Seasonally dependent herbicide responses in barley cultivars

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Introduction

Herbicide tolerance testing has previously identified herbicides Cadence® and Tigrex® as being damaging to specific barley cultivars. However a large degree of seasonal variability in sensitive cultivar yield responses to these herbicides has also occurred. Potential underlying causes of this seasonal variability, were investigated in this experiment.

Methodology

- ❑ Field trials conducted, strip plot designs, 2003-2009.
- ❑ Cadence® (200g/ha), Tigrex® (1L/ha) applied at GS15.
- ❑ Harvested yields analysed across years using linear mixed spatial methods of analysis.
- ❑ Annual yield analyses compared to seasonal climate data including: Growing Season Rainfall (GSR), Daily rainfall, Max temps, Min temps and Solar radiation.

Figure 1a: Tigrex® symptoms on barley leaves

Figure 1b: Cadence® damage in 2010 herbicide tolerance preliminary trial showing biomass retardation and prostration of cultivars (2nd bay).

Table 1: Barley cultivar grain yields under Tigrex® and Cadence® herbicide treatments from 2003 to 2009 at Kybunga, South Australia.

	Herbicide, Rate and Application Timing																		
	Untreated Control							**MCPA + Diflufenican (Tigres®)** (250 + 25 g ai ha-1) Z(16,22)							**Dicamba (Cadence®)** (140 g ai ha^{-1}) Z16,22)				
	Year																		
Cultivar	03	04	05	06	07	08	09	03	04	05	06	07	08	09	06	07	08	09	
	t/ha							as% of untreated control											
Buloke	-	-	-	1.45	2.07	1.71	3.46	-	-	-	96	94	101	100	89*	91*	93	105	
Capstan	5.52	1.86	-	-	-	-	-	99	90*	-	-	-	-	-	-	-	-	-	
Commander	-	-	4.74	1.45	1.9	-	-	-	-	100	98	99	-	-	88*	101	-	-	
Dhow	4.86	-	-	-	-	-	-	101	-	-	-	-	-	-	-	-	-	-	
Flagship	-	-	4	1.57	2.04	1.93	3.1	-	92*	97	96	101	94	101	94	93	100	86*	
Fleet	-	1.84	4.33	1.68	-	-	-	-	93*	99	92*	-	-	-	-	-	-	-	
Hindmarsh	-	-	-	-	2.65	2.41	3.54	-	-	-	-	92*	95	102	-	100	105	102	
Maritime	5.34	1.8	4.07	-	-	-	-	97	93*	97	-	-	-	-	-	-	-	-	
Torrens	4.17	-	-	-	-	-	-	98	-	-	-	-	-	-	-	-	-	-	
Yarra	-	-	4.67	1.65	1.95	-	-	-	-	99	96	100	-	-	91	94	-	-	
Mean	4.97	1.83	4.36	1.56	2.12	2.02	3.37	99	92	98	96	97	97	101	90	96	99	98	

*Shading denotes a significant yield reduction (p<0.05).

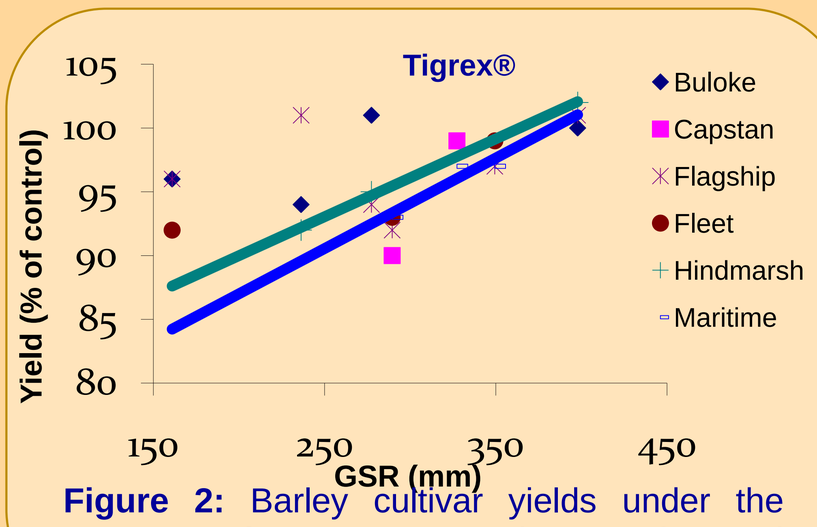

Figure 2: Barley cultivar yields under the treatment **Tigrex®** expressed as % of control across varying Growing Season Rainfalls

