



PERFORMANCE & PROFITABILITY

Resources 2022



Validate your management practices

Knowledge is power, especially with all the information precision agronomy has to offer.

The most successful plans – from crop rotation to soil zone management, crop nutrients and fertilizer strategy – leverage that knowledge to continuously improve economic and environmental sustainability on your farm.

Catch up on insights and useful resources about all things soil health and nutrient management best practices with our eBook.



Minimize field nutrient loss, maximize crop uptake of nutrients and optimize your investment in crop inputs effectively



Precision Nutrition and Its Impact on a Sustainable Future

The days of applying a flat rate of fertilizer to entire fields is coming to an end. In its place is more efficient soil fertility and fertilizer management practices that follow the principles of nutrient stewardship.

These practices can help you meet the rising demand for food while minimizing pressures on the environment and help meet societal expectations for sustainability regarding food sourcing.

Efficient fertilizer management is integral to any program that aims to reduce agricultural greenhouse gas (GHG) emissions. This is especially true for nitrogen, an essential crop nutrient, that if applied inefficiently, can contribute to nitrous oxide (N₂O) emissions, which are three hundred times more harmful than carbon dioxide.

Nutrient Stewardship

In the past, farmers used a flat rate of fertilizer on their fields to try to achieve the best results. But that method has been challenged in recent times, ushering in a new era of nutrient stewardship for the future of agriculture. The goal is a smaller environmental footprint while maintaining optimal soil fertility and nitrogen levels, by using precision agronomy techniques.

Adopting a nutrient management technique like a variable rate (VR) program has a lot of benefits for growers, the general public, and the environment.

There are four principles of nutrient stewardship, called the 4R Principles:

1. **Right source** – Matching the fertilizer type to crop needs. This includes taking a close look at the available sources of nutrients and making informed decisions about the bioavailability of products.
2. **Right rate** - Matching the amount of fertilizer to crop needs. This depends on both the prior state of the soil and which crops are being grown.
3. **Right time** – Making nutrients available when crops need them. This involves calculating the interplay of crop uptake, soil supply, nutrient loss risks, and field operation logistics.
4. **Right place** – Keeping nutrients where crops can use them. This involves analyzing and tracking the interplay between roots and soil to see nutrient movement and mitigate nutrient losses from the field.

By aligning four simple principles, you can minimize field nutrient loss, maximize crop uptake of nutrients and optimize your investment in crop inputs effectively. In fact, thousands of farmers already participate in [4R nutrient stewardship](#) farming because they know that feeding people starts with feeding the soil.



Precise control and measurements for exactly what you put into every field



Make the most out of each farmable acre

We farm in a time where working smarter, rather than harder, is essential to running a successful, sustainable business. There's an incredible push in agriculture today for you to balance economics on the farm with environmental practices that keep farmland healthy for generations to come.

The key to achieving this balance lies in using agtech to increase production and manage costs from every acre, while reducing waste at the same time. Precision agriculture is helping farmers like you understand more about your fields than ever before, while incorporating variable rate (VR) technology to up productivity and minimize waste.

While Prairie growers have become more familiar with VR fertilizer strategy over the years – precisely placing the right applications for nutrient uptake in the right areas of the field, VR seeding – adjusting seeding rates to the growing conditions in every zone on your farm, might be a newer concept. However, the ideas are similar, and they answer the challenges around increasing yield while managing costs.

The key to using VR technology to optimize your acreage production is extremely zone management specific and that's why selecting a proven program is important. With anywhere from five-to-seven zones in a field, all with differing soil characteristics and topography, each must be treated very differently. In contrast to broadly applying nutrients and seeding in the same ratios everywhere, VR technology gives you precise control and measurements for exactly what you put into every zone on your farm.

Manage each zone within the field based on its yield potential

This is key. Every opportunity is maximized when you can individualize both seeding and crop nutrition applications to each different zone in your fields. The most and least productive areas in each field are matched with the corresponding seed rates and applications.

