Manipulating canola agronomy for weed suppression

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ABSTRACT

Weed control options in canola have improved considerably with the development of a range of herbicide–tolerant (HT) cultivars. However, the widespread incidence of weed resistance to many herbicide groups requires the inclusion of non-chemical control tactics in management strategies. Volunteer cereals can also significantly impact on canola yields. Competitive crops can reduce weed costs, and also increase the efficacy of currently-effective herbicides. Studies in 2009, examined the range in competiveness available in 15 current diverse canola types with annual ryegrass (*Lolium rigidum* Gaud.). Significant differences in grain yield of canola were recorded in weedy and weed-free plots, with percentage yield reductions from weeds of 60-100%. The hybrids were higher yielding and were more competitive than the open-pollinated cultivars, and especially the triazine–tolerant ones. Higher crop seeding rates improved the competitive ability of two of the diverse canola genotypes against volunteer wheat, especially in more weakly competitive genotypes compared to stronger competitors. The role of crop competition, as influenced by choice of genotype and seed rate, is discussed as an important low cost component of integrated weed management systems to reduce dependence on herbicides, improve performance of HT cultivars, and retard resistance spread in weed species.

Key words: herbicide-resistance – competition – hybrid – seed rate – herbicide-tolerance

INTRODUCTION

Weeds commonly occur in canola (Lemerle *et al.* 2001) and are a major cost to production due to reduced yields, quality and costs of herbicides. The widespread resistance of weeds to many herbicide groups is a major challenge, even with the availability of HT canola genotypes. Non-chemical control tactics, such as crop competition, are essential for sustainable weed management strategies to reduce the impacts of weeds, and to ensure the durability of still-effective herbicides (Blackshaw *et al.* 2007). In Canada canola competitiveness was increased by choice of cultivar and use of higher seeding rates (Harker *et al*. 2003, Beckie *et al*. 2008). In addition, F_1 hybrids which were taller, more vigorous, and establish a denser canopy than the open-pollinated types, were generally more competitive than open-pollinated types (Zand and Beckie 2002).

This paper reports some results of the first reported Australian experiments undertaken to examine the potential and quantify impacts of canola competition for weed management using strongly competitive genotypes and elevated seeding rates.

MATERIALS AND METHODS

The two experiments were undertaken at Wagga Wagga NSW in south-eastern Australia in 2009. The first compared the competitive ability of 15 canola genotypes with annual ryegrass, covering the currently available range of competitive types from poor to strong competitors. The second experiment compared the competitive ability of two extreme types (hybrid 46Y78 a strong competitor and ATR-409 a poor competitor) at four crop densities (from around 10-80 plants/m^2) with volunteer wheat. Grain yield of canola was used to measure competitive impacts. Yields were low in both experiments due to drought. The detailed methods and results are available (Lemerle *et al*. 2010, Lemerle *et al.* 2011).

RESULTS

Genotypes

The grain yield of canola infested with annual ryegrass was affected by a significant interaction between canola genotype and the presence or absence of annual ryegrass (Fig.1). Three 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.

