"Placement of P & K Does Start an Avalanche Effect"

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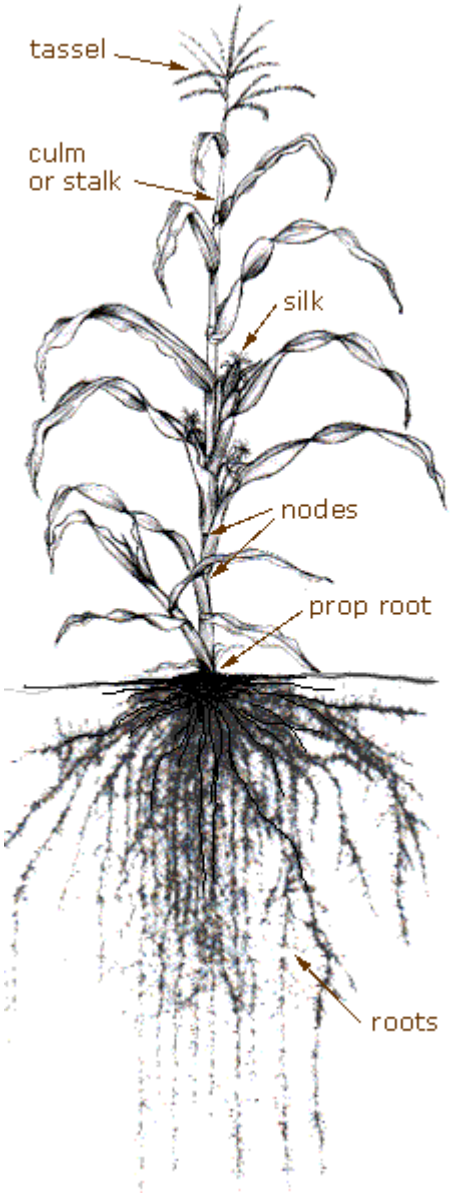
During the first 45 days of growth in this coming 2008 corn crop, you as a farmer are setting the crops potential. Is your phosphorus (P) and potassium (K) in the right place to make the difference? If you have already applied the lion's share of your fertilizer with a broadcast application, stay with us and read on.

Numerous scientists and field researchers have looked at the effects of P and K uptake and their uses. Let us look at some of those and what we believe can make a difference in your 2008 crop.

1. *The ability of the corn or soybean plant to absorb P is largely due to the crops early root distribution in the upper 15-18 inches of the soil profile. This is important because 98% of the plants P and K uptake come from the root rhizosphere and in the pore space soil solution.*

2. *Any restriction/factor that slows or retards root growth will diminish the P or K uptake. Those could be: cold soil temperatures, soil compaction within the upper 10 inches, herbicide injury, soil saturation, hail or wind damage, insect injury from feeding on young roots, and extreme dryness in the upper portion of the soil profile.*



3. *The bulk of soil phosphorus is available in two major sources; organic fraction of the soil and then the clay fraction where the chemical ions bond to the clay particles.*

4. *Soil pH of the soil solution – pH outside of the most favorable range of 5.9 to 7.3*

5. *Availability of organic forms of P and K are dependant on soil temperature and moisture directly effecting microbial activity. Mineralization of organic P to the inorganic forms is favored in specific pH levels, level of the nutrient in the soil solution, favorable porosity, stable soil structural units in the soil with more than 20% clay and warm moist conditions.*

6. *Phosphorus is not a very mobile in soils unless runoff takes it away or heavy rains leach it deeper than where placed and away from the early root system. P is usually in stable forms whether or not organic versus inorganic. This is why, even with top management techniques, the efficiency of crops uptake of P can be as low as 20 percent and less.*

7. *Biological function – activity of enzymes, bacteria and some mycorrhizae living symbiotically with corn and soybean roots. These miniature creatures are the converters to make nutrients available to the plant roots, without them N, P and K would not be available to most plants.*

Several of these factors originated from D.B. Beegle, PhD., Penn State in Agronomy Facts #13 Penn State Univ. Extension Service Bulletin – ***Managing Phosphorus for Crop Production***.