“We have a full-time geographic information system (GIS) team trained in global positioning systems (GPS) and all the programs that go with it. They work together with the producer to build a high-resolution boundary,” says Bilodeau. “Our process is designed to build a multi-year composite fertility index map using normalized difference vegetation index (NDVI) imagery and topographic data to build a map that is representative of the field.”

Soil sampling is then conducted based upon the unique vegetative index for each field with samples taken on every zone at 0-6” and 6-24”. With that, we ensure your VR prescription is customized specifically to all your farmable zones.

Invest your dollars where it matters most

While you're maximizing your yield potential on every acre, you're also controlling costs and getting the most of every dollar spent on inputs and seed. “We want to be sure to return a tangible value to our farmers,” says Bilodeau. “There are so many different ways we can return value.”

The effects of success will ripple across your entire farm

Making the decision to move to a VR program on the farm is an investment. No doubt you're wondering, how do we see that investment returned? The truth is, it's a loaded question precision agronomy companies get asked a lot. And sometimes, the answer is complicated considering the ways a solution performs on each farm depends on environmental factors, individual management and implementation.

As useful as it is, return on investment is often a quantitative, numbers-driven conversation that requires accurate data analysis conducted at the zonal level. But it's also important to understand that while yield is the most obvious profitability determinant, it's not the only factor at play. To that



end, a qualitative review of your integrated on-farm solutions can be just as impactful as numbers when determining the effectiveness of your VR program. Undertaking such a review should encompass factors such as productivity, quality, efficiency and profitability.

When considering your overall ROI, here are a few outcomes where your VR program's success should be evident:

- ✓ **Invest where it matters most:** While you're trying to maximize your yield on every acre, you're also controlling costs and getting the most of every dollar spent on inputs and seed.
- ✓ **Improve overall crop input efficiency:** When you use VR technology to apply the right amount of nutrients combined with the ideal seeding rate, you can produce more from every acre of your land.
- ✓ **Increase crop quality:** Using VR increases understanding around all the ways you can achieve better quality, increased protein or more uniform establishment across all your acres.
- ✓ **Better standability:** That uniform establishment also delivers a more uniform plant stand. This may help reduce lodging and improve harvest timing as well as fungicide timing and control of disease management.
- ✓ **More sustainable field management:** While you're protecting your investment using VR, you're also protecting the environment and farming sustainably. When you understand and adapt to your soil's variable qualities, you'll prevent application loss to volatilization, denitrification and leaching.

- ✓ **Traceability of crop production:** VR's digitized information and memory cards, where your prescriptions are installed, make it easy to trace the history of everything applied to your fields. This provides the traceability and transparency the industry is increasingly demanding, so you'll be ahead of the game.

The ROI-related impacts of your VR program are clearer to see and measure when you can review your performance insights at the end of each season with the accurate data and expertise your VR program provides. The information and knowledge gained and stored through your VR program is especially valuable when it comes to any decision making that can increase revenue on your farm.

When it comes to the performance review, it must be thorough, examining your farm in zones rather than at the farm level. With anywhere from five-to-seven zones in each field, all with differing soil characteristics and topography, the value in treating each differently cannot be stressed enough.



Return on investment in variable rate technology is about a lot more than yield



Performance insights: validate your management practices and discover opportunities for improvement

One of your most powerful tools is the collection and understanding of good data. “Having sound data, you can make decisions on how to fertilize certain areas of your field or what seed rates are needed to help increase your return on investment,” says Garth Donald, Decisive Farming co-founder and manager of agronomy. “This kind of information allows you to make the best decision of what you want to grow in subsequent years to try and gain the best overall return on investment.”

When it comes to managing and applying all that information for your farm’s plans today, tomorrow and beyond, insight and hindsight can bring 20-20 vision for the best decision making. When you have a second set of eyes, it’s even more clear.

Keep improving

“The farmers who are excited about VR are looking for ways to continue to aggressively take on the world in conjunction with the 4Rs,” says Andrea Bilodeau, Decisive Farming senior agrologist. “Performance insights is a great piece and part of the conversation and how we do that. We focus on the areas of the field the farmer can make shine, open up a conversation around why some are lower yielding, and how to maximize on the investment being put out there.”

