WILDCAT AGRI-SERVICES

Volume 30 Issue 3
April 2025

Pioneer Premium Seed & Treatments, Crop Insurance, Agronomy Services, Field Days, Seed Wheat, Seed Delivery, & Personal Service

Inside this issue:

2025 Pioneer Infinity Program

10% Base Discount Benefits

- 50% Replant
- Granular Insights
- Financing Prime—1 @ 7% Discount

Ag Risk Management

Crop Insurance today offers...Lots of choices, if you want a crop insurance agent that can help you make choices from a farmers perspective contact Steve McGinn at 316-284-1935

Corn Stand Evaluation

Many different stress factors are capable of reducing corn stands, such as:

- Cold or wet soils
- Insect feeding
- Unfavorable weather conditions

Stand Counts

- Take several sample counts to represent the field.
- Sample a length of row equal to 1/1000th of an acre.
- Measure off the distance appropriate for your row width, count the number of live plants and multiply by 1000 to obtain an estimate of plants/acre.

Row Width	Length of Row
38 inches	13 ft. 9 inches
36 inches	14 ft. 6 inches
30 inches	17 ft. 5 inches
22 inches	23 ft. 9 inches
20 inches	26 ft. 2 inches
15 inches	34 ft. 10 inches

When an injury event such as frost or hail occurs it is best to wait a few days to perform a stand assessment, as it will allow a better determination of whether or not plants will recover.

Growth of green tissue near the growing point indicates that this plant would have recovered. Fig. A.

Figure A

Figure B

Soft translucent tissue near the growing point indicates that this plant will not recover. Figure B

Stand counts should be taken randomly across the entire area of a field being considered for replant; this may include the entire field or a limited area where damage occurred.

ÑTHERÆ CTORSÆOÆV LU TE

ŖtŻndÆniformityÆ An uneven stand will yield less than a relatively even stand with the same number of plants.

ÕŻntÆeŻlthÆ Plants that are severely injured or defoliated will have reduced photosynthetic capability and a lower yield potential.

This plant was defoliated by hail. New green tissue indicates that it is recovering, but its yield potential has been reduced

Corn yield is influenced by stand density as well as stand uniformity:

- Variation in plant size can have a negative impact on yield
- Uneven emergence timing leads to uneven plant size

Several factors can lead to uneven emergence:

- Variation in soil moisture
- Poor seed to soil contact du to working or planting into we soil
- Variation in soil temperature caused by uneven crop residue distribution
- Soil crusting
- Insects of disease

Late emerging plants are at a competitive disadvantage with larger plants in the stand and will have reduced area, biomass and yield.

Intensively Manage Soybeans for Maximum Yields

Growing top-end yield soybeans involves intensive management throughout the growing season, from start to finish. You have already "set the stage" for top-end soybean yields on your farm by planting Pioneer soybean varieties and protecting them with Pioneer Premium Seed Treatment at optimum seeding rates. In addition, you have to implement an aggressive fertility program to meet your crop's potential needs, and follow through with an intensive weed management program. Now is the time to be thinking about the next steps of your high yield management plant o achieve your yield goal, whether it is adding 10 bu/ac to existing yield levels, or achieving 100+ bu/ac. Several key

Continued on page 3

How Corn Plants Regulate Nutrient Uptake

TAKEAWAYS

- Thirteen of the sixteen nutrients essential for corn growth are taken up from the soil.
- As corn roots extract nutrients from soil, regulatory proteins determine essential quantities and ratios of nutrients to support yield.
- High affinity transport system (HATS) proteins supply sufficient nutrient to keep the plant alive if the concentration of a nutrient in the soil is very low, while low affinity transport system (LATS) proteins are most efficient when nutrient concentrations are relatively high.
- Ideal nutrient ratios within the corn plant change as the growing season progresses.
- A profitable and sustainable fertility program replaces nutrients removed by harvested grain and increases the nutrient reserve in the soil as monetary resources allow.

NUTRIENT NEEDS IN CORN PRODUCTION

The yield potential of modern corn hybrids continues to increase, as does the quantity of nutrients removed from the soil as grain leaves the field. A long-term, sustainable fertility program maintains current and future high grain yields. Fertility management decisions include what nutrients to apply, how much of each nutrient to apply, and when to apply these nutrients. Fertilizers must be applied appropriately to support high grain yield, create a profit, and responsibly steward the land to minimize nutrient loss to neighboring waterways and other non-target land areas. The process starts with proper soil testing to determine quantities of available nutrients and then adding fertility to support desired grain yields.