So knowing these items along with a common thought that all terrestrial plants have a root system that grows downward to obtain necessary water and nutrients, we at Orthman Mfg are continuing to study placement of fertility for high sustainable ag production. Since 2001 we have teamed up with scientists to purposefully study placement of N-P-K products to help growers gain a better set of ideas why the Strip-Till System really can work for them.

Nutrients and Root Development

Roots grow downward following the warm moisture front as soil temperatures increase into the summer months. As water is withdrawn then replenished from the surface with gravitational pull being a large factor in root development, we can not assume surface applied N-P-K will feed the crop well enough to gain top yields. As soil temperatures in the upper six inches reach 78° F. and higher, University of Georgia scientists in the late 1990's observed the fine roots of corn desiccate and die. We have also observed in Western Nebraska and Eastern Colorado in July soil temperatures reaching 90°+ F. the only roots near the surface surviving are directly under the plant stalk extending down into the soil. I have carried out experiments in barren soils of residue and differing residue cover amounts to see what soil temperature changes exist and soil textural differences – soils with 55-75% sand can reach 120° F. and higher which can really scorch roots and bring quick root death. Roots suffer; nutrient and water uptake is slowed – all detrimental to top production. Residues left from previous crops are a great insulator and absorbing blanket for moisture, even certain residues with light colors will reflect heat away which can be a great help in the semi-arid West.

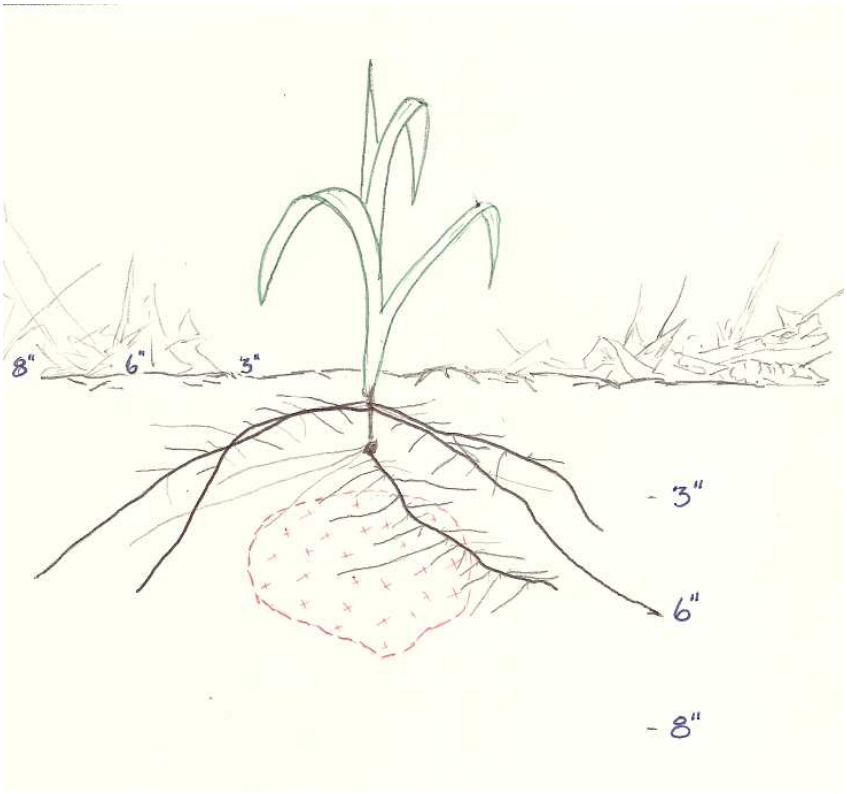


Figure 1. Early root development of corn and fertility placed at 4 inches below the surface to better feed the plant

In our (Orthman's) present and past studies at the Irrigation Research Foundation [near Yuma, Colorado] and near Lexington, Nebraska, we are monitoring root development to better appreciate and understand soil temperature effects to water and nutrient uptake. It is of value to know that P needs in corn are greatest from 40 days after emergence (DAE) to ~80 DAE. To get the N-P-K into plant cells for growth and nutrition to manufacture the grain we must realize where the nutrients are in the soil respective of the root system.

