Wheat 2012 NVT trial results and key agronomy issues

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KEY MESSAGES

Mace has rapidly become the dominant variety in WA for a number of very good reasons and is unlikely to be displaced in the immediate future. Varieties that have been released in recent years that are under consideration to complement Mace as a risk management strategy should be grown in situations that match their strengths. Analysis of NVT data 2008-12 indicates the following:

- Magenta best suited to early May sowing where there is a high probability of Yellow Leaf Spot (YLS),
- Emu Rock in short growing season areas that are likely to yield no more than 2t/ha,
- Corack where protein may be restricted to APW grade, YLS is a risk but there is a low probability of frost,
- Cobra where subsoil pH is below 5 ($CaCl_2$), YLS is a risk, and yields are likely to exceed 2.5t/ha,
- Estoc as a stem rust resistant alternative in the traditional Yitpi growing areas for early May sowing
- Scout or Envoy in the southern areas where a reasonable level of sprouting tolerance is required.

BACKGROUND

Unlike the eastern states of Australia where wheat breeding programs were established in the late 1800s, the development of dedicated wheat breeding programs in WA occurred in relatively recent times. From the 1970s through to the 1990's varieties bred in the eastern states dominated (e.g. Gamenya, Halberd, Spear, Stiletto) and Aroona). The first truly WA adapted varieties such as Gutha, Kulin and Amery were developed and began to make up a significant share of WA sowings from the 1980's, until the breakthrough varieties Westonia, Carnamah and Calingiri which dominated at the close of the century. These varieties combined Yellow Leaf Spot (YLS) resistance with acid soil tolerance and the ability to fill large plump grain under the stresses of the WA wheat belt. The release of the variety Wyalkatchem that combined all of those qualities with short stiff straw and a high harvest index in 2002 set a new benchmark for yield in WA (Figure 1).

Wyalkatchem dominated until Mace was released to growers in 2009. Bred from Wyalkatchem and Stylet (a Spear family wheat from Roseworthy) it combines many of the best traits from both families. This combination effectively lifted yield by around 5per cent on average and quality from APW to AH while broadening the already high level of adaptation to WA that Wyalkatchem had offered. The response from WA growers was rapid and by 2012 Mace already made up more than 40 per cent of the area sown to wheat in WA (Figure 1). With further increases in the area sown to Mace expected in 2013, the search is on for varieties that provide either a viable alternative or alternate strengths to Mace for WA.