This article will view nutrient uptake from a corn plant's perspective, exploring how the corn plant regulates nutrient uptake to maintain nutritional balance during the corn plant's life cycle. Ideal nutrient ratios change as corn growth progresses from germination to maturity. It will also consider nutrient removal as grain leaves the field and suggest a starting point for a fertility program to sustainably maintain high grain yields in future years.

SOURCES AND QUANTITIES OF NUTRIENTS

Sixteen nutrients are essential for corn growth. Two of these nutrients, carbon and oxygen, are extracted from the air. Hydrogen is extracted from soil water. Corn plants split water molecules into hydrogen and oxygen. Hydrogen is consumed and incorporated into organic compounds such as sugars, starch, proteins, and cell wall materials. Oxygen is either consumed by mitochondrial respiration in the corn plant or is released as molecular oxygen into the atmosphere.

Nutrient	Content per Bushel (15.5% moisture)	Total Removal 300 bu/acre	Ratio Relative to Cu
	lbs./bu	lbs.	
Nitrogen	0.615	184.5	4100
Phosphorus	0.428	128.4	2850
Potassium	0.273	81.9	1820
Sulfur	0.0506	15.18	337
Magnesium	0.0733	21.99	489
Calcium	0.0132	3.96	88
Iron	0.00168	0.504	11.2
Zinc	0.00126	0.378	8.4
Boron	0.00028	0.084	1.86
Manganese	0.00023	0.069	1.53
Copper	0.00015	0.045	1.0
Molybdenum	Trace	Trace	Trave
Chlorine	Unknown	Unknown	Unknown

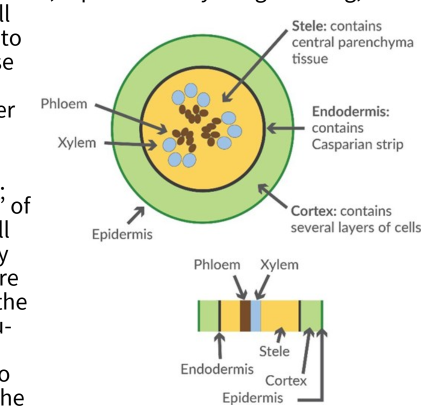
The remaining thirteen nutrients are extracted from soil. These are the nutrients that must be considered as part of a fertility management program. The three primary macro- nutrients – nitrogen, phosphorus, and potassium – are called primary macronutrients because the corn plant requires hundreds of pounds of these nutrients per acre for maximum yield. The three secondary macronutrients – sulfur, calcium, and magnesium – are called secondary macronutrients because the corn plant consumes tens of pounds of each of these nutrients per acre to make yield. The seven micronutrients – boron, chlorine, copper, iron, manganese, molybdenum, and zinc – are consumed at rates of ounces per acre for corn grain production

The remaining three essential nutrients – carbon, oxygen, and hydrogen – are also present in grain. The corn plant's chemical composition consists of 44% carbon, 45% oxygen, and 6% hydrogen along with the thirteen soil-supplied nutrients (Latesha and Miller, 1924). For a 300 bushel/acre yield, approximately 6,300 pounds of carbon, 6,400 pounds of oxygen, and 850 pounds of hydrogen are transported as grain. The organic matter composition of this amount of grain contributes about 25.9 million calories of energy to food and feed chains as this grain is consumed in different feed, fuel, and industrial products.

REGULATION OF NUTRIENT UPTAKE IN CORN

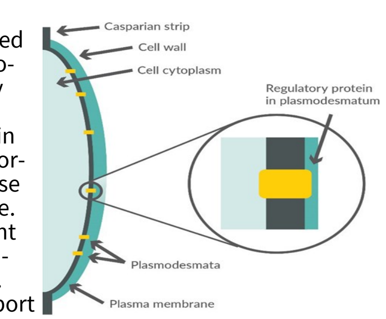
In order to understand how the corn plant regulates nutrient uptake, it is necessary to first understand some basic corn anatomy. Figure 1 shows two different views of a corn root.

The outermost layer of cells – the epidermis – is in direct contact with surrounding soil. Just inside the epidermis, represented by the green ring, is the cortex. The cortex is several cell layers thick. One of its functions is to temporarily store nutrients as these nutrients move from soil to corn roots. Initially, when nutrients enter corn roots, these nutrients are retained in "non-living" spaces between cortical and epidermal cells. Nutrients enter the "living portion" of the corn root when they cross a cell plasma membrane (represented by the black circle). These nutrients are now in the central core or stele of the corn root. Once inside the stele, nutrients move into xylem vascular tissue and translocate as needed to all parts of the corn plant such as the stalk, leaves, ears, and grain.



