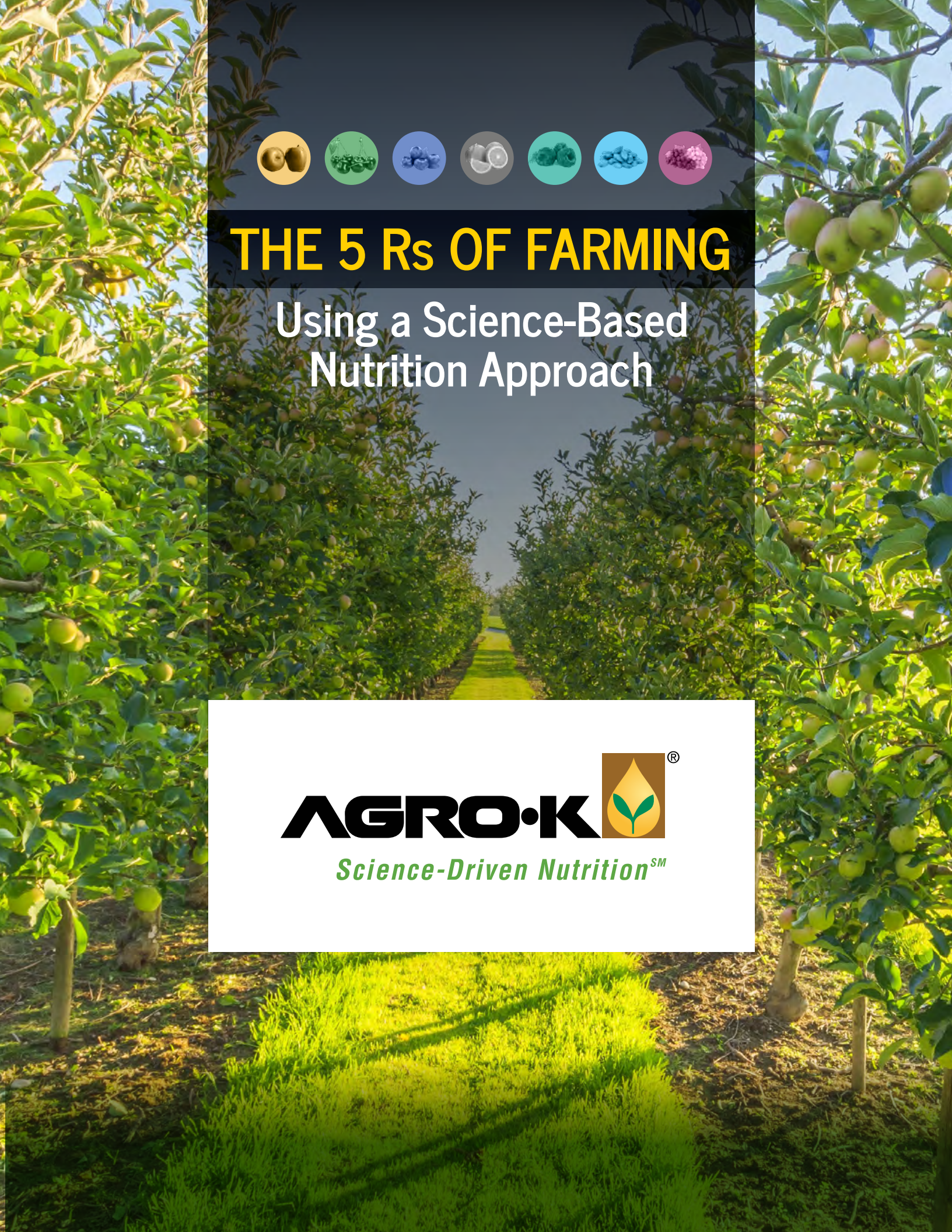


THE 5 Rs OF FARMING

Using a Science-Based Nutrition Approach

AGRO·K®

Science-Driven Nutrition℠

SCIENCE-BASED APPROACH

The 5 Rs of Farming

THE 5 Rs OF FARMING USING A SCIENCE-BASED NUTRITION APPROACH

GROWERS NEED TO ANSWER KEY QUESTIONS for their crops when making agronomic decisions. What nutrients are necessary? What is the best mode of delivery for those nutrients? What nutrient forms make sense? What method and placement will be the most effective? What timing is best for maximum impact? Growers must maximize the productivity of their time, methods, and dollars. They need practical, reliable, proven solutions and strategies when answering these questions.

