain quality and top-end yield capabilities.

Astute(b) is suited to high yield potential areas of NSW and Victoria, with a very similar flowering time to Hawkeye(b) and Fusion(b). Astute(b) is a fully awned triticale with excellent agronomic characteristics for grain production.

Berkshire(b)

A mid-season awned variety with good straw strength. Stem rust R, stripe rust MRMS# and leaf rust R. Has been purpose bred for high yield and feed quality traits for pigs by the University of Sydney and Pork CRC, registered 2009.

- Improved ileal digestible energy—13 MJ/kg compared to Tahara at 12 MJ/kg
- Reduced fibre content—5 to 10% less than Tahara
- Excellent yield—equivalent to best grain only varieties currently available
- Good straw strength
- Quick to mid-season maturity
- Moderately resistant to WA and Jackie strains of stripe rust [26]

New Bison(b)

An early to mid season reduced awn variety best suited to low-medium yielding environments. Intended as a replacement for Rufus. Stem rust RMR, stripe rust R# and leaf rust RMR. It has a reduced awn, and is early to mid-season maturity.

- Early-mid maturing, feed quality triticale
- Tall plant type with reduced awns and excellent disease package
- Resistant to stem rust and stripe rust, and resistant-moderately resistant to leaf rust
- Resistant to CCN, moderately resistant to YLS, and resistant-moderately resistant to septoria tritici blotch
- Tolerant to acid soils

24 Advance cover crops – Triticale. http://www.advancecovercrops.com/portfolio_item/triticale/

25 NCRS. (2011). Cover crop – Planting specification guide. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1081555.pdf

26 Waratah Seed Co Ltd. (2011). Triticale: Variety guide. http://www.waratahseeds.com.au/content/Triticale-guide-varieties.pdf

MORE INFORMATION

Bogong(D) and Fusion(D) – inseperable in 2014 trials

Bogong(D) and Canobolas(D) SA/Vic/NSW

Chopper(D) - AGT

Fusion(D) - GRDC

Goanna triticale

PODCAST

LISTEN: Ground Cover Radio 110: Triticale program further lifts crop productivity.

Bogong(D)

Bogong(D) (tested as H127) was released by the University of New England, Armidale, in 2008. It is a grain variety with early to mid-season flowering (similar to Treat). It is fully awned, stiff strawed and has good resistance to all common field strains of rust. Bogong(D) has been one of the top yielding varieties over the past seven seasons (up to 15% above Tahara) of evaluation across all environments. It is a widely adapted spring variety that is moderately susceptible to CCN. [27]

Canobolas(D)

Early to mid-season awned variety with stiff straw, shorter than Tahara. A widely adapted spring variety with acid soil tolerance. Stem rust R, stripe rust MRMS# and leaf rust RMR. Bred by the University of New England, registered 2009.

Chopper(D)

An early maturing, awned semi dwarf variety which resists lodging in high yielding environments. Has good grain quality and performs best in short growing seasons or late sowing situations. Stem rust MR, MRMS# to stripe rust and leaf rust R. Released in 2010.

Chopper(D) is a fully awned spring triticale, that is very early maturing (3–4 days earlier than Speedee, 7–15 days earlier than Tahara). Chopper(D) is a semi-dwarf, making it significantly shorter than all other currently available triticale varieties (15% shorter than Tahara). Therefore, Chopper(D) will not lodge to the extent of commonly grown tall or moderately tall triticale varieties.

Fusion(D)

A mid-season variety (similar to Tahara), fully awned grain only triticale. A moderately tall variety that yields well in dry or sudden finishes. Stem rust R, stripe rust RMR#, leaf rust R and resistant to CCN. Released in 2012. Fusion(D) produces large grain with low screening losses. Hectolitre weight is similar to that of Hawkeye(D) and Jaywick(D), the benchmark varieties for this quality attribute. Fusion(D) is a mid-season maturity, spring-habit variety. Its desirable sowing time is similar to Hawkeye(D) and Tahara. Fusion(D) is a fully awned triticale variety. It has moderate plant height, slightly taller than Hawkeye(D) and Jaywick(D), and similar height to Rufus.

Goanna

An early to mid-season, fully awned grain only triticale. Stem rust R, stripe rust RMR#, leaf rust R and resistant to CCN. Released in 2011. Goanna is an early-medium season (similar heading time to Treat, Tickit, Rufusand Hawkeye(D)), spring type, grain triticale, which has good resistance to current pathotypes of stem, leaf and stripe rusts (2010 season) plus full resistance to cereal cyst nematode. Goanna is a fully-awned, tall, white-chaffed variety, which is appearing for the first time in the National Variety Trials, in 2011.

