

Heat stress and frost risk in Victorian wheat crops

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Following on from last month's diatribe on sowing dates, we decided to do our own play around with temperature data. Some quick Googling came with interesting approaches from both Department of Agriculture and Food Western Australia (DAFWA), New South Wales Department of Industry and Investment (NSW I&I), Birchip Cropping Group (BCG) and Department of Environment and Primary Industries (DEPI) staff at Hamilton. So we could say 'we did it our way'. We used Yield Prophet® to determine the flowering dates for Yitpi wheat sown at four different locations and at five different sowing dates. Using the Queensland Department of Agriculture, Fisheries and Forestry (DAFF Qld) Patch Point dataset of daily temperatures for Ouyen, Longerenong, Tungamah and Lismore, we counted the number of years where one or more extreme frost or heat events had occurred during flowering or grain fill over the last 125 years and converted that number to a percentage chance of occurrence. The median (close to the average) value shows how many frost or heat events are likely in the years that have one or more events and the range indicates the largest number of events ever recorded. We decided to look only at severe frosts of below 0°C (frosts occur at +2°C), five days before or 15 days after flowering and severe heat stress of a 34°C day (heat stress starts at 30°C) in the grain fill period 30 days after flowering. As with all things in life there are tradeoffs. With sowing date, it's a race between too early and belted by frost and too late and getting smashed by heat.

Not surprisingly, at Ouyen the frost risk sowing on ANZAC day is the lowest of the four locations chosen, at only five years in a 100, or put another way, a 95 per cent chance of not getting severe frost. In those years where frost occurred the average number of frosts was one, but in the odd year there was up to five. Longerenong shows the most risk with a one in four year chance of frost. So to avoid frost, you say to yourself, "I will sow later", but the frost figures pale into insignificance when you look at the chance of heat. Those later sowings are nearly a Monty for getting a touch-up from heat. Sown on the 10th of June, places north of the divide have nearly no chance of frost but a one in two year chance of heat, with up to two or three days of it.

This data perhaps sheds light on the success of early and dry sowing in recent years in the Mallee and in the NE. It suggests a small amount of caution at Longerenong for earlier sowing while suggesting that SW growers could be going earlier than they are. Of course it all comes down to whether you have moisture to sow or not. Some farmers are also aware that they possess low hollows that are prone to frost more often than the rest of the region. These need to be planned for.

Sown 25 April							
	Flowering date	% Chance of a frost near flowering	Median No. days in years with frost	Range in No. of days	% Chance of heat at grain fill	Median No. days in years with heat	Range in No. of days
Ouyen	5 Sept	5	1	1-5	10	1	1-2
Longerenong	20 Sept	25	2	1-5	6	1	1-2
Tungamah	19 Sept	10	1	1-2	4	2	1-3
Lismore	23 Sept	12	1	1-2	2	1	1

Sown 10 May

	Flowering date	% Chance of a frost near flowering	Median No. days in years with frost	range	% Chance of heat at grain fill	Median No. days in years with heat	range
Ouyen	20 Sept	2	1	1-2	27	1	1-4
Longerenong	5 Oct	16	2	1-6	21	1	1-4
Tungamah	2 Oct	3	1	1	19	1	1-4
Lismore	7 Oct	6	1	1-4	5	1	1-2

Sown 25 May

	Flowering date	% Chance of a frost near flowering	Median No. days in years with frost	range	% Chance of heat at grain fill	Median No. days in years with heat	range
Ouyen	1 Oct	1	0	1	46	2	1-6
Longerenong	15 Oct	14	1	1-4	34	2	1-11
Tungamah	12 Oct	0	0	0	34	1	1-7
Lismore	18 Oct	2	1	1-3	9	1	1-2

Sown 10 June

	Flowering date	% Chance of a frost near flowering	Median No. days in years with frost	range	% Chance of heat at grain fill	Median No. days in years with heat	range
Ouyen	10 Oct	0	0	0	62	2	1-9
Longerenong	23 Oct	5	1	1-3	50	2	1-15
Tungamah	20 Oct	0	0	0	46	1	1-12
Lismore	27 Oct	2	1	1	22	1	1-4

Sown 25 June

	Flowering date	% Chance of a frost near flowering	Median No. days in years with frost	range	% Chance of heat at grain fill	Median No. days in years with heat	range
Ouyen	17 Oct	0	0	0	70	3	1-14
Longerenong	30 Oct	5	1	1-2	66	2	1-15
Tungamah	26 Oct	0	0	0	54	2	1-14
Lismore	2 Nov	0	0	0	32	1	1-4

What we and the other researchers found is an upward spike in the number of potentially damaging frosts since 1995. Recent research from a PhD student at the University of Melbourne has shown strong correlations between this frost incidence and the rainfall deficit experienced during the Millennium drought. Interestingly the wet La Nina in spring 2010 had very few frosts during flowering, as soil moisture is a critical buffer against frost. Whether this trend continues and for how long, remains to be seen.

Long term number of frosts during flowering
Yitpi. Longerenong. Sown 10th May