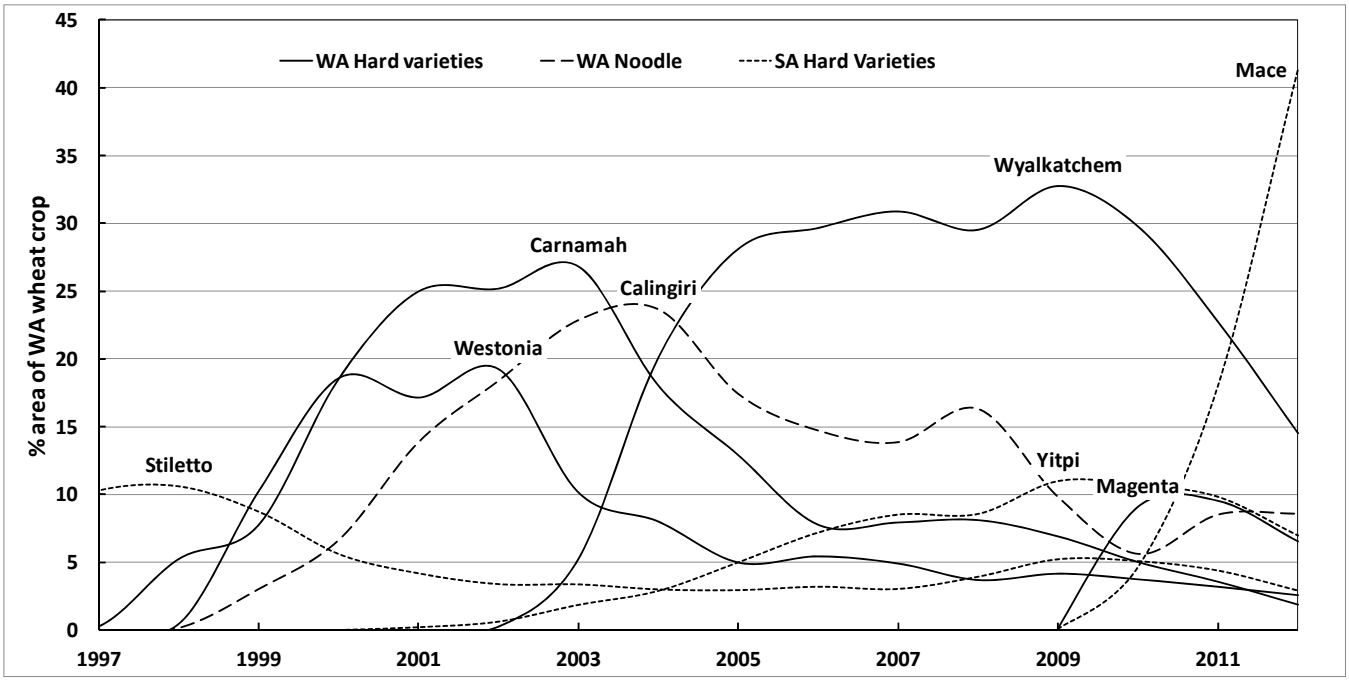

Figure 1. Percentage of area sown to the wheat varieties that have exceeded 10% of area sown to wheat in WA from 1997 to 2012. Data provided by Co-operative Bulk Handling Ltd.

AIMS

The aims of this study were to:

i) Analyse the NVT database to examine the performance of Mace in WA for the past five years and compare against recently released varieties
ii) Identify the attributes and potential roles for varieties that either complement or provide superior alternatives to Mace in WA.

METHOD

Yield data and trial site details including location, sowing date, previous crop and soil pH in the surface soil (0-10 cm) and at depth (10 - 60 cm) were downloaded from the NVT database for the years 2008 to 2012 from the website: http://www.nvtonline.com.au/

For each variety predicted mean yields from each trial were plotted against the yield of Wyalkatchem for each year and linear regressions fitted. Data was sorted by Agzone (see Shackley *et al* 2012 for map of Agzones of WA), previous crop, subsoil pH, and/or sowing date to look for any specific adaptation of any of the newer varieties compared to Wyalkatchem or Mace. The analysis was largely restricted to Agzone2 and 4 to minimise interactions between traits and vastly different environments as these represent the most similar environments and produce over half of WA's wheat production.

In particular, variety performance on subsoil with pH below 4.5 where there can be a marked increase in extractable Al (Wilson 1984); sowing dates prior to May 15th which would better suit long season varieties and the performance of varieties in a wheat-on-wheat rotation where Mace has been observed to perform poorly compared to Wyalkatchem were investigated.

RESULTS

The comparisons described above resulted in the production of hundreds of graphs and tables. Only those that represent the major strengths and possible weaknesses are presented here.

Yield performance of wheat variety Mace relative to other varieties

A direct comparison 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 (Figure 2).