The solution to this difficult decision-making process is Agro-K's 5 Rs. By combining the foundational principles of plant physiology, chemistry, and microbiology with the practical knowledge gained through analytical agronomy, Agro-K's 5 Rs distills the science into a friendly and easy-to-use assessment.

Know the Variables – Agro-K's 5 Rs:

- The Right Nutrient
- The Right Timing
- The Right Form
- The Right Mix
- The Right Place

When assessing the nutritional requirements of a crop, employing the core principles of Agro-K's 5 Rs and asking the relevant questions provides a focused approach that is directed by science.

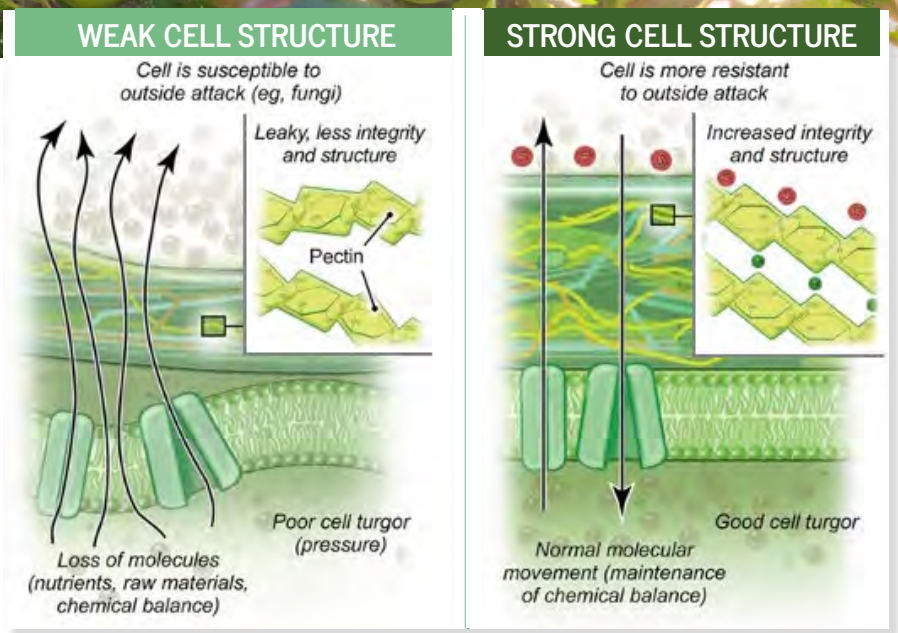
"When we are developing crop programs, these are the fundamentals we think about. These are the questions we ask ourselves," explains Rick de Jong, International Business Development Manager for Agro-K.

"We start with the foundations of chemistry, plant physiology, microbiology, and biochemistry," points out Sean Jacobs, Senior Sales Agronomist at Agro-K. "Then we work with our NovaCrop sap analysis, which provides a snapshot of nutrients currently circulating within the plant, to assess nutrient needs, nutrient balances, and how well our products are working. This helps us better educate growers on using our products, as well as develop new products.

"By getting into the plant, we can better assess the changes that are occurring on every level," he adds. "The core of it starts with the foundational sciences and then goes through analysis so we can better understand how everything plays together."

Agro-K's products are meant to serve specific needs at specific plant growth stages, de Jong explains. "We build these products into programs to help the farmer achieve their results for the crop," he says. "We then use science to adjust these programs over time."

Agro-K's 5 Rs are the basis for a holistic nutritional program driven by science. As de Jong says: "They are the fibers of our science-driven nutrition approach. Science is our guide."



1 THE RIGHT NUTRIENT

It is not new information that nutrients are essential to crop health. As crops grow and growers harvest them, existing nutrients in the soil decrease. Over time, most soils require the addition of nutrients to support crop nutrient removal rates.

There are a combination of macronutrients and micronutrients that crops need. While macronutrients are used in large amounts by plants, micronutrient deficiencies can be equally damaging to yield and profitability. Having an appreciation for the different roles that each of the individual nutrients play within a plant is therefore essential to success.

