2.1 Annual soil tests improve nitrogen returns

KEY PRACTICE: Predicting how much nitrogen is reserved in the soil is difficult. Given its high cost in canola production, conducting an annual soil test on each field to determine appropriate rates is a good idea. The wild card is moisture supply throughout the growing season.

PROJECT TITLE, LEAD RESEARCHER: "Long-term effects of different soil test based fertilizer rates on crop production, contribution margin, and soil quality in the Peace region." 2009-12, Kabal Gill, Smoky Applied Research and Demonstration Association (SARDA)

GROWER ORGANIZATION FUNDER: ACPC, MCGA, SaskCanola

Nutrient carryover has a major effect on crop yield. In order to predict recommended fertilizer rates, an annual soil test is wise. Testing for nitrogen (N) levels helps, but this study did not show a benefit to testing for phosphorus (P), potassium (K) and sulphur (S) every year. Recommended rates for these were the same each year.

SARDA's objectives were to study the long-term effects of different soil-test based fertilizer rates on crop production, and whether soil testing can detect the effects of different fertilizer rates in previous years. Fertilizer rates were applied at zero, 60, 80, 100, 120 and 140 percent of the recommended rate through the four-year study. The same fertilizer rate was applied each year in a given plot to demonstrate the long-term effects. The study used a wheat-canola-barley-pea rotation, with all four crops grown every year. The study was done in the Peace River region with no tillage.

A composite soil test was taken each year for each plot at zero to six inch and six to 12 inch depths.

Spring and in-season moisture levels were much lower than normal in both 2009 and 2010. After the 2009 drought, there was no consistent effect on the recommended fertilizer rates for 2010. But after the 2010 drought, plots that had the higher N rates in 2009 and 2010 came back with a lower recommended N rate than plots that had lower N rates.

The first 60 percent of the recommended nutrient rate had the biggest improvement in yield in all years, and in the drought years there was little to no benefit to higher rates. This is as expected.

However, with adequate moisture in 2011 and 2012, canola yield continued to increase with higher rates. Maximum yields were observed at the 140 percent fertilizer rate for canola in 2011 and at the 120 percent rate in 2012.

Because canola seemed to use all the nitrogen available in 2011, regardless of rate, the recommended rates for 2012 were similar in all treatments. This was also true for P, K and S treatments.

In fact, residual nutrient levels after crop harvest showed no effect on the fertilizer rates with very similar amounts of P, K and S recommended in different treatments.

Conclusions

1. A soil test based fertilizer recommendation has to consider the odds of profit each year.

2. Soil tests were able to detect the effects of moisture supply levels and fertilizer rates applied on the residual nitrogen (N, P, K and S that could be available for the next crop).

3. Soil tests to show available N can be useful each year. When the previous crop has not used all available N (e.g. in a dry year) residual N in soil may result in lower N recommendations. Knowing this, growers may be able to trim N rate, make use of the soil N reserves, and increase profits in that year. Following a year with good moisture supply, residual N levels may be too low to achieve maximum yield using an average traditional rate, and growers may benefit from higher soil test based N application.

4. Soil tests for available P, K and S may not be required every year, given that their residual levels have less effect on recommendations, regardless of yield or moisture for the preceding crop. This is probably because they are applied at relatively small rates compared to much larger total soil reserves.

5. Greatest yield and economic benefit per unit of fertilizer came from the first 60 percent of the recommended fertilizer rates, but maximum yield was usually at higher rates.

6. The 100 percent rate seems to strike a balance. Soil tests, especially after very dry and wet years, appear to be a good strategy to optimize crop yields and profits. ●

Canola seed yield at different fertilizer rates

FERTILIZER RATE % of recommended	CANOLA (bu./ac.)			
	2009	2010	2011	2012
0	43.9	27.4	42.5	30.0
60	56.1	34.7	57.9	61.1
80	54.0	39.3	64.7	70.3
100	54.3	39.7	67.0	71.3
120	53.8	40.6	68.7	78.5
140	50.5	41.5	72.4	77.9
LSD	8.02	3.57	6.59	7.19
CV, %	8.46	5.3	5.7	6.1

Differences have to be greater than the LSD (least significant difference) to be statistically different. CV is coefficient of variation.