SOUTHERN
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GRDC™
GROWNOTES™

GRDC™
GRAINS RESEARCH & DEVELOPMENT CORPORATION

WHEAT

SECTION 2

PRE-PLANTING

VARIETAL PERFORMANCE AND RATINGS | VARIETY CHARACTERISTICS | PLANTING SEED QUALITY

SECTION 2

Pre-planting

2.1 Varietal performance and ratings

For best results, use varieties yielding consistently well over several years that offer the best combination of yield potential, grain quality and disease resistance. Sow at least two different wheat varieties each year; this spreads the risk of frost and disease damage (Figure 1).

To ensure high yields, select varieties by considering:

- varieties that have performed well at a local level
- grain quality to attract premium payments
- good disease-resistance package
- maturity suited to sowing time
- strong seedling vigour
- resistance to lodging and shattering
- tolerance to herbicides
- tolerance to soil acidity or sodicity
- tolerance to pre-harvest sprouting
- ability to perform well in low or marginal moisture conditions
- good threshing ability
- tolerance to frost [1]

More information

GRDC National Variety Trials: Crop variety guides

Superior Seed Co.: Choosing new wheat varieties

Video

NVT PLAYLIST - SA Trial Results 2014

Figure 1: Sow at least two different wheat varieties each year; this spreads the risk of frost and disease damage. (Photo: Paul Jones Photography)

[1] P Matthews, D McCaffery, L Jenkins (2015) Winter crop variety sowing guide 2015. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/agriculture/broadacre/guides/winter-crop-variety-sowing-guide

More information

BCG/CSIRO/APSIM: Yield Prophet

BCG: Trial details. Agronomic information for growing biscuit wheats–2000

Southern Farming Systems: NVT wheat: should I diversify my wheat varieties?

Southern Farming Systems: Evaluation of early sown European wheat varieties without grazing—Nile, Tas.

Southern Farming Systems: Wheat variety trial—Bairnsdale, Vic.

Southern Farming Systems: Cereal Cropping in Gippsland—evaluating suitable wheat & barley varieties

MFGM: MacKillop Farm Management Group trials 2015

BCG: Research & Extension

2.1.1 Yielding ability and GRDC-funded National Variety Trials

Productivity of the grains industry depends on the continued adoption and deployment of new technologies, including the adoption of new varieties with superior yield and useful disease-resistance characteristics. When considering a new variety, growers should compare the yield, grain quality and disease resistances of the new variety with the currently grown varieties.

National Variety Trials (NVT) collect the most relevant varieties for each region, both new and old, and test them alongside the elite lines from the breeding programs. For all information on the released varieties in the NVT, visit the website (www.nvtonline.com.au). [2]

Individual trial results from NVT provide only a snapshot in time and may lead to unsuitable varietal choice. Combining data across trials (and years) enhances the chance of selecting appropriate varieties, and the current long-term analysis is based on geographic region. A new method of analysis forms environment groups from 'similar' trials rather than geographic regions and will provide the most accurate prediction of relative yield performance of varieties for an environment. [3]

For more information about the online crop production model Yield Prophet®, see GrowNotes Wheat South Section 1. Planning and paddock preparation.

Alkaline Soils Group
Established in 1999 by farmers and consultants, the YP Alkaline Soils Group aims to identify research and to demonstrate and promote best practice farming systems in medium-rainfall areas with alkaline soils. The group is run by a voluntary committee of farmers and agronomists and has two part-time staff. Research and communication activities are subcontracted to specialists.

Farmlink Research
FarmLink is made up of individual growers, grower groups, research organisations, advisers and agribusiness in southern New South Wales (NSW). FarmLink gives growers the power to influence research priorities and to be actively involved in the research process. The main objective of FarmLink is the co-ordination and communication of research and development activities funded privately, publically and by growers' groups within the region.

Grain Orana Alliance
Grain Orana Alliance aims to facilitate greater cooperation and develop linkages between research providers, growers and consultants across the region who currently compete for funds and, most importantly, lack the capacity to validate research results on-farm in a timely manner and extend research outcomes outside their respective boundaries cost-effectively.

Hart Field Site
The Hart Field Site is a premier agronomic field demonstration and trial site in South Australia.

Liebe Group
The Liebe Group is a progressive group working together to sustain and enhance the rural environment through a whole-systems approach to agriculture.

Mallee Sustainable Farming Project
Mallee Sustainable Farming Inc. is a farmer-guided participatory research, development and extension organisation. Their mission is to increase the adoption of sustainable and profitable farming systems in the low-rainfall Mallee regions of NSW, Victoria and South Australia.

[2] National Variety Trials (2014) Queensland 2014 wheat varieties. GRDC/Department of Agriculture, Fisheries and Forestry Queensland, http://www.grdc.com.au/NVT-QLD-WheatVarietyGuide

[3] A Kelly, A Smith, B Cullis (2013) Which variety should I grow? New statistical methods for NVT allow for better decision making. GRDC Update Papers 12 March 2013, http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2013/03/Kelly-Alison-What-should-I-grow

Riverine Plains Inc
Riverine Plains Inc. is a vibrant farmer group promoting excellence in farming systems by providing quality information, leading research and sharing ideas for the economic, environmental and social benefit of the Riverine Plains, covering north-eastern Victoria and southern NSW. The group strives to solve common issues through trial work and good communication of results, both from their trials and from those of other researchers, to farmers in the Riverine Plains.

South Australian No-Till Farmers Association (SANTFA)
South Australian No-Till Farmers Association (SANTFA) is a state-wide farming organisation with >1150 members across the farming areas of South Australia.

Southern Precision Agriculture Association (SPAA)
The Society of Precision Agriculture Australia (SPAA) is a non-profit, independent group that exists to promote the development and adoption of precision agriculture technologies within the Southern Hemisphere, including livestock, horticulture, viticulture, grains and cropping.

Victorian No-Till Farmers Association (VNTFA)
Victorian No-Till Farmers Association (VNTFA) is aimed at educating farmers on how to develop economically, agronomically and environmentally sound crop-production systems through the application of no-till farming techniques.

More information

http://www.sfs.org.au/announcements/wheat-varieties-yield-is-king

http://dpipwe.tas.gov.au/documents/species-for-profit-book_web.pdf

http://www.extensionaus.com.au/cereal-disease-guides/

http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2013/02/Understanding-farmer-decision-making-and-adoption-behaviour

FAQ

2.2 Variety characteristics

A survey of Victorian wheat growers shows that the most valuable traits of wheat are strongly related to end use or classification, yield, and suitability to the sowing window. [4]

Wheat variety characteristics are presented below, including flour milling assessment (Table 1), agronomic traits (Table 2), and yield and disease resistance (Table 3) to aid decision-making.

Table 1: Victorian wheat varieties: a domestic flour miller's assessment [5]

Hard wheat			End product category		
Variety	Preferred grade	Max class grade	Plant bakery	Artisan bread	Comment
Axe	AH	AH	1	1	Very poor water absorption, strong dough characteristics and long mix time.
Bolac	AH	AH	2	2	Marginal AH - strong dough characteristics.
Chara	AH	AH	1	2	Optimum value as separate segregation due to excess mix requirement.
Condo	AH	AH	1	2	Marginal strong dough & mix time. Possible specialist application.
Corack	APW	APW	2	1	Acceptable APW quality. Suit domestic mills.
Correll	AH	AH	3	1	Acceptable AH quality.
Cosmick	AH	AH	3	2	Acceptable AH for Domestic market.
Derrimut	AH	AH	3	1	Appears acceptable as AH quality to suit plant bakery.
EGA Gregory	APW*	APW*	2	1	Limited data, but indicate suitable for domestic APW.
EGA Wedgetail	APW*	APW*	1	2	Over strong APW. Long mix requirement. Appears to suit specialist segregation.