KM10

A fast growing early to mid season variety with good early production of forage. Tends to smaller grain and is ideally suited to short season environments. Stem rust R, stripe rust R#, leaf rust MRMS but susceptible to CCN. Released in 2014. It is very quick growing and is a reduced awn head type with excellent early forage production in all rainfall zones. Although tending to have reduced grain size, KM10 is particularly suited to grain production in shorter season areas.

Tahara

A variety that has been widely grown for many years because of its reliability across a range of environments, but now outclassed by newer options. It may lodge in high yielding situations. Stem rust R, stripe rust MRMS#, leaf rust R and resistant to CCN.

27 Jeisman C. (2015). Triticale variety sowing guide 2015.

Suited to most districts with rainfall up to 550 mm. Released 1987 by the Victorian Department of Agriculture.

Tahara has long been the benchmark variety for use in cereal rotations in most districts up to 500 mm average annual rainfall however its tall plant height makes it prone to lodging under high yielding situations.

Tahara has good resistance to CCN and root lesion nematode (*Pratylenchus neglectus*) making it a valuable disease break option.

Tahara is moderately susceptible to stripe rust however and outclassed for yield by many newer grain varieties. Tahara seed can be purchased from commercial growers.

MORE INFORMATION

Yowie triticale

Endeavour® triticale

Yowie

A medium to tall mid-season grain variety that is fully awned and white-chaffed. Stem rust R, stripe rust MR#, leaf rust R and resistant to CCN. Released in 2010.

Yowie is a medium season (slightly later heading than Tahara), spring type, grain triticale, which has good resistance to current pathotypes of stem, leaf and stripe rusts (2010 season) plus full resistance to cereal cyst nematode.

Yowie is a fully-awned, medium-tall, white-chaffed variety, of similar yield performance to other triticale varieties in the National Variety Trials, in which it appeared for the first time in 2010. Test weights were relatively good and screening levels relatively low.

Hawkeye®

Hawkeye® (tested as TSA0108) was released by AGT in 2007 and is a broadly adapted, mid maturing variety with high yield potential and CCN resistance. It has good resistance to all rusts and produces large grain with low screenings (similar to Tahara) and good test weight (like Treat). It is considered a high yielding alternative to Tahara and a CCN and stripe rust resistant alternative to Kosciuszko.

Jaywick®

Jaywick® (tested as TSA0124) was released by AGT in 2007 and is a broadly adapted, mid maturing variety with high yield potential and CCN resistance. It has moderate to good resistance to all rusts and produces large grain with low screenings and good test weight. It is considered a slightly earlier, higher yielding alternative to Tahara.

2.2.1 Dual-purpose triticale

These varieties can be grazed early and then allowed to produce grain or cut for hay.

Endeavour®

Long season variety with similar maturity to Breakwell®. Semi-awnless with excellent dry matter production and grain recovery after grazing. Stem rust R, stripe rust RMR#, leaf rust R. Registered 2008.

- Resistant to current strains of stripe rust at both seedling and adult growth stages
- Excellent dry matter production
- High yield after grazing
- Good straw strength

Rufus

A mid-season maturing variety, with a tall growth habit and reduced awns which is favoured for hay production. Stem rust R, stripe rust MRMS#, leaf rust R and resistant to CCN. Grain yields in higher rainfall regions have been superior to Tahara but may also cause lodging. Released in 2005 by University of New England.

MORE INFORMATION

Tobruk(D) triticale

Triticale trials

Tobruk(D)

With a strong winter habit Tobruk(D) is a dual purpose or long season grain only variety with excellent grain yield. Stem rust R, stripe rust MR#, leaf rust R. Earlier flowering than Breakwell(D) and Endeavour(D). Released 2007.

- Seedling susceptible but adult plant resistant to the Jackie strain of stripe rust
- Strong winter habit
- Excellent yield after grazing compared to all other varieties in the NSW mixed cereal trials
- Easy threshing
- In some environments, it is affected by stripe rust head infection

Tuckerbox

Tuckerbox is a late-medium season, tall, high tillering variety with reduced awn head type, which may be grown for forage or grain. Stem rust MR, stripe rust MR#, leaf rust R. Released in 2009. Tuckerbox has good resistance to all rusts and CCN.

Yukuri

Yukuri was bred by the University of New England in 2004 and is a late-medium season variety with reduced awn head type. It is suitable for forage and grain production in environments with 450 mm+ rainfall. It has very good rust resistance, but is susceptible to CCN.

