

Determination of optimum desiccation timing in white clover seed crops

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Abstract

Time of harvest experiments, defined as date of desiccation, were carried out at three sites on the Canterbury plains, in Lincoln, Leeston and Chertsey. Crop management was carried out by the host farmer up to desiccation. Plots were desiccated at weekly intervals beginning three weeks after peak flowering and extending to eight weeks post peak flowering. Harvest consisted of two strips cut by a rotary lawn mower, dried and threshed and yields calculated as kg ha⁻¹. There was a linear yield increase of 40% from weeks 3 to 7. Based on thermal time optimum harvest date was approximately 725 C° days after peak flowering.

Introduction

White clover (*Trifolium repens* L.) is an important crop on arable farms in the Canterbury region of New Zealand where it provides an ideal break crop in the wheat, grass seed and vegetable seed crops rotation. However white clover seed crops can be highly variable in their harvested seed yield which can have large effects on profitability. Common yields range from 200 to over 1200 kg ha⁻¹ depending on grower management and weather conditions experienced during the summer period. Commonly white clover is desiccated prior to harvest using diquat (600g active ingredient ha⁻¹) and combine harvesting follows 3-5 day later. The timing of desiccation is often a difficult decision due to the indeterminate nature of white clover where flowering often occurs over several weeks. General guidelines to the harvesting of herbage seeds were published by Simon et al. (1997) which include suggestions on harvest timing including days after flowering, seed color and seed moisture content etc.

The use of thermal time has been successfully used in computer simulation to estimate the time from anthesis until maturity e.g. Sirius wheat model (Jamieson et al. 1998). Within the Sirius wheat model the time from anthesis until maturity is split into three sections, i) anthesis to the beginning of grain fill, this is based on one phyllochron. ii) Grain filling, typically based on 550 C° days (base temperature 0 °C) with thermal time based on air temperature. iii) An interval of 200 C° days is allowed for the grain to dry down after the end of grain filling. Data supporting the use of thermal time on cereals in relation to seed development has also been presented by Loss et al. (1989) and reviewed by Hay and Kirby (1991). Moot (2000) suggested thermal time alone gave the best correlation for the prediction on the seed filling period in 32 different brassica cultivars when trialed under Canterbury growing conditions.

The aim of the current study was to investigate if the timing of desiccation (quantified using days and thermal time) and harvest timing have any effect on the harvested seed yield in white clover.

Methods

Trial sites were selected in two farmer fields and the Chertsey FAR demonstration site. The sites and cultivars were:

- i. Leeston on a good soil with cv Riesling, a mid-large leaf-size cultivar
- ii. Lincoln on a heavy soil prone to winter water logging and more exposed to cool easterly winds in summer with cv Tribute, a medium leaf size cultivar,
- iii. Chertsey on a shallow Templeton soil with cv Tribute.

Flower numbers were counted weekly with a 0.25m² quadrat, with two counts per plot, one at each end of the plot. Flowers were counted if they had 3+ open florets and had less than half the florets turned down from pollination. Temperatures were recorded at the nearest available weather station, for Lincoln this was located approximately 5 km from the trial site, for Leeston temperature data was sourced from Pendarves, approximately 16 km away and at Chertsey a weather station was located approximately 150 m from the trial area.

Prior to harvest all management was undertaken by the host farmer. Plots were desiccated at weekly intervals and harvested with two strips cut by a rotary lawn mower, dried and threshed. Yields from these plots were adjusted relative to the mean yield of an adjacent machine harvested topping trial. Statistical analysis of data used GenStat v9.

Results

Flower head production increased per week at all sites and peaked approximately 5 weeks after December 1st, for example at the Leeston site flowering peaked at 250 flower heads/m² on the 5th January (Figure 1.).

