

TIMELY INFORMATION

Agriculture & Natural Resources

S-03-10

April, 2010

Spring Nutrient Deficiencies in Alabama Crops

Charles C. Mitchell

Extension Agronomist-Soils & Professor

Every spring we can anticipate certain nutrient deficiencies to show up under certain conditions in corn and cotton on Alabama soils. Nutrient deficiencies are never widespread. They are usually spotty in fields and occur only in certain fields. Widespread problems across fields or in multiple fields on the same farm may represent weather-related issues or pesticide-residue issues. Crops tend to grow out of early spring nutrient deficiencies if the producer has taken care of the basics e.g., soil tested, applied recommended lime and fertilizers, etc. By far, the most common report of problems are related to low soil pH. Acid soils can create aluminum toxicity to roots of cotton and corn or manganese toxicity in cotton. Young crops can show symptoms of any number of abnormalities, all related to a low soil pH. Check pH problems first.

CORN

Corn in Alabama is a short-season, determinate crop that is usually planted very early in the spring (or late winter) into cool soils with the intention of making a crop before the stresses of summer heat, drought, insects and diseases take its toll. Any stress on the plant from the time it emerges until physiological maturity (90 to 120 days) can reduce yield. Unlike cotton or peanuts which are indeterminate crops, there is no time for corn to overcome stress. Therefore, once you see a deficiency, you've already lost some yield potential. Trying to correct it at this point may not be cost effective.

Phosphorus deficiency. A true phosphorus deficiency may not be noticed in seedling corn. However, it will result in overall slow and stunted growth, delayed maturity, and low yields. This is not likely to be a problem because most Alabama fields have been historically fertilized with P to the point that soil test P levels are high (>50 pounds/acre Mehlich-1 extractable P). However, often we see purple or red-colored seedling corn in early spring. This is also characteristic of a P deficiency even though the soil test may be high, very high or extremely high in P. Some varieties are more prone to the purple color than others. Cool soils and slow root growth may prevent the normal uptake of P through the limited root system of



Phosphorus deficiency on corn. Photo courtesy of IPNI.

ALABAMA A&M AND AUBURN UNIVERSITIES, AND TUSKEGEE UNIVERSITY, COUNTY GOVERNING BODIES AND USDA COOPERATING

The Alabama Cooperative Extension System offers educational programs, materials, and equal opportunity employment to all people without regard to race, color, national origin, religion, sex, age, veteran status, or disability.

seedling corn. Preventing this situation is one reason P fertilizers are included in starter fertilizers for corn. Once the soil warms up and root growth expands, the purple color goes away.

Zinc deficiency. Zinc deficiency is more likely on sandy soils that have recently been limed or soils that have a pH above 6.5. The A.U. soil testing laboratory recommends applying 3 pounds Zn per acre in the preplant or starter fertilizer on recently limed land or where the pH is above 6.5. Fields where poultry litter has been applied is usually so high in Zn that a deficiency is unlikely under any circumstance. Zinc deficiency in seedling corn is easy to identify because it shows up as a “white bud” in the center of the whorl of leaves. Again, in most cases, the crop will grow out of this deficiency as roots extend deeply into the acid subsoil where Zn is available. A foliar spray of a zinc sulfate solution or a zinc chelate will help if the deficiency is widespread.



Zinc deficiency of corn. Photo courtesy of IPNI.

Sulfur deficiency. Sulfur deficiency of corn or any other crop is most likely on deep, sandy soils that are low in organic matter or on soils with a pronounced hardpan that prevents roots from growing into the sulfur-rich subsoil. Red or yellow, clayey soils are not likely to have sulfur-deficient crops. Sulfur deficiency on corn is most likely observed during the seedling stage before roots have a chance to grow into the sulfur-rich subsoil of most Alabama soils. It appears as a general yellowing of the upper leaves whereas nitrogen deficiency is usually observed on the older leaves. Sulfur deficiency is more likely to be seen on corn where excessive N has been applied and no sulfate sulfur ($\text{SO}_4\text{-S}$) resulting in a N:S ratio in the plants greater than 20:1. We've also seen S deficiency in corn during extremely wet springs when corn roots remain shallow and all the plant available S has leached out of the upper few inches of soil. Again, seedling corn will usually grow out of a S deficiency if the roots can get into the S-rich subsoil. Otherwise, an application of a sulfate-S source (ammonium sulfate, 21-0-0-24S), gypsum ($\text{CaSO}_4\cdot 2\text{H}_2\text{O}$) or a liquid ammonium thiosulfate (12-0-0-26S) will quickly correct the problem.