We have observed by improved placement and subsequent soil sampling from 2002 to 2007 these important nutrients, N-P-K, are absorbed into the root system from the 3 to 20 inch depth. In a more precise based fertility program in our strip-till system we have substantiated the previous statement from 2001 to 2007.

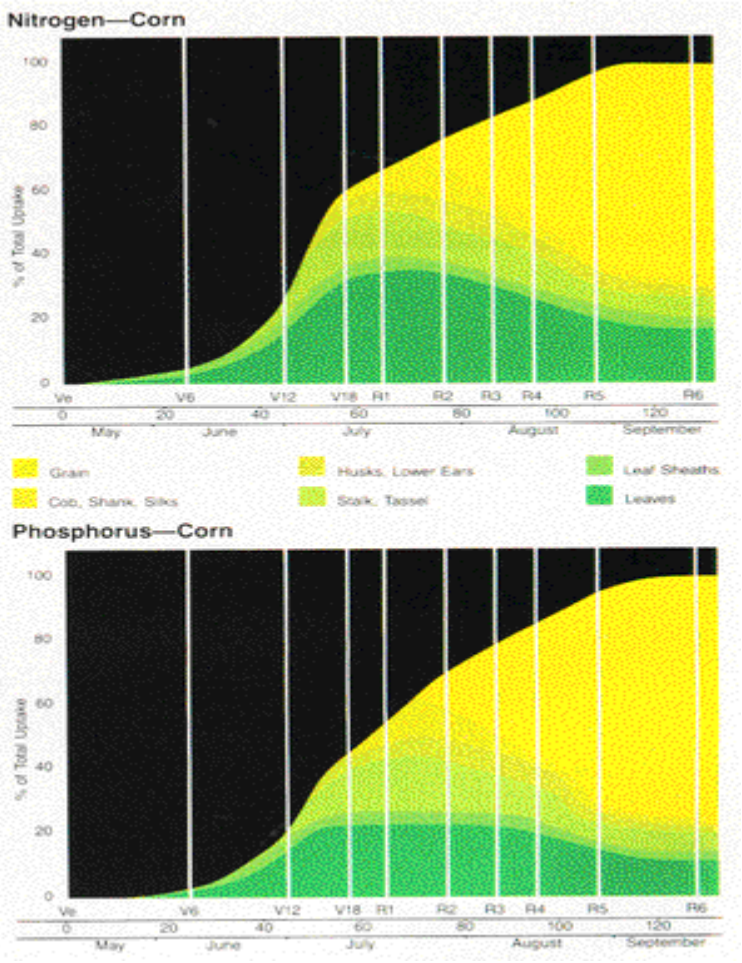


Figure 2. Nitrogen and phosphorus uptake curves in corn – source: Iowa State University, Spec. Report #48, 1993 "How a Corn Plant Develops".

As you study Figure 1 which depicts a shallow placement of nutrients by a strip-till implement in the first 20-25DAE how the root profile is fed. In Figure 2 you can see that phosphorus (lower segment of graphic Iowa State University, 1993 ***'How a Corn Plant Develops'*** – Special report #48) is being called for by the plant from 25-30 DAE to the R2/R3 stage approximately 80 DAE. At ~50-60DAE the corn is needing P to fulfill it's grain needs. We have observed that corn roots are extending as deep as 50 inches in depth and more by that time, but the greatest portion of the roots are in the upper 24-30 inches actively taking in nutrients. As you look at Figure 3 the second depiction of the root system and placement of fertility, you will see that the root system at 40 DAE is primed to offer nutrients for the plants demand.

How Does Strip-Till Make a Difference?

With any pre-plant tillage operation(s) the farmer is attempting to set the stage for the best possible seed to soil seedbed and get the plant growing from that seed. For hundreds of years farmers have tilled and over-tilled soils across the entire surface of the field to develop a small area ready for a seed to start in. With strip-till, we advocate a narrow zone be tilled only then follow behind with a planter to place the seed above a fertilized band, not without some precautions though. Not all 100% of the soil surface is churned and tumbled with a strip-till implement systems approach only 25-30% is tilled and is not mashed back down as done by mulchers-packer implements.

