

Panel discussion

Agronomic and economic impacts of growing herbicide-tolerant canola

Herbicide Tolerant Canola: 10 years experience in Canada

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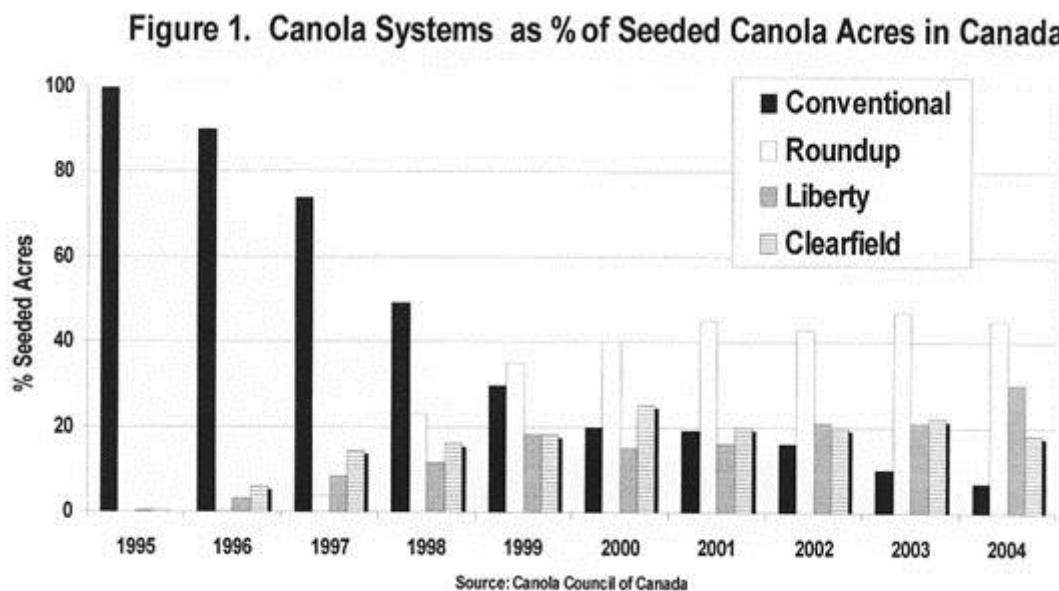
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Introduction

The past ten years since the introduction of herbicide tolerant (HT) canola in Canada have been very interesting. During my career as a government crop specialist, I have seen remarkable changes in canola production practices, and the adoption of HT canola ranks near the top. In this short presentation I will discuss the major impacts of this technology on western Canadian crop producers.

The following graph (Figure 1) shows the percentage of seeded canola acreage by herbicide tolerant system since 1995. By 2004, conventional non-HT canola declined in popularity to near extinction. In contrast, HT varieties have surged in popularity, with Roundup Ready systems most popular, followed by Liberty Link and then Clearfield.



There are several important points to note about HT canola adoption in Canada.

Firstly, the overwhelming adoption of HT canola has occurred through producer choice. The HT systems must be more profitable or make farming easier. Weed control in conventional canola has been less effective and more difficult than in

cereal crops. Pre-emergent herbicides, which were the standard in conventional canola, were not conducive to adoption of direct seeding systems. HT canola has provided producers with more effective herbicides and simpler application (less tank mixes and separate applications, no soil incorporation needed). Good weed control is important in canola production since uncontrolled weeds results in significant yield loss (for example Harker, 2001).

Secondly, farmers have adopted HT canola in spite of significant market uncertainties due to genetically modified organism (GMO) market restrictions and fear campaigns waged by some non-government organizations. Also, adoption has occurred in spite of significantly higher seed costs for many HT varieties. Thus, farmer perceived benefits of HT canola had to outweigh increased costs for seed and possible market restrictions or price discounts for transgenic grain.

Thirdly, not all HT canola systems have been adopted by Canadian farmers. Triazine tolerant canola varieties were released in Canada in the early 1980's, but never achieved popularity due to significant yield drag. Bromoxynil tolerant canola varieties were released more recently but never gained popularity and were removed from commercial production.

