# The forgotten success — Manitoba yield increases

by Doug Wilcox, MCIC

Manitoba producers continue to face economic stress which will only be relieved through either higher prices, lower production costs, higher yields or a change in career. But in this potentially bleak situation, hope comes in knowledge of Manitoba's forgotten success. Yields of most crops have increased substantially, and are likely to continue to increase.

I have heard concerns that yields of crops such as canola and flax have reached a plateau. I don't see it.

Using MCIC records I have plotted yield trends for eight crops from 1965 to 2003 — results are shown in Figures 1 and 2. The individual symbols indicate the average yields for each crop in each year. The lines represent the yield trend for each crop. Each annual point on the trend line represents the average yield for the previous 10 years (e.g. 1974 trend-point = average of 1965-1974 period). This creates a "lag" to the trend line, which means that it is not always within the current data point scatter.

Nonetheless this simple approach is easier to follow than many others and is similar to what MCIC uses to determine regional long-term average yields.

Figures 1 and 2 illustrate how annual yields are highly variable and that all crops show a long-term upward trend — from 1974 to 2003 the ballpark trend for most crops has been a doubling of yields. The trend lines illustrate that occasionally yields plateau, and occasionally they decline. This is undesirable but fluctuations are normal and will occur occasionally for various reasons. With patience a return to a yield increase mode can likely be expected.

## Flax yields likely to recover

So even though flax yields may be in a plateau now, the increase will probably resume. Ten years from now we will be concerned about some other crop. As a case in point, even though the provincial average flax yield was near the plateau at 21 bu/ac, some varieties in some municipalities reached 35 bu/ac. Obviously we haven't maxed out flax's potential in all of Manitoba yet. I'm sure this is the case for most crops.

I have also plotted the yield variability trends for eight crops from 1965 to 2003. The yield variability trends are illustrated in Figures 3 and 4.

The individual symbols indicate the average yield variability for each crop in each year. The lines represent the yield variability trend for each crop calculated similar to the yield trend lines discussed previously. For you statisticians, the variability in this analysis was calculated and standardized as the CV (Coefficient of Variation) and a few outliers were detected and removed using a 1.5*IQR-criterion. To interpret these graphs you just need to know that the larger the number, the greater the yield variability.

Figures 3 and 4 illustrate how yield can vary from year to year and that most crops show a long-term decline in variability. This is a good thing — it means more stable yields and lower risk. This should mean yields are becoming more predictable, and may mean producers can look forward to crop insurance rates being reduced over time.

## "M" is for management

When I used to run around the university with a lab coat and pocket protector I learned that yield is a function of G times E (Genetics and Environment) and that farm management simply influenced G and E. These days I now run around fields with my lab coat and pocket protector and have learned to appreciate that we should be thinking about G times E times M — Management, the third factor.

By pulling out the M it forces us lab-coat types to focus more directly on the influence of management at the field level. In fact the M component even transcends the field level. M should also include sociological issues as diverse as risk management concerns, peer pressures, regulations, extension resources, etc. The practical reality is that the yields farmers can actually obtain in the field is a function of GxExM, not just GxE.

*Over the period 1974 to 2003 the ballpark trend for most crops has been a doubling of yields.*

So what are the major factors behind these increases? This can likely be established by taking a GxExM approach and focusing on a simple review of variety improvement, climate change, and management differences.

## Varietal improvements

Despite decades of research, the perfect variety has not yet been created. This is not for lack of effort. The number of varieties available has never been better. In the early 90s Manitoba producers grew roughly 10 red spring wheat varieties and 15 canola varieties. In 2003 the numbers for commercial production were at least 20 for RS Wheat and 90 for canola. Having more varieties provides more opportunity for selecting locally optimized varieties which in turn should lead to greater yields and reduced yield variability.

However, it is also known that with declines in public breed-

ing, current varieties will tend towards a very narrow genetic base. The increasing use of transgenics with value-added traits has been very effective in developing those traits, but likely has had little effect on yield potential.

Hybridization has potential to increase yields in crops where it is currently not common, but has likely had only limited influence on recent Manitoba yields. Breeders have better tools now, but I don't think they are any better at selecting varieties than the breeders of the past. They can just respond faster.

In fact, modern breeders have a more challenging job than breeders of the past — they have a more limited gene pool to work with and are trying to make improvements on the best-of-the-best.

So in my mind, plant breeding is essential to make sure yields don't decline, but I don't think variety improvement is, or will be, the key factor in future Manitoba yield increases.

## Climate change

Weather variability and climate change could have a big impact on yield. Scientists indicate that climate has gradually been getting warmer and more variable. This would be expected to help some heat-loving crops such as corn, but reduce yields of cool season crops such as wheat. Yet yields of all Manitoba crops are increasing, and many are showing reduced yield variability.

This suggests that it is not weather or climate change that is responsible for Manitoba's yield increases to date. It is also likely that any increases that might occur from climate change could largely be offset by losses from new pests and diseases. I am not optimistic that climate change will result in a net yield gain for Manitoba crops.

