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Soil Facts

Variable Rate Nitrogen Application: A Producer Profile

Vance and Fran Simpson of Raymore, Saskatchewan started precision farming in 1997. They currently grow wheat, barley, oats, canola and peas on 4,600 acres in the thin black soil zone. Most of their land base consists of gentle to moderately undulating slopes featuring many knolls and depressions. The Simpsons' decision to use precision farming in their operation was made to increase profits or improve their bottom line. Their hope was that precision farming could net them an extra $10 per acre, either by increasing crop yields or reducing fertilizer inputs. Vance also states he always had a fascination with precision farming technology, and was not afraid to use it on his own farm

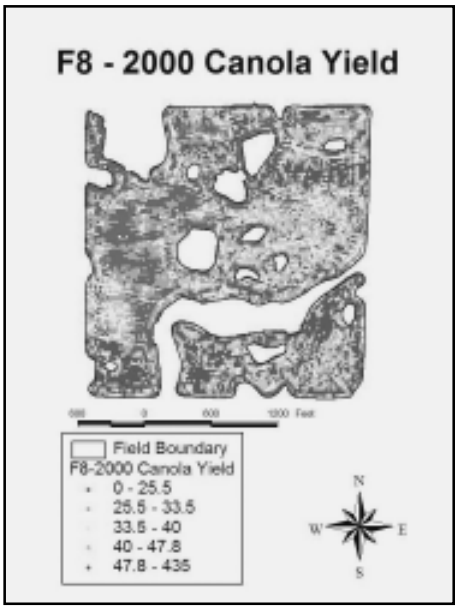
Vance understood that knolls and depressions in a variable landscape have differing production capabilities, due to variations in soil moisture, organic matter, and inherent fertility status between upper, mid and lower slope positions. The agronomic differences and yield variation between slope positions convinced Vance that yields and nutrient use efficiencies were not being maximized with one general fertilizer application rate across an entire field. Vance realized that, over time, a single fertilizer rate across the entire field might have caused the low slope positions to be under-fertilized while the high slope or knolls were over-fertilized. As a result, Vance decided to investigate the merits of precision farming.

To make precision farming viable on the Simpson farm, Vance said they had to invest in the necessary equipment. Following the purchase of two new Case IH 2188 combines in 1997, they began precision farming. The combines were equipped with the full AFS (Advanced Farming Systems) option, which included a yield monitor to gather yield and moisture data, as well as a global positioning system receiver to record the exact location of that data in the field. Elevation data is also calculated and recorded with this system.

In 1998 Vance purchased a Flexi-Coil 50 series air cart with three tanks and the variable rate option. This option gave Vance the ability to automatically change rates "on the go" in the field.

In 2001 Vance upgraded his equipment, trading his combines for two Case IH 2388 models that contained factory yield monitors. He also made the switch into low disturbance direct seeding when he purchased a 57 foot Flexi-Coil 5000 air drill. The air drill was fitted with side band openers that apply seed and dry fertilizer on nine-inch row spacing.

With the equipment in place for precision farming, the next step was to make use of it. 1997 was the first year that yield data was gathered. The yield results were then downloaded into the Case IH Advanced Farming Systems software package, to generate yield maps.



The Simpson's base their management decisions on a variety of data sources including yield maps.

Instead of precision farming all their acres, the Simpsons decided to precision farm only about 1000 acres. Dr. Dan Pennock of the University of Saskatchewan's soil science department recommended the Simpsons delineate three management zones on these fields. To delineate management zones based on slope position, the U of S Soil Science department used image analysis software on black and white aerial photos of the precision farmed fields. This analysis separated the knolls from the depressions by the differing grey-scale shades on the image. Light coloured areas represented the knolls, while dark coloured areas represented the depressions. Three benchmark sites, representing each slope position, were chosen from each field and then soil sampled to determine nutrient requirements. The resulting soil test recommendation for each slope position was then extrapolated to represent low, mid and high slope positions for the entire field.

The next challenge was to write a prescription that represented the nitrogen fertility requirements for each slope position. The fertilizer rates, blends and prescriptions were developed with the assistance of Zane Lewchuck, Soils & Crops Agrologist (SAFRR), and were entered onto special software by Vance himself. The prescription is then downloaded on to a card that is installed in the controller mounted in the tractor. This prescription card, along with the GPS receiver from the combine, allows variable nitrogen rate changes to occur at that

particular point in the field.

The analysis of the yields resulting from using variable rate fertilization across differing slope positions was conducted by Zane Lewchuck. Vance said the results of the 1998 precision farming venture were encouraging, but somewhat variable. The yield differences between slope positions were generally extreme, especially with canola where the lower sloped positions significantly out-yielded the upper slope positions.

The Case-IH AFS yield monitor on the Simpson's combine.

In 1999, Vance reviewed the previous year's results, and thought the three delineated management zones might be too refined. Dr. Dan Pennock suggested that Vance go down to two management zones - an upper zone and a lower zone. Technicians at the U of S Soil Science department again used image analysis software to help delineate the two zones on the precision-farmed fields. Soil tests were taken at 15 mid slope positions on the quarter and then analyzed. The upper management zones received the recommended nitrogen rate, while the delineated lower slope management zones received anywhere from 1.5 to 2 times the recommended nitrogen rate, depending on the crop. For example, on a canola crop in 2004, the upper slope positions received 80 lbs/acre of actual nitrogen, while the lower slope positions received 110 lbs/acre of actual nitrogen.

The Simpson's use the Flexi-coil variable rate controller to vary fertilizer rates.

Vance currently uses this two-management zone system. He states it is much simpler to use because it reduces the number of management zones per field. Since beginning the two management zone system, Vance said he is not seeing significant variation from the lower to the upper slope positions with the cereals. In one wet year, however, Vance claims that canola in the lower slope positions significantly out-yielded the canola in the upper slope position. In fact, on this particular field, Vance claims that precision farming gave him an extra economic return of approximately $9 per acre compared to the constant check strip. Vance cautions this was an exceptional year for moisture, and that moisture is required to make precision farming work.

Vance continues to experiment with variable rate technology. His latest venture is a three-year partnership with the Indian Head Agricultural Research Foundation (IHARF) and Agriculture and Agri-Food Canada. This project utilizes previous yield maps along with satellite imagery to delineate management zones. The imagery uses a Normalized Difference Vegetative Index (NDVI) to measure biomass production on the previous crop. This production is then correlated to the yield maps. Once the management zones are delineated, soil tests are conducted. Six different nitrogen rates are determined, and then superimposed into each zone to determine response. Dr Guy Lafond, a production systems agronomist with IHARF, states the results generated midway into this project seem encouraging. More research, however, is required.

Vance cautions producers about the costs associated with purchasing precision farming equipment, and cautions producers to ensure the technology is user friendly, quick and reliable. The biggest barrier to precision farming is not the technology itself; it is linking that technology to the agronomy of crop production. There are a number of methods producers can use to practice precision farming and site-specific management on their own farm, but what works well for one producer, may not work to well for others.

Vance will continue to use precision farming in his operation. He states there has been a huge learning curve but remains optimistic that the potential for this technology could be unlimited.

For More Information

1-800-213-4287 or www.ssca.ca

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