RESPONSE OF CANOLA YIELD TO SOWING DATE IN A MEDITERRANEAN ENVIRONMENT

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INTRODUCTION

Canola (Brassica napus L.) is becoming an important crop in Western Australia, with over 900,000 ha in 1999. As a recent crop, information on crop management for farmers and advisers has been derived from experiences in a few seasons. In Mediterranean environments, with high rainfall variability within the season and between seasons, sowing dates can vary considerably from year to year. Early sowing with early-maturing cultivars has been identified as an important factor to grow profitable canola in the region, due to terminal droughts and the adverse effect of delayed sowing on grain yield and oil content (Carmody, 2001). Farmers have limited control over the earliest possible sowing date, being determined by the onset of rainfall in autumn. However, farm management logistics may mean that sowing is delayed. In order to devise crop management recommendations incorporating climatic risk, canola industry personnel have posed two questions to be addressed with simulation analysis for different soil types and locations in the canola-growing areas: (1) In what situations do early-maturing cultivars perform better than late-maturing cultivars?, (2) What are the yield penalties associated with a delay in sowing date?

METHOD

The APSIM-Canola model had been previously tested in eastern (Robertson et al., 1999) and Western Australia growing regions (Farre et al., 2001). The model was used in simulation experiments with long-term weather data from 1900 to 1999 to simulate grain yield. The following simulations were established: five sowing dates with 20 day intervals between 5 April and 24 June, two locations, Kojonup (high rainfall, long season) and Mullewa (low rainfall, short season) and two canola cultivars, Pinnacle (Triazine tolerant, late-maturing) and Karoo (Triazine tolerant, early-maturing). Current management practices were selected for the simulations (sowing depth 2 cm, plant density 80 plants per m²). Soil type was duplex soil. Nitrogen supply was 210 kg N ha⁻¹ split in 3 applications. The soil water profile was re-initialized at the lower limit at 1 January in each year.

RESULTS AND DISCUSSION

Choice of cultivar

Delay in sowing date caused a decline in yield in all cases (Fig. 1). At Kojonup (the high rainfall location), on average the late-maturing cultivar Pinnacle outyielded the early-maturing cultivar Karoo for early sowings. The decrease in yield with delay in sowing was greater for Pinnacle than for Karoo, being Karoo more productive than Pinnacle on average for sowing dates later than 1 May. At this location it would be advantageous to sow a late-maturing cultivar only in case of an early sowing opportunity, otherwise early-maturing cultivar would be preferred. At Mullewa, a drier location, the long-term average yield was higher for Karoo than for Pinnacle at any sowing date. At this location, where the season is characterized by a high chance of terminal water stress, an early-maturing cultivar would be preferred for any sowing date on average most of the years.
Yield penalties
The long-term average yields from the first to the last sowing date ranged from 2.9 to 1.5 t ha\(^{-1}\) for Pinnacle and from 2.7 to 1.8 t ha\(^{-1}\) for Karoo in Kojonup and from 1.8 to 0.5 t ha\(^{-1}\) for Pinnacle and 2.0 to 0.6 t ha\(^{-1}\) for Karoo in Mullewa (Fig. 1). The standard deviation in Fig. 1 shows a high yield variability, being in Kojonup higher for late sowings whereas in Mullewa the variability was higher for early sowings. The decline in yield caused by delayed sowing was due to a reduction in growth duration and an increased chance of a more severe water deficit during grain filling. The relative long-term average yield decline, resulting from a delay in sowing date, was 4 and 3% per week for Pinnacle and Karoo respectively, for Kojonup (high rainfall) and 5.1 % per week for both cultivars for Mullewa (low rainfall). These results were similar to that found in previous studies (Mendham et al., 1981; Hocking, 1993; Robertson et al., 1999). Model results, in the hands of advisers, can be used to devise rules-of-thumb for farmers at to which variety to sow given an opening rainfall event or what penalty would be associated in delaying sowing beyond the opening rains.

Fig. 1. Long-term simulated average canola yields for cultivar Pinnacle (\(\sigma\)) and Karoo (\(\lambda\)) in (a) Kojonup and (b) Mullewa for 5 sowing dates. Bars represent the standard deviation of the mean.

CONCLUSION
Simulation analysis using the APSIM-Canola model and historical weather data can incorporate the effect of a variable climate on canola yield and can be used as another tool for advisers in making recommendations to farmers throughout Western Australia. Ultimately, by overlaying model outputs with production economics will provide the most effective decision aid for farmers in the future.

REFERENCES