[4] S Longley, E Seymour, G Kaine (2012) Farmer identification of valuable traits in agricultural crops and pastures: case studies in adoption and decision-making. Department of Primary Industries Victoria, http://geoffkaineresearch.com/download/getfile/22

[5] National Variety Trials (2015) NVT Victorian winter crop summary 2015. GRDC/Department of Economic Development, Jobs, Transport and Resources Victoria, http://www.grdc.com.au/Resources/Publications/2015/03/NVT-Victorian-Winter-Crop-Summary-2015

Hard wheat			End product category		
Variety	Preferred grade	Max class grade	Plant bakery	Artisan bread	Comment
Elmore CL Plus	AH	AH	3	1	Good water absorption & acceptable bake performance. Acceptable AH quality.
Emu rock	AH	AH	3	2	Acceptable AH. Marginal long mix requirement.
Estoc	APW	APW	2	1	Marginal APW quality. Some interest from domestic mills.
Forrest	APW	APW	2	1	Acceptable APW quality for Domestic market.
Gladius	AH	AH	1	2	Very strong dough properties with excessive mix time.
Grenade CL Plus	AH	AH	2	2	Marginal strong. Limited domestic interest.
Justica CL Plus	APW	APW	1	3	Strong dough. Appears to suit specialist segregation.
Kellalac	APW	APW	2		Acceptable APW quality - has weak dough & poor bake.
Kiora	AH	AH	2	2	Marginally strong dough. Some interest from Domestic market.
Kord CL Plus	AH	AH	3	1	Appears suitable for domestic mills.
Livingston	AH	AH	3	2	Acceptable as AH quality to suit plant bakery.
LRPB Cobra	AH	AH	3	1	Appears acceptable. Some concerns over low viscosity and high yellow pigment.
LRPB Dart	AH	AH	2	1	Good dough & bakery performance, but low FN. Limited interest.
LRPB Gauntlet	APW	APW	3	1	Appears acceptable. Good dough & bakery results.
LRPB Lancer	APW*	APW*	2	1	Acceptable APW. Good water absorption & bake volume, but marginal long mix time.
LRPB Lincoln	AH	AH	2	1	Appears to have limited suitability as domestic AH.
LRPB Merlin	AH	AH	2	2	Strong dough, long mix. Possibly specialist applications.
LRPB Phantom	AH	AH	3	1	Appears to suit domestic mills.
LRPB Scout	AH	AH	2	1	Suitable AH, marginal long mix time.
LRPB Spitfire	AH	AH	2	2	Long mix requirement and short extension, appears limited suitability for domestic mills.
LRPB Trojan	APW	APW	2	1	Some interest from domestic mills. Marginal water absorption, long mix time but good bake volume.
LRPB Viking				2	Limited data available. Early indication is that it has excessive strength & mix time.
Mace	AH	AH	3	1	Suitable as domestic AH.
Magenta	APW	APW	2	1	Marginally acceptable for plant bakeries.
Merinda	AH	AH	3	3	Has strong and extensible dough properties.
Sentinel 3R	ASW	ASW	1	1	Appears to have limited suitability for domestic mills.
Shield	AH	AH	3	1	Marginal strong. Expect some domestic interest.
Suntop	AH	AH	2	2	Strong AH. Good water absorption, but marginally long mix time.
Wallup	AH	AH	1	2	Long mix requirement. Appears to suit specialist segregation. Limited interest from domestic millers.
Yitpi	AH	AH	3	2	Acceptable AH quality.
Young	AH	AH	2	2	Acceptable AH quality - has strong dough & long mix time.

Hard wheat			End product category			
Soft or noodle wheat						
Variety	**Preferred grade**	**Max class grade**	**Biscuit**	**Cake**	**Hot plate goods**	**Comment**
Barham	Soft	SF1	3	3	2	Acceptable Biscuit quality
LRPB Gazelle	Soft	SF1	3	2	1	Acceptable Biscuit quality
LRPB Impala	Soft	SF1	3	2	1	Acceptable Biscuit quality
Yenda	Soft	SF1	3	2	1	Acceptable Biscuit quality

Interpretation provided by David Hogan, Quality Operations Manager, Laucke Flour Mills. On the quality scale: 3, preferred for a particular varietal end use; 2, suitable; 1, not suitable

Table 2: Wheat variety agronomic guide [6]

Screening, lodging and sprouting resistance: R, resistant; S, susceptible; M, moderately; V, very. Maturity: E, early; M, mid; L, late; (+W), winter wheat. Height: S, short; M, medium; T, tall. Coleoptile length: S, short; M, medium; L, long. Head colour and type: W, white; B, black; R, red; A, awned; AL, awnless. Soil tolerance: I, intolerant; T, tolerant; M, moderately

		Rainfall									Head type		Soil tolerance	
Bread wheat	Maximum quality Vic	Low <400mm	Med 400-500mm	High >500mm	Screenings	Maturity	Height	Coleop length	Lodging	Sprouting	Colour	Awn	Boron	Acid
Axe	AH	✓			MR	E	M-S	MS	MR	SVS	W	A	I	I
Bolac	AH		✓	✓	S	M-L	M	M	MR	S	W	A	I	I
Chara	AH	✓	✓	✓	MR	M-L	M	MS	MR	S	W	A	MI	MI
Condo	AH	✓	✓		R	E	MT	M	MS	S	W	A	I	MT
Corack	APW	✓	✓		R	E-M	S	MS	MR	S	W	A	I	T
Correll	AH	✓	✓		MR	M	M	ML	MS	SVS	W	A	MT	MT
Cosmick	AH	✓	✓		MRMS	E-M	M	L	MRMS		W	A		
Derrimut	AH	✓	✓		MS	E-M	MS	MS	MRMS	S	W	A	MT	
EGA Gregory	APW*		✓	✓		M-L	MT		MS	S	W	A		MT
EGA Wedgetail	APW*			✓	MR	ML (+W)	M	MS	MR	S	W	A	I	MT
Elmore CL Plus	AH		✓		MS	M	M	M	MRMS	S	W	A	I	I
Emu Rock	AH	✓	✓		R	E	S	M	R	S	W	A		
Estoc	APW	✓	✓			M-L	M	ML	MR	MRMS	W	A	MT	MT
Forrest	APW		✓	✓	MR	L	M	S-M		S	W	A		
Gladius	AH	✓	✓		MR	M	M	M	MRMS	SVS	W	A	MT	MT
Grenade CL Plus	AH		✓		MR	EM	MT	ML		S	W	A	MT	MT
Justica CL Plus	APW		✓		MR	M	M	M	R	S	W	A	MT	MT
Kellalac	APW		✓	✓	MR	L	M	M		S	W	A	MI	I
Kiora	AH		✓	✓	MS	M-L	M	M	MR	S	W	A	MI	MI
Kord CL Plus	AH	✓	✓			M	M			SVS	W	A	MT	MT
Livingston	AH	✓	✓		MRMS	E-M	M		MS	S	W	A	I	I
LRPB Cobra	AH	✓	✓	✓	MRMS	E-M	S		MR	SVS	W	A	I	MT
LRPB Dart	AH	✓	✓		MRMS	E	SM	L		S	W	A	I	MT
LRPB Gauntlet	APW		✓	✓	MRMS	M-L	SM	M		S	W	A	I	MT
LRPB Lancer	APW*		✓	✓	MR	M-L	S	M	MR	S	W	A	I	MI-I
LRPB Lincoln	AH	✓	✓	✓	MR	M	M	MS	MS	SVS	W	A	I	MT

