

## Predicting wheat flowering dates in Western Australia

B.J. Shackley, DL Sharma, D Tennant and C.M. Zaicou-Kunesch

Department of Agriculture and Food, Western Australia. [www.agric.wa.gov.au](http://www.agric.wa.gov.au) Email [bshackley@agric.wa.gov.au](mailto:bshackley@agric.wa.gov.au)

### Abstract

The choice of sowing date and variety is the key to maximising yield potential. Earlier sowing should mean better water use efficiencies and higher yields. Successful adoption of this strategy hinges on matching variety to sowing time to maximise growth and minimise the likelihood of frost damage after flowering, yet avoid the incidence of high temperature events and terminal drought during grain fill. The Flowering Calculator is a tool developed in the mid 1990's that enables the user to estimate flowering dates and compare the dates relative to risks of frost and high temperature events and the likelihood of experiencing optimum conditions during grain development.

Data collected between 2003 and 2005 has been used to update the "Flowering Calculator" to predict the flowering time of current wheat varieties grown in a range of locations and sowing times in Western Australia. Predicted and observed flowering dates are compared and discussed.

### Key Words

Wheat, flowering dates, Flowering Calculator, predicting phenology.

### Introduction

The choice of sowing date and variety is the key to maximising yield potential. Earlier sowing should mean better water use efficiencies and higher yields. Successful adoption of this strategy hinges on matching variety to sowing time to maximise growth and minimise the likelihood of frost damage after flowering, yet avoid the incidence of high temperature events and terminal drought during grain fill. The Flowering Calculator (2000) is a tool developed in the mid 1990's, that enables the user to compare flowering dates relative to risks of frost and high temperature events and the likelihood of experiencing optimum conditions during grain development. The Flowering Calculator provides a procedure to calculate flowering date using average daily temperature and day length.

Parameter data are supplied to enable flowering time to be calculated for a selection of varieties for each of several crop species using a range of phenological models. The model was selected on the basis of enabling easy generation of parameters as new varieties come to hand using sowing date, flowering date, and daily temperature and site latitude data.

The model used is as follows

$$1/D = a + b(\text{Temp mean}) + c(\text{Day length mean})$$

where  $D$  = the duration from sowing to flowering in days

$a, b$  &  $c$  = are coefficients related to basic vegetative period (BVP), temperature response and photo-period response respectively.

New parameters were developed to enable the Flowering Calculator to predict the flowering times of wheat varieties introduced since the Flowering Calculator was first published.

## Methods

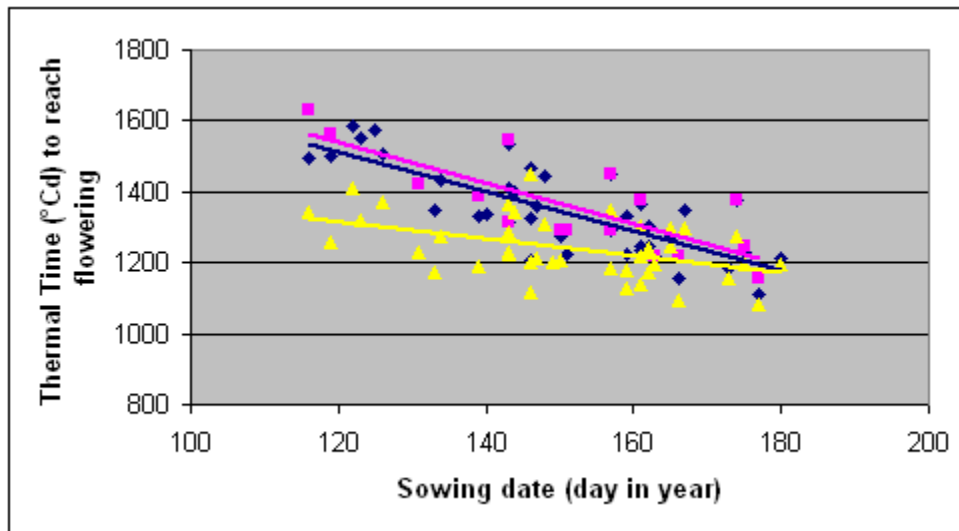
Flowering dates (50% anthesis) were observed for twenty current and potential new varieties sown at three sowing dates at five locations scattered through the southwest land division of Western Australia between 2003 and 2005.

The sum of the mean daily temperature was calculated from sowing to flowering from the closest weather station located near each of the sites. The latitude of the location was used to calculate the mean day length. These values were then used to calculate the regression parameters for each variety.

## Results

### *Flowering response*

Wheat varieties currently grown in WA show a wide range of development responses. Figure 1 shows the range of thermal times required for Spear, EGA Jitarning and Wyalkatchem to reach flowering at various sowing dates. EGA Jitarning is very similar to Spear, a variety known to respond more strongly to photoperiod. At the other extreme of the varieties examined, Wyalkatchem (Figure 1), Westonia, Arrino and H46 indicate that thermal time primarily controls their development.



**Figure 1.** Thermal time ( $^{\circ}\text{Cd}$ ) to reach flowering over a range of sowing dates for Spear ( $\diamond$ ), EGA Jitarning ( $\blacksquare$ ) and Wyalkatchem ( $\blacktriangle$ ) sown between 2003 and 2005 at five different locations in WA.

### *Predicted flowering dates*

Over the last three years new parameters for the Flowering Calculator have been developed for the current wheat varieties. With the new parameters the predicted flowering dates for late May and June sowings closely respond to actual flowering dates observed in the field (Table 1). However mid to early May predictions tend to underestimate the flowering time.

**Table 1.** Observed and predicted flowering dates for two sowing dates and three varieties at Mingenew, 2003

Sowing date	Variety	Observed flowering	Predicted flowering	Difference (days)
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14 May	Westonia	14 August	11 August	- 3
	Wyalkatchem	16 August	13 August	- 3
	Carnamah	24 August	19 August	- 5
27 May	Westonia	28 August	27 August	- 1
	Wyalkatchem	29 August	30 August	+ 1
	Carnamah	2 September	3 September	+ 1

### **Conclusion**

A tool such as the Flowering Calculator is useful in determining when a variety may flower. The data to update the parameters is easily collected and the parameters are easily changed within the program. However information on flowering dates is generally sort for the extreme sowing dates ie early May and the predicted values equate poorly to observed data. Further work will examine if the Flowering Calculator can be modified to account better for extremes of sowing time.

### **References**

Flowering Calculator v0.91 (2000) Department of Agriculture and Food, Western Australia.