Nutrition and Plant Timing

A plant goes through various growth stages, and each of these benefit from specific nutrients.

Calcium, for instance, supports fruit cell wall development and fruit firmness. Phosphorus is a key nutrient behind the energy driving healthy cell division. Zinc assists with leaf and vascular tissue development on new growth. Potassium can help move sugars through plants and regulate plant moisture. Additionally, magnesium, manganese, sulfur, and iron maximize chlorophyll production, photosynthesis, and nitrogen metabolism. Agro-K products, such as Vigor-Cal™ or Clean Calcium (for calcium applications), AgroBest® 9-24-3 (for phosphorus), KDL and Clean Potassium (for potassium), and Zinc Plus +5 D.L. (for multiple micronutrients with a zinc emphasis supporting leaf development and function) can help optimize these various plant phases.

Knowledge Is Power When It Comes to Nutrition

Many growers determine their nutrient availability through soil testing. The addition of plant sap analysis can provide deeper nutrient details.

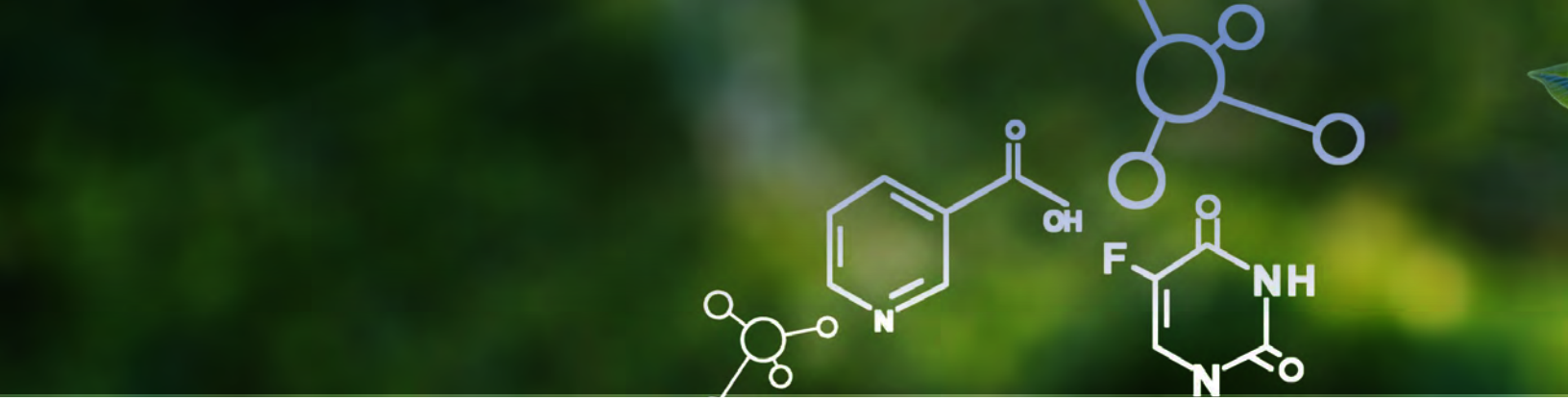
Agro-K uses NovaCrop sap analysis technology to aid in nutrient management. It measures nutrient content in leaf sap for detailed and accurate data about available nutrient levels within the plant and their mobility. Agro-K uses crop-specific nutrient target levels to aid growers in identifying and correcting imbalances to boost crop quality and yield. This real-time data gives growers a chance to make timely decisions, so a nutrient doesn't get the chance to become deficient or excessive, negatively impacting overall yield or quality. It's all about achieving and maintaining optimum nutritional balance for your crop.

The Power of Phosphites

A phosphite compound, a salt of phosphorous acid, is a nutrient form with systemic capabilities within plants. Systemic nutrients are able to move beyond leaf tissue to other parts of the plant. Phosphite nutrients, in addition to being xylem mobile, are also phloem mobile, meaning that phosphite nutrients from a foliar application will not only move up the plant but will also move down into the roots.

