Canola competition for weed suppression

Deirdre Lemerle, Peter Lockley, David Luckett and Hanwen Wu
EH Graham Centre for Agricultural Innovation (Charles Sturt University and Industry and Investment NSW), PMB 588, Wagga Wagga, NSW 2678, Australia
Corresponding author: dlemerle@csu.edu.au

Summary Competitive crops are an important component of integrated weed management systems to reduce dependence on herbicides and resistance spread. Canola (*Brassica napus*) is a useful break crop but its potential to suppress weeds such as annual ryegrass (*Lolium rigidum*) has not been quantified in Australia. A study was conducted in 2009 to examine the range in competiveness available in 15 current canola types with annual ryegrass. Significant differences in grain yield of canola were recorded in weedy and weed-free plots, with percentage yield reductions from weeds of 60–100%. Crop competiveness was also assessed by weed dry matter suppression at flowering, which was negatively correlated with crop dry matter. The hybrids were higher yielding and were more competitive than the triazine–tolerant cultivars.

Keywords Weed competition, competitive cultivars, weed interference, grain yield, herbicide resistance.

INTRODUCTION

Weeds are a considerable cost to farmers through reduced grain yields and quality. Annual ryegrass is the most important weed of canola crops in south-eastern Australia (Lemerle *et al.* 2001), and herbicide resistance is continuing to spread, often developing within several years of the first herbicide application. Alternative non-chemical control tactics are required by farmers, including crop competition (Blackshaw *et al.* 2007), to reduce dependence on herbicides. Choice of competitive wheat cultivars to suppress weeds is now an important component of integrated weed management.

Canola is a break crop of rotations with a wide range of cultivars currently available, including triazine-tolerant (TT), Roundup-Ready, 'Clearfield System' (imidazinolinone-tolerant), conventional, forage and hybrid types. Triazine-tolerant cultivars are generally considered poorly competitive against weeds, whilst the vigorous hybrids are thought to offer an opportunity to suppress weeds as has been recorded in wheat (Lemerle *et al.* 1996). In Canada, limited data suggest that hybrid cultivars may be more competitive than traditional types and may allow herbicide inputs to be reduced (Harker *et al*. 2003). However, there are no Australian data on the competitive ability of canola genotypes for weed suppression and grain yield in the presence of weeds.

This study compared the effects of canola genotype on crop grain yield in the presence and absence of weeds, and suppression of weed growth.

MATERIALS AND METHODS

The experiment was conducted at Wagga Wagga, New South Wales, in 2009 in a silty clay loam with pH 4.6 and organic matter of 1.8%. Treatments were arranged in a split-plot design with four replicates. Main plots were genotype and split-plots were weedy and weed-free conditions. Genotypes were conventional cultivar ('AV-Garnet'), triazine-tolerant ('ATR-Marlin', 'Tawriffic-TT', 'ATR-Cobbler', 'ATR-409', 'Hurricane-TT', 'Thunder-TT', 'Bravo-TT', 'Argyle', 'CB-Tanami'), hybrids ('Hyola-571CL', 'Hyola-50', '45Y77-CL', '46Y78'), a conventional *Brassica juncea* ('Dune') and a forage rape ('Winfred').

Weed-free plots were obtained through pre-season weed control using non-selective herbicides. Weedy plots were sown at the same time as the crop with commercially available seed of annual ryegrass cv. 'Guard' resulting in a uniform weed emergence of around 200 plants m^{-2}. Canola was sown on 26 June 2009 following the 'opening' rain using a combine seeder with knife point coulters and press wheels at a seed rate of 4.5 kg ha^{-1} with 225 mm row spacing. Plot size was 1.4 m wide by 8 m long. Fertiliser was applied at sowing equivalent to 20 and 18 kg ha^{-1} P and N, respectively. Crop and weed emergence was measured in late August, crop and weed dry matter (harvested area of 2.43 m^{-2}) were recorded at late flowering (mid October), and grain yield was harvested at crop maturity by harvesting the whole plot with a small-plot harvester in early December. Growing season rainfall (July–November) was 131 mm, less than 50% of the annual average rainfall for the site. Data were analysed using REML in Genstat Version 12. The regression coefficient between crop and weed biomass was analysed from the genotype means using Excel.