That includes configuring your equipment and linking all your systems for convenient information access you can trust. “Having a complete calibrated data set from a combine can be a valuable tool in identifying places of concern more specifically,” says Bilodeau.

Accurate as-applied records around your pesticide and in-crop applications also mean you can more effectively react to changes in more precise ways that minimize disruption to the rest of your crop plan. “As-applied records give you a history of what you applied so you can go back in the growing season to make sure that application actually worked for what you were applying it for,” says Donald. “Once you have a digital copy of that data, it allows you to make decisions going forward around what you can grow, or what you may need to grow.”

Farm-wide, in-depth analysis

As the season wraps, you can validate or adjust your plans with a deep delve into your farm’s performance to discover what’s working and where the best opportunities for improvement lie.

“This review allows us to sit down frankly with customers and have a really incredible conversation,” says Bilodeau. “Sitting down and evaluating each field to this level and having someone discuss what all this data really means is different for them.”

This discussion creates a clear vision around factors at play including your yield variability, production expenses and historical performance as you work together to see patterns and make assessments for growth and efficiency. “Data collection gives farmers a yearly dataset of which products they use, but it also creates a history,” says Donald. “You can go back and understand whether what you did worked or not.”

Going forward, these records make for the best rotation decisions. “Maybe you stretch them out a bit and limit certain crops,” says Bilodeau. “It may also give you an opportunity and better knowledge in terms of the varieties you’re choosing.”

That different perspective around field performance drives stronger management decisions. For example, “Did areas of long-time poor performance respond to how you treated them?” says Donald. “If they did not, you can create a new plan moving forward by using data as opposed to guessing or trial and error.”

Collaborative insights and reviews are powerful tools to continuously improve performance on your farm. “We have this incredible overview of where we started this process, where we ended it and how we’re going to continue forward,” says Bilodeau. “It creates this wonderful conversation with our farmers about their goals and strategies for improving their farms. That’s the biggest thing.”



Insight and hindsight can bring 20/20 vision for the best decision making



How precision technologies are helping farmers increase profitability while also meeting growing demand for nutritious calories

From ox and plow to the advent of autonomous tractors, farmers have always sought new and more efficient ways to grow crops. The demand for high-quality, protein and nutrient-rich food increases annually as the global population is on pace to reach 9 billion by 2050. The explosive growth of plant-based protein food products is testament to the nearly insatiable demand for healthy calories. Consumers and food manufacturers are also seeking greater transparency and traceability from the agriculture industry, literally from the box of cereal on the shelf right back to the farmer who grew the contents – what, where, when and how.

Juxtaposed against swelling food demand is the reality that available productive agricultural land remains static or decreases annually. Farmers are under immense pressure to find production solutions that are both economically and environmentally sustainable. The strategic employment of data collected from the field and managed through precision farm applications is a rapidly growing solution that is paying off for both farmers and foodies alike.

From corn to soybeans, potatoes to strawberries, soil health and soil fertility management are crucial in the production of nutritious and high-yielding crops. In order to reach maximum potential, a maturing plant needs access to as many as 17 elements at exactly the right time during its growth cycle – from carbon, hydrogen and oxygen, to

nitrogen, phosphorous and potassium, as well as many micronutrients such as boron, copper and iron. If the plant suffers nutrient deficiencies during its early emergence, the yield and overall nutritional quality of the crop will be adversely impacted.

In order to reach maximum potential, a maturing plant needs access to as many as 17 elements at exactly the right time during its growth cycle – from carbon, hydrogen and oxygen, to nitrogen, phosphorous and potassium, as well as many micronutrients such as boron, copper and iron. If the plant suffers nutrient deficiencies during its early emergence, the yield and overall nutritional quality of the crop will be adversely impacted.