[6] National Variety Trials (2015) NVT Victorian winter crop summary 2015. GRDC/Department of Economic Development, Jobs, Transport and Resources Victoria, http://www.grdc.com.au/Resources/Publications/2015/03/NVT-Victorian-Winter-Crop-Summary-2015

Bread wheat	Maximum quality Vic	Rainfall Low <400mm	Rainfall Med 400-500mm	Rainfall High >500mm	Screenings	Maturity	Height	Coleop length	Lodging	Sprouting	Head type Colour	Head type Awn	Soil tolerance Boron	Soil tolerance Acid
LRPB Merlin	AH		✓		MR	E-M	M			MS	W	A	I	
LRPB Phantom	AH		✓	✓	MR	M-L	MT			S	W	A	MT	MT
LRPB Scout	AH	✓	✓	✓	MR	M	M	ML	MRMS	MS	W	A	MI	MT
LRPB Spitfire	AH	✓	✓		MR	E-M	M	L	MS	S	W	A	I	MT
LRPB Trojan	APW		✓	✓	MR	ML	M	M	MR	MSS	W	A	MT	MT-MI
LRPB Viking			✓	✓		ML	MT	MS	MS	S	W	A	I	MT-MI
Mace	AH	✓	✓		MR	E	M	MS	MR	S	W	A	MT	MT
Magenta	APW	✓	✓		MS	M-L	M	L	MRMS	S	W	A	I	MT
Merinda	AH	✓	✓			M	M		MRMS		W	A		
Sentinel 3R	ASW		✓	✓	MRMS	ML	M	S	MRMS	S	W	A		MT
Shield	AH	✓	✓		MR	EM	SM	S		S	W	A	I	MT
Suntop	AH	✓	✓	✓	MRMS	M	M	M	MR	SVS	W	A	I	MT
Wallup	AH		✓		MR	M	M	M	MR	S	W	A	I	I
Yitpi	AH	✓	✓		MR	M	MT	ML	MS	MS	W	A	MT	MT
Young	AH	✓	✓		MS	E-M	M	M	MSS	S	W	A	I	MT
Biscuit wheat														
Barham	ASF1		✓	✓	MR	M	M	ML	MS	S	W	AL	I	I
LRPB Gazelle	ASF1		✓	✓	MRMS	M-L	M		MR	S	W	A	I	MT
LRPB Impala	ASF1	✓	✓	✓	MR	E-M	ML		MS	MSS	W	A	I	MT
Yenda	ASF1		✓	✓	MR	M-L	SM	S	RMR	S	W	A	MT	MT
Durum														
Caparoi	ADR		✓			M	S-M	S-M	MR	M				I
DBA Aurora	ADR		✓		R	M	M		MR	MR	W	A		
EGA Bellaroi	ADR		✓		R	M	S-M	S	R	M	W	A	I	I
Hyperno	ADR		✓			M	M		MR	MR	W	A	I	
Jandaroi	ADR	✓	✓			E	M	S-M	MR	MR				I
Saintly	ADR	✓	✓			E				S	W	A	I	
Tjilkuri	ADR				MS	M	M			S	W/B	A	T	
WID802	ADR				MS	E-M				MR				
Yawa	ADR				MS	E-M				MR				
Feed wheat														
Beaufort	Feed		✓	✓		ML	M		MR-MS	MR	R	AL		MT
Manning	Feed			✓		L (+W)					W	AL		
Naparoo	Feed			✓		L (+W)					W	A		
Preston	Feed			✓		L	S		MR			A		
SF Adagio	Feed		✓	✓		M-L (+W)					R	A		
SF Scenario	Feed			✓		L (+W)					R	AL		
SQP Revenue	Feed			✓		L (+W)	S				R	AL		

Table 3: Mean yield (as % of district average) of varieties from SARDI and NVT trials (2009–13), and reaction to common diseases and to black point, which is a physiological response to certain humid conditions [7]

No. of trials for each variety in each district is in italics; –, insufficient data. Reaction: R, resistant; S, susceptible; M, moderately; V, very; –, variety to be evaluated (stripe rust ratings are for new WA Yr17 strain). Information on disease reaction was provided by the Field Crop Pathology Unit (SARDI) and compiled before the full data for 2014 were available. Contact Dr Hugh Wallwork (08 8303 9382)

	Agricultural district																		
	Lower Eyre Pen		Upper Eyre Pen		Murray Mallee		Mid North		Yorke Pen.		Upper South East		Stem Rust	Stripe Rust#	Leaf Rust	Septoria tritici blotch	Yellow leaf spot	Powdery Mildew	Black point
AGT Katana	102	15	104	31	105	28	103	21	103	16	103	17	MSS	MRMS	MS	MS	MS	MRMS	S
Axe	97	15	99	31	99	28	99	21	97	16	98	17	MS	RMR	MR	SVS	S	MSS	S
Barham											93	17	MR	MSS	MRMS	MSS	MSS	SVS	MRMS
Bolac											96	6	MRMS	RMR	MS	MS	S	MRMS	MSS
Catalina	96	14	97	31	96	28	96	21	95	16	96	17	MR	MS	R	MS	MSS	MSS	S
Cobra	107	9	104	18	104	12	108	8	109	6	109	8	RMR	MSS	MR	MSS	MRMS	MSS	MSS
Corack	110	12	110	25	111	24	112	17	110	13	110	14	MR	MS	S	MSS	MR	VS	MSS
Correll	100	15	101	31	102	28	99	21	99	16	98	17	MRMS	MRMS	MSS	MRMS	SVS	MRMS	MS
Cosmick	-		-		-		-		-		-		MRMS	MSS	S	S	MR	MS	
Dart	99	8	99	12	99	12	101	13	99	10	100	8	MR	MRMS	RMR	S	MSS	MRMS	MRMS
Emu Rock	104	12	107	25	108	24	106	17	104	13	104	14	MRMS	MRMS	MSS	S	MRMS	MSS	MS
Espada	102	15	106	31	107	28	102	21	102	16	101	17	MR	MRMS	R	S	MS	S	S
Estoc	102	15	103	31	103	28	101	21	102	16	101	17	MR	MRMS	MRMS	S	MSS	MSS	MS
Gladius	100	15	102	31	102	28	101	21	100	16	100	17	MR	MRMS	MS	MSS	MS	S	MS
Grenade CL Plus	96	9	99	18	99	18	95	12	96	9	94	11	MR	MRMS	MS	MSS	S	MSS	MS
Harper	102	5	103	7	104	12	100	9	101	7	99	7	MRMS	MS	MRMS	MSS	MSS		RMR
Impala											100	17	RMR	MR	S	SVS	MSS	RMR	MRMS
Justica CL Plus	98	12	99	25	99	24	98	17	98	13	98	14	MR	MRMS	MSS	SVS	S	S	S
Kiora											-		RMR	RMR	MR	MS	MSS	MS	MRMS
Kord CL Plus	98	9	102	19	102	18	98	13	98	10	97	10	MR	MRMS	MS	MSS	MSS	MSS	MR
Mace	107	15	110	31	110	28	107	21	107	16	105	17	MR	SVS	MS	MRMS	MRMS	MSS	MS
Magenta	102	12	104	25	104	22	100	21	102	16	100	13	RMR	MS	MRMS	MRMS	MRMS	MRMS	S
Mackellar											-	-	MR	RMR	VS	MRMS	MRMS	MRMS	S
Orion											93	17	MR	MSS	R	MS	MSS	MS	SVS
Peake	100	12	99	25	98	27	101	21	99	10	100	17	MR	MRMS	R	MS	S	MRMS	MSS
Phantom	103	12	99	25	99	24	102	17	102	13	102	14	MRMS	MR	MS	MRMS	SVS	MRMS	MR
Scout	108	15	104	31	105	28	110	21	108	16	109	17	MR	MS	R	MS	SVS	MRMS	S
Sentinel											97	9	RMR	RMR	R	MRMS	MS	R	MSS
Shield	101	9	103	18	104	18	102	12	100	9	100	7	RMR	MR	R	MSS	MSS	MR	MS
SQRevenue											82	4	RMR	R	S	MS	MS	R	MSS
Trojan	110	9	108	18	109	18	109	12	111	9	110	11	MR	MR	MRMS	MS	MSS	-	MRMS
Wallup	103	10	100	12	100	11	104	17	104	13	105	14	RMR	MRMS	S	S	MSS	S	MR
Wyalkatchem	106	15	105	31	105	28	106	21	106	16	106	17	MS	S	MSS	MR	MR	SVS	MS
Yitpi	99	11	99	25	99	22	96	17	98	13	97	13	S	MRMS	MSS	MS	SVS	MRMS	MS
av trial yield t/ha	**4.49**		**2.38**		**2.42**		**3.77**		**4.51**		**4.48**								

