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# Arable Update

**Herbage:** Issue 86

# Effect of row spacing on seed yield in two white clover cultivars

## Background

Row spacing is an important management strategy in white clover (*Trifolium repens*) seed crops. Stolons grow outward from the crown of the plant into the space between rows. Nodes produced along the stolon bear either vegetative axillary growth (e.g. a branch) or a reproductive leaf-flower combination. The more nodes that are produced per stolon, and subsequently per unit area, the greater opportunity for flower production and thereby seed yield. In theory, wider row spacing should produce more flowers/m$^2$ due to more space for stolon proliferation.

This three-year study investigated the effects of 30, 45 and 60 cm row spacing on seed yield, flower production and total biomass of two commercial white clover cultivars, 'Quartz' (medium-leaved) and 'Legacy' (large-leaved).

## Key points

- Seasonal conditions were the biggest driver of white clover seed yield.
- Wider row spacing increased seed yield during seasons with wet flowering periods. Otherwise, cultivar performance was not enhanced by row spacing >30 cm.
- 'Legacy' produced 5% higher seed yield than 'Quartz' across all seasons.
- Wider row spacing reduced flowers per m$^2$ but did not affect peak flowering date, flowers per stolon, or thousand seed weight.

## Methods

Four replicated small-plot trials were conducted over three consecutive seasons in Canterbury. In 2019-20, two trials were established at Chertsey, Mid Canterbury: one managed under dryland conditions and the other under irrigation. In 2021-22, a trial was established at the AgResearch farm near Lincoln, under irrigation, and in 2022-23, a trial was established under irrigation at Insignis Park, Yaldhurst. Each trial consisted of six treatments replicated four times.

The number of visible white flowers within a 30 cm length of row were counted at several times in each plot. Peak flowering date was defined as the date on which the highest white flower population was recorded. Prior to harvest, total biomass was measured on each plot. A representative subsample was weighed and dried in a forced-air oven for at least 24 hours to determine dry matter content. Plots were desiccated then harvested individually using a Wintersteiger plot combine. Seed was cleaned using a stationary air-screen seed dresser to determine machine-dressed seed yield per plot. Thousand seed weight (TSW) was calculated on the machine-dressed seed after cleaning. Treatment effects were analysed using analysis of variance (ANOVA), with significance declared at $P < 0.05$.

## Results and discussion

### Effect of row spacing on seed yield

Row spacing influenced seed yield (Figure 1), but the size of the effect depended strongly on the season (P=0.001). The three trial years represented very different Canterbury conditions. In 2019-20, drought conditions meant the dryland trial received 450 mm of rainfall; irrigation added 230 mm, giving the irrigated crop 680 mm and effectively creating a wet-summer scenario. The 2021-22 season was favourable until December, when persistent rain during flowering delayed harvest. The 2022-23 season was a typical Canterbury pattern of high winter rainfall followed by a warm, dry summer. Because of this variation, season had the greatest influence on seed yield (P<0.001, Wald = 289). Across the project, widening rows beyond 30 cm only increased seed yield (P=0.007) in the wetter seasons (irrigated 2019-20 and 2021-22). In 2019-20 under irrigation, 'Legacy' produced 65% more seed in 60 cm rows than in 30 cm rows, while 'Quartz' showed no spacing response. There was no consistent cultivar by row spacing interaction, and overall 'Legacy' yielded 5% more than 'Quartz' (P=0.025).

### Effect of row spacing on yield components

Individual leaf size measured at Lincoln on 16 December 2021 averaged 23 cm$^2$ per leaf for both cultivars. As soil moisture was not limiting in 2021-22, plants produced larger leaves which meant that they did not need extra stolon growth for maximum light capture. As a result, wider rows did not translate into more flowers. Instead, the biggest impact on yield that season came from harvest challenges - lodging, humidity, and pre-harvest sprouting. Row spacing did not affect the timing of peak flowering.

At Chertsey in 2019, peak flowering occurred on 13 December in the dryland trial and 31 December in the irrigated trial. At Yaldhurst in 2022, peak flowering occurred around 20 December. Because flowering follows leaf appearance and all row spacings experienced the same conditions to induce flowers, flowering timing remained similar across treatments. Flower numbers per $m^2$ decreased as row spacing increased (P=0.036). Previous FAR trials showed no effect of cultivar or spacing on flowers per stolon, meaning the reduction in flowers/$m^2$ was simply due to lower plant populations in wider rows. Thousand seed weight was similar between cultivars and unchanged by row spacing in 2019-20 and 2021-22, showing that wider rows did not improve seed filling.

## Effect of row spacing on biomass accumulation

When averaged across all trials, 'Legacy' produced 460 kg DM/ha more dry matter than 'Quartz' (P=0.02), with 'Quartz' averaging 6580 kg DM/ha. Cultivar performance did not change with row spacing. When cultivars were combined, 30 cm rows produced the most biomass (7280 kg DM/ha, P<0.001), while 45 cm and 60 cm rows averaged 6230 kg DM/ha. Season also strongly affected dry matter production, regardless of cultivar or row spacing. Irrigated Chertsey trial averaged 6920 kg DM/ha, the Yaldhurst trial averaged 7550 kg DM/ha, and the Lincoln trial had the highest biomass accumulation at 8930 kg DM/ha. When soil moisture stayed above 50% potential soil moisture deficit, vegetative growth was favoured, producing larger leaves and reducing stolon extension.