Sulfur deficiency of corn. Photo courtesy of IPNI.

COTTON

Unlike corn, cotton is usually planted into warm soils in late spring. Soil chemical processes such as phosphorus availability and sulfur mineralization occurs faster. Roots also grow faster in these warmer soils so deficiencies are not seen as often. Cotton is also an indeterminate plant with the ability to compensate somewhat for stresses prior to fruiting. It also fruits over a longer period of time so a short-term drought or a temporary nutrient deficiency is not as devastating as it would be on corn.

Nitrogen. Nitrogen is always the most difficult nutrient to manage in cotton. While many growers apply all of the recommended N at or before planting (up to 120 lb. N/acre), this is not the most cost-effective way of managing N. We get by with this practice in most years because May and June are typically dry months in Alabama so all that preplant N remains in the root zone through flowering in July and August. However, records show that 1 year out of 3 will have a wet May and/or June where preplant N could be lost to leaching rains or denitrified. Inadequate vegetative growth in May and June can lead to lower yields in the fall. Whereas starter fertilizers are not as predictable for cotton as they are for corn, they do provide some early season N that cotton needs for vegetative growth prior to flowering. Sidedress N can be applied anytime prior to flowering without loss of yield.



Nitrogen deficiency on flowering cotton. Photo courtesy of IPNI.

Sulfur. Because cotton is a taproot crop, sulfur deficiencies are not as likely to be observed on cotton compared to corn. However, in sandy soils, anything that prevents deep rooting can set the crop up for a S deficiency, e.g., a wet spring with shallow roots, a hardpan, a very acid subsoil. Leaf analysis is a quick way to positively identify a S deficiency in cotton. An additional sidedress of ammonium sulfate (21-0-0-24S) or liquid ammonium thiosulfate (12-0-0-26S) will correct the problem quickly. Including about 20 pounds of sulfate-S per acre in the preplant fertilizer on sandy soils will usually prevent this problem.



Sulfur deficiency of cotton. Photo by C. Mitchell

Potassium. You are not likely to see a K deficiency in cotton early in the season even on soils testing very low in soil K. Even a tissue analysis may fail to pick up on the situation. This is because the primary sink for K in the cotton plant is the bolls. This is why deficiencies show up mainly after flowering when the bolls are developing. It is seen as a yellowing of the new growth as the bolls are developing. Classic K deficiency is marginal leaf burn of the older leaves as K is withdrawn from these leaves into the developing boll. The higher the yields, the greater the sink for K. Unfortunately, at this stage of growth (late flowering) absolutely nothing economical can be done to get K into the plant.



Potassium deficiency on late-season cotton. Photo courtesy of IPNI.

PEANUTS

Nutrient deficiencies are unlikely to be seen on young peanuts because the plant itself is extremely tolerant of acid, infertile soils. Peanut is a deep rooted, indeterminate crop that is usually planted into warm soils in rotation with a highly fertilized crops such as corn or cotton. Phosphorus deficiencies are extremely rare. Potassium and calcium deficiencies will not be observed in young plants. Because peanut soils often get gypsum applications, sulfur deficiencies are also very rare in these tap-rooted plants. Calcium deficiencies show up in the yield and quality of the nuts at maturity. Failure to adequately inoculate peanuts with *Rhizobia* bacteria when they are first planted on new land could lead to a severe N deficiency as seen in the attached photo.



Severe N deficiency on 2 rows of un-innoculated peanuts in a field where peanuts have never been planted before. Photo by C. Mitchell.

ACKNOWLEDGEMENT

Many of the photos used in this Timely Information sheet were courtesy of International Plant Nutrition Institute (formerly PPI) provided on a CD in 1999.