More strategic crop management is getting a boost from precision agriculture platforms that are making use of big data, artificial intelligence (AI) and predictive analytics to offer farmers highly customized plant fertility solutions based on hyper-local growing conditions. Sustainable agriculture starts with managing social, environmental, and financial aspects equally and in balance.

The impact is also being seen in improved environmental performance by better soil nutrient management and reduced CO₂ emissions. It's a win-win for global food production and the individual farmer's profitability.

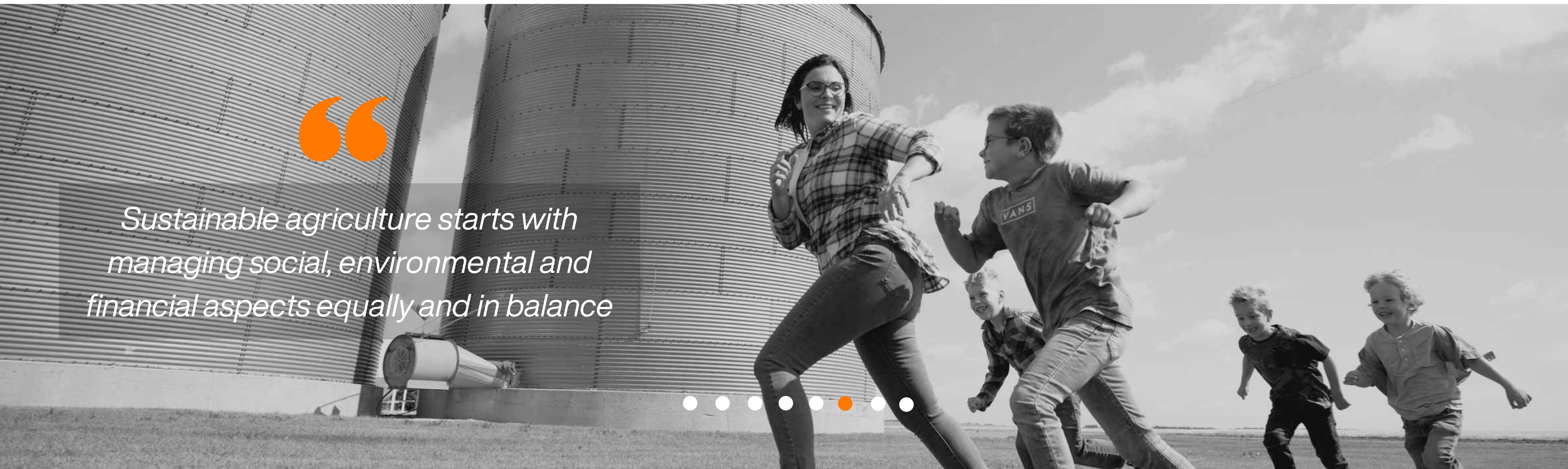
Emerging technologies like soil sensors, satellite infrared imagery, and GPS-guided equipment are being coupled with crop industry best-practices like the [4R Nutrient Stewardship](#) program. The 4R approach provides a framework to achieve increased production, enhanced environmental protection, and improved sustainability by incorporating the right nutrient source applied at the right rate, at the right time, and in the right place.

The opportunity to trial and demo these emerging technologies and best practices has been instrumental in helping to prove the return on investment from building a digital farm. Olds College's [Smart Farm](#), launched in Alberta in 2018, is "using the technologies and data gathered to make evidence-based decisions to improve productivity, profitability and sustainability," according to the College. The Smart Farm has proven to be a tremendous success to date.

We are entering a new golden age in farm productivity that is helping boost global yields and also allow farmers to extend their capacity, automate routine tasks and give them more time to do things computers can't. It's not to replace the personalized care farmers put into creating resources essential to life, nor should technology determine the root cause of a problem in the field. Farmers can now, with the help of advancements in agriculture, deliver the best product with more nutrients to the growing population.



Sustainable agriculture starts with managing social, environmental and financial aspects equally and in balance





Food As Medicine: What Biochemistry And Genetics Are Teaching Us About How To Eat Right

We often talk about genetics as if it's set in stone. "She just has good genes" or "He was born with it" are common phrases.

