

Choosing the right wheat variety for the system (part A)

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Key messages

Mace dominates the area sown to wheat in WA due to its consistent high yield over a large range of environments.

Avoid sowing Corack early in environments where staining is a risk.

Magenta and Cobra perform better than Wyalkatchem in high rainfall environments BUT staining and sprouting susceptibility are risks.

Background

The challenge for WA growers is choosing the right wheat variety for a system. Managing the risk factors and productivity within systems such as wheat on wheat and early sowing options is important. Mace has become a dominant variety across the state contributing to 53% of the area sown in 2013 (source: CBH and published in Wheat Variety Guide for WA, 2014). Productivity and grain quality have driven the adoption of the variety.

DAFWA agronomy trials and national variety trials (NVT) funded by GRDC are able to provide information to support growers with their decisions on variety choice and management for their farming system. The individual trial results provide an indication of a varieties performance at one location and one year. Collation of this information over a number of years provides another level of information. For example, the interrogation of the GRDC's NVT database by Young (2013) enabled direct comparisons of varieties in an Agzone. Comparisons of the yield of Mace to Wyalkatchem shows a consistent and stable advantage to Mace in a wide range of growing seasons from 2008 to 2012. Kelly (2013) described cluster analysis as the most accurate prediction of relative yield performance of varieties for an environment. Reporting on the outputs of clusters is expected to be available on the NVT online website.

A new method of analysis is proposed which will assist growers in an Agzone to choose a variety based on its performance relative to Wyalkatchem (and Mace with future analysis) if sown before or after the end of May. A second level of analysis to assess performance based on rainfall, rotation and soil pH is also provided.

Aims

The aim is to support growers with variety selection and management by providing:

- An understanding of whether the performance of current and new varieties (in terms of predicted yield) in an Agzone could be explained by a set of factors comprising sowing day (# in a year), soil pH, rainfall, soil texture or rotation.

Analysis will be based on National Variety Trial data and wheat agronomy research from WA. The focus of this analysis will be Mace, Magenta, Corack and Cobra and recently released varieties.

Method

Influence of factors (sowing date, soil pH, rainfall, soil texture or rotation) on variety performance

The GRDC national variety trials database (2007 – 2012) for wheat trials in WA and the site descriptions were provided by NVT online <<http://www.nvtonline.com.au>>. The yield data and trial site details included location, sowing day of the year, previous crop and soil pH in the surface soil (0-10 cm) and at depth (10 - 60 cm). Rainfall data was provided and modelled by Scott Chapman (CSIRO) and computed as the growing season rainfall (sowing to heading) for a mid-range cultivar for each trial.

Predicted yields for each NVT of each variety within each Agzone were described according to whether they were above (better) or below (worse) the predicted yield for Wyalkatchem. Three analytical tests were undertaken.

Logistic regression analysis was undertaken to test yield response of the variety compared to Wyalkatchem for the following factors

- 1) day of sowing before or after 31st May (d150);
- 2) subsoil soil pH (greater or less than 4.5); and
- 3) rainfall low (less than 160, 188, 242, 139, 189 and 265mm in Agzones 1-6 respectively)
- 4) rotation (Canola, Cereal and Legume - Lupin/pasture).

The regression coefficients were tested and provided an indication if the varieties predicted yields were superior or poorer compared to Wyalkatchem. Note: the factors (1-4) were considered separately.

The Fisher Exact Test (FET) was used to investigate if the varieties predicted yields in the NVT's relative to Wyalkatchem were higher (better) or lower (worse) when sown early (\leq d150) or when sown late ($>$ d150). The 'FET p-value' in Table 1 is an indication of the significance of the responses in each Agzone. If the p-value was less than 0.05, then the variety performed differently (better or worse) when sowing date was before or after the end of May (d150).

