

# Innovations underpinning yield improvements in the Canadian canola industry

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## Key messages

- Canadian prairie farmer canola yield increased 695 kg ha<sup>-1</sup> from 2000 to 2013; more than 50%.
- The yield increase was due primarily to the adoption of hybrid varieties with herbicide tolerance, the increase in spring precipitation and CO<sub>2</sub> concentration, and the use of solid management practices.
- New hybrids with herbicide tolerance must be accompanied by new agronomy.

Canola is Canada's second largest crop in production following wheat with over 8 million ha seeded in 2014. Driven by high price and strong world demand, production has increased from 3900 tonnes in 1986 to nearly 18,000 tonnes in 2013. The majority of canola production occurs on the Great Plains or Prairie provinces of Saskatchewan, Alberta and Manitoba. Prairie farmer canola yields increased by 64% from 1986 to 2013 with the majority of the yield improvements occurring after 2000 (see Figure 1). From 2000 to 2013, Prairie farmer canola yields have increased by 695 kg ha<sup>-1</sup> or 54 kg ha<sup>-1</sup> per year; which is an increase of 53 % or 4.1% per year.

The increase in Prairie farmer canola yield during the first part of this century has largely been the result of the adoption of hybrid canola with herbicide tolerance (HY/HT, see Figure 2). Today over 95% of the canola varieties grown are HY/HT. The yield gain from the adoption of new varieties of canola was estimated from the Prairie Canola Variety Performance trials to be ~2.4% per year, accounting for about 32 of the 54 kg ha<sup>-1</sup> per year increase. When surveyed, farmers indicated that herbicide tolerant canola: was a must with zero tillage systems, reduced the cost of production, increased yields, reduced dockage charges, and volunteer canola plants were easily cleaned-up in the rotation year. Farmers were concerned about the potential for herbicide tolerant weeds and that export to some nations may be blocked. The adoption of HY/HT varieties has not affected export sales of canola.

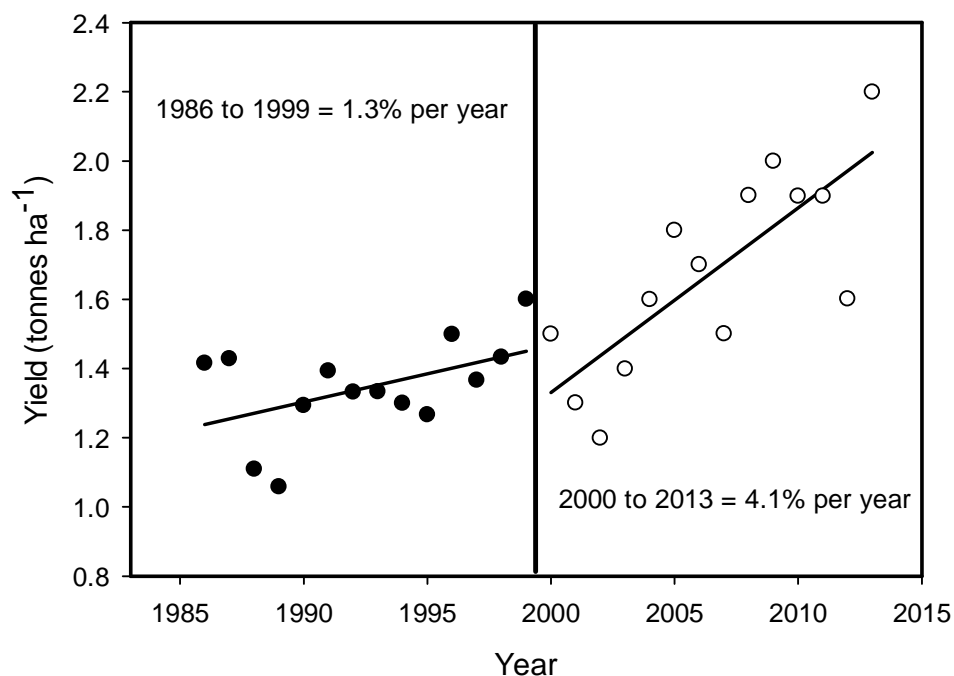
Another reason for canola yields increasing on the Canadian Prairies has been the increase in spring precipitation. From 2000 to 2013 precipitation during the months of April and May increased by 4 mm per year resulting in 16 of the 54 kg ha<sup>-1</sup> per year yield increase. Atmospheric carbon dioxide (CO<sub>2</sub>), used by plants during photosynthesis, has increased by 25 ppm since 2000. Experiments have found that canola yields increased by ~1.7 kg ha<sup>-1</sup> per ppm CO<sub>2</sub>; therefore, about 3 of the 54 kg ha<sup>-1</sup> increase may have been due to increased CO<sub>2</sub>.