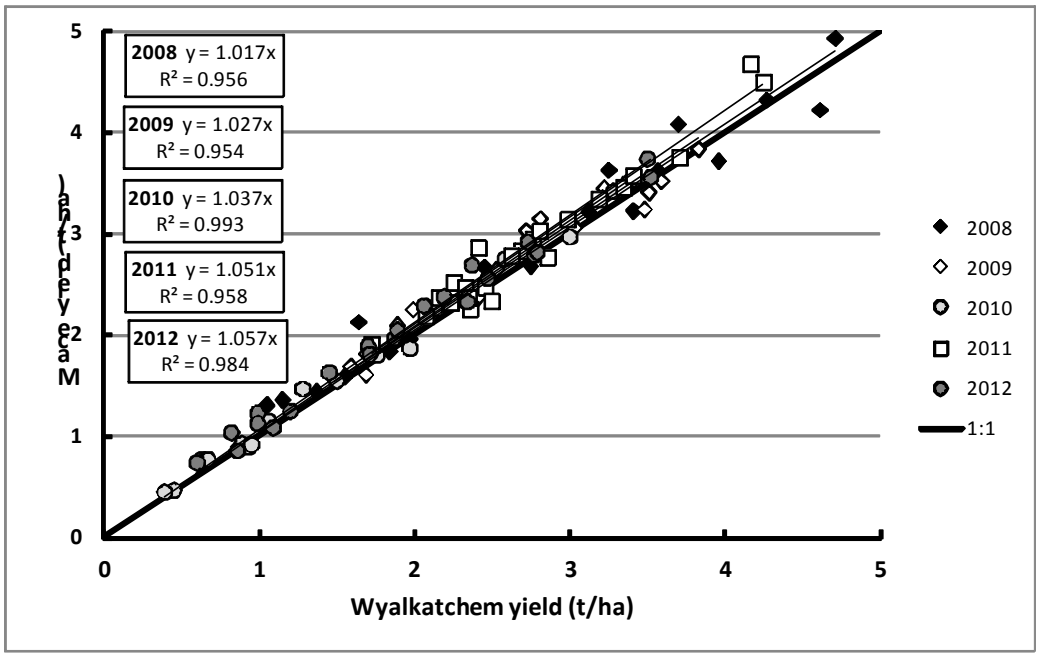

Figure 2. Grain yield (t/ha) of Mace compared to Wyalkatchem in Agzones 2 and 4 from 2008 to 2012.

By comparison other varieties released in the past 5 years were relatively unstable when compared in the same way. A good example is Magenta (later maturing variety best adapted to early sowing) which showed no consistent trend across years (Figure 3) or any advantage when sown early (data not shown).

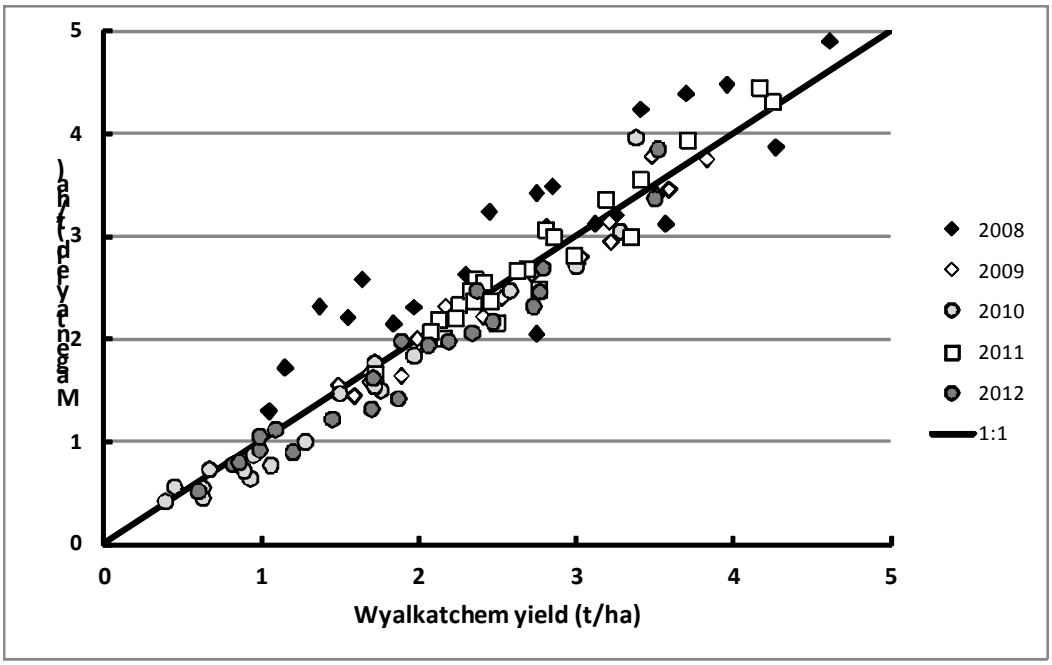

Figure 3. Grain yield (t/ha) of Magenta compared to Wyalkatchem in Agzones 2 and 4 from 2008 to 2012.

When Magenta is compared directly to Mace it is clear that in all years (other than 2008) its yield was not competitive with Mace (Figure 4) other than in isolated cases. The exception was 2008 a year with widespread frost damage that may have advantaged a later maturing line like Magenta in trials that were only marginally frost affected.