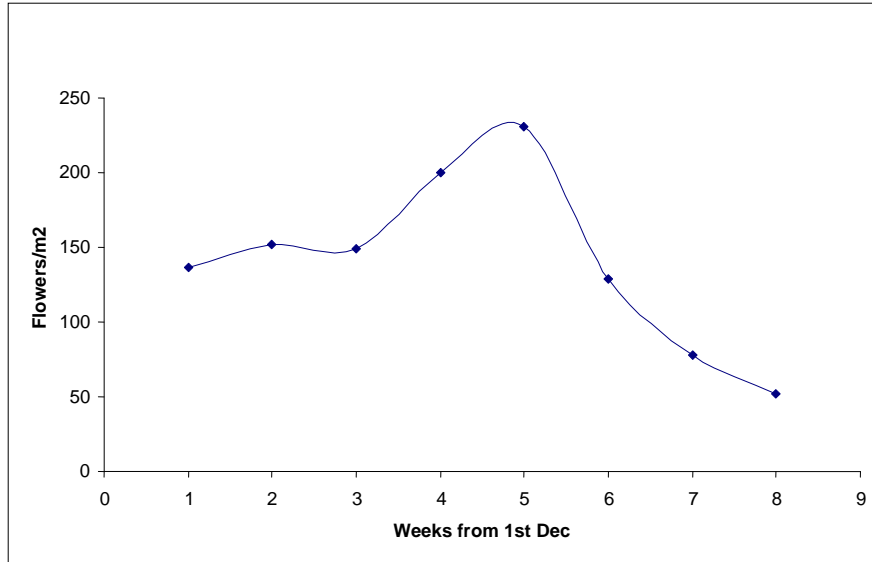


Figure 1. Weekly flower counts for time of harvest trial at Leeston cv Riesling (peak 5 Jan).

Combined data using weeks three to seven from peak flowering showed a linear increase ($R^2=0.97$) in seed yield, with relative yield increasing at 9% per week between three and seven weeks after peak flowering (Figure 2).

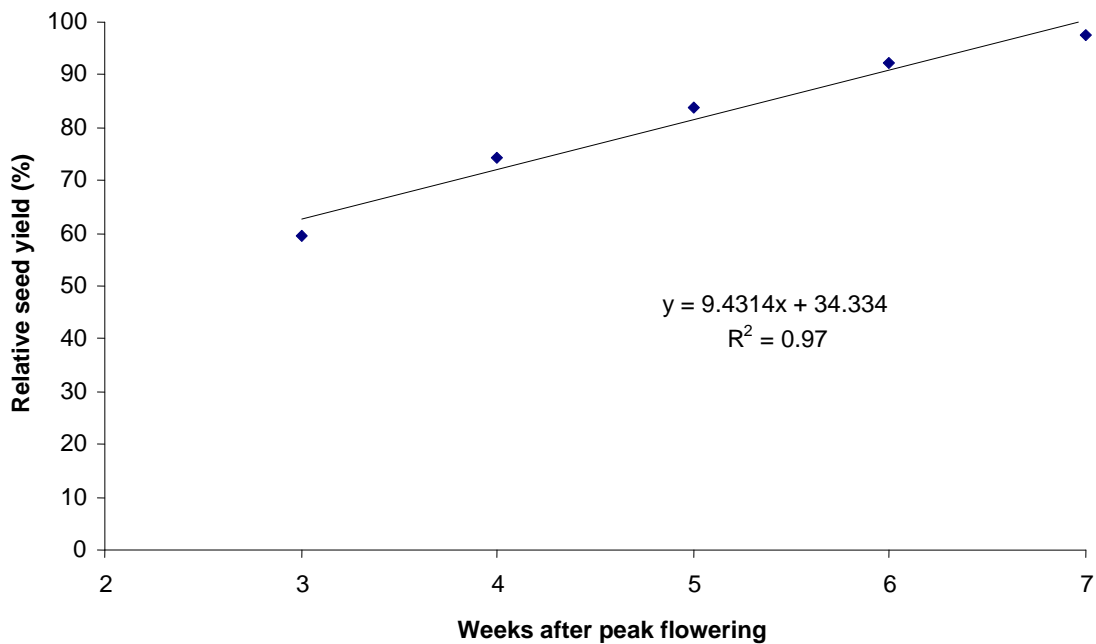


Figure 2. Combined data for seed yield (relative to an adjacent trial) and five harvest dates for weeks 3 to 7 past peak flowering.