2.3 Planting seed quality

Before determining seed sowing rates, seed germination levels need to be known. For purchased seed this will be stated on the bags supplied. For home grown seed percentage germination can be simply estimated by moistening the seed in blotting paper on a saucer covered by another inverted saucer. The seed should be kept warm (20°C) and moist for 10 days and after that period, the percentage germination can then be recorded. Seed with approximately 90 per cent germination or more is suitable for sowing. Seed produced in tableland cooler environments may tend to have poorer germination levels than seed produced in warmer regions; hence the need to check the germination rate. [28]

Heat damage in seeds 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.

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

Source: Grain SA

28 Jessop RS, Fittler M. (2009). Triticale production Manual – an aid to improved triticale production and utilisation. http://www.apri.com.au/1A-102_Final_Research_Report_.pdf

Seed impurity can occur from contamination through harvest, storage and machinery. Measurement of seed impurity will be included in a seed purity certificate. Varieties that have been retained for multiple generations have an increased risk of seed impurity, with multiple chances for contamination events and build-up. Ensuring that seed comes from clean, pure and even crops is imperative, and seed purity tests should be carried out. Growers should conduct paddock audits prior to harvest to establish which paddocks best meet these criteria.

With dramatic increases in herbicide resistance, growers need to take seed purity into account when selecting paddocks for seed. Ryegrass and black oats frequently appear in harvested grain samples and have the potential to infest otherwise clean paddocks. [29]

2.3.1 Seed size

Seed size is an important physical indicator of seed quality that affects vegetative growth and is frequently related to yield, market grade factors and harvest efficiency. A wide array of different effects of seed size has been reported for seed germination, emergence and related agronomic aspects in many crop species. Generally, large seed has better field performance than small seed. Triticale has the largest seed size of all common small-grained cereal crops (Photo 5).

With increased seed size, higher germination and emergence has been noted in triticale. Large seeds show a higher emergence potential than smaller seeds. Larger seeds are capable of emerging from greater planting depths and showed an enhanced ability to penetrate ground cover and survive burial by litter. [30]

Photo 5: *Triticale seed (left) is much larger than wheat seed (right).*

Source: Alberta Ag

Early research found that Triticale plants from larger seed were superior in total germination, seedling dry weight, and in seedling establishment than those from small seed. Large seed of a given cultivar gave 51% higher field stand, 62% more seedling dry weight and 37.8% higher grain yield than plants from small seed. [31]

Early seedling growth relies on stored energy reserves in the seed. Good seedling establishment is more likely if seed is undamaged, stored correctly and from a plant that had adequate nutrition. 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. Seed size is also important—the larger the seed, the greater the endosperm and starch reserves (Photo 6). Although size does not alter germination, bigger seeds have faster seedling growth, a higher number of fertile tillers per plant and potentially higher grain yield.

29 S Simpfendorfer, A Martin, M Sutherland (2012) Seed impurity undermines stripe rust resistance. 16th Australian Agronomy Conference. Australian Society of Agronomy/the Regional Institute Ltd, http://www.regional.org.au/au/asa/2012/disease/8325_simpfendorfer.htm

30 S. Ambika, V. Manonmani and G. Somasundaram, 2014. Review on Effect of Seed Size on Seedling Vigour and Seed Yield. *Research Journal of Seed Science, 7: 31–38.*

31 Bishnoi, U. R., & Sapra, V. T. (1975). Effect of seed size on seedling growth and yield performances in hexaploid triticale. *Cereal Research Communications*, 49–60.

Photo 6: *Plants from small seeds have less vigour and lower yield (right).*

Source: DAFWA

Seed size is usually measured by weighing 1000 grains, known as the 1000-grain weight. Sowing rate needs to vary according to the 1000-grain weight for each variety, in each season, in order to achieve desired plant densities. [32]

To measure 1000-grain weights, count out 10 lots of 100 seeds, then weigh. When purchasing seed, remember to request the seed analysis certificate, which includes germination percentage, and the seed weight of each batch where available.

The coleoptile is the pointed, protective sheath that encases the emerging shoot as it grows from the seed to the soil surface (Photo 7). Coleoptile length is an important characteristic to consider when planting a crop, especially in drier seasons when sowing deep to reach soil moisture.