[7] SAGIT (2015) South Australian sowing guide 2015. GRDC/SARDI, http://grdc.com.au/SASowingGuide2015

	Agricultural district													
	Lower Eyre Pen	Upper Eyre Pen	Murray Mallee	Mid North		Yorke Pen.		Upper South East	Stem Rust	Stripe Rust#	Leaf Rust	Septoria tritici blotch	Yellow leaf spot	Powdery Mildew	Black point
Durums															
DBA-Auroa				111	9	109	9		RMR	RMR	RMR	-	MRMS	MR	MS
Caparoi				98	15	101	15		MR	MR	MRMS	RMR	MR	-	MSS
Hyperno				107	15	103	15		R	MR	RMR	RMR	MRMS	MR	MS
Saintly				104	15	105	15		MR	MR	MRMS	MRMS	MRMS	VS	MS
Tamaroi				97	15	99	15		MR	MR	MR	S	MRMS	MSS	MS
Tjilkuri				104	15	104	15		MR	MR	MR	MRMS	MRMS	S	MSS
WID802				110		107			RMR	MR	RMR	MR	MRMS	MRMS	MSS
Yawa				115	15	110	15		RMR	MR	MR	MR	MRMS	MS	MRMS
av variety yield t/ha				**3.74**		**3.97**									

More information

Southern Farming Systems: Wheat varieties—yield is king

DPIWE: Species for profit—a guide for Tasmanian pastures and field crops

extensionAUS: Cereal disease guides

GRDC Update Papers: Understanding farmer decision making and adoption behaviour

GRDC: NVT Victorian winter crop summary 2015

GRDC: South Australian sowing guide 2015

2.2.1 Maturity

The maturity, or length of time taken for a variety to reach flowering, depends on vernalisation, photoperiod and thermal time requirements. Recommended sowing times are arrived at by assessing the maturity of varieties in different environments and with different sowing times. Figure 2 shows the variation in development stages when a variety is sown on different dates. [8] Some varieties have a wide planting window and they are not adversely affected by a later sowing date, for example EGA Gregory(). [9]

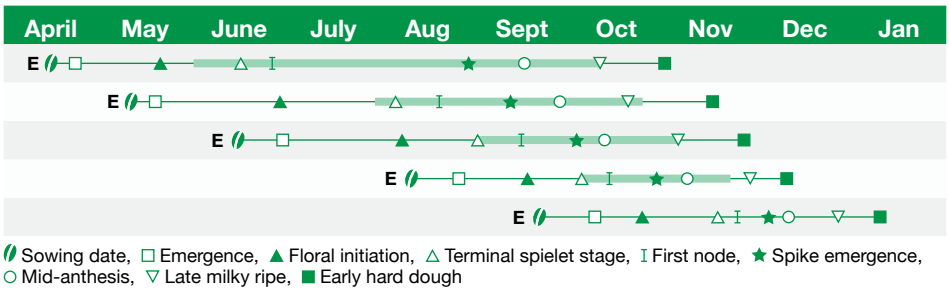

Figure 2: Development stages for varieties sown on different dates. (Based on M Stapper and R Fischer 1990)

The solid line in each panel is the estimated grain yield. The dashed lines are upper and lower 95% confidence limits.

It is critical to match variety and sowing date so that flowering occurs early enough to allow a long grain-filling period before the high evaporative demands and soil-water deficit of early summer. The flowering period must also be late enough to avoid damage by frosts in early spring.

No-till farming and stored summer moisture means many growers now 'calendar sow', i.e. start sowing at the earliest opportunity within a variety's recommended sowing window, regardless of the autumn break.

Understanding how each variety responds to the environment will help to target varieties to their best sowing time. [10]

Varieties generally flower in the same order across years and sowing times.

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

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

[10] P Martin, H Eagles, K Cane (2014) Flowering time of wheat varieties in New South Wales. GRDC Update Papers, 4 March 2014, http://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/03/Flowering-time-of-wheat-varieties-in-New-South-Wales

http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2015/08/Managing-the-risks-of-early-sown-wheat-in-South-West-Victoria

http://www.grdc.com.au/Research-and-Development/GRDC-Update-Papers/2015/02/Early-sowing-in-Victoria-2014

Varieties generally flower in the same order across years and sowing times.

For more information, see http://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/03/What-is-driving-flowering-time-differences-of-wheat-varieties-between-years[11] For more information, see the GRDC project summary 'What is driving flowering time differences of wheat varieties between years'. [12]

http://www.grdc.com.au/Resources/Factsheets/2011/03/Time-Of-Sowing

For more information on the influence of sowing time, see GrowNotes Wheat South Section 3. Planting.

More information

GRDC Factsheets: Time of sowing

Research paper: Grain protein concentration of several commercial wheat varieties

2.2.2 Varieties

Information about each variety is presented as overview statements, then as comparison tables of yield, crop growth and disease-reaction characteristics.

Abbreviations used:

- ⦶ denotes that Plant Breeder Rights apply
- S, MS, VS: susceptible, moderately susceptible, very susceptible
- R, MR: resistant, moderately resistant
- (p), provisional rating
- AGT, Australian Grain Technologies
- CCN, cereal cyst nematode
- BYDV, Barley yellow dwarf virus
- RLN, root-lesion nematode
- APR, adult plant resistance
- APH, Australian Prime Hard (min. protein 13%)
- AH, Australian Hard (min. protein 11.5%)
- APW, Australian Premium White (min. protein 10%)
- ASW, Australian Standard White
- ADR, Australian Premium Durum
- ASWN, Australian Standard Noodle (protein 9.2–11%)
- APNW, Australian Premium Noodle (protein 10–11.5%)
- ASFT, Australian Soft (protein 9.5%)
- FEED, Australian Feed
- * denotes default classification
- EPR, end point royalty, 2015–16 quoted as $/t ex-GST

Bread wheats

AGT Katana⦶: an early flowering, premium quality variety. Derived from Kukri, Katana has good physical grain quality, similar to Yitpi, and yields similar to Wyalkatchem on average. MR to rust, MS to CCN, MS to yellow leaf spot, MR–MS to powdery mildew. Seed available from AGT (conditional Seed Sharing™ allowed).