When the balance sheet of 54 kg ha<sup>-1</sup> per year increase was totalled, 32 kg was due to improved genetics and 19 kg due to precipitation and CO<sub>2</sub> (Environment), leaving about 3 kg attributed to management practices. This may seem like a low number but it must be remembered that many of the best management practices such as tillage method, seed treatments, planting, fertilizing, and harvesting methods may have been perfected prior to 2000 were already being practiced.

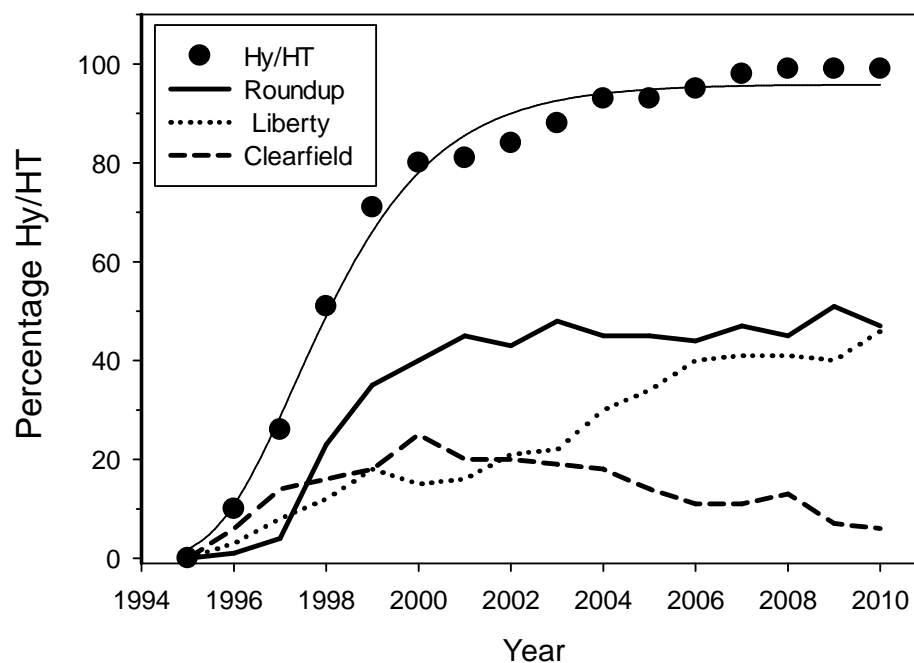
New HY/HT varieties may need new management practices in order to achieve their full yield potential. Experiments have shown that HY/HT varieties will respond to higher nitrogen fertilizer than older open pollinated ones, but they may not necessarily be more nitrogen use efficient. Tests done on farmer's canola fields with variable rate N application based on sensor technology, have shown that it can successfully improve the economic bottom line. While ~70% of prairie farmers only use a two year cereal-canola rotation, research has shown that yields improve with a three year rotation that includes a legume, due to reduced disease pressure and lower N demand.

Seed costs are the second highest input cost after fertilizer. Even with a high germination rate seed, only 50 to 60 % emerge above the soil surface. On average, a plant population of 80 plants  $\text{m}^{-2}$ , achieved with a seeding rate of  $\sim 150$  seeds  $\text{m}^{-2}$  offered the best opportunity for high yield in the Prairie environment.

**Figure 1. Prairie farmer canola yield (tonnes  $\text{ha}^{-1}$ ) from 1986 to 2013** (*Statistics Canada 2014*)



**Figure 2. The adoption of canola hybrids with herbicide tolerance (HY/HT)** (*Canola Council of Canada 2014*)



## **Conclusion**

The large improvement in canola yield over the past 13 years has been due to improved hybrid varieties with herbicide tolerance. Farmers purchase and use new treated seed every year. Good seed = good yield. Greater spring moisture has also improved yield. It is not known how high hybrid canola yields can go. In future, management practices will need to be tailored to new varieties.

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