32 NSW DPI District Agronomists (2007) Wheat growth and development. PROCROP Series, NSW Department of Primary Industries, https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/449367/Procrop-wheat-growth-and-development.pdf

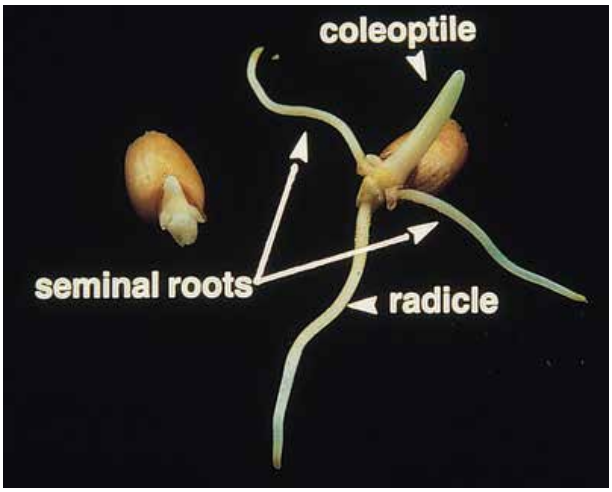

Photo 7: *The coleoptile is the pointed, protective sheath that encases the emerging shoot as it grows from the seed to the soil surface.*

Photo: David L. Hansen, University of Minnesota

For a 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, because the shoot will emerge from the coleoptile underground and it may never reach the soil surface. [33]

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. [34]

2.3.2 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
- visible germination[35]

Triticale has excellent vigour due to its hybrid characteristics. [36] Triticale germination increases with increasing seed size.

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.

This process, called physiological ageing (or deterioration), starts before harvest and continues during harvest, processing and storage. It progressively reduces performance capabilities due to changes in cell membrane integrity, enzyme activity and protein synthesis. These biochemical changes can occur very quickly (a few days) or more slowly (years), depending on genetic, production and environmental

33 J Pumpa, P Martin, F McCrae, N Coombes (2013) Coleoptile length of wheat varieties. NSW Department of Primary Industries, Feb. 2013, https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/459006/Coleoptile-length-of-wheat-varieties.pdf

34 J Pumpa, P Martin, F McCrae, N Coombes (2013) Coleoptile length of wheat varieties. NSW Department of Primary Industries, Feb. 2013, https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/459006/Coleoptile-length-of-wheat-varieties.pdf

35 NSW DPI Agronomists (2007) Wheat growth and development. PROCROP Series, NSW Department of Primary Industries, https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/449367/Procrop-wheat-growth-and-development.pdf

36 AGF Seeds. (2012). Triticale. https://agfseeds.com.au/triticale

factors not yet fully understood. The end point of this deterioration is death of the seed (i.e. complete loss of germination).

However, seeds lose vigour before they lose the ability to germinate. That is why seed lots that have similar, high germination values can differ in their physiological age (the extent of deterioration) and so differ in seed vigour and therefore the ability to perform. [37]

For more information on factors affecting germination, see Section 4: Plant growth and physiology.

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. [38]

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.

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 (Photo 8). 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. 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. [39]

37 ISTA (1995) Understanding seed vigour. International Seed Testing Association, http://www.seedtest.org/upload/prj/product/UnderstandingSeedVigourPamphlet.pdf

38 GRDC (2011) Saving weather damaged grain for seed, northern and southern regions. Retaining seedFact Sheet, GRDC, January 2011, http://storedgrain.com.au/wp-content/uploads/2013/06/GRDC_FS_RetainingSeed2.pdf