"Phosphites can certainly have the best rating for foliar uptake," says Rick de Jong. "They are the most foliar-friendly products on the market today with rapid uptake and movement within the xylem and phloem. Phosphites move into the leaf rapidly and will translocate with both water and sugars. You get efficient uptake, efficient delivery, and positive impacts on crop yield and quality."

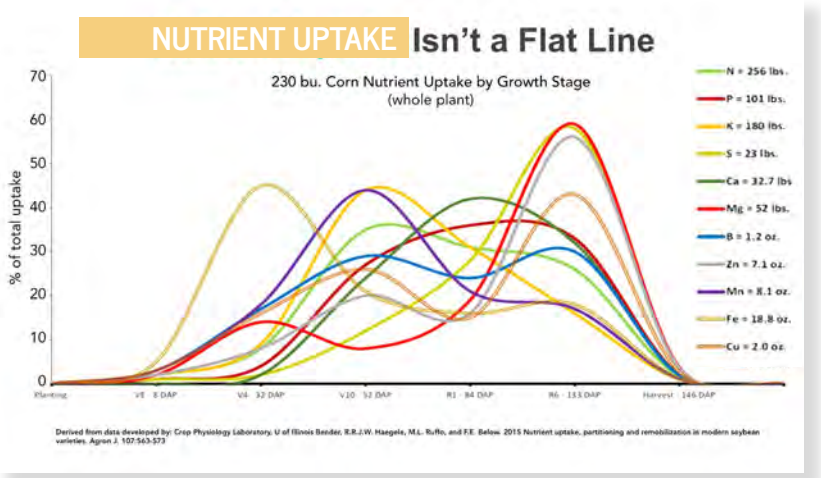
Agro-K's Sysstem® Series of foliar phosphite products provide the right blend of nutrients in the correct formulations to meet the crop's needs while ensuring rapid



nutrient uptake. "Our Sysstem Series phosphites are ionic compounds completely solubilized forming true solutions — not suspensions, emulsions, or encapsulations," adds Jeff Glass, AgroK's Southern Business Development Manager. "These products are designed to deliver nutrients into the plant, not just on the leaves."

Some of Agro-K's Sysstem Series products include:

- **Sysstem®-Ready** – a foliar fertilizer combining zinc and manganese phosphites. It is designed for use in a wide variety of crops to support photosynthesis, root, and vascular development.
- **Sysstem®-Advance** – a foliar fertilizer combining a small amount of nitrogen with sulfur, zinc, manganese, boron, and molybdenum in a phosphite form. It is designed for use on a variety of crops to support overall leaf function and root development.
- **Sysstem®-Cal** – a calcium foliar fertilizer designed to improve fruit quality and firmness. This true calcium phosphite helps bring a more mobile form of calcium to all areas of the plant. In contrast, soil-available calcium moves primarily in the transpirational stream of the plant, ending its movement with a significant amount in the leaves. Once in the leaves, nearly all of the calcium becomes incorporated into cell wall structures where it is no longer available to other plant parts.



2 THE RIGHT TIMING

Timing is everything when it comes to nutrition. In fact, deficiencies of certain nutrients during peak demand windows — bloom, fruit set, cell division, and bulking — can irreversibly impact yield and fruit or vegetable quality in a negative way. This means smaller size, poor color, lack of firmness, or even more limited shelf life. Unfortunately, for perennials a nutrient deficiency not only affects this year's crops, but also can impact future crops.

Providing crops with what they need at the correct timing is a key element of the science-driven approach to nutrition. This strategy not only gives growers great results in the field, but also cuts down on costs since there is no overapplication of products or wasted field time.

"You want to make sure the plant's needs are being met at the correct time," says Sean Jacobs. "That's how you're going to determine the nutrient or nutrients that you will need. You can't take time out of the equation."

> "You want to make sure the plant's needs are being met at the correct time."
>
> — SEAN JACOBS

Know Your Crops

Every crop has different physiological growth stages that we need to appreciate in order to delineate the timing of nutrient applications. "Once we understand what is going on within the specific physiological growth stages, foliar fertilizer applications can target the correct supportive nutrients," says Rick de Jong.

We need to know our crops. Why? Because if we don't, we will waste product and cause issues that could be detrimental to the crop.