By inserting fertilizer, whether dry or liquid products, we can encourage the rooting system to grow in the presence of nutrients not spending energy and nutrients seeking and probing out and beyond its normal rooting architecture early on. With strip-till, immediately behind the till/knife shank the farmer now can place products that feed the crop the first 20-25 days then as the roots grow deeper they grow into another zone to feed the plant into the next 60 days when the plant is demanding larger portions of nutrients (see Figure 3).

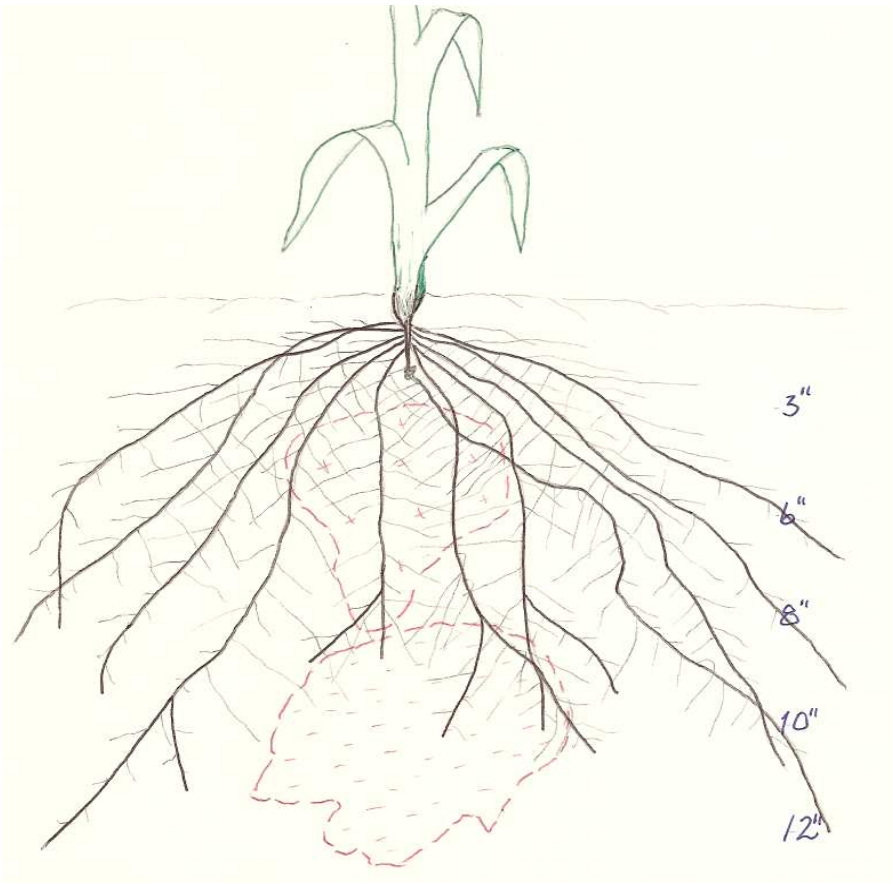


Figure 3. Early root development of corn plant with dual placement of fertility, corn plant is 40 days after emergence (dashed red lines depict zones of fertilizer placed at 4 and 9 inches by strip-till tool.)

Conclusion

The "avalanche effect" is best known in the snow covered mountains and thought as something wondrous but destructive. With precise placed fertilizer products the roots that grow downward, just like the snow tumbling downward with gravitational pull, the snow gathers steam – roots proliferate and extend in inches and depth to take up more water and nutrients for the crops growth. We at Orthman are engaged in studies to determine how many, how far, and how effective roots grow in the strip-till environment so you the farmer can ascertain the benefits.

We have observed corn rooting patterns have enlarged with better early fertilization practices and placed precisely with the 1tRIPr™ for more than seven years. We are seeing great rooting results to gain more water, utilize soil nutrients more effectively, and better results in yields on less fertility inputs. Yields may not always improve, but for these same seven years (2001-2007) our joint studies with Monsanto, USDA-NRCS, Kugler Fertilizers, M&M Coop, and Irrigation Research Foundation we observed gains of 5.5% to 15.5% each year over surface broadcasted fertility and full-width conventional tillage in corn.

Keep watch of what is happening with strip-till system farming in your area and what other scientists are doing; it may "tumble" your present methods and thinking to make a sound change.