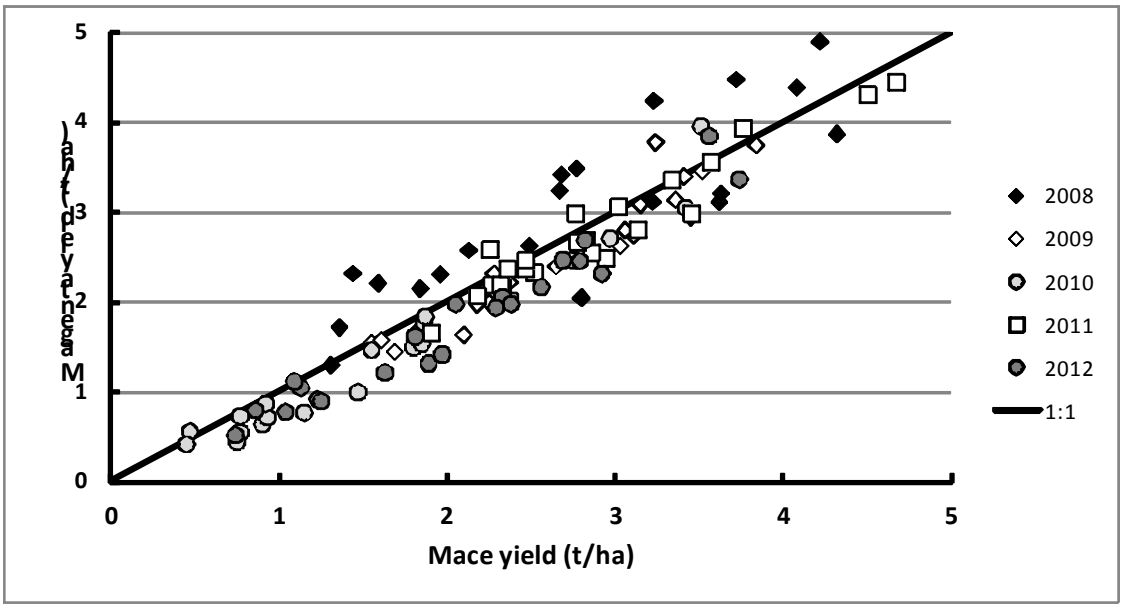

Figure 4. Grain yield (t/ha) of Magenta compared to Mace in Agzones 2 and 4 from 2008 to 2012.

Influence of previous crop rotation on relative yield

No difference in grain yield for Mace relative to Wyalkatchem following wheat was observed compared to the overall mean, when comparing the influence of the previous crop. This may be because wheat sown into wheat stubble does not guarantee a severe yellow leaf spot (YLS) infection without conditions conducive to onset of the disease. Data examined from two sites in 2011 (Mingenew and Buntine) where YLS was observed to be at very high levels (M Peipi, *pers. comm*) showed the varieties Magenta, Cobra and Corack to have superior YLS resistance to Mace, as reflected in higher grain yields (Table 1).

Table 1. Grain yield (t/ha and per cent relative yield) for wheat varieties sown at two NVT sites in 2011 (Mingenew and Buntine) under a high level of YLS infection

	Grain yield (t/ha)		Yield relative to Mace (%)	
Nearest Town	**Mingenew**	**Buntine**	**Mingenew**	**Buntine**
Sown	18/05/2011	25/05/2011	18/05/2011	25/05/2011
Mace	4.14	3.76	100	100
Magenta	4.61	3.94	111	105
Cobra	4.91	4.00	119	106
Corack	4.47	3.98	108	106
Scout	3.08	2.83	74	75
Wyalkatchem	4.64	3.71	112	99

Influence of subsoil (10 - 60 cm) pH on relative yield

Data demonstrating the relative performance of varieties with a higher degree of acid soil tolerance to low (< 4.5) subsoil pH showed variable results depending on site and season. The yield of Westonia (a variety recognised for acid soil tolerance) relative to Mace showed no clear trend when plotted against subsoil pH (data not shown). However, when data was restricted to 2011 (a year in which there was reasonable finishing rain and root growth was likely to extend into the high aluminium layer at depth) both Westonia and Cobra (bred from Westonia) appeared to have some advantage at low pH (Figure 5 a, b) though the results are variable.