When the data for week 8 is added (data from two sites available) the response is a quadratic response with an optimum harvest time of six weeks after peak flowering. The decline in seed yield eight weeks after harvest is large and significant. Based on thermal time, optimum harvest date is approximately 725 C° days after peak flowering (Figure 3). There was some variation between sites in weekly temperature accumulation however, at week 7 only 40 C° days separated all sites.

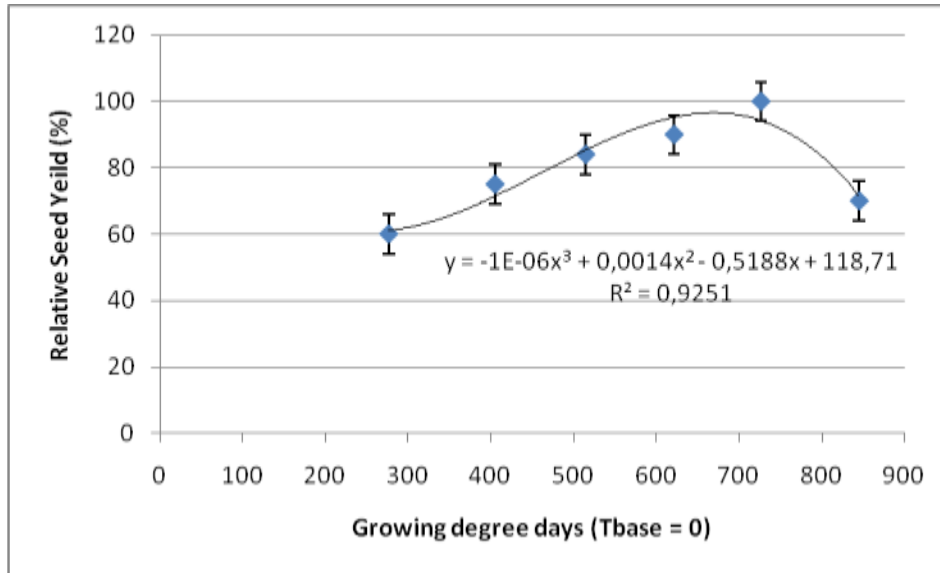


Figure 3. Relative seed yield (three sites combined) (optimum = 100%) and five harvest dates expressed against thermal time from peak flowering (2006/07) (harvest date = desiccation date).

Discussion

Flower numbers gradually increase during late November, followed by a rapid increase in late December / early January. Harvest generally occurs in February, the exact timing depending on soil moisture and other environmental conditions e.g. temperature. Based on thermal time, optimum harvest date is approximately 725 C° days after peak flowering. In 2006/07 this was approximately seven weeks after peak flowering. Seed development is generally well represented by thermal time. This result was consistent across three sites with two different cultivars and should be transferable from season to season and site to site. It is assumed that thousand seed weight (TSW) and number of seeds harvested account for the increases in seed yield. Loss of seeds through decomposition and sprouting are likely to contribute to the lower yields after seven weeks.

The timing of desiccation should occur when the maximum number of seed heads are ripe and likely to be harvested. Premature desiccation will lead to lower seed yields and lower TSW. Generally the majority of seed should be changing color at the time of desiccation. If desiccation occurs too late lower yields will result. Our results indicate that 725 C° days predicts this optimum time.

Conclusions

- Harvesting too soon after peak flowering reduced seed yield. The optimum time was six to seven weeks after peak flowering, with seven being best. Waiting 8 weeks resulted in yield loss.
- Seven weeks was equivalent to 725 C° days (base temperature 0°C) at all sites

Acknowledgement

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