Early sowing in 2014 – how did it go?

James Hunt, Brad Rheinheimer, Tony Swan, Laura Goward
CSIRO Agriculture

Neil Fettell
Central West Farming Systems

Barry Haskins, Rachael Whitworth, Mat Ryan
AgGrow Agronomy

Tony Pratt
FarmLink Research

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Take home messages

- If sowing before 20 April, winter wheats (Wedgetail, Wylah, Whistler, Osprey) are at lower risk of stem frost damage than slow maturing spring wheats (e.g. Eaglehawk, Lancer, Bolac, Forrest).
- Keep spring wheats within 5-7 days of their optimal sowing date e.g. if Gregory's optimal sow date is 5 May, then don't sow it any earlier than 29 April.
- Be prepared to back-up imidacloprid treated seed with foliar insecticides if aphids are persisting in to autumn. Common wisdom in NZ is that imidacloprid activity ceases at the start of tillering.

Background

Southern NSW was one of the areas hardest hit by stem frost in July and August 2014, and this combined with heavy aphid infestations (due to above average temperatures in May) transmitting BYDV definitely took the shine off a lot of early sown crops. The early sowing trial sites at Junee Reefs and Rankins Spring were among the worst frost affected areas, and results from these trials highlighted some lessons for managing early sown crops into the future.

However, despite stem frost and BYDV, early sowing was certainly not the disaster many thought it would be. As a general rule, yields of early sown crops tended to be the same or slightly less than main season crops, with some notable commercial and trial exceptions, both positive and negative. To put 2014 in perspective, early sowing of slow maturing cultivars in southern NSW did not work as well as it has in previous years, but it wasn't terrible and this is the first year for a very long time where sowing early wasn't by far the most profitable thing to do.

Managing the risk of stem frost and BYDV in the future

Warm conditions in the first half of May made crops more vulnerable to stem frost. Above average temperatures put crops 11 days ahead of average by the time frosts hit in July. Crops that had moved from vegetative to reproductive phases (i.e. past Z30) were vulnerable.

Whilst the stem frost of 2014 was unprecedented in extent and severity, we can't ignore the potential for it to happen again. There are convincing links between the increasing occurrence and severity of frost events in SE NSW and anthropogenic climate change. Periods of above average temperatures during autumn are also likely to increase in frequency as the earth warms, which have the potential to accelerate the development of crops and make them more vulnerable to frost. It will also change the behaviour of insect vectors of viruses such as BYDV. We therefore have to learn what we can from 2014 in order manage these risks into the future. Big lessons from trials and grower experience in 2014 are;

1. If planting before 20 April, winter wheats (Wedgetail, Wylah, Whistler, Osprey) are at lower risk of stem frost damage than slow maturing spring wheats (e.g. Eaglehawk, Lancer, Bolac, Forrest). This is because winter wheats are slower to move from the vegetative to reproductive stage than slow maturing spring wheats, which are held back during stem elongation by photoperiod sensitivity. Winter wheats also have greater frost tolerance than spring wheats when both are in the vegetative stage. Provided they flower at the same time, yields of the best winter wheats are equivalent to yields of the best slow maturing spring wheats.
2. Keep spring wheats within 5-7 days of their optimal sowing date e.g. if Gregory's optimal sow date is 5 May, then don't sow it any earlier than 29 April. A lot the crops very badly affected by stem frost were sown much earlier than their optimal sowing date. Unless it is a very dry year, there is no real upside to sowing much earlier than a cultivar's optimal date.
3. In early sown crops be prepared to back-up imidacloprid treated seed with foliar insecticides if aphids are persisting later into autumn. Common wisdom in NZ is that imidacloprid activity ceases at the start of tillering.