"Agronomy 101 taught everybody that your soil is your bank," says Jeff Glass. "You cannot make a withdrawal from your bank account if you don't have money in the bank. So, for example, you must have potassium in the soil and you must have calcium in the soil. Everybody thought if you had a little bit extra in there, that was good. Why not keep the bank full? Unfortunately, this mentality has bridged over to what is inside the plant, too. Excessive nutrient levels in the plant, can be just as detrimental to plant growth and development as deficiencies."

"Plants are different than people," adds Sean Jacobs. "We can take a multivitamin every day and, for the most part, our bodies are able to regulate how much they want to keep and how much they want to pass on. Sure, you can still overdo it as a person, but a plant doesn't really work the same way. It has some mechanisms for isolating certain things and trying to sequester others, but if you have high levels of certain nutrients, the result may be leaf burn or delayed crop maturity."

When you're trying to nurture a plant, just adding to the soil isn't always the right strategy. This new philosophy is a paradigm shift that is important to understand.

"Just-in-case treatments could waste product and time, in addition to costing you more money," Jacobs says. "This is especially true if you put something down you don't need, offsetting the balance in the soil and/or the plant leading to a negative impact on your crop. It's a shotgun approach that is often more harmful than helpful to the farmer."

If your soil is already high in phosphorus, for instance, you're going to inhibit uptake of the micro nutrients if you add more phosphorus. As de Jong points out, "This can absolutely hurt your crop's growth and productivity."

The Right Timing Makes a Big Difference

A plant's nutritional needs during bloom provides an excellent example of the importance of timing. Boron is essential for pollen viability and flower health during this period. That makes bloom time the right time for making sure boron is in the optimum range to meet the plant's needs.

"We work with farmers to develop crop programs to help meet the needs of their crops as they move through the growing season," says de Jong.

"At Agro-K, we have developed combination products designed to meet specific physiological growth stages with the right nutrients at the right times. We also have a full line of individual nutrient products," de Jong adds. "This way we have the flexibility to target individual nutrient needs or broader nutrient requirements, as dictated by the science and the crop, to support specific windows of opportunity."

THE RIGHT FORM, THE RIGHT MIX

3

4

Growers have some key windows of opportunity to maximize their crop's yield as nutritional needs change throughout the season. To support optimal growth and develop a marketable yield, the science-driven approach calls for nutrition based on the right mix of nutrients delivered in the right form. Some nutrient combinations should be avoided due to antagonisms, and other combinations can be embraced to capitalize on nutrient synergies. Also, not all nutrient forms can penetrate leaf cuticles. Just because a fertilizer is a liquid or water soluble does not mean it is capable of entering the plant through the leaf. Not all fertilizers are optimized for foliar application and uptake.

Mixing Nutrients Synergistically

The best nutrient mixes embrace synergistic nutrients that improve product performance. These mixes also save the grower time by reducing the number of spray applications needed to meet the nutritional demands of the crop. "When we develop products, we try to take advantage of synergies. We ask ourselves, 'What nutrients are needed around the same time and are there synergies?'" says Rick de Jong. For example, with calcium and boron, research shows that by having these two nutrients applied together, the uptake of both the calcium and boron can increase by 10% to 15%.

This combination is ideal during bloom time when plants need boron. So, applying boron and calcium together results in synergistic uptake and assimilation of both nutrients. "We're taking advantage of the scientifically demonstrated synergies to improve uptake of both calcium and boron, in this case," de Jong explains.

