

# Economics of integrated weed management in canola

Research at Agriculture and Agri-Food Canada at Lacombe and Lethbridge has shown that selecting a competitive variety, seeding at a higher seeding rate, and removing weeds early will optimize yield. But this integrated weed management (IWM) strategy can also bring increased seed costs. To analyze the risk and average annual return for this IWM strategy, an economic study was conducted.

In the study, a competitive LibertyLink® (glufosinate-tolerant) hybrid (InVigor 2153) variety was compared to an open-pollinated (Exceed) LibertyLink® variety. Crop seeding rates were 100, 150 and 200 seeds per square metre (on a weight basis these seeding rates averaged 4.9, 7.4, and 9.9 lb per acre for InVigor 2153, and 3.2, 4.7 and 6.3 lb per acre for Exceed). Weed removal timings were either at the two-, four-, or six-leaf stage of canola.

## More competitive variety nets more

At the Lacombe site, the study showed that the strategy for maximum return was to grow a hybrid rather than an open-pollinated variety. Overall, InVigor returns were about \$74 per hectare (\$30 per acre) higher than the less competitive variety Exceed. Higher seed rates of 150 and 200 seeds per square metre increased yield, but the increased seeding costs negated the production benefit of the higher seeding rate.

At Lethbridge, similar trends were observed, with InVigor returning about \$115 per hectare (\$46 per acre) more than Exceed. Earlier weed control had higher mean net returns, but these were not significantly different than the six-leaf stage of weed control. Returns across seeding rate were equal for the two- and four-leaf stage.

## Assessing the risk of higher seeding rates

The economic analysis also investigated the risk premium (RP) that an individual would willingly pay to convert a risky proposition into a certain prospect. For risk averse farmers, at Lacombe, for example, the InVigor variety sown at 100 seeds per square metre with weed control at the four-leaf stage was the most risk efficient. In this case, the competitive variety with the lowest seeding rate required removal of weeds in the four-leaf stage to be able to withstand competition later in the growing season.

For risk neutral farmers at Lethbridge, the InVigor variety sown at 150 seeds per square metre with weed control at the two-leaf stage was the most risk efficient. Early weed removal was successful because the competitive variety was sown at a heavier rate and the crop was better able to compete with later emerging weeds.

Overall, InVigor seeded at 100 or 150 seeds per square metre was the most successful strategy. InVigor seeded at 200 seeds with weed removal at the four-leaf stage, and Exceed sown at the 100 seed rate with weed control at the

two-leaf stage were the least successful strategies. The set of all IWM strategies that are risk efficient include those with an RP less than \$58 per hectare, and are shown in the table below. It is noteworthy that the lower competition open-pollinated variety (Exceed) was risk efficient only when seeded at the highest (200 seeds per square metre) seed rate.

Ranks of strategies by risk premium for different risk attitudes.

Risk averse		Risk neutral	
Lacombe IWM strategy*	Risk premium (\$/ha)	Lacombe IWM strategy	Risk premium (\$/ha)
INV-100-4L	0	INV-150-2L	0
INV-150-6L	4	INV-150-6L	13
INV-100-2L	11	INV-100-4L	16
EXC-200-2L	18	INV-100-2L	53
EXC-200-4L	26	INV-200-6L	54
Lethbridge IWM strategy	Risk premium (\$/ha)	Lethbridge IWM strategy	Risk premium (\$/ha)
INV-150-2L	0	INV-150-2L	0
INV-150-4L	23	INV-200-2L	1
INV-200-2L	41	INV-100-2L	22
INV-100-6L	44	INV-150-4L	25
INV-200-4L	56	INV-100-6L	36

\*InVigor 2153 (INV) seeded at 100, 150, or 200 seeds per square metre, and weed removal at the two- (2L), four- (4L), and six-leaf (6L) stages of canola. Source: Upadhyay, B.M., Smith, E.G., Clayton, G.W., Harker, K.N., Blackshaw, R.E., 2006. Economics of integrated weed management in herbicide-resistant canola. *Weed Sci.*, 54:138-147.

In summary, a substantial economic benefit was observed for the adoption of hybrid compared to open-pollinated cultivars. Looking at the overall trends, the use of the competitive InVigor variety was more important than time of weed removal or seeding rate in risk management strategies. Using an exceptionally high seed rate in the IWM strategy was a financially costly and risky practice. Herbicide application at the two- or four-leaf stages was more likely to be a risk-efficient strategy versus applications at the six-leaf stage of canola.

Based on this analysis, growing a competitive hybrid variety, with adequate plant stand establishment (seeding rate of approximately 5.6 to 8.4 kg per hectare; 5 to 7.5 lb per acre) and early weed removal at the two- to four-leaf stage of canola is the most risk-efficient IWM strategy.