[11] GRDC (2014), What is driving flowering time differences of wheat varieties between years. http://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/03/What-is-driving-flowering-time-differences-of-wheat-varieties-between-years

[12] P Martin, M Gardner, G McMullen (2014) What is driving flowering time differences of wheat varieties between years. GRDC Update Papers, 5 March 2014, http://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2014/03/What-is-driving-flowering-time-differences-of-wheat-varieties-between-years

Axe(Ⓟ): APW classification in NSW. Very early maturity, similar to or slightly earlier than H45. MR–MS to stem rust, R–MR to stripe rust, MR to leaf rust, S to yellow leaf spot and CCN. Axe is not boron-tolerant. S–MS to black point. Produces very large grain with low screenings. (AGT)

Bolac(Ⓟ): APH quality in southern NSW, APW in central and northern NSW. Later maturing than Chara. Adapted to mildly acidic, neutral and alkaline soils. MR–MS to stem rust, R–MR to stripe rust and black point, MS to leaf rust, S to yellow leaf spot. Small grain size. (Viterra)

Chara: AH quality in southern zone. White-grained and suited to medium–high-rainfall zones. MR–MS to stem rust, MS–S to stripe rust, S(p) to leaf rust, R to CCN, MS–S to yellow leaf spot. Performs well on the moderately acid soils of central and north-eastern Victoria and southern NSW and irrigation where high yields are possible. Good straw strength. Has a reputation for waterlogging tolerance. Registered 1999 and marketed by Seednet. EPR $1.

Condo: AH quality in southern zone. A very early-maturing variety. Excellent yield potential in north-central and north-eastern Victoria and southern NSW. R–MR to stem rust, MS–S to stripe rust, MR–MS(p) to leaf rust, MR to CCN, MS–S to yellow leaf spot. Moderately tolerant to aluminium, large grain size, low screenings and intermediate for sprouting tolerance. Released 2014, tested as VX1634. Marketed by AGT. EPR $3.25.

Corack(Ⓟ): an early-maturing Wyalkatchem derivative that has yielded well in low- and medium-rainfall environments and/or with sharp finishes to the growing season. It has high straw strength, and is rated R to CCN and yellow leaf spot. May be suitable for a wheat-on-wheat situation, low-rainfall environments or late sowings. Rated MR to stem rust and MS to stripe and leaf rust, S to powdery mildew and black point. Has a high level of tolerance to acid soils. Has an APW classification for southern NSW. (AGT)

Correll: AH quality (southern zone). Fully awned with midseason maturity. MR–MS to stem and stripe rust, S(p) to leaf rust, MR to CCN, S–VS yellow leaf spot. Tolerant of boron toxicity, S–VS to pre-harvest sprouting and low test weights. Released 2007 and marketed by AGT. EPR $2. Generally higher in grain yield than Yitpi, but averages ~3 kg/hL lower test weight and is susceptible to sprouting. 2–5 days earlier flowering than Yitpi and considerably more when sown very early. Seed available from AGT (conditional Seed Sharing™ allowed).

Cosmick: AH quality (southern zone). Fully awned with early to midseason maturity. MS to stem rust MS–S to stripe rust, S(p) to leaf rust, MS to CCN, MR–MS to yellow leaf spot. Good wheat-on-wheat option where CCN is managed. Excellent yield, moderate grain size, similar to Yitpi and good test weight. Released 2014, tested as IGW3423 and marketed by Intergrain. EPR $3.85. Notes for South Australia: Cosmick has had limited evaluation in SA NVT (2013 only). Seed from Intergrain affiliates in 2015.

Derrimut: AH quality (southern zone). Semi-dwarf with early to midseason variety, widely adapted in Victoria. MR to stem rust, MS–S to stripe rust, MS(p) to leaf rust, R to CCN, S to yellow leaf spot. Moderately tolerant of boron toxicity and moderate grain size. Released 2007 and marketed by Nuseed. EPR $2.95.

EGA Gregory(Ⓟ): APH quality in northern NSW, AH quality in central and southern NSW. Similar maturity, straw strength and height to Batavia and Strzelecki. MR to leaf, stem and stripe rust. Good tolerance to RLN (*P. thornei*). S–MS to yellow leaf spot, S to crown rot, MR–MS to common root rot. (Pacific Seeds)

EGA Wedgetail(Ⓟ): APW* quality (southern zone). A mid- to long-season, dual-purpose winter wheat. Developed for early sowing, suited to medium–high-rainfall areas. Has a similar maturity to Rosella. MR–MS to stem rust, MS to stripe rust and leaf rust, S to CCN, MS–S to yellow leaf spot. Tolerant of acid soils and suitable for early winter grazing. Registered 2002 and marketed by Seednet. EPR $1.45.

Elmore CL PLUS(Ⓟ): AH quality classification in NSW. A mid-maturing variety with Clearfield® Plus technology, which provides tolerance to label rates of Intervix® herbicide. Has an adaptation pattern similar to Janz and is expected to perform well in

areas of moderate to high yield potential in NSW, providing an alternative strategy for in-crop weed control. Rated as MR–MS to stripe rust, R–MR to leaf rust, MR to stem rust, S to yellow leaf spot and CCN. (AGT)

Emu Rock(Φ): AH classification for southern NSW. Early-season variety with broad adaptation. Produces large grain with good test weight and has a low susceptibility to screenings. MS to yellow leaf spot, MR–MS to stripe and stem rust, MS–S to leaf rust, S to CCN. Bred by InterGrain, marketed by Nuseed. This early-maturing, large-grained wheat is derived from Kukri. Notes for South Australia: MR–MS to yellow spot. Across two seasons of NVT in SA, Emu Rock has shown yields aligning with Wyalkatchem. Seed is available from Intergrain (conditional Seed Sharing™ allowed).

Espada(Φ): sister line to Gladius, with higher yield potential. Agronomically similar to Gladius and MS to CCN, but features improved leaf rust resistance. Espada has APW quality and is susceptible to sprouting like Gladius. Seed available from AGT (conditional Seed Sharing™ allowed).

Estoc(Φ): ASW quality in southern NSW. Mid–late season variety, 1–3 days earlier then Yitpi. MR to stem rust, MR–MS to stripe (including Yr) and leaf rust, R–MR to CCN, S–VS to RLN (*P. thornei*) and boron tolerance. It is a mid–late-maturing variety like Yitpi, with better yellow leaf spot (MS–S) resistance and significantly higher grain yields. Eligible for APW classification, with good physical grain quality like Yitpi. It has shown good sprouting tolerance. Seed available from AGT (conditional Seed Sharing™ allowed).

Forrest: APW quality (southern zone). Awned semi-dwarf, long-season variety suited to the high-rainfall zones for early April–early May sowing. R–MR to stem and stripe rust, MS–S(p) to leaf rust, S to CCN, MR–MS to yellow leaf spot. Possesses resistance/tolerance to *Wheat streak mosaic virus*. Released 2011. Bred by Advantage Wheats and marketed by Seednet. EPR $3.50.

Gladius(Φ): AH quality in southern NSW, APW in central and northern NSW. Mid–quick-season maturity, similar to Diamondbird and Drysdale. Maintains high relative grain yields under drought stress. MR–MS to stripe rust, MR to stem rust, MS to leaf rust and yellow leaf spot, S to *Septoria tritici* blotch. Tolerant to boron. MS to CCN, S to RLN (*P. neglectus*). Gladius has midseason maturity and good grain size like Yitpi, albeit with slightly lower test weight, and is susceptible to pre-harvest sprouting. Trials indicate Gladius to have a lower tolerance to Ally® and Hussar®. Seed available from AGT (conditional Seed Sharing™ allowed).