The binomial test was used to identify if a variety's predicted yield response was better or worse than Wyalkatchem irrespective of sowing day. The test was assessed in terms of odds of superior to inferior predicted yields compared to Wyalkatchem, and a binomial p-value was derived. If the binomial p-value was less than 0.05, then the variety performed better or worse than Wyalkatchem in each Agzone. Refer to the columns 'Compared to Wyalkatchem sown (\leq d150)' and 'Compared to Wyalkatchem sown $>$ d150' to identify if the response was better or worse.

Results and discussion

Sowing day influence on performance

Sowing day did not influence the performance of Mace relative to Wyalkatchem. Mace has performed better than Wyalkatchem when sown before or after d150 (Table 1, Binomial test p-value <0.05) in all Agzones except Agzone 6. In contrast, Cobra has performed better before d150 and worst than Wyalkatchem after d150 in Agzones 1 and 2 (FET test, $p<0.05$). In Agzone 3 Cobra performed better than Wyalkatchem both before and after d150 (however there was a small sample size) (Binomial test, $p<0.05$).

Corack yielded higher than Wyalkatchem when sown before or after d150 in all Agzones (Binomial test, $p<0.05$) except Agzone 6. However the risk factors for Corack are staining susceptibility in high rainfall environments (Table 2). Early sowing of this variety will increase the risk of reduced grain quality.

Trial number (sample size) will influence the results of the FET and Binomial analysis. In particular Agzone 4, 5 and 6 had small sample sizes. The analysis was based on research up to and including 2012. Inclusion of the 2013 data in further analysis will be important for analysis of the newer varieties in these zones.

The influence of rainfall, soil texture, soil pH and rotation on each variety's performance relative to Wyalkatchem was assessed using logistic regression analysis. There were a limited number of factors which significantly influenced the performance of these varieties.

In Agzone 2, both Magenta and Cobra performed better in the high rainfall and poorer in the low rainfall compared to Wyalkatchem (analysis not provided). However staining and low falling number with pre-harvest rain are risks in high rainfall environments but influenced by sowing time and season (Table 2). The analysis did not indicate if Corack, Cobra, Mace or Magenta performed better or worse than Wyalkatchem when subsoil pH was greater or less than 4.5.

When dry sowing and with no indication of when the season will break choosing a variety such as Mace, which performed better than Wyalkatchem when it was sown before and after d150 may be a risk management strategy. This is because if the variety was sown before d150, but emerged after d150, its performance is more likely to be better than Wyalkatchem at both sowing times. Other varieties which performed better than Wyalkatchem when sown before d150 could be targeted if sowing into moist soil or if there is an indication that the season will break close to seeding and before d150 (Table 1).

Table 1 The performance of a variety (better or worse) relative to Wyalkatchem, sown before (\leq) or after ($>$) d150 and based on the number of NVT's in each Agzone.

AgZone	Variety	N of trials sown \leq d150 $>$ d150		Compared to Wyalkatchem Sown \leq d150	Compared to Wyalkatchem Sown $>$ d150	FET p- value	Binomial p-value
1	Cobra	7	5	better	worse	0.02	1.00
	Corack	7	5	better	better	1.00	0.01
	Mace	16	7	better	better	1.00	0.01
	Magenta	17	10	worse	worse	0.19	0.05
2	Cobra	13	16	better	worse	0.03	0.71
	Corack	13	16	better	better	0.30	<0.01
	Mace	27	29	better	better	0.54	<0.01
	Magenta	34	48	better	worse	<0.01	0.32
3	Cobra	4	4	better	better	1.00	0.07
	Corack	4	4	better	better	1.00	0.01
	Mace	8	8	better	better	1.00	<0.01
	Magenta	14	11	better	better	0.41	0.04
4	Cobra	8	3	better	worse	0.55	1.00
	Corack	8	3	better	better	1.00	<0.01
	Mace	10	13	better	better	0.60	<0.01
	Magenta	13	20	worse	better	0.15	0.49
5	Cobra	9	1	same	worse	1.00	0.75
	Corack	9	1	better	better	1.00	0.02
	Mace	13	6	better	better	1.00	<0.01
	Magenta	22	8	worse	worse	1.00	0.02
6	Cobra	5	0	better	n/c [†]	1.00	0.06
	Corack	5	0	better	n/c [†]	1.00	0.38
	Mace	6	4	same	better	0.20	0.34
	Magenta	11	5	better	worse	0.28	1.00