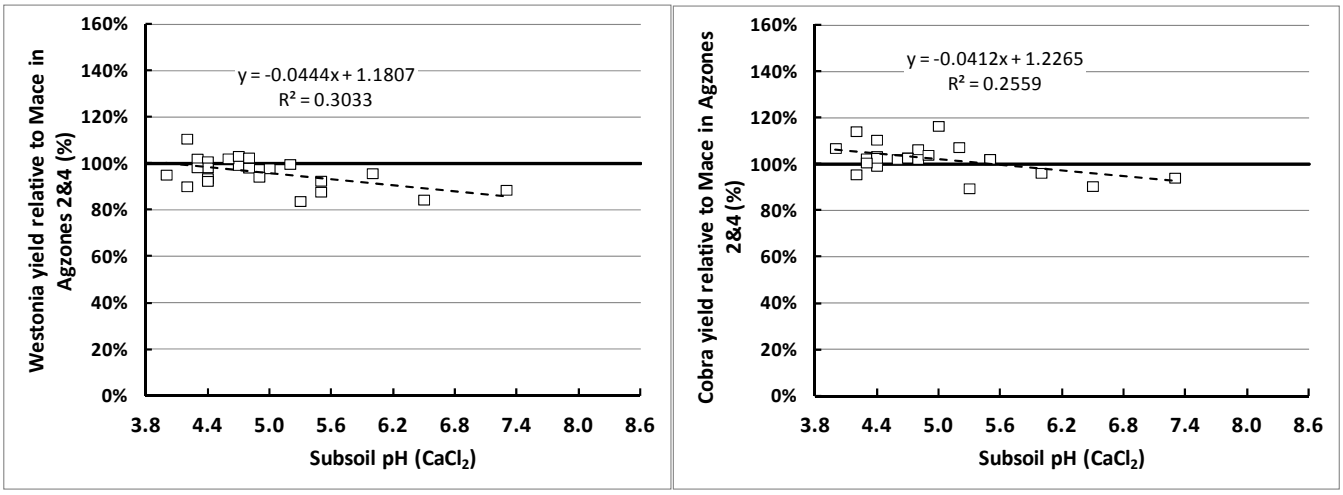

Figure 5. Grain yield (t/ha) of a) Westonia and b) Cobra relative to Mace across a range of sub-soil pH conditions for Agzone 2 and 4 in 2011. The dashed line represents the fitted linear trend.

In a much drier year (2010), Cobra showed no trend associated with subsoil pH. Relative yield compared to Mace across the two years, suggests that Cobra yields best at sites that exceed 2.5t/ha (Figure 6). No other varieties showed any clear trend with subsoil pH.

