Yield of different herbicide-tolerant canola varieties: are there any differences among TT, RR, Clearfield and conventional canola technologies?

Heping Zhang and Jens Berger, CSIRO; and Mark Seymour, Jackie Bucat and Raj Malik, DPIRD

Key messages

- The yield difference between Triazine Tolerant (TT), Clearfield® and conventional canola is small and insignificant in the low rainfall zones of Western Australia and in low yielding environments.
- Roundup Ready® (RR) canola produced 0.2-0.3t/ha higher yield than TT in the medium and high rainfall zones, but the yield difference was small for trials in the low rainfall zone.
- Different herbicide tolerant technologies offer growers alternative weed control options. Growers need to take into account weed control issues and adopt herbicide tolerant technologies in line with grower specific needs.

Background

Herbicide tolerant technologies have been widely used in canola production in order to control weeds. Four types of herbicide tolerant technologies (Triazine Tolerance (TT), Roundup Ready® (RR), Clearfield (CL) and conventional (CV)) are currently used in Australian canola production. Each technology has its potential benefit in controlling weeds and impact on yield. TT varieties offer an inexpensive method of weed control, with intermediate effectiveness, but at the cost of reduced yield potential associated with lower rates of photosynthesis. Conversely, RR canola provides stronger weed control, has no yield penalty, but attracts higher input costs and a potentially lower price for the harvested GM grain. Growers are interested in the yield advantage of different herbicide tolerant technologies compared with the widely used TT technology and their potential role in farming systems. We conducted a trial series across high, medium and low rainfall zones of WA to investigate the yield performance of these four types of technologies.

The experiments

A multiple-environment trial (MET), consisting of 19-20 canola varieties each year, were conducted in the low (Merredin), medium (Cunderdin), and high (Kojonup) rainfall zones in WA from 2013 to 2017 (Figure 1). Current varieties were used, balanced by heterosis (Open pollinated, (OP) and hybrid), herbicide group (TT, RR, CL and CV) and phenology (early, mid and late flowering) as much as possible.

Figure 1 High yielding site (left) at Kojonup and low yielding site (right) at Merredin
Figure 2 Average yield of different herbicide tolerant technologies (CL: Clearfield; CV: conventional; RR: Roundup Ready; TT: triazine tolerance) in the low rainfall zone (Merredin 2014-2016), the medium rainfall zone (Cunderdin 2013-2014), and the high rainfall zone (Kojonup 2013-2017). The bars indicate the standard error of the yield.

Figure 3 Relative yield of four herbicide tolerant technologies (CL: Clearfield; CV: conventional; RR: Roundup Ready; TT: triazine tolerance) across low (Merredin), medium (Cunderdin) and high (Kojonup) rainfall zones in WA. Individual treatment data is plotted against environment mean yield. Treatments varied and included high and low nitrogen, early and late sowing, rain fed and irrigation. The bars indicate the standard error of the mean yield.
Yield performance

Among the herbicide tolerant technologies, RR canola produced higher yield than Clearfield, and TT canola in four of the 10 trials: Cunderdin 2013, 2014, Kojonup 2013, 2015 (Figure 2). Conventional canola had significantly higher yields than OP TT at 4 trials: Merredin 2015 and Kojonup 2013, 2016 and 2017. The Finlay-Wilkinson analysis across all combined experiments showed that RR canola produced 0.2-0.3t/ha more yield than the OP TT canola across a wide range of environments from 1.3t/ha to 3.5t/ha (Figure 3). The yield difference between the TT, Clearfield and conventional canola was small when yields were less than 2t/ha. However, conventional canola produced similar yield to RR canola when yield was above 2.5t/ha.

Conclusion

In summary, RR canola had a yield advantage of 0.2-0.3t/ha compared with TT and Clearfield canola. In high yield conditions, conventional canola produced similar yield to RR canola. The yield difference between TT and Clearfield canola was small across a wide range of yields and from the low to high rainfall zones of WA. Different herbicide tolerant technologies offer growers alternative weed control options. Growers need to take into account emerging weed control issues and adopt these technologies in line with their specific needs.