## Management

Improvements in equipment have resulted in better timing of operations, improved input placement and better product handling. For example, precision planting equipment has resulted in earlier plantings with less plant stand losses and need for replanting. Improvements have also resulted in better placement and timing of fertilizer and pesticides, and faster, more efficient harvesting.

Agronomy has improved due to improved knowledge, specialty consulting, area-wide monitoring and pest forecasting.

Increased crop diversity has led to more rotation options. Fertilizer use has increased. In the early 90's a Red River Valley canola crop would receive 90 lbs/ac N and 5.5 lbs/ac S. Today that crop would receive 100 lb/ac N and 11 lbs/ac S.

Pesticides continue to be introduced and are likely applied more effectively than in the past. The agronomy knowledge pool continues to grow and producers are increasingly adopting technologies that allow rapid transmittal of information. Improved agronomic practices will not only continue to be developed but will be adopted more quickly. I am confident that management has had a significant role in the recent yield increases and reduced yield variability in Manitoba.

My simplistic review of GxExM has led me to conclude that Manitoba's yield increases have primarily been from management improvements. Genetics and climate are important but in my opinion have not been the main factors. Experience has shown that new varieties rarely lead to substantial increases in yield unless coupled with changes in managements.

The way I see it, if Manitoba producers are to survive in a competitive world, they must depend on a strategy of continued yield increases, which will largely have come from continued improvements in their own management practices.

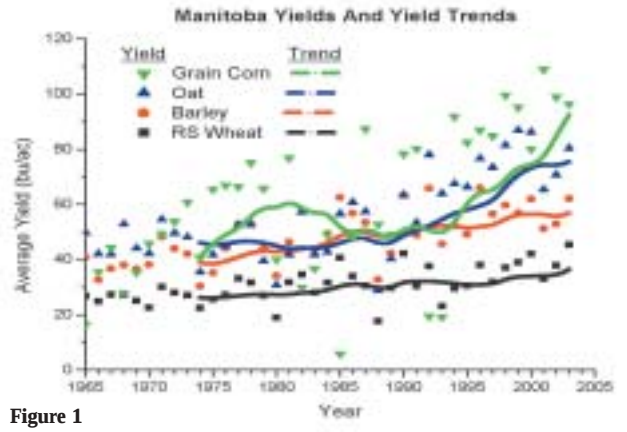

Figure 1

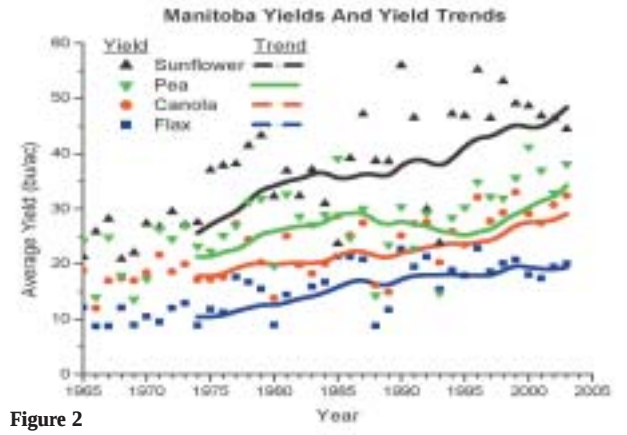

Figure 2

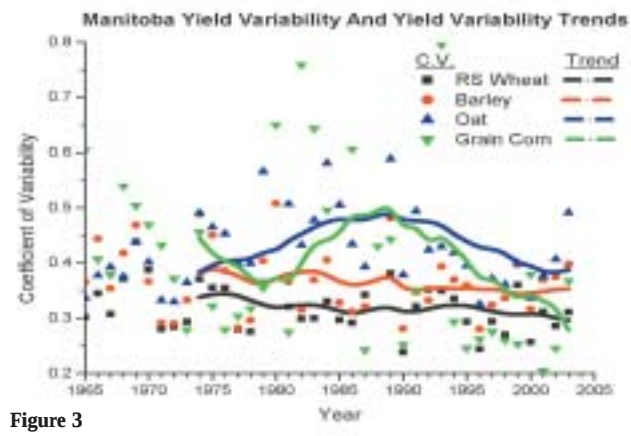

Figure 3

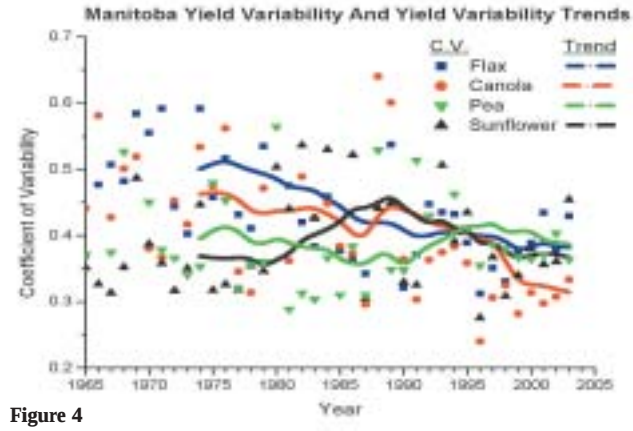

Figure 4