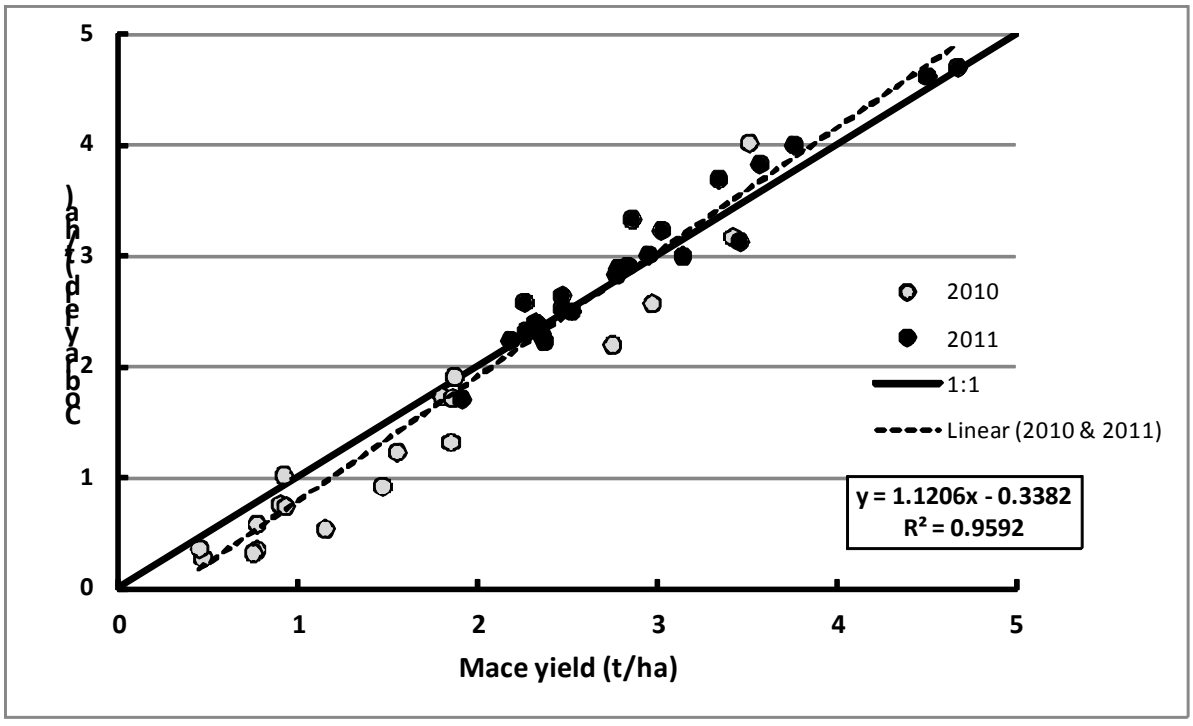

Figure 6. Grain yield (t/ha) of Cobra compared to Mace in Agzones 2 and 4 in 2010 and 2011.

Performance of earlier maturing varieties compared to Mace

Corack (bred from Wyalkatchem) is a variety that has on occasion shown a significant yield advantage over Mace as was observed in the contrasting years of 2010 and 2011 (Figure 7). However, yields in 2012 were erratic and generally lower than Mace (Figure 7) Temperature data from sites where Corack was significantly lower than Mace in 2012 revealed sub zero temperatures in August and September. This may suggest that Corack's slightly earlier maturity (compared to Mace) has disadvantaged it either during a frost event or period of moisture stress. Some doubt therefore exists in regards to Corack's yield stability.