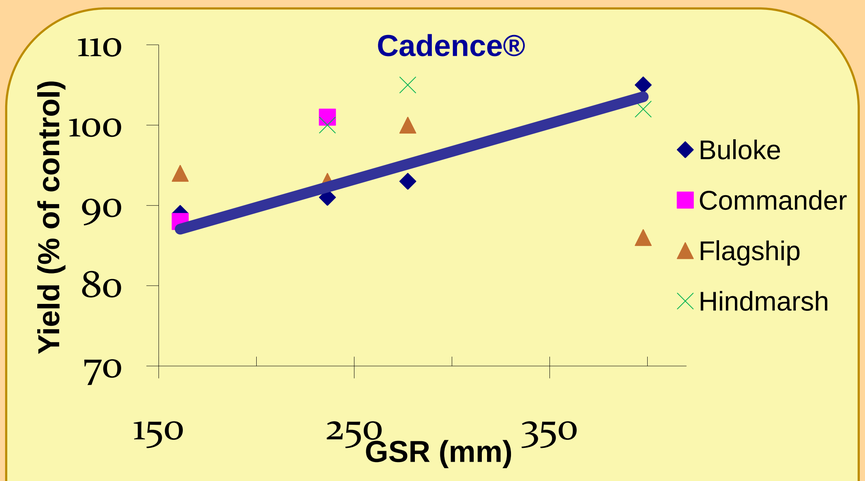

Figure 3: Barley cultivar yields under the treatment **Cadence®** expressed as % of control across varying Growing Season Rainfalls

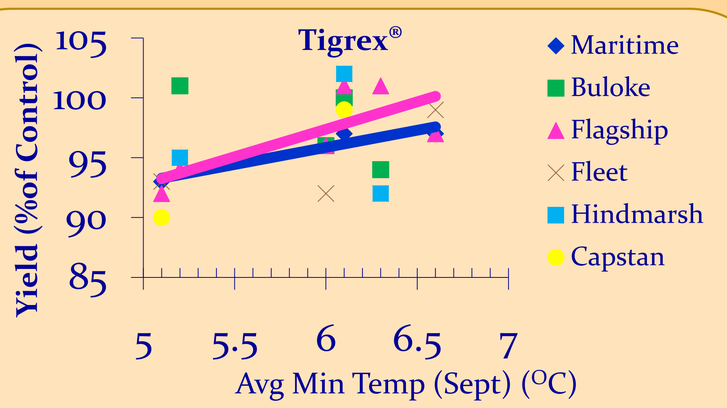

Figure 5: Barley cultivar yields expressed as % of control across varying minimum average temperatures for the month following Tigrex® application

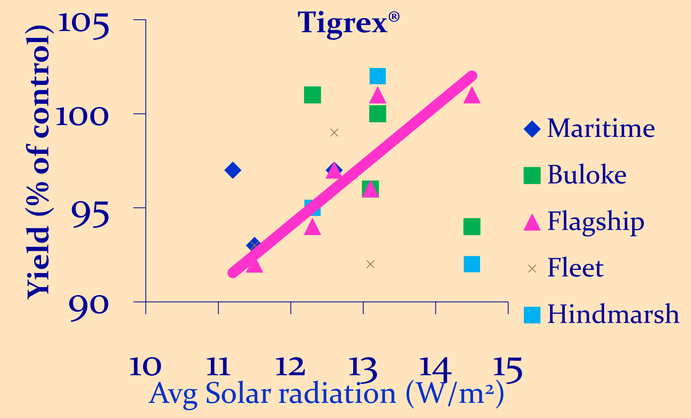

Figure 4: Barley cultivar yields expressed as % of control across varying seasonal solar radiation s for the month of Tigrex® application

Key Findings

- ❑ **Cadence®** most consistently damaging in Buloke, but seasonally variable.
- ❑ A linear increase in Buloke yield observed under an increase in GSR after Cadence® treatment. (Fig. 3)
- ❑ **Tigrex®** damaging in Flagship, Fleet, Maritime and Hindmarsh.
- ❑ Maritime and Hindmarsh yield responses gave a linear increase with GSR (Fig 2.)
- ❑ Flagship yields (after Tigrex®) have a positive linear relationship with avg. Sol. radiation at application (Fig. 4)
- ❑ Figure 5 highlights an increasing linear relationship between average min temps and Maritime and Flagship yield responses (Fig. 5)

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Conclusions

Growing season rainfall appears to influence the level of damage seen from Cadence® in sensitive cultivar Buloke, and from Tigrex® in cultivars Maritime and Hindmarsh. Solar Radiation at the time of application and min temps following application appeared to influence the response of Flagship yields to Tigrex® providing clues as to the cause of variation in yield responses across seasons. Further investigation of conditions surrounding the days of application with particular reference to these seasonal indicators (GSR, min temps and sol radiation) may reveal more specific information on conditions conducive to crop damage in sensitive cultivars.