The plasma membrane (plasmalemma) and Casparian strip (represented by the black line in Figure 2) are impermeable to water and nutrient penetration. Holes in the plasma membrane, called plasmodesmata, allow the transport of water and nutrients across the plasma membrane. Regulatory proteins located in the plasmodesmata determine how much of each nutrient crosses the plasma membrane

Two types of regulatory proteins – called HATS and LATS – are located in plasmodesmata. HATS stands for high affinity transport system proteins. These proteins select nutrients that are present in very low concentrations in the outer portion of the corn root and transport these nutrients across the plasma membrane. HATS proteins supply sufficient nutrient to keep the plant alive if the concentration of a nutrient in the soil is very low. However, HATS proteins cannot transport enough nutrient to meet demands for high grain yields. Corn plants stay alive but may still show nutrient deficiency and potential yield loss because nutrient supply does not meet nutrient demand. LATS (low affinity transport system) proteins supply the biochemical power to transport sufficient nutrients across plasma membranes to meet demands for high grain yields. LATS proteins are most efficient when nutrient concentrations are relatively high in soil.



According to our current knowledge, specific HATS and LATS proteins tend to bind selectively to particular nutrients. There is a specific type of protein that matches each of the nutrients; however, not all proteins are entirely nutrient specific. For example, the chemical structure of a regulatory protein binds semi-selectively to calcium (Ca2+). However, other divalent cations such as magnesium (Mg2+) or zinc (Zn2+) may also bind to and be transported by this same regulatory protein. This lack of complete

Continued on Page 3

How Corn Plants Regulate Nutrient Uptake -Part 2

specificity may partly explain why nutrient concentrations tend to have a range of values in harvested grain or why some nutrients are present in "luxury quantities" in the corn plant.

Uptake of each nutrient is regulated independently. If a soil has high nitrogen fertility but is low in sulfur, LATS proteins will efficiently take up and transport all of the nitrogen needed to support grain yield. However, in a low sulfur soil, there is insufficient sulfur for the LATS to work efficiently. HATS proteins therefore conduct the majority of sulfur uptake and transport. These HATS proteins supply whatever sulfur they can to support growth, but they cannot meet the high demand to support maximum growth. The end result is the corn plant will express sulfur deficiency.

RATIOS OF NUTRIENT UPTAKE CHANGE DURING THE GROWING SEASON

HATS and LATS regulatory proteins adjust amounts of nutrient uptake and nutrient ratios during the entire growing season. As the corn plant matures, rates of uptake of some nutrients are faster than for other nutrients, thus changing the ideal nutrient ratio for corn growth at different growth stages. Scientists at the University of Illinois have published research showing how nutrients accumulate during the corn life cycle. The corn plant accumulates up to approximately 11% of its total nutrient uptake between germination and V6. Between V6 and V10, nitrogen, potassium, and boron uptake increase more rapidly than other nutrients. Nutrient uptake during vegetative growth is most rapid during V10 to V14. At V14, the corn plant has accumulated approximately two-thirds of the total nitrogen, potassium, magnesium, boron, and manganese. By VT, the corn plant has acquired approximately 70% of its total uptake of these five nutrients while acquiring only 40% of total carbon. At VT, the corn plant has achieved maximum vegetative growth. Additional nutrient uptake after VT supports ear growth. Today's corn hybrids devote about 50-60% of total dry matter accumulation to ear growth.

The corn plant acquires very few nutrients during pollination, probably because the corn plant is devoting the majority of its resources to support successful pollination and fertilization of embryos. Nutrient uptake during reproductive growth is most active between R2 and R4. The corn plant accumulates a substantial portion of its total carbon, sulfur, boron, manganese, and copper during this growth phase. In addition, the corn plant moves some of the nitrogen, phosphorus, potassium, magnesium, sulfur, and zinc from vegetative leaf and stalk matter to the developing grain.

Between R4 and R6 (maturity) the corn plant acquires nearly 20% to almost 40% of the total carbon, nitrogen, phosphorus, potassium, magnesium, sulfur, zinc, and copper during late- season grain fill. Accumulated carbon during R4 to R6 is deposited in the kernels. Grain fill during R4 to R6 accounts for approximately 25% of the increase in total weight of the corn plant at maturity. Figure 4G also illustrates what percent of the total nutrient acquired by a corn plant during the growing season is present in the grain. As this grain leaves the field approximately 80% of phosphorus, 62% of zinc, 58% of nitrogen, 57% of sulfur, 34% of potassium, 32% of magnesium, and 30% of copper also leaves the field and is no longer part of your future soil fertility program.