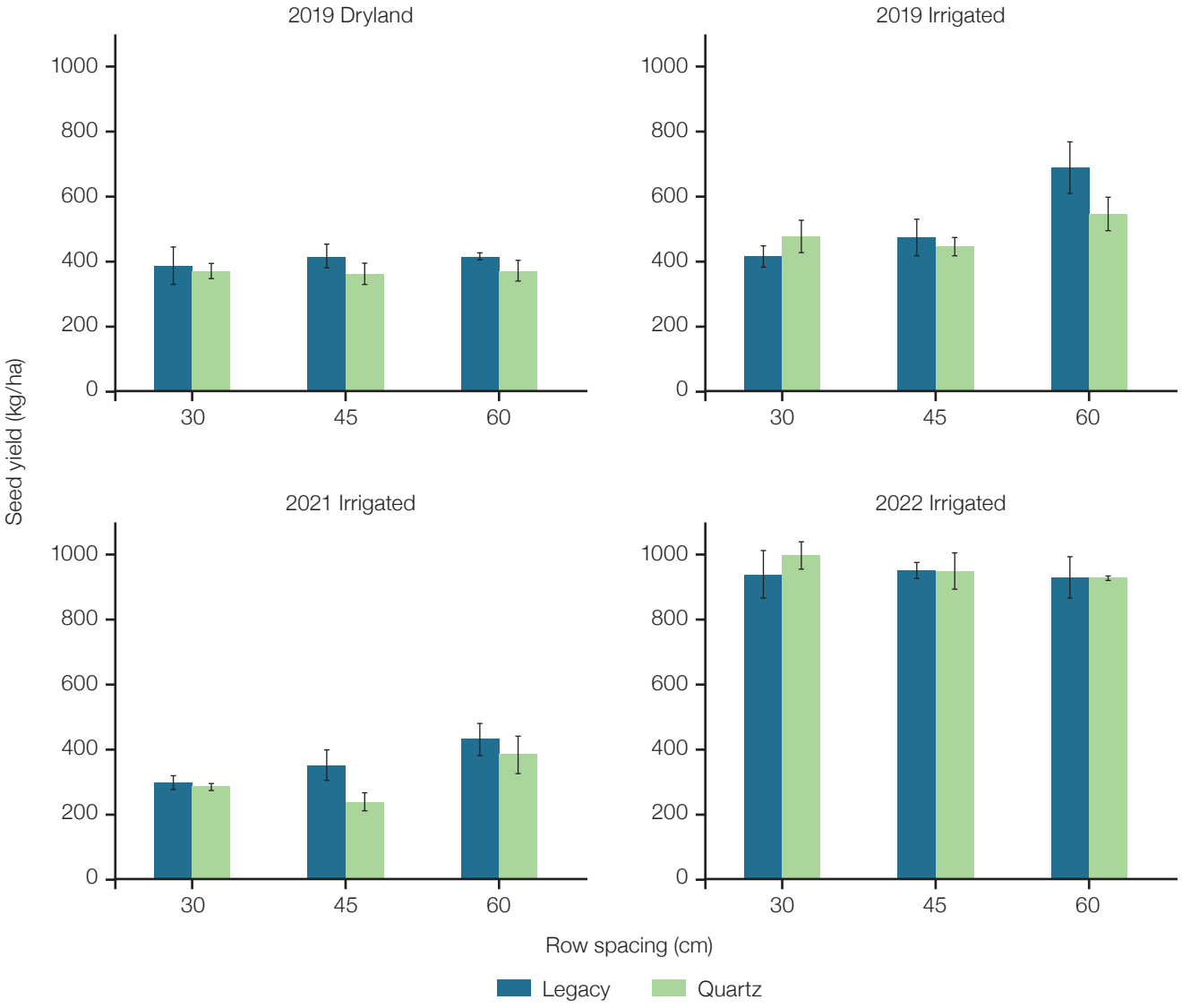


**Figure 1.** Machine-dressed seed yield of two white clover cultivars ('Legacy' and 'Quartz') over three growing seasons (2019, 2021, 2022) in Canterbury. Three different row spacings of 30, 45 and 60 cm were tested.

## Implications for growers

Wider row spacings can improve white clover seed yields; however, this is dependent on the season. In a dryland system or during good conditions throughout flowering and harvest the benefit from wider rows was not significant. When there was excess moisture during flowering until harvest, wider row spacings enhanced seed yield compared with 30 cm rows. Cultivar choice had a modest effect, with Legacy yielding slightly more seed than Quartz. Seasonal conditions, especially moisture and harvest weather remain the biggest drivers of seed yield.

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## References

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