However, over the past decade, biochemists and geneticists have discovered that your genetic expression changes over time. Based on environmental factors, certain genes may be strongly expressive while others are dormant.

In fact, a [2016 study of human longevity](#) found that only 25% of health outcomes are attributable to genetics. The other 75% of outcomes are attributable to environmental factors. Among those environmental factors, diet and nutrition play a major role.

An entire branch of scientific research has now exploded around nutrigenomics, the study of the interaction between nutrition and genetics. Scientists now understand that genes set the baseline for how your body can function, but nutrition modifies the extent to which each gene is expressed.

As more data comes in about the types and quality of food that improve health outcomes, high-tech farmers are also entering the nutrigenomics conversation. Using precision agriculture, they hope to produce food that's targeted to deliver a nutrient-rich, genetically beneficial diet.

Implications Of Nutrigenomics

Researchers have found that there's no such thing as a perfect diet. Dietary recommendations are not one-size-fits-all. Each individual needs different nutritional choices for optimal health and gene expression. In addition, each person is different in the extent to which their genes and health are impacted by their diet.

Geneticists and nutritionists are working together to study the dietary levers that most impact genetic expression. If they're successful, it may be possible to [prevent and treat disease](#) through individualized nutrition tailored to your genetic profile. Indeed, you may walk into a doctor's office and leave with a dietary "prescription" customized to your DNA.

"In the near future, instead of diagnosing and treating diseases caused by genome or epigenome damage, health care practitioners may be trained to diagnose and nutritionally prevent or even reverse genomic damage and aberrant gene expression," [reports Michael Fenech](#), a research scientist at CSIRO Genome Health and Nutrigenomics Laboratory.

The initial results of nutrigenomics studies are promising. A healthy, personalized diet has the potential to prevent, mitigate, or even cure certain chronic diseases. Nutrigenomics has shown promise in [preventing obesity, cancer and diabetes](#).

If Food Is Medicine, Food Quality Matters

Nutrient abundance or deficiency is the driving factor behind nutrigenomics. Foods that have grown in poor conditions have a lower nutritional density. In turn, eating low-quality foods can have a significant [impact on human gene](#) expression. In order to take advantage of the findings of nutrigenomics, consumers need access to high-quality, nutrient-dense foods.

Similar to human health, plant health is impacted by the combination of genes and nutrient intake. Healthy soil, strategically applied fertilization techniques, and other forms of environmental management lead to healthy crops.

However, applying these custom growing techniques at a large scale is a major challenge. Agtech will play a big role in allowing farmers, like you to precisely manage the growing conditions and nutrient delivery for their crops. In turn, this precision farming will make crops more nutritious and targeted for nutrigenomics-driven diets.

Making Food That's Better For Us

Plant health relies on nutrient uptake from the soil. In order to ensure plants receive the nutrients they need, you need to precisely apply additives where they're needed. With in-ground sensors, advanced mapping of crop quality across a field, and other technologies, you can target your



applications of water and nutrients to match plant needs. The days of broadly applying generic fertilizer to entire fields are coming to an end.

“Farmers play an integral role in providing access to diverse, nutritious food,” explains Garth Donald, manager of agronomy and co-founder of Decisive Farming. “Nutrient deficiency in plants and the soil can contribute to the deficiencies found in humans. The opportunity exists to address these deficiencies through precision nutrition delivered by the agriculture sector.”

Using Biochemistry And Big Data To Create Better Food And Healthier People

Nutrigenomics will completely change how we think about health and disease prevention.

A key part of making nutrigenomics effective is having access to high-quality, nutrient-dense foods. AgTech is using the Internet of Things, AI, and precision farming to make nutrient-dense food more readily available.



Healthy soil, strategically applied fertilization techniques and other forms of environmental management lead to healthy crops.





Contact us for more information or to arrange a no obligation appointment

LET'S GET TO WORK. TOGETHER.

decisivefarming.com

1-800-941-4811



@DecisiveFarming



/DecisiveFarming