

# Not Everything Yellow is a Lemon...

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RESEARCH

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## Key messages

- **Yellowing of wheat leaves, similar to the old 'Frame yellows' has been observed again in SA over the last few years.**
- **There does not seem to be a clear cause of the yellowing.**
- **Yellowing can lead to yield reductions, but also yield increases!**
- **The effect of yellowing on the relative performance of varieties is far less than the effect of all the other traits that go into making a good variety.**
- **If anyone has any ideas on what is causing this yellowing – send them through!**

## Why do the trial?

Growers have been reporting mysterious leaf yellowing (often forming in blotches and sometimes stripes) in some of their wheat crops, so we wanted to look into the cause and effects of yellowing so that growers can make effective management decisions.

Crop diseases can lead to a reduction in profit either through reduced production, or the added cost of control measures

(i.e. fungicide application). The last thing anyone wants to do is spend money controlling a 'disease' if it isn't actually going to cause any yield damage. So for this mysterious yellowing, we want to know the answers to three questions: 1) does yellowing actually cause any yield loss, 2) what is causing the yellowing to occur, and 3) if it is necessary, how can you control it?

This work focussed mainly on question number one – does yellowing even matter (and to some extent we looked into its possible causes)?

## How was it done?

1. AGT variety yield trials are scattered over the cropping zone of Australia, so within any one year we have the opportunity to observe a lot of different diseases. In 2008 and 2009, yellowing was scored at eight different locations across southern Australia and its effect on grain yield was investigated.
2. At Roseworthy in 2008, tissue samples were taken from plants affected and unaffected by the yellows and their nutrient status was compared.

## What happened?

At four of the eight locations where yellowing was observed (Elmore, Roseworthy, Pinnaroo & Coomalbidgup), there was no effect of yellowing on yield (Table 1). In other words, varieties with a high degree of yellowing performed just as well as those with low levels of yellowing. The yields at the remaining four sites were affected by yellowing – but the results were not the same at all sites. Varieties with yellowing yielded less than the lines without yellowing at the high yielding (and relatively stress free) sites Winulta, Lake Bolac and Dookie, but at Kumarl (very similar to much of the EP) which suffered terminal heat and water stress, varieties with more yellowing actually yielded more than those without yellowing! Why would this happen? Perhaps at the high yielding sites where moisture was not limiting, the loss of green leaf area led to a reduction in yield? At Kumarl, where heat and drought were bigger factors, the reduction in green leaf area (and therefore water use) may have been an advantage. Regardless of the reason, it seems that even when yellowing is present in a trial, it is often not responsible for any yield differences between varieties.

**Table 1 Effect of leaf yellowing on wheat variety performance in southern Australia**

Location	Significance of yellowing on yield	Average yield (t/ha) of <u>least</u> yellow lines	Average yield (t/ha) of <u>most</u> yellow lines
Coomalbidgup (WA)	Not significant		
Dookie (Vic)	$P \leq 0.01$	2.90	2.69
Elmore (Vic)	Not significant		
Kumarl (WA)	$P \leq 0.001$	2.15	2.52
Lake Bolac (Vic)	$P \leq 0.01$	2.96	2.43
Pinnaroo (SA)	Not significant		
Roseworthy (SA)	Not significant		
Winulta (SA)	$P \leq 0.05$	3.07	2.81

So how did a variety like Axe (which tends to suffer from the 'yellows') perform in comparison to a variety like Wyalkatchem which tends to remain greener? In Figure 1 you can see that at these eight sites where yellowing was observed, varieties that are often affected by the 'yellows' (Axe, Gladius, Correll) did not suffer a yield penalty when compared to a variety like Wyalkatchem. Why is this? Well even at the sites where yellowing did affect yield, it was only responsible for 3-5% of the variation in yield between varieties – most of the differences between varieties is due to all the other traits that go into making a variety yield well. This can be seen when we compare Mace and Wyalkatchem (neither of which go very yellow – usually) across all sites: there is a bigger difference between these two varieties than between any of the other varieties and this is simply because of the elite yield genes that have been bred into Mace.