BUILDING A NUTRIENT MANAGEMENT PLAN

A successful nutrient management plan is one that assures there is enough of every nutrient in the soil to support corn growth at each developmental stage to meet the targeted grain yield. Maintaining adequate fertility levels of all nutrients during the entire growing season is more important than fertilizing for specific nutrient ratios because HATS and LATS regulatory proteins continuously adjust nutrient uptake to provide maximum yields allowed by the growing environment.

The optimal fertility management program will depend, in part, on soil type. High CEC soils may require relatively few fertilizer applications with greater amounts of fertilizer applied at each application, while low CEC soils may need substantially more applications to "spoon-feed" specific nutrients depending on the corn growth stage.

Additionally, a successful nutrient management plan needs to be sustainable and consistently support high yields in future years. A fertility program will include replacement amounts of nutrients that leave the field as the crop is harvested and will also include additional fertility to increase soil reserve fertility levels as your budget allows. A place to start when calculating replacement amounts of nutrients is to multiply the nutrient contents listed in pounds per bushel by the most recent corn yield. This information, in combination with soil test values helps to define a profitable and sustainable fertility program.

Nutrients most likely to show deficiency first are the macronutrients, nitrogen, potassium, and phosphorus, followed by the secondary macronutrients, sulfur and magnesium, and then followed by the micronutrients, zinc and copper, because corn grain removes relatively large amounts of these nutrients as grain leaves the field. Other nutrients may show deficiency under specific soil environments.

Intensively Manage Soybeans for Maximum Yields -Part 2

ideas to consider this summer are as follows.

Insect Control—Insect pressure in soybeans should be monitored regularly throughout the growing season to monitor potential threshold levels. Often times, one individual insect species may not be at threshold levels, but the combined numbers of multiple insect species may reach levels that warrant an insecticide treatment application.

Disease Control– Disease control begins with scouting to understand disease risks and their potential severity in each field. Variety selection, crop rotation, seed treatments, and foliar fungicides are the best tools available to counter most disease threats.

In-Season Nitrogen (N)- An 80 bu/ac soybean crop requires 416 lbs./ac of N uptake by the plant to achieve such yield levels. Although healthy soybean root nodules can provide adequate amounts of N for lower yield levels, high soybean yield goal environments (≥ 65 bu/ac) have shown a response to 30-50 lbs. N/ac applied at the early bloom (R1) to beginning pod (R3) growth stages. Caution must be taken to prevent leaf burn and canopy damage from application. Fertigation is a simple and safe method of in-season N application, however top-dressing Urea with a urease inhibitor has shown to work well also.

In-season Potassium (K) and Sulfur (S) - As soybean plants prepare for pod formation and ultimate seed fill growth stages, the daily nutrient uptake of a soybean plant increases significantly. Research has shown soybean plants can uptake 5.8 lbs. to 9.6 lbs. K20/ac/day in the R2 and R3 stages. In-season application of 15-30 lbs. K20ac and 10-20 lbs. S/ac at the R2-R3 growth stages have shown positive yield response , even in fields with sufficient soil fertility levels for the respective nutrients. Fertilizer sources include, but are not limited to: P, thiosulfate, ammonium sulfate, and other fertilizer blends. Caution must be taken to evaluate fertilizer forms, rates and application methods to minimize crop injury from in-season fertilizer applications.

Irrigation Management– the effect of drought stress on soybeans is most critical during the beginning bloom to mid-seed fill period (growth stages R1-R5.5). Many soybean fields across the area are at R1(beginning bloom), and will soon be at the R2-R3 (full bloom to beginning pod) growth stages. Total crop water use from evapotranspiration (ET) at these growth stages typically ranges from .25-.32" water per day or 1.8"-2.3" per week, however daily ET rates can be as high as .5" per day. As witnessed in recent years, it is critical to not delay irrigation to the point of depleting the 2nd foot of soil moisture before initialing irrigation. Doing so can make it very difficult to maintain crop water needs without large well capacity and /or the help of timely rainfall.

PIONEER
WILDCAT AGRI-SERVICES

1123 West 4th Street
Sedgwick, KS. 67135

STANDARD
U.S. Postage Paid
Sedgwick, KS.
Permit # 14

Contact Information

Pioneer & Wheat Seed

Korey Carmichael 316-641-3160
korey.carmichael@plantpioneer.com

Tye Engel 316-217-6253
tye.engel@plantpioneer.com

Mike McGinn 316-772-7171
mikemcginn@plantpioneer.com

Tanner Gatz 316-284-1597
TGATZ4@gmail.com

Insurance

Steve McGinn 316-284-1935
mcginnst@hotmail.com

Billing Questions

Susannah McGinn Off. 316-772-5050
wildcatagriservices@gmail.com