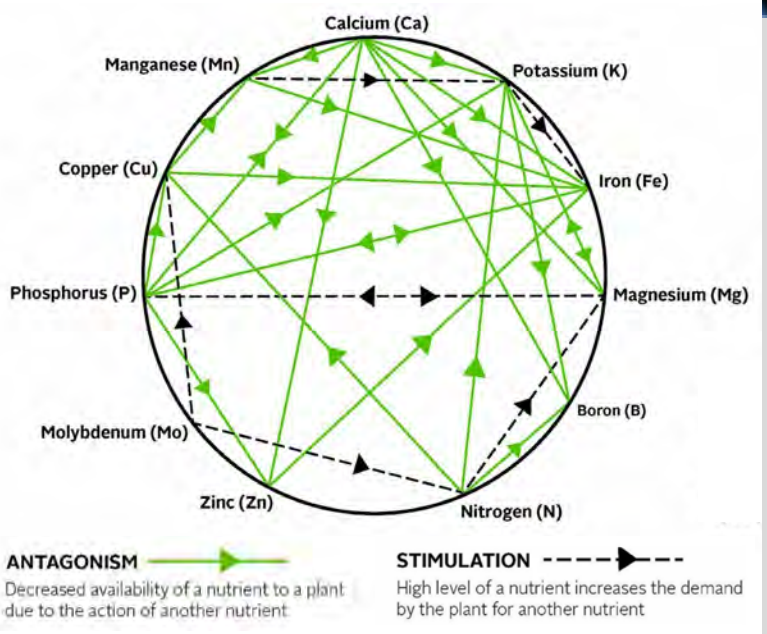
Knowing What Combinations Don't Work Is Just as Important

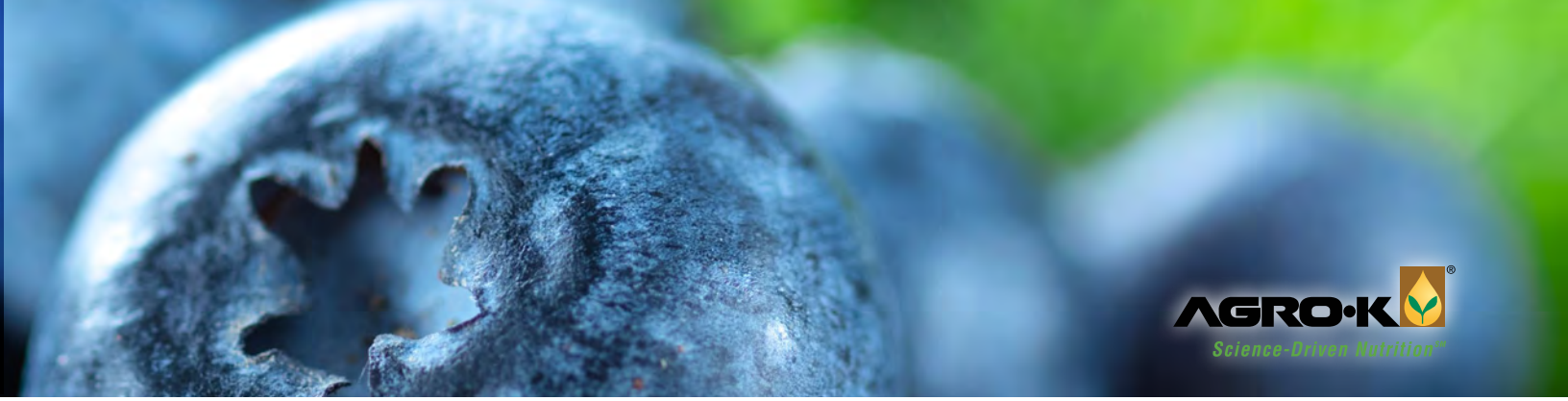
Nutrient mixing takes an understanding of balance. For example, "during the cell division window for fruit, you want to avoid high potassium applications, particularly foliar-based forms, because that will prevent calcium from going into the fruit cell wall structure like we want it to during that window of cellular division," de Jong points out. "So, potassium and calcium are antagonists, while calcium and boron are more synergistic."

Manganese, on the other hand, is a regulator for potassium uptake. "So, if we can increase manganese in the plant, the plant will be able to better regulate potassium uptake versus passively taking it in," de Jong says. "This will not antagonize the calcium as much. There are, however, domino effects that can happen if you don't make informed choices."

As Sean Jacobs says, "It's a very intertwined system

MOULDER'S CHART PERSPECTIVE





where the application of one nutrient can affect the levels of other nutrients in the plant in seemingly inexplicable ways. Having competent guidance in this process will help ensure that nutritional decisions have the desired outcomes."

5 THE RIGHT PLACE

When it comes to the right place in the plant for adding various nutrients, you have two main choices: targeting the roots through the soil or targeting the leaves with a foliar application. With only these two choices, making the decision is easier, but still important. Both places serve a purpose for specific crops at specific times of the year for given nutrients. Knowing when to apply nutrition to the foliage versus to the soil will make achieving your quality and production goals more realistic and cost effective.