### So what is causing this yellowing?

The simple answer is: we still don't know. We cannot find any evidence of disease. And when we took leaf samples at Roseworthy in 2008 from affected and unaffected leaves (from the same plant and different plants) we could not find any consistent differences between them (eg iron or zinc differences). Our best guess (and it really is a guess), is that it is a genetically inherited physiological trait that is triggered by some environmental conditions that are still unknown. Axe, Gladius and Correll all have the drought tolerant line RAC875 in their pedigree and it seems fairly likely that they have inherited this yellowness along with the drought tolerance genes from RAC875. The good news is that varieties such as this that tend to go yellow, are still able to show high yields across a range of environments.

### What does this mean?

- There does not seem to be any obvious disease or nutrient imbalance present when this yellowing is observed. So there does not seem to be any control options.
- Growers are still best off picking varieties based on performance data from their local area. That way, they are likely to grow varieties that have the resistances and tolerances that are needed to perform well on their farm.
- We would still like to find out what is causing this yellowing because no one wants to grow a yellow crop, even if it still yields well.
- If you have noticed any trend, or possible reason for the yellowing, feel free to send through your ideas!

### Acknowledgements

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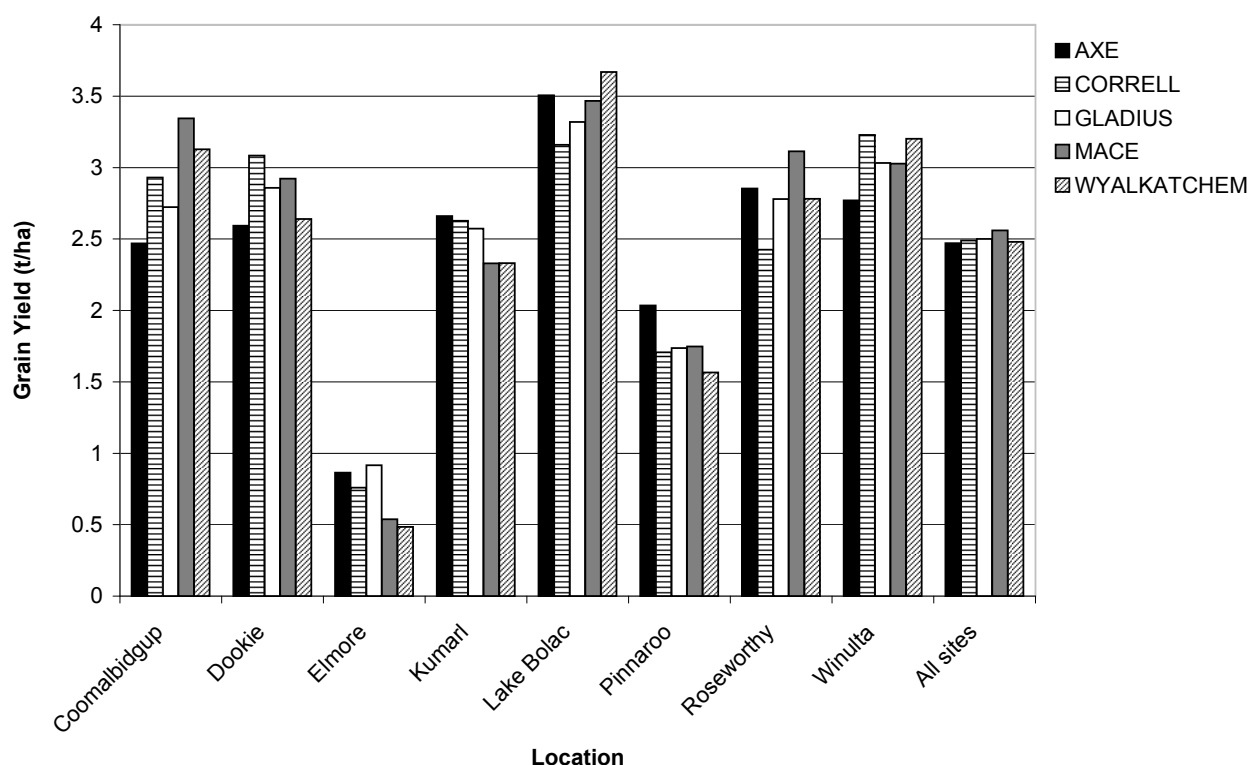


Figure 1 Performance of varieties at locations affected by 'leaf yellows'