Grower Surveys on Experience with HT canola

Fortunately, there have been two studies that provide more detail about producer benefits and disadvantages of HT canola adoption. Due to the negative publicity surrounding transgenic crops, the Canola Council of Canada commissioned a study in 2000 on the agronomic and economic impacts associated with transgenic canola in western Canada. This study was conducted by Serecon Consulting and Koch Paul Associates under guidance from the council, growers from prairie provinces, provincial government crop specialists, and representatives of the canola and biotechnology industry. The report is available for download at: www.canola-council.org/manual/gmo/gmo_main.htm

This study was conducted by surveying six hundred and fifty canola growers in western Canada on their attitudes, production practices and costs. The survey sample was controlled to match the geographical distribution of canola production by province and ecozone. One half of the growers were surveyed on their transgenic canola fields (Roundup Ready or Liberty Link but excluding Smart or Clearfield since it is not transgenic), while the other half answered questions about their conventional canola fields. Also, thirteen detailed case studies were conducted with growers who grew both transgenic and conventional canola.

From this study, the primary motivation for farmers to adopt transgenic canola was agronomic, and secondarily economic. Transgenic canola allows for simpler and more effective weed control that fits with direct seeding systems. The economic value of "simplicity" is difficult to quantify, but is obviously very

important to canola producers. Other agronomic benefits attributed to transgenic canola include improved ability to handle herbicide resistant weeds, more flexible rotations and earlier seeding. Research by Harker et al (2000) found that HT canola can provide more effective and consistent weed control and higher yields.

Transgenic canola growers found that the higher cost for seed and the Technology Use Agreement for Roundup Ready varieties was more than offset by higher yield (10%), lower dockage, lower herbicide costs, less tillage and corresponding lower fuel use. Growers estimated \$14/ha higher net return with transgenic varieties, while the detailed financial records in the case studies found a \$26/ha increase. Although \$26/ha does not seem much for producers in highly subsidized agricultural countries, it amounts to approximately a 32% improvement in net returns for these Canadian producers. Over the period 1997-2000, the direct benefit to Canadian canola growers of transgenic canola adoption was estimated to be in the range of CAN \$144 to 249 Million.

Several environmental benefits resulted from the adoption of transgenic canola. Approximately 6000 less tonnes of herbicide were applied annually to canola in 1999 and 2000, and producers felt that they were applying herbicide compounds of lower toxicity. Transgenic varieties involved herbicides that fit better with conservation tillage and allowed more flexible rotations with less summerfallow. Less tillage resulted in less fuel used and thus would be a positive factor in greenhouse gas mitigation.

The adoption of transgenic canola has created issues and concerns. Market access has been restricted in some countries (mainly Europe) due to GMO moratoriums. This market uncertainty initially caused some farmers to bin transgenic canola separate from conventional types as a precaution. However, very little conventional canola is grown anymore, and bin separation is not practiced except for identity preserved (IP) programs (specialty oils; and a small Clearfield IP program). Negative public opinion about GMO's concern many farmers since they believe public policies based on paranoia will be developed that control how they farm. It is ironic that public concerns with pesticide use in agriculture could be eased with transgenic crops, but they remain opposed to that technology. Some farmers in the survey felt that volunteer canola was harder to manage now with HT systems. Higher seed costs and the cost of the TUA were cited as disincentives for growing transgenic canola. Restrictions on farm-saved seed with the TUA and the increasing domination of multi-national companies in the canola seed business were also negatively viewed by some producers.

In response to the comments of difficult management of HT canola volunteers, the Canola Council of Canada commissioned a subsequent study "Herbicide Tolerant Volunteer Canola Management in Subsequent Crops" which has been recently published (www.canola-council.org/PDF/ht_canola_final.pdf). A telephone survey of growers (335) was used to compare their management of volunteer

canola from conventional or HT systems (Roundup Ready, Liberty Link and Clearfield). However, this second study also used actual weed density data from producer fields – this data was obtained from an independent government project (2001-2003 Prairie Weed Survey conducted by Agriculture and Agri-Food Canada in conjunction with provinces). In this government survey, there was a subset of 316 sampled fields with canola as previous crop. Summer weed counts and grower responses to a management survey in this project provided excellent data since they were conducted for weed analysis and were not initiated by the canola industry.