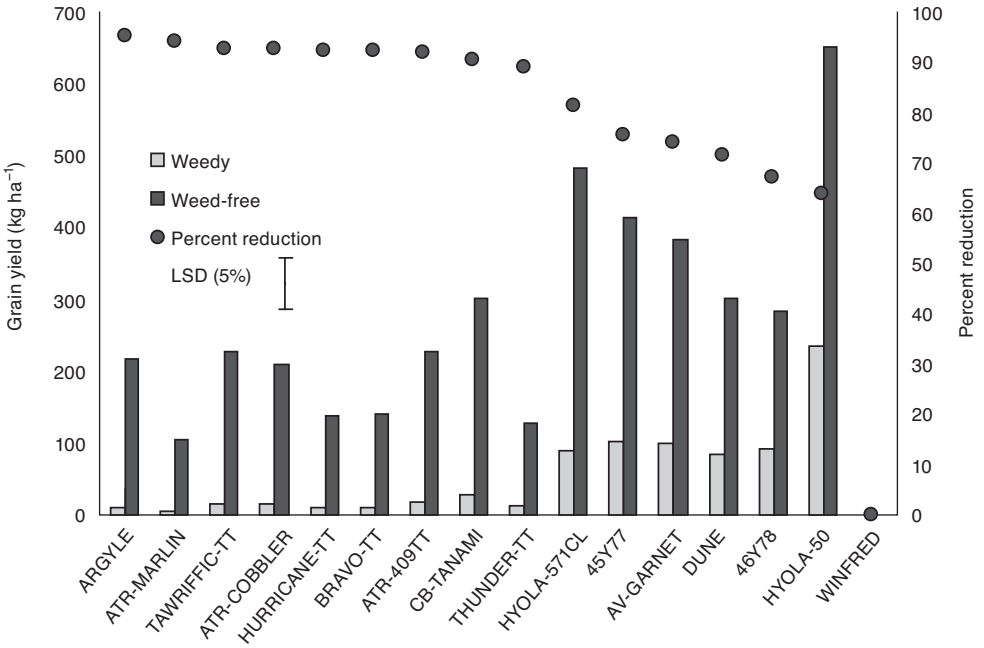

Figure 1. Effect of cultivar and presence or absence of weeds on the grain yield (kg ha^{-1}) and percentage reduction in yield.

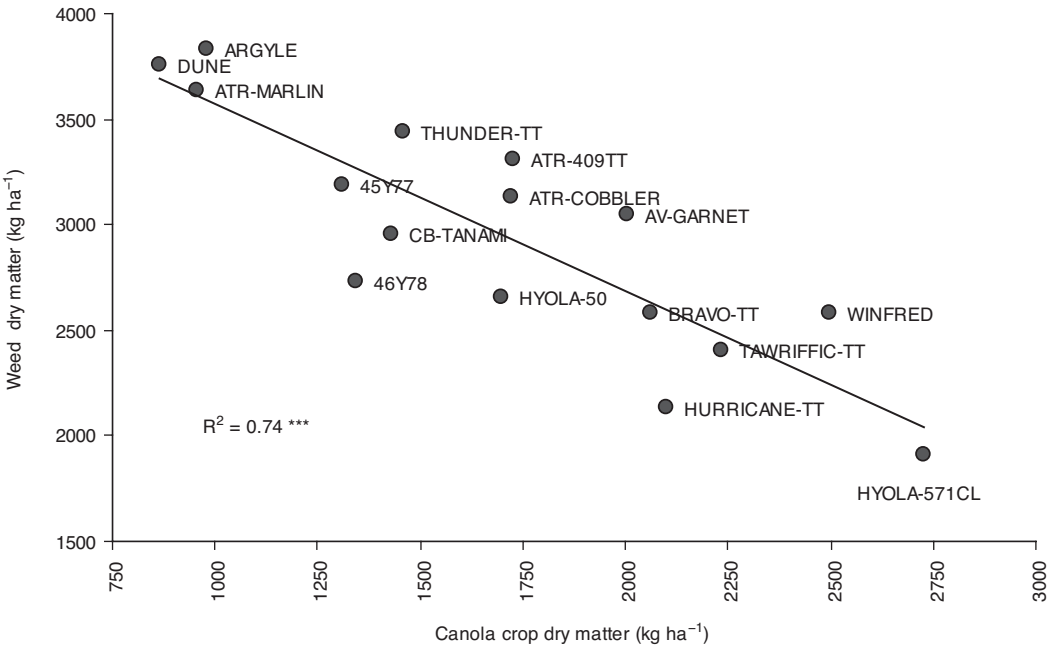

Figure 2. Relationship between crop and weed dry matter at late flowering.

RESULTS AND DISCUSSION

Grain yield was affected by a significant interaction between canola genotype and the presence or absence of annual ryegrass. Grain yields were low due to drought and ranged from zero to 600 kg ha^{-1} (Figure 1). Three of the hybrids ('Hyola-50', 'Hyola-571CL', '45Y77'), the conventional cultivar ('AV-Garnet'), and the *B. juncea* ('Dune') yielded more in both the weedy and weed-free treatments than the TT canola genotypes. The high yielding types in weed–free conditions also had lower percentage yield reductions (60–80%) from weed competition compared to 80–100% for the TT types. Therefore, this study agrees with Canadian results (Harker *et al*. 2003) that choice of genotype in canola shows potential as a tool for maintaining grain yield in the presence of weeds and reducing the impact of herbicide resistance.

Crop and weed dry matter at the end of flowering were negatively correlated (Figure 2), confirming the importance of crop vigour and high biomass accumulation for weed suppression (Beckie *et al*. 2008). Some of our high yielding genotypes (e.g. 'Hyola-50', 'Hyola-571CL', '45Y77') had high biomass, with low weed biomass and low percentage reduction, while 'Dune' had low biomass, high weed biomass and low percent reduction due to weeds.

The growing conditions were very dry and the experiment will be repeated in 2010 to confirm the results under another season.

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