

Consequences of Cutting Back on Potassium



Many growers in the Southeast reduced K fertilizer applications this season for economic reasons. Potassium is critical for plant water relations, enzyme activation, photosynthesis, protein synthesis, and resistance to various forms of plant stress. Failure to provide adequate amounts of this nutrient to the plant will result in reduced growth and yield loss. The answers to the following questions will outline the points that need to be considered when making future decisions about K fertilizer and monitoring the impact of past decisions.

What will happen if I don't apply K?

Well, it depends. Is a K application required for your cropping system? A soil test is the best way to determine your current soil nutrient status and the best piece of information you can use to evaluate your options regarding fertilizer applications. Several factors will affect soil K content, including parent material, climate, clay content, and CEC. Many soils in the Southeast are not naturally high in exchangeable K. This is especially true for the low CEC, deep sands found in the extreme Southeast where K leaching frequently occurs. The most recent IPNI soil test survey indicated that averaged across states, over half of the soil samples analyzed for K in the region required annual K fertilization for most major crops (Figure 1). In these situations, typically where soil test K is medium or lower, choosing to not apply the recommended fertilizer rate can definitely result in lost yield and profit.

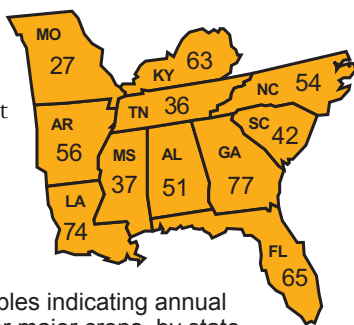


Figure 1. Percentage of soil samples indicating annual K fertilization needed for major crops, by state.

My soil test is high but K is recommended. Can I skip this application?

Most soil testing laboratories in the Southeast use a build-up/maintenance approach for making fertilizer recommendations. At soil test levels of medium or lower, the recommended fertilizer rate will include enough of the nutrient to satisfy crop requirements and to also build-up soil reserves and subsequent test levels. The fertilizer recommendation that is made when soil test levels are high is a maintenance application intended to replace some of the K that is removed in the harvested crop and



Dr. Steve Phillips
*Southeast Region Director
 International Plant Nutrition
 Institute (IPNI)*
 3118 Rocky Meadows Road
 Owens Cross Roads, AL 35763
 Phone: (256) 533-1731
E-mail: sphillips@ipni.net
Website: www.ipni.net

sustain the soil at the high-testing level. Choosing not to make this maintenance application will probably not have a major effect on yield in the short term. Over time, however, continued removal of K without replacing any through fertilizer application will lower soil test levels to the point that yield loss will occur. How long this process will take depends on crop type, yield level, and initial soil test K level.

Typical K removal estimates for crops common to the Southeast are reported in **Table 1**. Potassium removal is tied directly to crop yield. The removal values listed in **Table 1** are based on an average yielding crop; so, greater amounts of K than shown will be leaving the system in higher yielding environments.

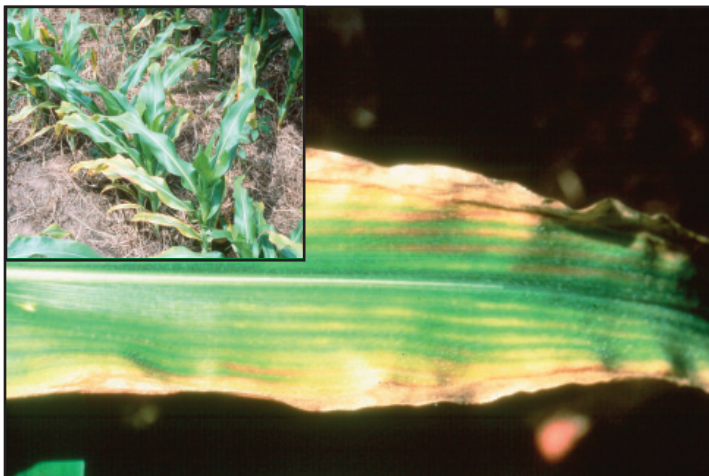
Table 1. Typical K removal estimates for crops common to the Southeast USA.

Crop	Yield	K ₂ O Removal
Corn	150 bu/A	44 lb/A
Soybean	40 bu/A	56 lb/A
Cotton	2 bale/A	40 lb/A
Wheat	65 bu/A	22 lb/A
Rice	150 bu/A	27 lb/A

How does crop K removal affect soil test K?

The rule of thumb used throughout much of the Southeast is that soil test K will be reduced by 1 ppm for every 8 to 16 lb K₂O/A removed on sandy loam to silt loam soils, respectively.

Abbreviations and notes: K = potassium; CEC = cation exchange capacity; ppm = parts per million.



Corn leaves showing K deficiency.

For example, a two-bale cotton crop grown on a sandy Coastal Plain soil can be expected to reduce soil test K by 4 to 5 ppm annually if K is not replaced. Another consideration regarding drawing down soil nutrient levels is that to build them back up, 8 to 16 lb K₂O/A will still be required to raise the soil K level by 1 ppm. However, this rate must be applied *above crop removal*, making it more costly in many situations to build soil test K levels back up after they have been allowed to decline than it is to maintain them at a high level with annual applications.

The reality in the Southeast is that many growers in the region have been skipping maintenance applications for 2 to 3 years already. It is in these situations where careful attention to nutrient balance and soil test levels needs to be directed.

I know I need to apply K. How much yield will I lose if I don't apply any?

Again, the answer to this question depends on the crop, location, climate, and initial soil test K level. Crop yield loss will occur when soil test levels fall below what is considered sufficient for plant growth. However, the upper limit of the K sufficiency range for a specific crop will vary from state to state. Responsiveness to fertilizer additions also varies across locations, which affects how laboratories categorize soil test K levels (e.g. low, medium, high). **Table 2** depicts a generalization for the Southeast of the expected response to fertilizer application and



Cotton plants showing K deficiency.

Table 2. Generalization for the Southeast of expected response to fertilizer application and expected yield loss if fertilizer is not applied at different soil test levels.

Soil test category	Probability of response to	Expected yield loss without
VL	>80%	50%
L	60-80%	25-50%
M	40-60%	0-25%
H	20-40%	0-10%
VH	<20%	0%

expected yield loss if fertilizer is not applied at different soil test levels. If recommended K applications are not made, intensified field scouting can help detect deficiencies early and efforts can be made to minimize yield losses using an in-season K application.

What does K deficiency look like?

Symptoms common to crops in the Southeast typically include marginal chlorosis and bronzing of the lower leaves. Eventually, necrotic areas occur around the margins and between the veins. Leaves can also become brittle with buckling and crinkling between veins and cupping under of the leaf lobes. In cotton, late-season deficiency can also occur with symptoms appearing first on the younger leaves in the upper third of the canopy and can ultimately result in premature leaf shedding, early cut-out, poorly formed bolls, inferior lint quality, and reduced yield. The images shown on this page can aid in identifying K deficiency symptoms.

The best practice to avoid yield losses due to K deficiency is to prevent the problem from occurring by regularly testing the soil and applying the recommended fertilizer rates to maintain sufficient soil K levels. However, each grower must decide for themselves what makes the most economic sense for their operation. If the decision to cut back on recommended K fertilizer applications is made, then the decision to accept greater risk of yield loss must also be made. This risk can be managed, however, by early and thorough scouting of fields and a return to normal fertilization practices as soon as possible. ■



Soybean plants showing K deficiency.