39 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

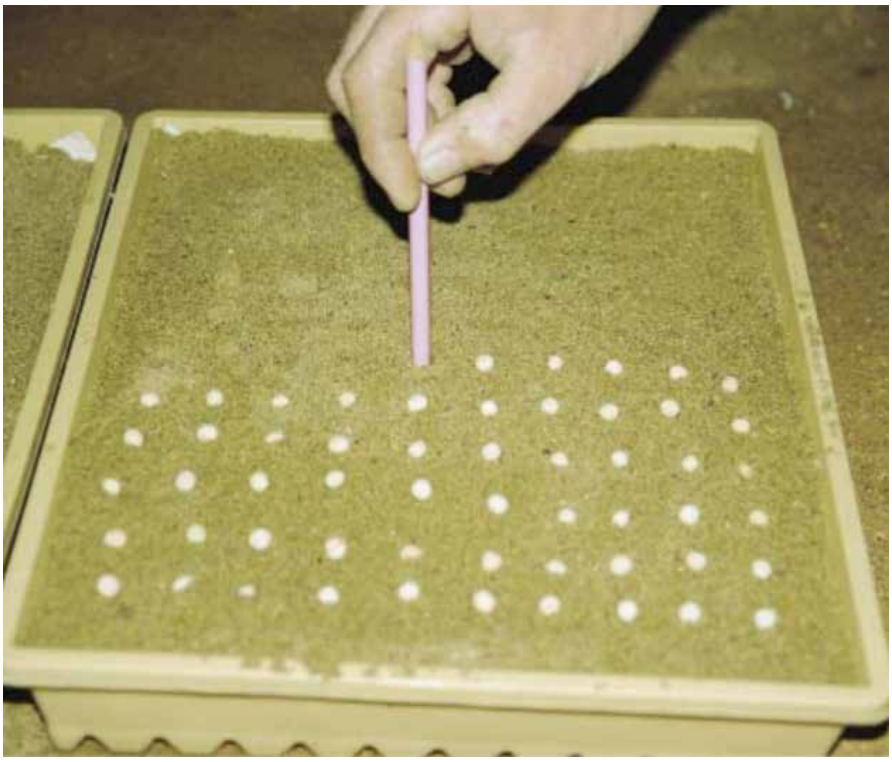

Photo 8: *Use a pencil or straw to poke holes in a testing tray.*

Source: NSW DPI

2.3.3 Seed storage

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 respires.

Triticale is a softer grain than wheat and barley, which may make it easier to mill for livestock diets, but may cause it to be more susceptible to insect damage in long term storage. [40]

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 is 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.
- No pests. Temperature <15°C stops all major grain insect pests from breeding, slowing down their activity and causing less damage. [41]

For more information, see Section 13: Storage.

MORE INFORMATION

Germination testing and seed rate calculation

VIDEOS

WATCH: Over the Fence: Insure seed viability with aerated storage.

40 Waratah see Co. Ltd. (2010). Triticale: planting guide. http://www.porkcrc.com.au/1A-102_Triticale_Guide_Final_Fact_Sheets.pdf

41 NSW DPI Agronomists (2007) Wheat growth and development. PROCROP Series, NSW Department of Primary Industries, https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/449367/Procrop-wheat-growth-and-development.pdf

2.3.4 Safe rates of fertiliser sown with the seed

A productive triticale will require application of phosphorous (P) and nitrogen (N) at sowing. Additional nitrogen is likely to be required for maximum dry matter production for grazing and grain yield, particularly if the crop has been grazed.

Consider applying 15—20 kg P per ha at sowing. This is equivalent to 75—100 kg MAP per ha which will also include 7.5—10 kg N per ha. A triticale used for grazing as well as grain production will require significant N. [42]

As with most crops, rates of fertiliser application should be based on soil testing and other historical response information as well as anticipated costs and returns.

Crop species differ in tolerance to N fertiliser when applied with the seed at sowing. Research work funded by Incitec Pivot Fertilisers has shown that the tolerance of crop species to ammonium fertilisers placed with the seed at sowing is related to the fertiliser product (ammonia potential and osmotic potential), the application rate, row spacing and equipment used (such as a disc or tine), and soil characteristics such as moisture content and texture.

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. 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 (Tables 6 and 7). [43]

Nitrogen 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.

Table 6: *Approximate safe rates of nitrogen as urea, mono-ammonium phosphate (MAP) or diammonium phosphate (DAP) with the seed of cereal grains if the seedbed has good soil moisture (at or near field capacity).* [44]

	25 mm (1") seed spread			50 mm (2") seed spread		
Soil texture	**Row Spacing**			**Row Spacing**		
	180 mm (7")	229 mm (9")	305 mm (12")	180 mm (7")	229 mm (9")	305 mm (12")
		SBU			SBU	
	14%	11%	8%	29%	22%	17%
Light (sandy loam)	20	15	11	40	30	22
Medium-heavy (loam to clay)	25	20	15	50	40	30

42 Waratah see Co. Ltd. (2010). Triticale: planting guide. http://www.porkcrc.com.au/1A-102_Triticale_Guide_Final_Fact_Sheets.pdf

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

44 Farmer Community (2014) Guidelines for suggested maximum rates of fertiliser applied with the seed in winter crops. Fertiliser Facts. Incitec Pivot Ltd, http://farmercommunity.incitecpivotfertilisers.com.au/

Table 7: *Urea rates for cereals on different soil types.* [45]

Crop:	**Wheat, barley**							
Product:	**Urea (46% nitrogen)**							
Soil Moisture : Good								
SBU %	5	10	15	20	25	30	40	50
					Kg/ha			
Heavy Soil	55	60	65	70	75	80	95	105
Medium Soil	45	50	55	60	65	70	80	90
Light Soil	25	30	35	40	45	50	60	65

Seedbed utilization (SBU)% = (width of seed row/row spacing) x 100. Contact your agronomist or fertiliser supplier for other details on other blends.

For more information, see Section 5: Nutrition and Fertiliser.

45 Farmer Community (2014) Guidelines for suggested maximum rates of fertiliser applied with the seed in winter crops. Fertiliser Facts. Incitec Pivot Ltd, http://farmercommunity.incitecpivotfertilisers.com.au/