Grenade CL PLUS(Φ): an early to mid-maturing line, carrying Clearfield® Plus technology, which provides tolerance to label rates of Intervix® herbicide. Combines the flexibility of improved weed-management options through use of Intervix® with high yield. MR to CCN, MR to stripe rust, R to stem rust, MR–MS to leaf rust, S to yellow leaf spot. Default APW classification NSW. (AGT)

Harper(Φ): derived from Yitpi and Stylet and released by Intergrain in 2013 as a mid–long-season APW variety. MR to CCN and stripe rust but MS to stem and leaf rust and S to yellow leaf spot. Harper is an alternative to Yitpi and Estoc with slightly higher yield. Seed available from Intergrain.

Justica CL Plus: APW quality (southern zone). Fully awned, semi-dwarf with midseason maturity. Two-gene tolerance to label rates of Intervix® herbicide. MR to stem rust MR–MS to stripe rust, S(p) to leaf rust, MS to CCN, S to yellow leaf spot. Moderately tolerant to boron. Released 2010 and marketed by AGT. EPR $3.55.

Kellalac: APW quality (southern zone). A late-maturity spring wheat, adapted to longer season environments, but intolerant of aluminium. MS–S to stem rust, MR–MS to stripe rust, S to leaf rust, MR to CCN, S to yellow leaf spot. Released 1988.

Kiora: AH quality (southern zone). Mid–late-season maturity with high yield potential suited to medium–high-rainfall areas. R–MR to stem and stripe rust, MR–MS(p) to leaf rust, MS to CCN MS–S to yellow leaf spot, MS(p) to black point. Released 2014, tested as VX2485 and marketed by AGT. EPR $3.25.

Kord CL Plus: AH quality (southern zone). Fully awned semi-dwarf with midseason maturity. Two-gene tolerance to label rates of Intervix® herbicide. MR to stem rust MR–MS to stripe rust, MS to leaf rust, MR to CCN, MS–S to yellow leaf spot. Based on Gladius with very similar adaptation. S–VS to pre-harvest sprouting. Released 2011 and marketed by AGT. EPR $3.55.

Livingston(D): AH quality. Early-maturing variety, later than H45 but earlier than Ventura and Sunstate. R to leaf rust, MR–MS to stripe and stem rust, MS to yellow leaf spot, S to crown rot, MR–MS to black point. Moderately tolerant–moderately intolerant to RLN (*P. thornei*). Intolerant of acid soils. (AGT).

LongReach Catalina(D): an AH quality, CCN-resistant variety suited to medium–higher rainfall districts across south-eastern Australia. Catalina is earlier flowering by several days than Yitpi and has acceptable physical grain quality. R to stem and leaf rust, MS to stripe rust, MS–S to yellow leaf spot. Long-term yields have been slightly below Yitpi and it has shown sensitivity to Cadence® at recommended label rate and timing. Seed available from Seednet.

LongReach Cobra: AH quality (southern zone). High-yielding early-midseason variety suited to both acid and alkaline soils. R–MR to stem rust, MS–S to stripe rust, MR to leaf rust MR–MS to CCN, MR–MS to yellow leaf spot. Compact plant height, MR to lodging, but S–VS to pre-harvest sprouting. Able to capitalise on above-average rainfall. Notes for South Australia: high yield potential, particularly in the medium–higher rainfall districts. Cobra has good grain size and moderate test weight. Released 2012 and marketed by Pacific Seeds, seed available from Pacific Seeds (conditional Seed Sharing™ allowed). EPR $3.50.

LongReach Dart(D): AH milling wheat with classification upgrade to APH. With quick maturity suited to later plantings, slightly quicker than Ventura, LongReach Crusader and H45. Suited to Queensland, NSW and north-eastern Victoria. Late plantings may be a useful tool in herbicide-resistance management. Good physical grain, milling and baking quality. R–MR to stem and leaf rusts, MR to stripe rust based on APR. Rated MS to yellow leaf spot. Lower tillering variety, with a long coleoptile and good early seedling vigour. Marketed by Pacific Seeds; seed available from 2013.

LongReach Gauntlet(D): AH quality in NSW. Main-season maturity, similar to Janz and Lang. Fully awned, medium-length coleoptile with good early-seedling vigour, short–medium plant height at maturity. R–MR to stem rust, MR–MS to stripe and leaf rust, MS–S to yellow leaf spot. Performs well in acid soils. (Viterra)

Lancer(D): Slow-maturing spring wheat to help capitalise on earlier planting opportunities. It has APH classification in northern and south-eastern zones (all NSW and Queensland) and has been welcomed by northern growers as a new, long season wheat. Solid grain package with good protein delivery, good grain size and low screenings. MR to stripe rust (based on APR), R to stem rust, R–MR to leaf rust. It has a shorter canopy height with good resistance to lodging and performs well under crown rot pressure. (LongReach)

LongReach Lincoln(D): AH quality. Medium maturity, slightly earlier than Janz. Erect, strong and upright canopy. Suited to southern NSW. MR to stem and leaf rust, R–MR to stripe rust, MR–MS to yellow leaf spot and black point, VS to crown rot and pre-harvest sprouting. (Pacific Seeds)

LongReach Merlin(D): AH milling wheat, with early–mid-season maturity similar to Ventura, Baxter and Drysdale. Suited to NSW and north-eastern Victoria. A Drysdale type with similar growth habit; sister line to LongReach Spitfire, with a similar grain quality package. MR to stripe rust (based on APR), MS to crown rot, moderately tolerant to RLN (*P. thornei*).

LongReach Phantom: AH quality (southern zone). A mid–late-season variety tolerant of boron and acid soil. MS to stem rust, MR to stripe rust, MS–S(p) to leaf rust, MR–MS to CCN, S–VS to yellow leaf spot, MR–MS to black point. Released 2012 and marketed by Pacific Seeds. EPR $3.80.

LongReach Scout(ⅰ): APW in southern NSW. Midseason maturity, similar to Gladius. Good grain package with low screenings and high test weight. R to CCN and leaf rust, MR to stem rust, MS to stripe rust, S–VS to yellow leaf spot. Medium–long coleoptile with good early vigour. Performs well in both alkaline and acid soils. (Pacific Seeds)

LongReach Spitfire(ⅰ): APH quality in NSW. Early–midseason maturity, similar to Ventura and Livingston. Good soil disease control against crown rot and RLN (*P. thornei*). Good grain package with low screenings and high test weights. MR to stem and stripe rust, MS to leaf rust, MS–S to yellow leaf spot. Long coleoptile and medium plant height. Performs well in acid soils and may have a protein advantage over other varieties. (Pacific Seeds)

LongReach Trojan(ⅰ): APW quality (southern zone). Mid–long-season variety. Semi-dwarf with awns suited to medium–high-rainfall areas. MR–MS to stem rust, MR to stripe rust MR–MS(p) to leaf rust, MS to CCN, MS–S to yellow leaf spot. MR to lodging and moderate tolerance to boron and aluminium. Released 2013, tested as LPB08-1799 and marketed by Pacific Seeds. EPR $4.

LongReach Viking(ⅰ): quality to be confirmed for southern zone but APH in NSW. An awned, semi-dwarf mid–long-season variety suited to medium–high-rainfall areas. MR to stem rust, R–MR to stripe rust, S–VS(p) to leaf rust, R(p) to CCN, MS–S to yellow leaf spot. Similar plant type and early growth habit to Chara, but a similar height to EGA Gregory at maturity. Released 2014, tested as LPB08-1799 and marketed by Pacific Seeds. EPR $4.25.