The key findings from this study show more similarities between systems than differences.

- Volunteer canola was rarely the primary broadleaf weed target in weed control programs --it's not a "superweed" in western Canada which is contrary to slanted reports of organizations opposed to GMO's (for example, "Seeds of Doubt" report by Soil Association, 2002).
- Incidence of herbicide and tillage use to control volunteer canola was similar across systems. Conventional growers made slightly fewer pre-seed herbicide passes but used more tillage.
- Herbicides used in subsequent crops were similar across systems except that Clearfield growers followed with mainly Group 4 products.
- Summer weed counts of volunteer canola in subsequent crops were similar across all systems. Economic thresholds as defined by growers (10 plants / m²) were rarely exceeded.
- Yield and dockage losses due to volunteer canola have occasionally been experienced in subsequent crops for all systems.
- There were no significant differences in herbicide or tillage costs between systems for volunteer control as estimated by the growers.
- Most growers were not targeting volunteer canola more than in the past, nor had they changed practices.
- Adoption of HT canola and direct seeding is correlated.
- 60% of growers reported a carry-over weed control benefit from HT canola into next year's crop, but this wasn't supported by weed survey data.
- **The majority of HT growers continue to believe that growing HT canola was more beneficial than conventional types, considering all things, including volunteer control.**

HT Canola and Total Herbicide Use

The general public is very concerned about pesticide use in crops and environmental groups constantly push for reduction / elimination. There is a perception that HT canola allows farmers to spray even more herbicides or compounds with higher toxicity. After 10 years, what is the evidence?

The initial Canola Council of Canada study reported that HT canola adoption led to a decline in total amounts of herbicide applied. A recent report (Brimner, Gallivan and Stephenson, 2005) provides further evidence that supports this conclusion. The authors used herbicide use data obtained from Canadian Farmers' Herbicide Use Study (Criterion Research Group). They determined changes in active ingredient use per ha and an environmental impact quotient (EIQ) over the period 1995-2000. The EIQ includes risks to workers, consumers and ecology considering such factors as persistence, toxicity to mammals, fish, etc. The following 2 figures from their research paper (used with permission) illustrate that **herbicide a.i. amounts per ha and environmental risk has declined significantly with HT canola adoption in Canada.**

