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Yellowing in Wheat

This research note was first published in 2009, and has been updated in 2013 in response to the yellowing that has been observed in this season; particularly in the variety Kord CL Plus®.

Key Messages

- Yellowing of wheat leaves, similar to the old 'Frame yellows' has been observed again in southern Australia 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

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 to help growers make effective management decisions.

Crop diseases can lead to a reduction in profit either through reduced production, or the added cost of control measures (ie. 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 wanted 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? Our research focussed mainly on question 1: does yellowing even matter (and to some extent we looked into its possible causes).

How was it done?

1. AGT yield trials are scattered over the cropping zones of Australia, so within any one year we have the opportunity to observe a lot of different diseases and leaf symptoms. In 2008 and 2009, yellowing was scored at eight different locations across southern Australia and its effect on grain yield investigated.

2. At Roseworthy in 2008, tissue samples were taken from plants affected by the yellows as well as unaffected plants, and their nutrient status compared.

'Yellows' on Axe® wheat

What happened?

At four of the eight locations where yellowing was observed (Elmore, Roseworthy, Pinnaroo and Coomalbidgup), there

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

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

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. At the high yielding (and relatively stress free) sites Winulta, Lake Bolac and Dookie, varieties with yellowing yielded less than the lines without yellowing, but at Kumarl 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.

So what is causing this yellowing?

The simple answer is: we still don't know. We cannot find any evidence of disease. 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). In nitrogen rate experiments we have seen that the yellows is reduced when nitrogen status is increased, but there is no evidence to suggest that the crops are actually nitrogen deficient (ie. increase their yield in response to nitrogen application more than 'non-yellow' varieties). 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. Kord CL Plus$^{\Phi}$, Grenade CL Plus$^{\Phi}$, Justica CL Plus$^{\Phi}$, Axe$^{\Phi}$, Gladius$^{\Phi}$ and Correll$^{\Phi}$ all have the drought tolerant line RAC875 in their pedigree and it seems fairly likely that they have inherited this yellowness 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 nutritional imbalance present when this yellowing is observed. Therefore 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
- If you have noticed any trend, or possible reason for the yellowing, please contact AGT

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