2014 trial results

Rankins Springs

This site was deliberately situated on a long (18 month) fallow to see what role early sowing might play in making the most of stored soil water in long fallows. Highest yields at this site came from winter wheat cultivars Wedgetail and Osprey sown in mid-April (Table 1). Wedgetail and Osprey out-yielded the best spring wheat (Gregory) sown in mid May by 0.8 t/ha despite being 12 and 32 years old respectively. This highlights the benefits of using slow maturing varieties and early sowing to take advantage of stored soil water in long fallows in the W NSW environment. It also highlights the lower exposure to stem frost of winter wheats. All spring wheats at the first time of sowing were affected by stem frost to a greater or lesser degree, whereas the winter wheats Osprey and Wedgetail almost entirely avoided it (Table 1). There was no stem frosting in the second time of sowing, however some of the faster maturing varieties may have been damaged by further frosts in mid-September. The high yields at this site were achieved by top-dressing 115 kg/ha N in July targeting 6 t/ha at 11% protein based on Yield Prophet forecasts suggesting high yields were likely given stored soil water from long fallow and the favourable start to the season. This high rate of N would also have affected the ability of stem-frosted treatments to re-tiller.

A density treatment at the mid-April sowing targeting 30, 60 and 90 plants/m² achieved densities of 23, 52 and 76 plants/m² averaged across cultivars. Establishment was patchy in the low density treatment, but despite this there was not a big effect of density on yield in most cultivars.

Table 1. Grain yield and infertile tillers (stem frost damage) from two times of sowing (including three different plant densities at the mid-April sowing) at Rankins Springs in 2014.

	Grain yield (t/ha)				Infertile tillers (tillers/m²)			
	Mid April			Mid May	Mid April			Mid May
Plant density (plants/m²)	23	52	76	70	23	52	76	70
Bolac	3.8	3.7	3.5	4.5	157	249	221	0
Dart	3.2	3.6	3.8	3.9	226	242	288	1
Eaglehawk	4.4	4.4	4.2	4.3	40	31	34	0
Gregory	4.1	4.0	4.0	4.9	203	180	243	0
Lancer	4.5	4.6	4.5	4.4	168	170	181	0
Osprey	5.3	5.7	5.1	4.7	2	19	23	0
Spitfire	3.7	3.4	3.1	4.1	227	225	323	0
Suntop	4.1	4.4	4.2	4.7	226	271	237	5
Sunvale	4.1	3.9	4.0	4.4	99	97	125	4
Wedgetail	5.7	5.7	5.7	4.6	0	1	12	1
P-value	<0.001				<0.001			
LSD (p=0.005)	0.5				68			

Junee (Hart Bros Seeds)

At Junee there were 18 individual stem frost events in 2014, 75 frosts (<2°C) in total including several in the period around anthesis in the first two weeks of October (Figure 1). There was also a string of hot days at anthesis. Wedgetail sown 7 April suffered 24-34 % stem frost damage and was not able to yield as well as Gregory and Suntop sown 21 May (Table 3). However, with the best agronomy treatment (100 plants/m² with all N fertiliser deferred until after Z30) it came close in spite of stem frost and severe BYDV infection. The results of the agronomy treatments highlight the importance of deferring top-dressing of N in early sown crops until after Z30.