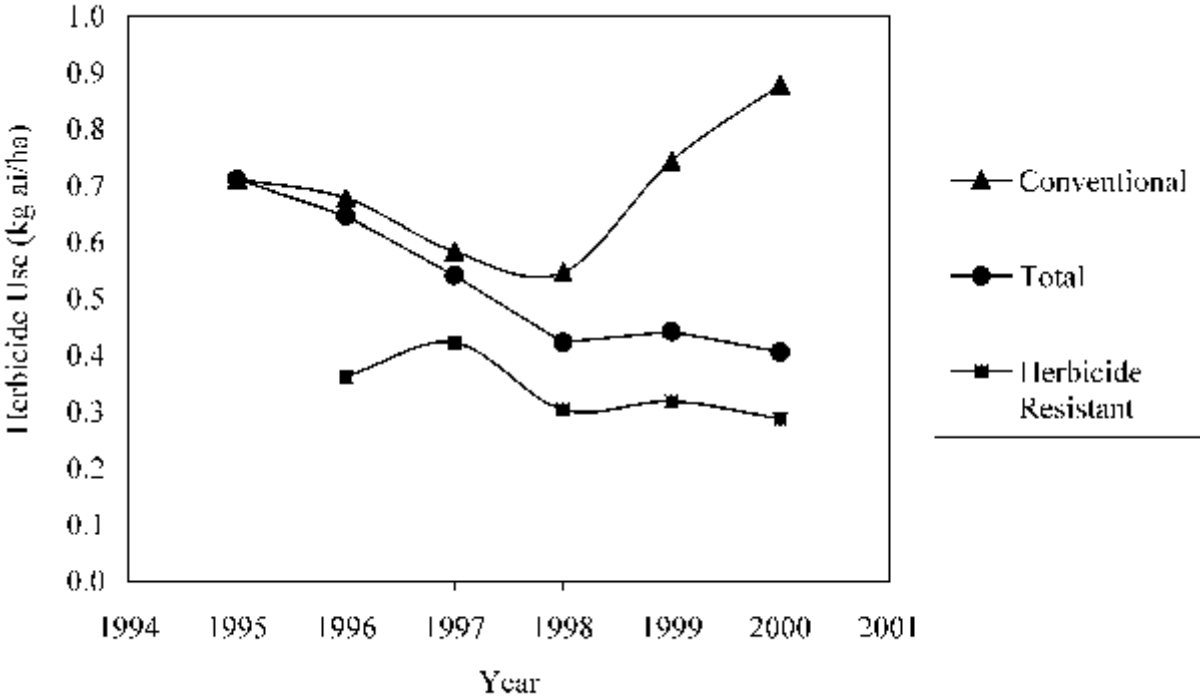


Figure 2: Herbicide active ingredient use per hectare in conventional, herbicide-resistant and total canola from 1995 to 2000 (used with permission).

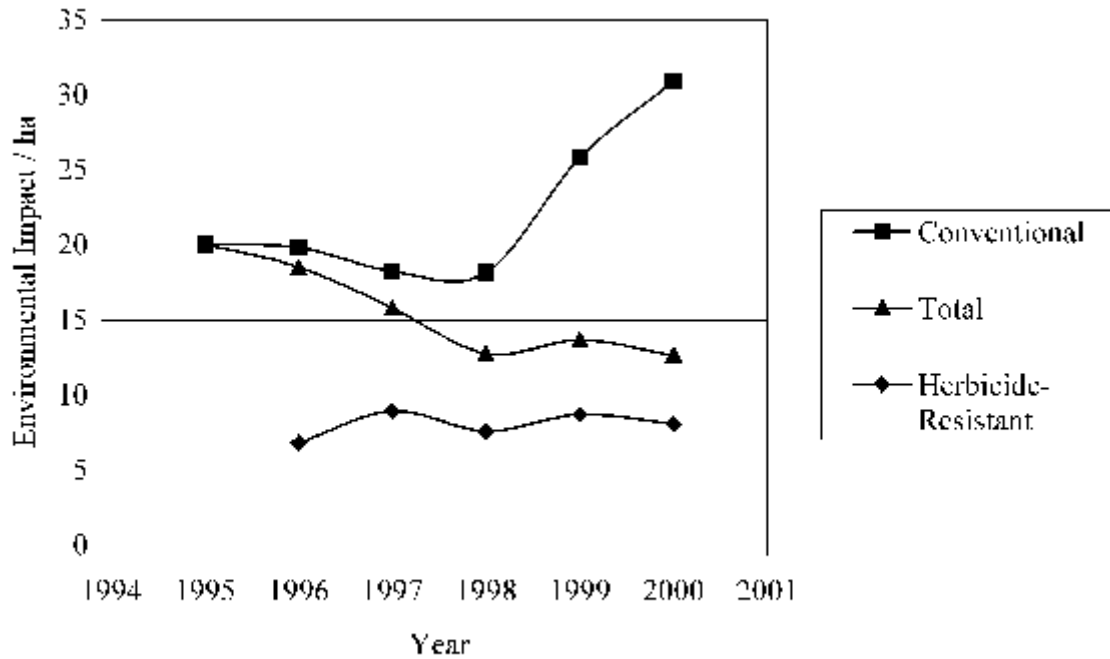


Figure 3: The environmental impact (EI) of herbicide use in canola for 1995 to 2000 as determined by the Environmental Impact Quotient (EIQ) per hectare of canola grown (used with permission).

Conclusions

Canadian canola producers have voluntarily adopted HT canola because of agronomic benefits (better and easier weed control) that helps improve profit.

The environment benefits of HT canola adoption include less herbicides applied per ha, less tillage and fuel consumption.

Producer resistance to HT canola is very limited, and revolves around concerns with farm-saved seed restrictions (TUA), and multi-national company concentration in the seed business.

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