Leaf appearance in seedling lucerne crops

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Abstract

The Leaf appearance of seedling lucerne was measured in New Zealand as part of an exercise to calibrate the APSIM_Lucerne module for temperate areas. The phyllochron of seedling 'Kaituna' lucerne ranged from 45?C to 75?C day/node as mean photoperiod decreased from 16 to 13 hours. These were longer than previously reported for regrowth crops. Results suggest photoperiod must be considered when predicting canopy development and subsequent biomass accumulation of seedling lucerne crops.

Introduction

Lucerne seedling crops have been shown to develop and grow at a slower rate than regrowth crops. Because of this, values of 51 and 34?C days/node are used by the Agricultural Production Systems Simulator (APSIM (1)) to predict leaf development for seedling and regrowth crops, respectively. Node appearance is then used as the basis for leaf area development and consequent biomass production. Therefore, accurate simulation of node appearance is essential for prediction of biomass production in seedling crops. The objectives of this study were to calculate the phyllochron for field grown seedlings of 'Kaituna' lucerne crops, to determine if this was influenced by sowing time, and to compare these with previous data for regrowth crops.

Materials and methods

This experiment was conducted at Lincoln University, New Zealand (43?38'S, 172?28'E) under irrigated conditions. Node appearance was measured by counting fully expanded leaves on six primary stems of seedling lucerne plants, sown in 4 replicates on 17 different sowing dates, from 10 February 2000 – 10 February 2002. Node appearance, from the first node until node accumulation became non-linear, was regressed as a function of thermal time (?C days) to calculate the phyllochron (?C day/node). Thermal time was calculated using the cardinal temperatures defined by Moot et al. (2) and mean photoperiod calculated for the duration of the linear phase.

Results

The rate of node appearance was constant ($R^2 \geq 0.93$) within each sowing date (Figure 1) but varied systematically from about 45?C d for a 16 hour mean photoperiod to 75?C d for a photoperiod of ≤ 13.5 hours. Linear ($R^2 = 0.831$) and broken stick ($R^2 = 0.851$) functions were tested to describe the relationship but there was insufficient data to definitively determine suitable functions.

Discussion

A single value could not be used to estimate the phyllochron in seedling 'Kaituna' lucerne crops. However, it was clear that the seedling phyllochron was longer than the seasonal range (34 – 52?C day/node) previously reported for regrowth 'Kaituna' lucerne crops (2). The systematic variation (Figure 1) highlighted the need to consider photoperiod as a factor when simulating growth and development of seedling lucerne crops. Further work is required to accurately define the response function and determine whether other development phases such as time to flowering are similarly affected. This may be best investigated in controlled environment chambers.

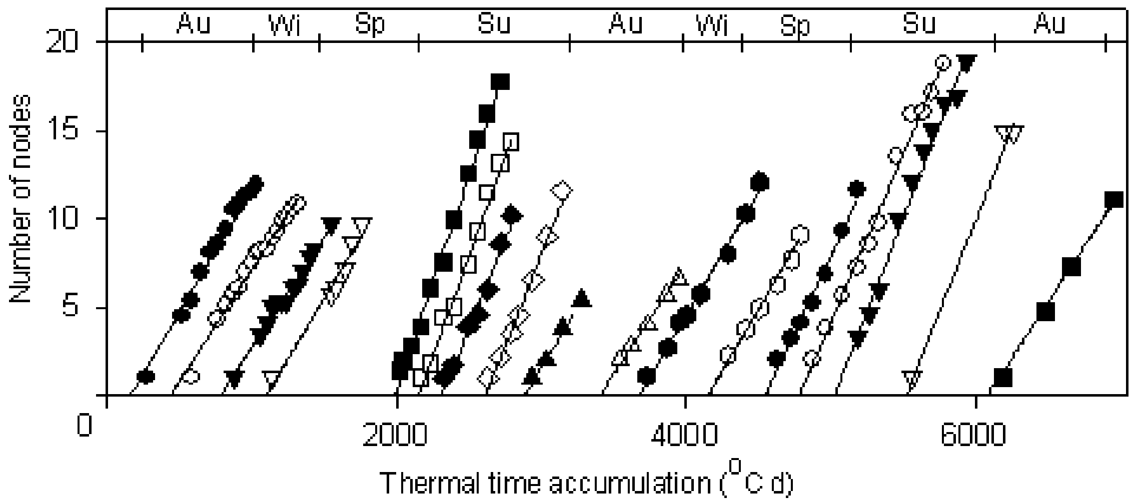

Figure 1: Node appearance of seedling ‘Kaituna’ lucerne sown on 17 dates from 10 Feb 2000 – 10 Feb 2002 in Canterbury, New Zealand. Au = autumn (1 May – 1 Jun), Wi = winter (1 Jun – 1 Sep),Sp = spring (1 Sep – 1 Dec), Su = summer (1 Dec – 1 Mar).

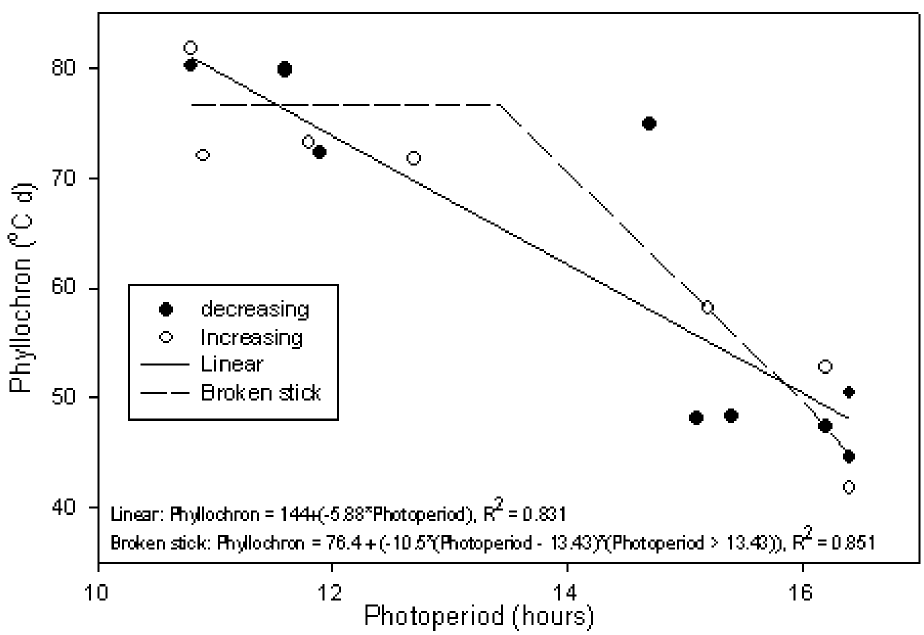

Figure 2: Node appearance rate (phyllochron) against mean photoperiod for seedling ‘Kaituna’ lucerne crops at Lincoln University New Zealand.

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Reference List

(1) Robertson, M.J., Carberry, P.S., Huth, N.I., Turpin, J.E., Probert, M.E., Poulton, P.L., Bell, M., Wright, G.C., Yeates, S.J. and Brinsmead, R.B. (2002) Aust J Agr Res., 53:429-446.

(2) Moot, D.J., Robertson, M.J. and Pollock, K.M. (2001) Validation of the APSIM-Lucerne model for phenological development in a cool-temperate climate. Proc. 10th Aust. Agron. Conf., Hobart, http://www.regional.org.au/au/asa/2001/1/a/oconnell.htm