Mace: AH quality (southern zone). An awned variety of medium height. MR to stem rust, S–VS to stripe rust, MS–S(p) to leaf rust, MR–MS to CCN, MR–MS to yellow leaf spot. Tolerant of boron. Growers of Mace must implement a comprehensive fungicide strategy to control stripe rust. Released 2008, marketed by AGT. EPR $3.

Magenta: APW quality (southern zone). An awned, semi-dwarf, mid–long-season variety. R–MR to stem rust, MS to stripe rust. Leaf coleoptile with good early vigour and tillering capacity. Moderate grain size. Released 2007 and marketed by InterGrain. EPR $3.

Merinda: AH quality (southern zone). An awned, semi-dwarf, main-season variety with white chaff, suited to north-eastern Victoria. R–MR to stem rust, MR–MS to stripe rust, R to leaf rust, S to CCN, MS–S to yellow leaf spot. High straw strength. Released 2007 and marketed by AGT. EPR $2.50.

Peake(ⅰ): released in 2007, medium–short-strawed, mid-maturing (5–6 days earlier than Yitpi) variety that is now generally outclassed for yield by newer varieties. MR–MS to stem and stripe rust, R to leaf rust and CCN, S to yellow leaf spot. Tolerant to boron. Peake has AH quality and can produce small grain under dry spring conditions. Available from Seedcell.

Sentinel3R(ⅰ): ASW quality in NSW. Later maturing than Janz. R–MR to stem and stripe rust, R to leaf rust, MS–S to crown rot, S to common root rot, MS to yellow leaf spot, R–MR to black point, S to pre-harvest sprouting, R to shattering. Short coleoptile. (Seednet)

Shield: AH quality (southern zone). A white, fully awned, early–midseason variety. R–MR to stem rust, MR to stripe rust, R to leaf rust, MR to CCN, MS–S yellow leaf spot. Short–medium plant height with a short coleoptile. Moderate tolerance to acid soils. Released 2012 and marketed by AGT. EPR $3.25.

Suntop(ⅰ): A main-season line well adapted to NSW, showing high and stable yields from areas of low–high yield potential. Quicker maturing than EGA Gregory, similar in maturity to Janz. MR to stem rust, R–MR to stripe rust, R to leaf rust, S–MS to yellow leaf spot, MS to crown rot. It has moderate tolerance to acid soils and RLN (*P. thornei*). Suntop has a final APH quality classification in northern NSW. AGT has enabled farmer-to-farmer sales of this variety but only from the initial purchaser of the seed to the next grower (Seed Sharing™).

Wallup(D): APH quality classification in NSW. A midseason wheat with very good grain-processing quality characteristics and high straw strength. Moderate coleoptile length. Best suited to environments of medium yield potential, but it has not performed as well in Mallee environments. Intolerant of toxic levels of soil boron and acid soils. Rated MR to CCN, R–MR to stem rust, MR–MS to stripe and leaf rust, MS–S to yellow leaf spot, MR to pre-harvest sprouting and black point. Expresses low levels of screenings. (AGT)

Yitpi: AH quality (southern zone). White, fully awned semi-dwarf that has dominated production in low-rainfall areas of Victoria with its high flexibility of sowing time, adaptation to stress and good physical grain quality. S to stem rust, MR–MS to stripe rust, S(p) to leaf rust, MR to CCN, S–VS to yellow leaf spot. Boron tolerant, large grain and low screenings. Suits low–medium-rainfall areas. Registered 2000 and marketed by Seednet. EPR $1.

Young: AH quality (southern zone). An early–mid-maturing variety suited to medium–low-rainfall zones. R–MR to stem rust, MS to stripe and leaf rust, R to CCN, MR–MS to yellow leaf spot. Tolerant of acid soils but has small grain size. An option for wheat-on-wheat and tight wheat rotations. Registered 2005 and marketed by Seednet. EPR $1.70.

Biscuit wheat

Barham: ASF1 quality (southern zone). Awnless midseason variety suited to medium–high-rainfall zones or irrigation. MR–MS to stem rust, S to stripe rust, MR–MS to leaf rust, MS to CCN, MS–S to yellow leaf spot. A replacement for Bowie, suited to sweet biscuit manufacture. Registered 2006 and marketed by Seednet.

LongReach Gazelle(D): ASF1 quality (southern zone). High-yielding, mid–late-season variety suited to medium–high-rainfall zones and irrigation. MR to stem, stripe and leaf rust, S to CCN, MS–S to yellow leaf spot. Released 2012 and marketed by Pacific Seeds. EPR $4.00.

LongReach Impala(D): ASF1 quality (southern zone). High-yielding, early–midseason variety suited to medium-rainfall zones in Victoria. MR to stem and stripe rust MR, S–VS(p) to leaf rust, S to CCN, MS–S to yellow leaf spot. Released 2012 and marketed by Pacific Seeds. EPR $3.50.

Yenda: ASF1 quality (southern zone). Awned, mid–late-season variety suited to medium–high-rainfall zones or irrigation. R to stem rust, S to stripe rust and CCN, MR–MS to yellow leaf spot. Very high straw strength. Released 2006 by AGT and marketed by Seednet. EPR $2.

Feed–dual purpose

Manning(D): feed quality (southern zone). A dual-purpose, white grain with high yield potential suited to zones with longer growing season and irrigation. MR to stem rust, R–MR to stripe rust, R–MR leaf rust, S to CCN, MR–MS to yellow leaf spot, R to BYDV. Bred by CSIRO/GRDC (as CS9274.33), released 2013 and marketed by GrainSearch. EPR $3.50.

Naparoo: feed quality (southern zone). A white-grained, awnless, long-season winter wheat suited to hay production or grazing. R–MR to stem rust, MR to stripe rust, S to leaf rust, MS to yellow leaf spot. Released 2007. Marketed by AGT. EPR $2.50.

SF Adagio: feed quality (southern zone). An awned, red winter wheat. Mid–long-season variety for high-rainfall zones and irrigation. Adagio is suitable for dual-purpose applications when early sowing is possible. S–VS to stem rust, R–MR to stripe rust, MS(p) to leaf rust, MR–MS to yellow leaf spot. Released 2014, marketed by AGF Seeds. EPR $3.60.

SF Ovalo: feed quality (southern zone). Awnless, red winter wheat. Long-season variety for high-rainfall zones and irrigation. Suitable for dual-purpose applications when early sowing is possible. S to stem rust, R to stripe rust, MS(p) to leaf rust, MR to yellow leaf spot. Bred by RAGT (France); released 2014 and marketed by Seedforce. EPR $4.

SF Scenario: feed quality (southern zone). Awnless, red winter wheat. Long-season variety with similar maturity to Frelon and a direct replacement for Frelon and Amarok. MS–S to stem rust, MR to stripe rust, S(p) to leaf rust, MS to yellow leaf spot. Bred by RAGT, released 2013 and marketed by AGF Seeds. EPR $3.60.

SQP Revenue: feed quality (southern zone). A red-grained winter wheat suited to longer growing season zones and irrigation. R–MR to stem rust, R to stripe rust, S(p) to leaf rust, S to CCN, MS to yellow leaf spot. Has good early vigour and stands well with good head retention. Bred by AusGrainz and CSIRO (as CSIRO 95102.1), released 2009 and marketed by GrainSearch. EPR $3.50.

2.3 Planting seed quality

2.3.1 Seed size

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. 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.

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. [13]

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 (see Figure 3). Coleoptile length is an important characteristic to consider when planting a wheat crop, especially in drier seasons when sowing deep to reach soil moisture. The results of 2008 research at three sites are presented in the NSW DPI publication: Coleoptile length of wheat varieties.