Table 2 Comparison of the staining (%) of grain of wheat varieties sown at Binnu and Eradu in 2013

Location	Eradu	Binnu
Sowing date	9 th May 2013	8 th May 2013
Bonnie Rock	4.5	
Cobra	8.2	7.1
Corack	10.9	9.0
Emu Rock	8.9	
Mace	3.5	1.4
Magenta	10.9	
Wyalkatchem	6.3	4.0
LSD	2.0	0.8

(Source: Zaicou and Reynolds, DAFWA Trial and Demo reports 2014– on line in February)

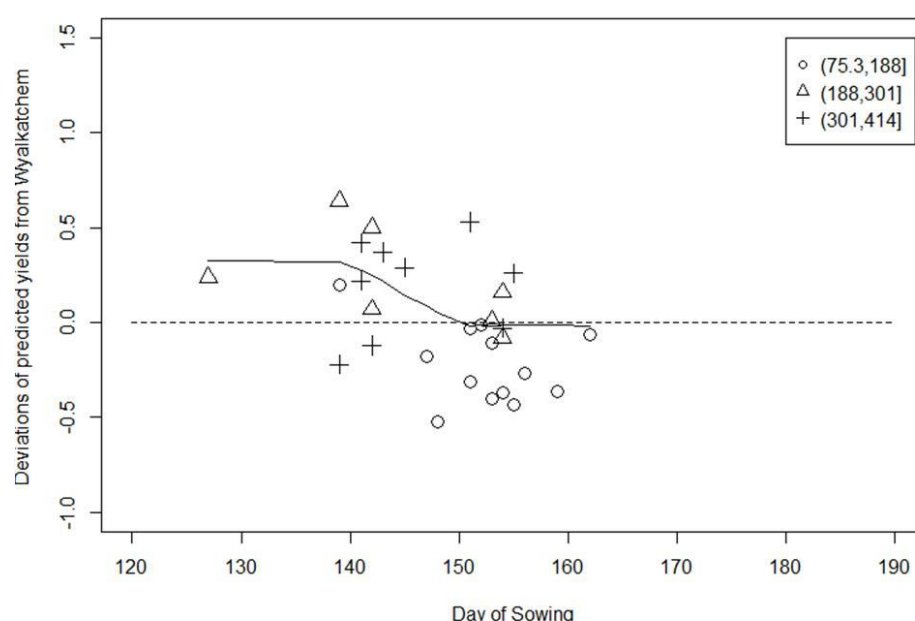


Figure 1 The difference (deviations) of predicted yield (Cobra - Wyalkatchem) for each NVT in Agzone 2 relative to sowing day of the year. Symbols indicate the growing season rainfall (mm) intervals. For example, the circle symbol indicates the interval >75.3 and ≤ 188mm.

Conclusion

A methodology to assess the performance of varieties using the NVT's has been undertaken to support growers with variety selection. The NVT data set from 2007- 2012 was analysed to assess how factors such as rainfall, soil pH, and rotation affect the performance of a variety. This information can be used to support growers in choice of variety given the break of the season and rainfall. The analysis did not provide a clear indication of which variety to choose given soil pH <4.5 or rotation.

The analysis validates the rapid adoption of Mace across the state and across sowing days. However the information must be used in collaboration with the knowledge of the agronomic traits. Mace dominates the area sown to wheat in WA due to its consistent high yield over a large range of environments. Avoid sowing Corack early in environments where staining is a risk. Magenta and Cobra perform better than Wyalkatchem in high rainfall environments BUT staining and sprouting susceptibility are risks.

Key words

National Variety trials, agronomy, wheat, varieties

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