Flowering times of wheat in Western Australia : a model approach

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Time of flowering of wheat is an important factor affecting the yield of wheat crops in southern Australia where the optimum times of flowering are narrow. The ability to predict the time of flowering could be an important management tool, especially in the choice of cultivar and sowing time so that yields are maximised.

Methods

The linear regression model of Perry et al. (1) which predicts the time of flowering of wheats, was simplified and its parameters were derived for 11 cultivars. The model, named FLOWER was of the form:

$1/D = b_0 + b1\ (TM) + b2\ (PM)$

where D is the duration from sowing to flowering, TM, PM are the daily mean temperature and photoperiod during the phase and b0, b1 & b2 are fitted regression parameters for each cultivar. The predictions of the model were tested against independent observations of ear emergence or flowering measured in time-of-sowing experiments and phenology nurseries conducted at five locations over three years. The model was then used to examine the effects of seasonal variation, sowing time and location on the flowering times of early (Aroona), mid-season (Spear) and semi-winter (Osprey) cultivars in south-western Australia.

Results and discussion

The flower model accounted for 71 to 95% of the variation in the independent observations of flowering date. The slopes of the regressions of observed versus predicted values were significantly less than 1.0 for four cultivars ($p<0.01$).The mean deviation of the predicted from the observed flowering date was two to ten days, depending on the cultivar, but showed no trends with the culitvars' vernalisation requirements. Predictions over sites, sowing dates and years demonstrated that the durations from sowing to flowering for vernalisation-responsive cultivars were less affected by the variation between years, locations and sowing times than cultivars which donot require vernalisation. At Cunderdin for 25 years of data, the standard deviation of the predicted flowering dates for Aroona from a constant sowing date was about twice that for Spear and Osprey (Table 1).

This model can assist farmers in the choice of cultivar given a range of sowing times and the optimum flowering time at a site. It is also of use to breeders for assessing the phenological adaptation of lines to environments without growing every line in every environment.

Table 1. The mean (and standard deviation) of the predicted durations from sowing to flowering, (days) for three cultivars sown on May 25th at Cunderdin and at Wandering using historical temperature data.

	Aroona	Spear	Osprey
Cunderdin (25 yrs)	111 (5.5)	129 (1.8)	140 (2.3)
Wandering (27 yrs)	128 (5.1)	136 (1.7)	136 (1.6)

1. Perry, M.W., Siddique, K.H.M., and Wallace, J.F. (1987). Aust. J. Agric. Res. 38,809-19.