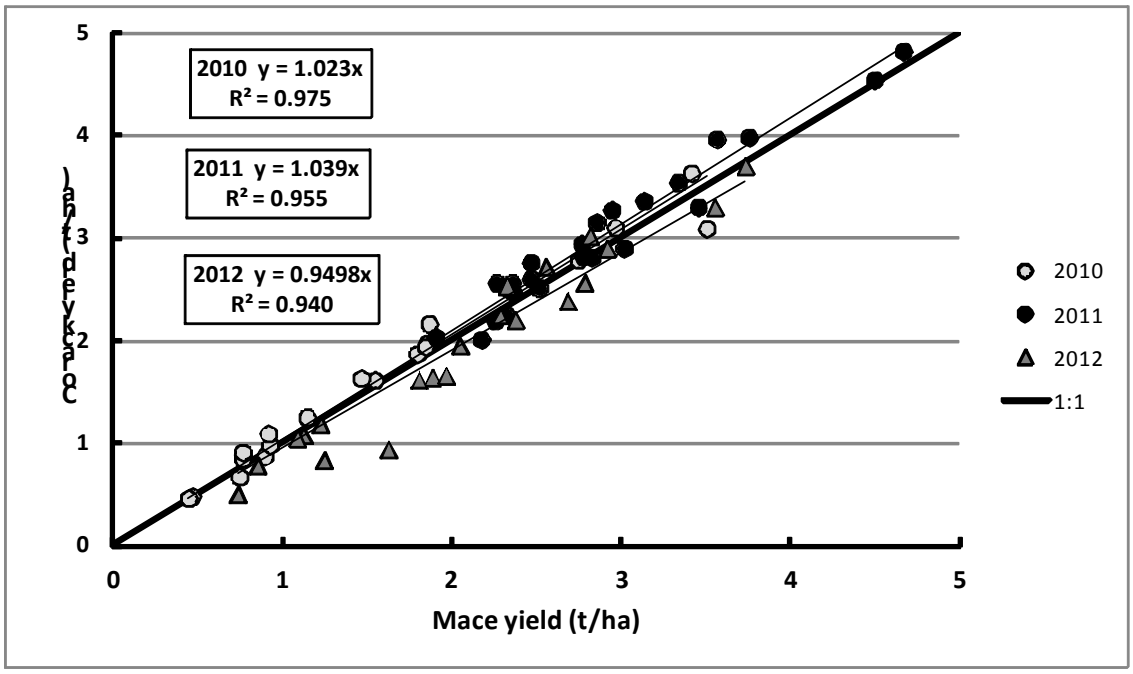

Figure 7. Grain yield (t/ha) of Corack compared to Mace in Agzones 2&4 in 2010 and 2011.

Another early maturing line recently released is Emu Rock. When compared over the three seasons that it has been tested (2010-2012) it appears that Emu Rock produces its best yield relative to Mace when the site yield was less that 2 t/ha (Figure 8). This suggests that Emu Rock may have an important role in the eastern wheat belt. This trend was not affected by subsoil pH.

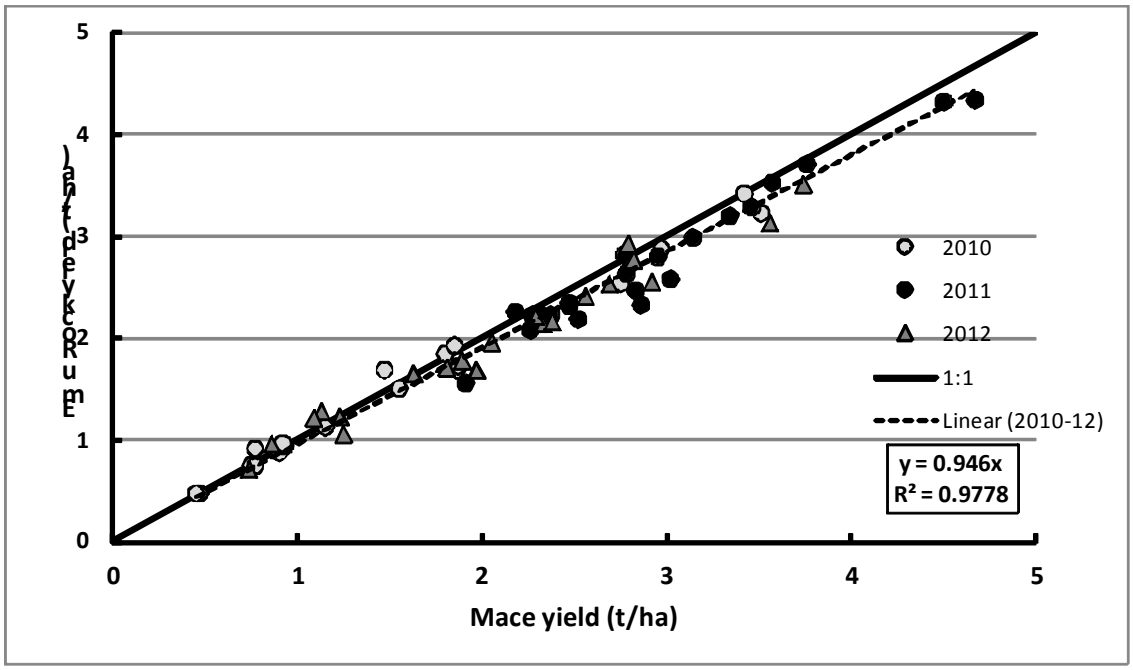

Figure 8. . Grain yield of Emu Rock compared to Mace in Agzones 2&4 in 2010-12 (t/ha).

Performance of later maturing varieties compared to Mace

For the South Coast and Lakes district there still appears to be a role for the Spear type wheats as complementary or viable alternatives to Mace. The most popular of these is Yitpi which complements Mace as a variety for early sowing, especially in areas of high frost risk. The recently released Estoc (also Spear family) demonstrates a positive yield advantage compared to Yitpi of approximately 6 per cent in Agzone 5 and 6 (Figure 9).