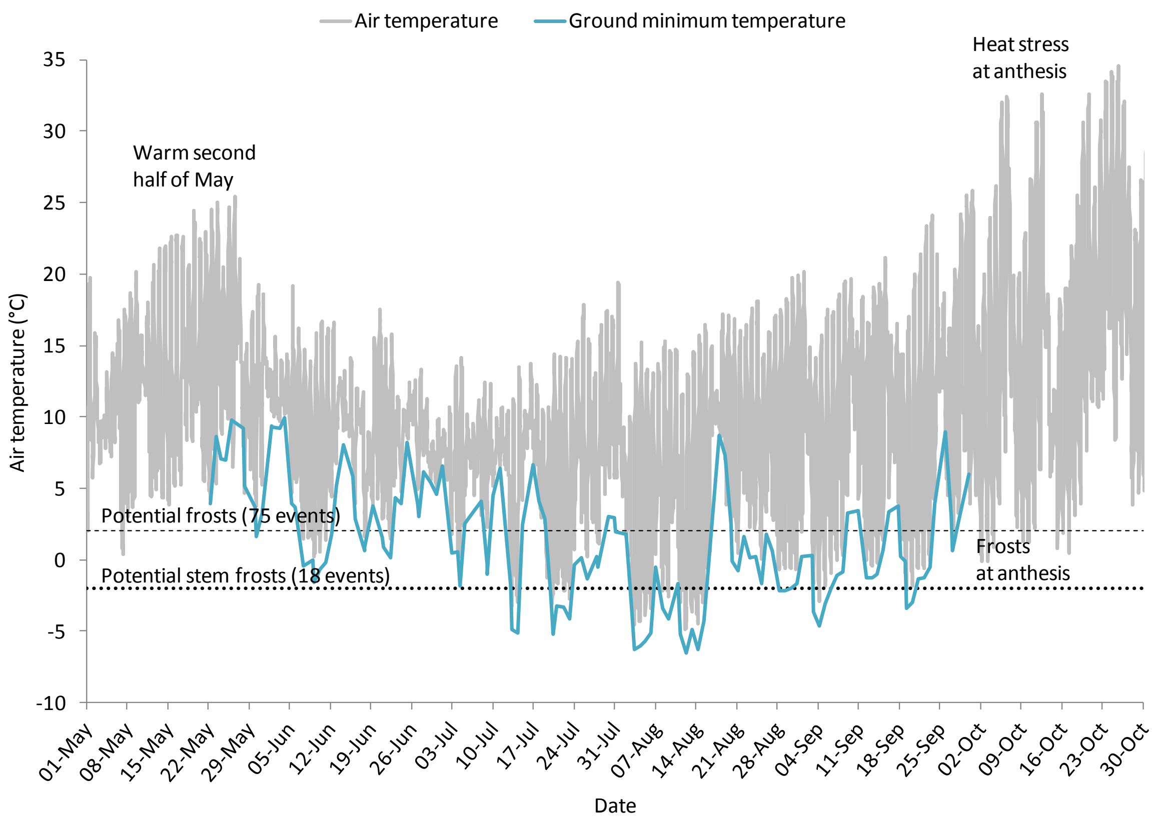

Figure 1. Air temperature at screen height and ground minimum temperatures for the 2014 growing season recorded at the Junee early sowing trial site at Hart Bros Seeds.

Table 3. Grain yield and frost damage of Wedgetail sown 7 April with different agronomy treatments applied vs. Gregory and Suntop sown 21 May.

Grain yield (t/ha) and stem frost damage (% stems)		Wedgetail sown 7 April		Gregory sown 21 May		Suntop sown 21 May	
Plant density (plants/m²)	Defoliation @ Z30	100 kg/ha N broadcast at sowing	100 kg/ha N top-dressed Z30	100 kg/ha N broadcast at sowing	100 kg/ha N top-dressed Z30	100 kg/ha N broadcast at sowing	100 kg/ha N top-dressed Z30
50	Defoliated	2.0 (27%)	2.3 (24%)	-	-	-	-
50	Undefoliated	1.6 (29%)	2.3 (24%)	-	-	-	-
100	Defoliated	1.9 (34%)	2.6 (27%)	-	-	-	-
100	Undefoliated	1.7 (34%)	2.5 (29%)	3.0 (1%)	2.9 (0%)	2.9 (2%)	3.1 (6%)
P-value (yield)				<0.001			
LSD (yield)				0.2			
P-value (frost)				<0.001			
LSD (frost)				9			

Wedgetail sown 7 April did not appear to handle stem frost and BYDV as well as some other winter wheat cultivars. Both Osprey and Wylah out-yielded it at this sowing time (Table 4). The best performing material at this sowing date were experimental CSIRO winter crossbreds made by crossing elite spring wheats and selecting winter progeny (Table 4). These crossbreds are F3 and still segregating for many traits and have not been selected for yield. The highest yielding of these out-yielded Wedgetail by 1.8 t/ha, Suntop/Gregory sown 21 May by close to 1.0 t/ha and matched the highest yielding treatments at the site (Mace and Corack sown 21 May yielded 4.1 t/ha in an adjacent trial). This material offers hope that in the future new winter cultivars will be developed that will have a significant yield advantage over the current ageing flock of winter cultivars and give growers some more competitive options for early sowing.

