



Balanced Crop Nutrition: Corn Rootworm and Nutrient Uptake

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Corn yields today are skyrocketing. Continued advancements in corn genetics and the next generation of insect-control traits have played a large role in improving yield potential. However, new research shows more than just yield potential of corn is changing. Nutrient uptake of new hybrids is also changing.

A study conducted at the University of Illinois comparing corn rootworm-resistant hybrids with their conventional counterparts showed that this trait had a significant effect on nutrient uptake. In fact, results suggest that in order to maximize yields, fertility plans must not only be increased to account for higher yields, but be revised to address unique increases in requirements for P, K and Zn.

Nutrients by the Numbers

University of Illinois researcher Dr. Fred Below compared corn rootworm-resistant hybrids with their conventional counterparts to examine the variance in nutrient uptake. Dr. Below examined six different hybrid pairs (each with the same genetics with and without corn rootworm protection) at two locations over the course of two years.

As anticipated, the study results indicated that corn rootworm-protected hybrids provided 9% more biomass compared to those without insect protection, and yielded on average 10% more than their conventional counterparts.

As expected, hybrids designed to resist corn rootworm take up more nutrients to perform at their top levels. However, uptake of all nutrients was not affected equally. As yields increased, the uptake of P and K

Table 1.

Corn plant macronutrient and micronutrient uptake with and without corn rootworm protection at 240 lbs/ac nitrogen fertilization

Parameter	No Protection	Protection	Increase (%)
Yield (bu/ac)	155	171	10
N (lbs/ac)	198	214	8
P ₂ O ₅ (lbs/ac)	62	70	13
K ₂ O (lbs/ac)	161	181	13
S (lbs/ac)	21	22	NS*
Zn (oz/ac)	5	5	12

*Increase in S was not statistically significant.

Source: Bender, Ross. 2012. *Nutrient Uptake and Partitioning in High Yielding Corn*. University of Illinois, Urbana-Champaign, Illinois.

increased by 13% while zinc increased by 12% – rates which exceeded the increase in growth. N uptake increased 8%, at a rate similar to growth increase, while S uptake did not significantly change (Table 1).

In the past, farmers have often assumed that an acre of corn requires the same nutrients regardless of the variety they plant. The results of this study indicate that fertility plans should not only be increased to support higher yields, but must be revised to address increases of nutrients including P, K and Zn.

New seed technology heightens the importance of understanding nutrient uptake and fertility needs

> FACT

To maximize yields in corn rootworm protected hybrids, fertility plans must address increase requirements for P, K and Zn.



Roots Make the Difference

Roots are the primary route for nutrients to enter the plant. For the plant to take up soil nutrients, they must reach the roots by either interception (in which the root physically contacts the nutrient), mass flow (in which nutrients dissolved in water move toward the plant as it takes up water) or diffusion (in which nutrients move from areas where they are in high concentration in the soil to areas where there is a lower nutrient concentration in the root).

Relatively immobile soil nutrients like P, K and Zn that require root interception and diffusion to be taken up by the plant are more sensitive to changes in root system health and size than those nutrients that are taken up by mass flow, like N and S. Hybrids with Bt traits for corn rootworm resistance develop more intact, healthier roots and greater root mass than their nonresistant counterparts, suggesting an improved ability to access nutrients.

Implication on Fertility Needs

Nutrient applications should not only be increased to support higher yields, but must also be modified to address the unique increases in requirements for certain nutrients, especially P, K and Zn, which are more sensitive to root growth.

Peak crop nutrition agronomic management practices are aimed at matching plant nutrient needs with nutrients from soil and fertilizer to optimize yield and get the greatest return on these genetics.

Regardless of whether an insect-resistant hybrid or their conventional counterpart is utilized, creating a sound crop fertility program is essential in achieving high yields.

While adequate N availability is necessary to achieve the greatest yields in corn rootworm protected hybrids, a balanced crop nutrition approach that addresses the unique increases for nutrients such as P, K and Zn is required.



The Next Generation of Fertilizer

> FACT

Products such as MicroEssentials® are designed to ensure balanced crop nutrition and establish the correct ratios of both macro and micronutrients. MicroEssentials® SZ™ combines a balanced formulation of N, P, S and Zn into every granule. The patented Fusion™ technology driving MicroEssentials ensures a uniform distribution of nutrients across the field that enhances plant uptake, allowing plants to use nutrients more efficiently, resulting in higher yields and profitability.

> FACT

P plays a critical role in energy storage and transfer and is essential to seeds in order to grow new plants.

> FACT

Zn, critical for seed formation, is fundamental to develop pollen grains.

> FACT

N is required in larger quantities during the plant's vegetative phases for its role in photosynthesis.



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