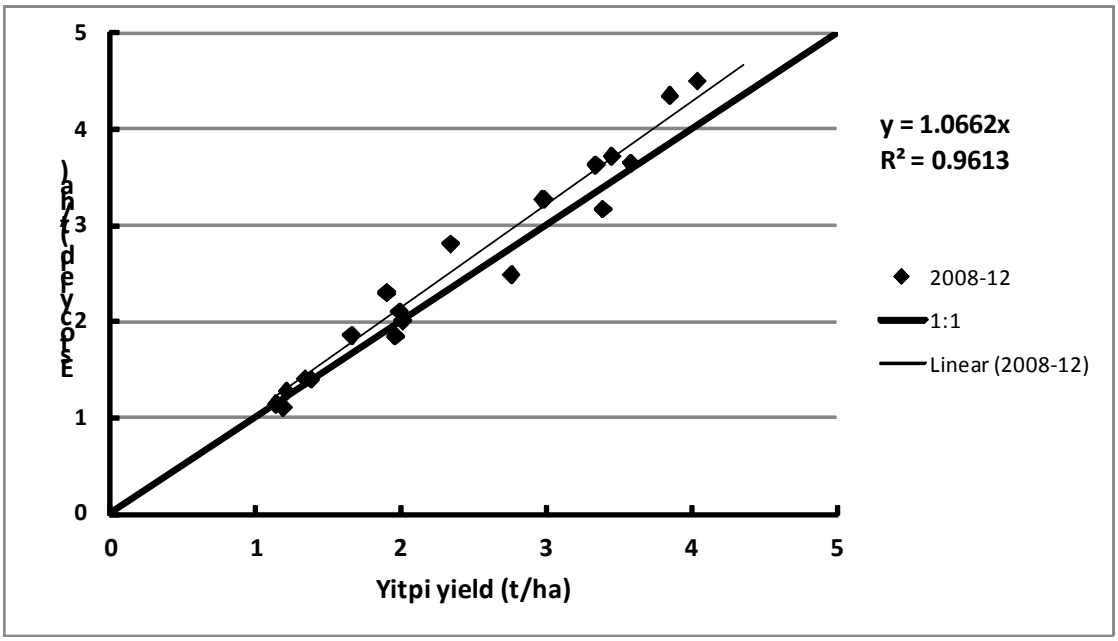

Figure 9. Grain yield (t/ha) of Estoc compared to Yitpi in Agzone 5 and 6 in 2008-12.

The Spear family wheats are very susceptible to YLS and have moderate tolerance of harvest rain and as such are better suited to the southern areas of the state. Recent research has also shown that the Spear type wheats (especially Yitpi) are slightly less susceptible to frost damage at flowering than Wyalkatchem types (Ben Biddulph *pers. comm.*). Estoc has a late maturity similar to Yitpi and may be a suitable rust resistant alternative, while the earlier maturing Scout and Envoy are far more competitive with Mace in the southern regions where YLS is less prevalent.

CONCLUSIONS

The consistently high yield of Mace compared to all other varieties in the NVT trials in the five seasons from 2008 to 2012 has confirmed that the rapid rate of adoption by WA wheat growers is justified. Alternative varieties released in the last 5 years have shown specific areas of adaptation that warrant them being considered as profitable alternatives to Mace. The varieties and their likely roles that match their strengths are as follows:

- Magenta (APW) has performed best when YLS is at high levels and being later maturing than Mace (AH) is best adapted to early May sowing.
- Emu Rock (AH) is an early maturing variety that produces the most competitive yields around 2 t/ha and below, and as such may have an important role in the lower rainfall regions.
- Cobra (AH) has improved YLS resistance and has out-yielded Mace on low pH subsoils where yields are above 2.5 t/ha.
- Corack (APW) out yielded Mace in the contrasting years of 2010 and 2011 however its yield in 2012 was very erratic.
- Estoc (APW) is a later maturing Spear type wheat that is a rust resistant alternative to Yitpi with a possible yield advantage of around 6per cent in Agzones 5 and 6.
- Scout (APW) and Envoy(APW) are earlier maturing Spear type wheats that are more competitive with Mace in the south where YLS is less prevalent and sprouting tolerance is important.

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KEY WORDS

Wheat, varieties, National Variety Trials, grain yield

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