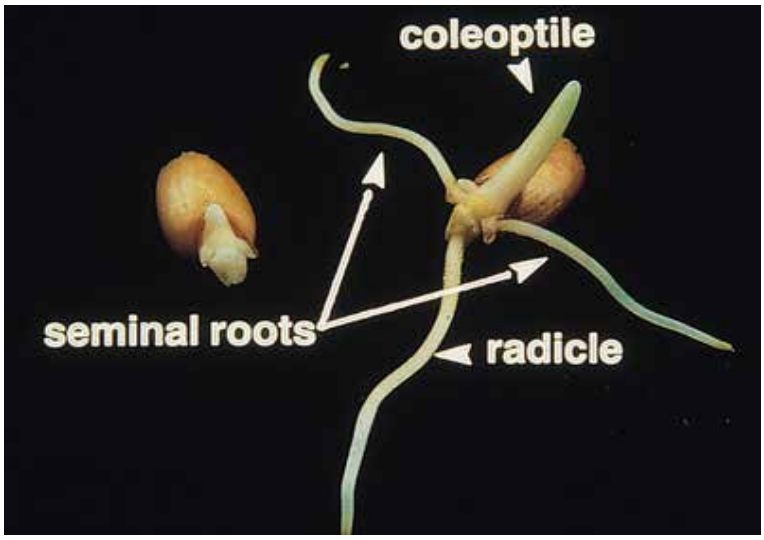

Figure 3: The coleoptile is the pointed, protective sheath that encases the emerging shoot as it grows from the seed to the soil surface. (Photo: David L. Hansen, University of Minnesota)

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

For wheat 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.

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 for wheat, in order to see what effect it may have on coleoptile length. [14]

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 [15]

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 through 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 factors not fully understood. The culmination 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. [16]

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

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. For a list of Australian International Seed Testing Authority laboratories, see Australian Seeds Authority.

Although 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

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

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

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

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. Cover with a little more sand or 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. [17]

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.

Seedborne disease generally cannot be identified from visual inspection, so requires laboratory testing. [18]

2.3.3 Seed purity

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 wheat. Ryegrass and black oats frequently appear in harvested grain samples and have the potential to infest otherwise clean paddocks.

More information

GRDC Podcasts: Driving agronomy. Variety checks increase

Sunvale case study

Research shows that impurity (variety contamination) is quite common in commercial Sunvale⊕ crops. Pure Sunvale⊕ remains moderately resistant to stripe rust and does not require in-crop fungicide management. However, if the Sunvale⊕ seed has been contaminated with a stripe-rust-susceptible variety, as evident in 16 of the commercial seed lots, then stripe rust may be prevalent and warrant chemical control. A simple variety mix-up (e.g. Sunvale 15⊕) also appears to be an issue, as well as variety misidentification, which meant that the crop did not have adult plant resistance to stripe rust.

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

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

Researchers were not surprised that high levels of impurity were observed in commercial Sunvale⊘ lots, given that it is a 17-year-old variety. Growers need to take care in ensuring variety purity and correct identification of seed lots for planting. This study also emphasises the value of growers conducting careful observation of head type and the pattern of disease distribution in crops that are showing unexpected disease reactions.

This is the first report of seed impurity being determined as the cause of unexpected stripe rust responses within a wheat variety. This situation is unlikely to be unique to Sunvale⊘ and may explain mixed reports of stripe rust levels commercially in more recently released, moderately resistant varieties such as EGA Gregory⊘. [19]

The GRDC has invested in the development of a new commercial, cost-effective DNA test to identify the variety and purity of wheat and barley samples.

2.3.4 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. The ideal storage conditions are as follows:

- 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 headspace may condense and fall back as free water, causing a ring of seed to germinate against the silo wall.
- Aeration, which 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 (Figure 4).
- No pests. Temperature <15°C stops all major grain insect pests from breeding, slowing their activity and reducing damage. [20]

[19] 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#TopOfPage

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

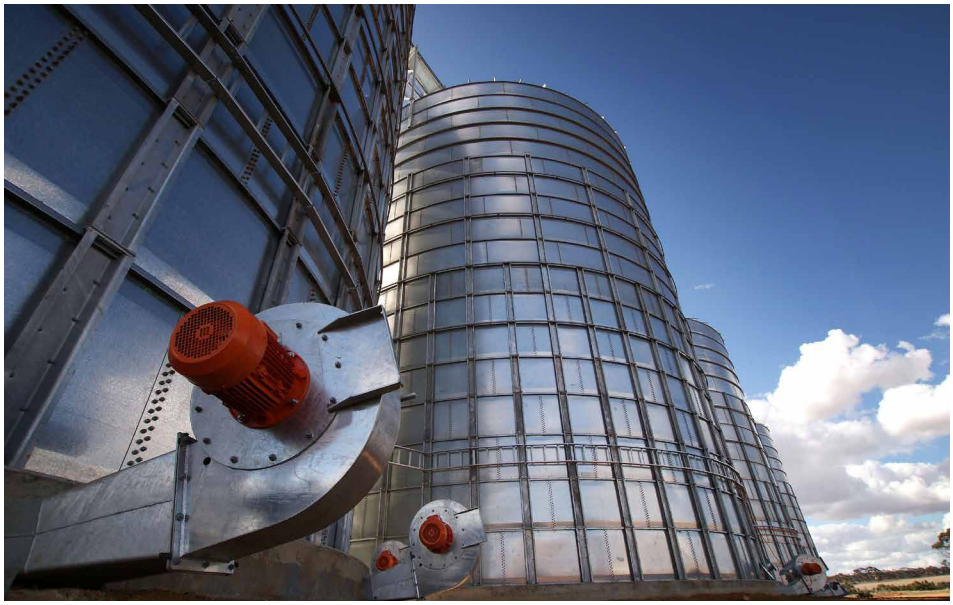

Figure 4: Aeration markedly reduces grain temperature. (Photo: Kondinin Group)

2.3.5 Safe rates of fertiliser sown with the seed

Crop species differ in tolerance to N fertiliser when applied with the seed at sowing. Research 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), application rate, row spacing and equipment used (such as a disc or tine), and soil characteristics such as moisture content and texture. [21]

The safest application method for high rates of fertilisers with high ammonium content is to place them away from the seed by physical separation (combined N–phosphorus products) or by pre- or post-plant application (N-only products). For fertilisers with lower ammonium content such as mono-ammonium phosphate, adhere to the safe rate limits set for the crop species and soil type. [22]

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, 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. [23] See Tables 4 and 5 for more detail.

Nitrogen rates should be adjusted 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.

[21] 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

[22] 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

[23] 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

Table 4: Approximate safe rates (kg/ha) of nitrogen as urea, mono-ammonium phosphate or di-ammonium phosphate with the seed of cereal grains if the seedbed has good soil moisture (at or near field capacity)

SBU, Seedbed utilisation is the amount of the seedbed over which the fertiliser has been spread; SBU% = (width of seed row/row spacing) x 100. Contact your agronomist or fertiliser supplier for other details on other blends

Soil texture	Seed spread 25mm			Seed spread 50mm		
Row spacing:	180mm					
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

Table 5: Urea (46% nitrogen) application rates (kg/ha) for wheat and barley on different soil types under good soil moisture conditions and different seedbed utilisation

	Seedbed utilisation rate (%)							
	5	10	15	20	25	30	40	50
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

More information

RMS Agricultural Consultants: Fertiliser toxicity

For more information, see GrowNotes Wheat South Section 3. Planting and Section 5. Nutrition and fertiliser.