Table 4. Grain yields of winter and spring wheats sown 7 April at Junee. Entries shaded light gray are experimental winter wheats developed by CSIRO from crosses of elite spring wheats. Entries shaded dark gray are existing winter wheat cultivars. Entries with no shading are existing spring wheat cultivars.

Entry	Cross derived from	Habit	Yield (t/ha)
SDWW-0008-1-3	Espada/Gregory	Winter	4.0
SDWW-0009-3-3	Mace/Sunvale	Winter	3.4
SDWW-0012-3-3	Derrimut/Magenta	Winter	3.3
SDWW-0009-1-3	Mace/Sunvale	Winter	3.3
SDWW-0043-3-3	Forrest/Gregory	Winter	3.0
SDWW-0008-3-3	Espada/Gregory	Winter	3.0
SDWW-0043-2-3	Forrest/Gregory	Winter	3.0
SDWW-0043-4-3	Forrest/Gregory	Winter	2.8
SDWW-0008-2-3	Espada/Gregory	Winter	2.7
Wylah		Winter	2.7
SDWW-0005-6-3	Bolac/Spitfire	Winter	2.6
Osprey		Winter	2.6
Whistler		Winter	2.5
SDWW-0043-7-3	Forrest/Gregory	Winter	2.5
SDWW-0043-5-3	Forrest/Gregory	Winter	2.5
SDWW-0005-1-3	Bolac/Spitfire	Winter	2.3
Wedgetail		Winter	2.2
Trojan		Mid spring	2.1
SDWW-0007-2-3	Spitfire/Sunvale	Winter	2.1
Forrest		Very slow spring	1.9
Janz		Mid-fast spring	1.8
Lancer		Slow spring	1.8
Bolac		Slow spring	1.7
Eaglehawk		Very slow spring	1.7
Sunvale		Slow spring	1.5
Gregory		Mid spring	1.5
SDWW-0012-2-3	Derrimut/Magenta	Winter	1.4
Chara		Mid-slow spring	1.3
P-value			**<0.001**
LSD (P=0.05)			**0.5**

Existing winter cultivars dominated yields at the 24 April sow date (Table 5). Sown at this time they managed to avoid stem frost, but were still severely infected with BYDV despite imidacloprid seed dressing. The best winter and slow maturing spring wheats (Sunvale, Lancer) were able to equal or exceed the yield of Suntop and Gregory sown 21 May (~3 t/ha).

Table 5. Grain yields of winter and spring wheats sown 24 April at Junee.

Entry	Habit	Yield (t/ha)
Wylah	Winter	3.7
Whistler	Winter	3.6
EGA Wedgetail	Winter	3.4
Sunvale	Slow spring	3.4
Rosella	Winter	3.2
Lancer	Slow spring	3.1
Kiora	Slow spring	2.8
Janz	Mid-fast spring	2.7
Bolac	Slow spring	2.5
EGA Eaglehawk	Very slow spring	2.3
EGA Gregory	Mid spring	2.1
Chara	Mid-slow spring	2.0
P-value		<0.001
LSD (P=0.05)		0.2

Conclusion

In 2014 despite an very unfavourable season with a warm May exacerbating multiple extreme stem frost events and favouring aphid activity and spread of BYDV, in many cases early sown wheat crops were able to equal main season crops. In the future, risk of stem frost damage can be minimised by using winter wheats if sowing prior to 20 April. Spring wheats should be kept within 5-7 days of their optimal sow date. Risk of BYDV should be managed by backing up imidacloprid seed dressing with foliar insecticides at the start of tillering if aphids are present. New winter wheat cultivars are in the pipeline and are likely to have significant yield advantages over current ageing material.

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Contact details

James Hunt
GPO Box 1600
Canberra ACT 2601
0428 636 391
james.hunt@csiro.au
Twitter: @agronomeiste

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