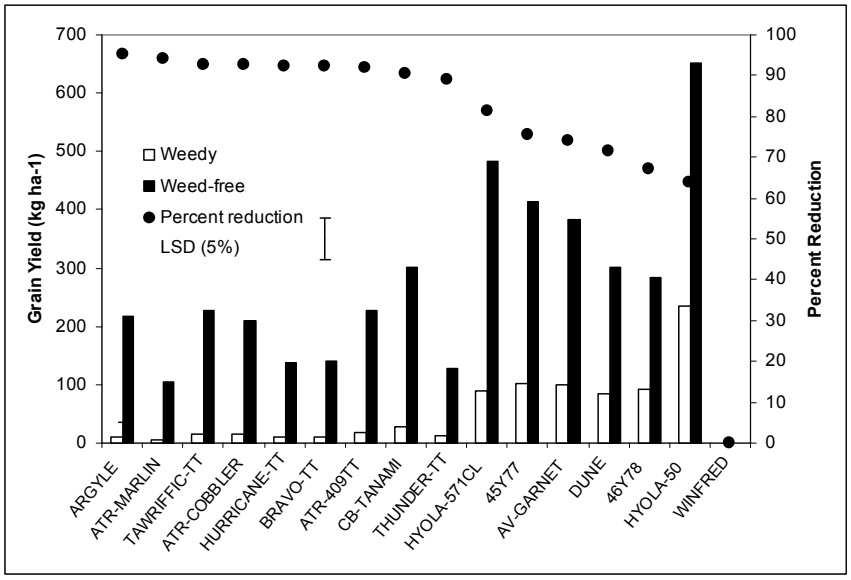

Fig.1. Effect of cultivar and presence or absence of weeds on the grain yield (kg ha^{-1}) and percentage reduction in yield.

Seeding rate x genotype interaction

Grain yields ranged from 0.05 t/ha with weeds at low crop densities to 0.25 t/ha in weed-free conditions at high plant densities (data not shown). Grain yield was affected by a significant interaction between canola genotype, canola plant density and the presence or absence of volunteer wheat (Fig.2). In weedy conditions at low crop densities, both genotypes had similar yield losses from competition with volunteer wheat. Higher crop seeding rates benefited the poorly competitive genotype relatively more than the competitive hybrid.

DISCUSSION

Crop competition through choice of genotype and elevated seeding rates is a low cost option for improving weed management in Australian canola crops, as has been the case in Canada (Harker *et al*. 2003, Beckie *et al*. 2008). The interaction between cultivar and seeding rate requires further quantification over a broader range of genotypes at the regional level with grower groups. More information on the effects of this interaction with herbicide performance is also needed. These results highlight the importance of using high quality crop seed and maintaining adequate crop seeding rate to optimise plant densities, grain yields and competitive ability. The likely improved performance of HT cultivars in combination with competition will reduce weed costs and help retard resistance spread in weed species. The combination of seeding rate and hybrids for weed control is likely to be an important non-chemical control option in Australia as herbicide resistance spread to more chemical groups and weed species.

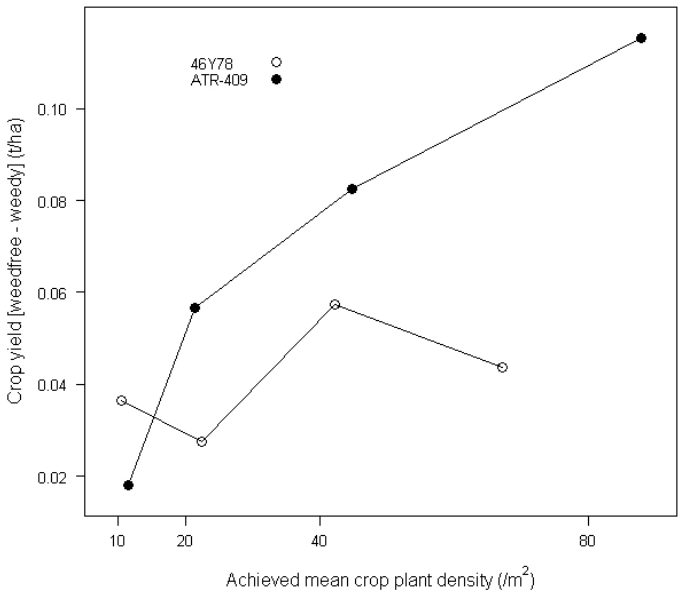

Fig. 2. Reduction in grain yield (t/ha) for two canola cultivars (low vigour, conventional triazine-tolerant cultivar ATR-409, and vigorous F_1 hybrid - 46Y78) with increasing crop plant density (plants/m^2). LSD 5% for crop yield = 0.058 t/ha.

ACKNOWLEDGEMENTS

The authors thank the Grains Research and Development Corporation for financial assistance; and Bill Littlewood and Peter Shephard for technical assistance in the field.

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