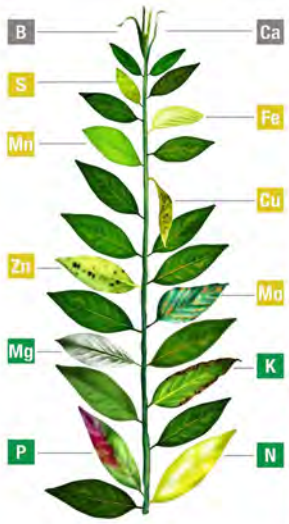
Understanding "Place" in the Role of Nutrition

The various essential and non-essential nutrients support and influence many different plant functions such as root growth, vascular tissue development, chlorophyll production, photosynthesis, nitrogen metabolism, and crop development.

When it comes to crop development, zinc is a micronutrient with a large role. Zinc is involved in the synthesis of proteins and the production of auxins that strengthen vascular structure and development. With increased vascular function, larger leaves and fruit can be supported, increasing production and quality. Foliar applications of Agro-K's Zinc +5 D.L. supports that growth. It is a leaf function product with zinc, manganese, magnesium, iron, copper, and molybdenum in the Dextrose, Lactose (D.L.) sugar-complexed nutrient form. "Agro-K Dextro-Lac nutrients, when applied foliar, have superior uptake and availability. Once inside the leaf, the nutrient is stripped from the sugar, and the plant is able to assimilate these sugars into its carbon cycle for future metabolic processes," explains Sean Jacobs.

Agro-K also has products that use zinc in the phosphite form to help translocate this nutrient faster, moving it from a foliar application in the leaf and pushing it down *into* the root tip to support root growth. "That's a prime example of pushing a foliar-applied nutrient into the root system; into the right place within the crop," says Rick de Jong.

MINERAL MOBILITY WITHIN THE PLANT



IMMOBILE:
Deficiency Appears First in Young Leaves
Calicium (Ca)
Boron (B)

MODERATELY MOBILE:
Sulfur (S)
Iron (Fe)
Manganese (Mn)
Zinc (Zn)
Copper (Cu)
Molybdenum •Mo)

MOBILE:
Deficiency Appears First In Older Leaves
Nitrogen (N)
Potassium (K)
Magnesium (Mg)
Phosphorus (P)

"The phosphites get in so well they almost bypass the leaf even though you apply them to the leaf. They get in and go right into the vasculature and move to those growth points before they are metabolized."

In pistachios, for instance, the leaves get thick and waxy later in the season after leaf out. Once they get past May or June, they have a reputation of being impervious. "But we've proven that Agro-K's D.L. and Sysstem Series products get in just fine," Jacobs says.

Know Your Placement Options

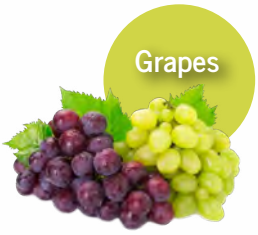
Using the right form to ensure nutrients are getting into the right place in the plant is another science-driven factor of nutrition that must be considered for optimum results. Not every form of nutrient is meant to go through the leaf; some are better distributed through the root system like EDTA chelates..

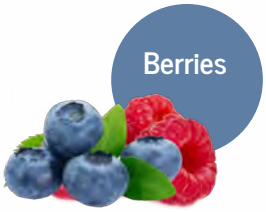
Take the guesswork out of crop nutrition by using accurate, real-time insight into the plant's nutritional status.

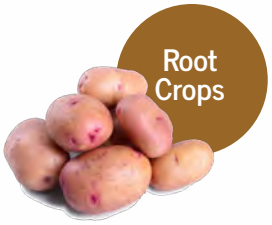
Combine this forward-looking data with science-based knowledge of what each crop needs at specific times in its growth cycle to maximize yield and quality. Inputs are a significant part of grower costs — following the 5Rs of nutrient management and implementing SAP analysis gives growers better information to make efficient, proactive nutrient decisions about their crops.

AGRO-K'S PRODUCT LINES
support the 5 Rs of Science-Driven Nutrition™

Providing solutions for:







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