

Late Season Potassium Nutrition for Cotton and Soybeans

by Dr. Julian Smith, Ph.D., CZO Agronomics &
Jim Thomas, Director of Specialty Products, Crop Excellence®

Overview of potassium nutrition in plants:

I believe that potassium (K) is probably the most underrated macro-nutrient in plant physiology – nitrogen and phosphorous garnering the bulk of attention in research circles at least. The original work in England back in the 1800's indicated a flush of growth in the piles of burnt wood after field clearing. This was later attributed to potassium nutrition and subsequently produced for farms accordingly by incinerating wood in crucibles, hence "pot ash".

So why is potash so important at multiple plant growth stages?

Potassium is a univalent ion and as such is highly mobile in plants and only second to nitrogen in terms of required amounts – K is the most abundant cation in plant cells. Some of the key functions in plant physiology of potassium include:

- ✔ Plant water relations, invariably low K plants are associated with water stress and wilt.
- ✔ In a related role, osmotic regulation at the cellular and organ level is largely regulated by potassium. What does this mean?
 - Cell rigidity and high turgor confers stress and disease tolerance.
 - Viability of the photosynthetic machine via chloroplast survival and gas absorption through the control of guard cells of the stomates.
- ✔ Here's a good one and often overlooked!
 - Enzyme activation in the metabolic processes that allow for sugar synthesis (post-photosynthetic carbon fixation) and energy transfer at a cellular level – think about it, cells without water and energy die, hence K deficiency is a wilted, necrotic leaf in many plants.
- ✔ Note that CO₂ fixation / photosynthesis declines as water stress and K shortage increase.
- ✔ K is directly related to loading the products of photosynthesis to the plant transportation system, notably the phloem.
- ✔ Without adequate K, other nutrient uptake can be severely limited – so why apply only in the fall and forget about in season K applications?
- ✔ Leaf orientation – this is often referred to as photonasty- not a phyto porn movie but the ability for the plant to vary the position and angle of leaves in response to light to maximize sunlight interception and thus photosynthetic productivity.
- ✔ Some clay soils will "fix" K which is a double edged sword – for soils, soil quality such as clay structure can be improved, however, such fixed clay may not be plant available despite what the soil test says – the latter often being a total picture and not representative of plant availability...



Put all that together and it is clear that K is fundamental to plant nutrition all season long!

SOYBEANS:

Considering all of the above, a key role of potassium in soybeans, notably late season will manifest itself in nitrogen efficiency. Wait! It's a legume...fixes its own nitrogen...trust the plant physiology force! High yielding beans will run short of both water and nitrogen in late season due to seed demand and the nodule system quite simply cannot keep up with demand.

As a result, later season K for beans will enhance:

- Nitrogen efficiency
- Produce more nodes per plant
- More beans per pod
- Pod retention
- Better cell turgor and cell wall strength to assist in pest and disease tolerance

COTTON:

Cotton is possibly one of the most fascinating crop we grow and care take as crop advisors – originally a desert non-perennial we have made a tree in to an annual indeterminate bush through genetics and nutrient management.

Think about this, like your kids, cotton bolls are a major sink for resources!

In the 80's and 90's, most folks dismissed the idea of later season K applications. In some land grant institutes this was totally contra to their traditions yet late-season K deficiency was a disorder that still plagues high yielding crops – poor soil test calibration, it's a disease, tissue test analysis and establishment – go figure...

As a result of such luminaries that I had the privilege of working with including Dr. Ken Cassman and Dr. Derrick Oosterhuis provided solid support for late season K applications – check the research at www.fluidfertilizer.org

So bolls are a major sink, check the prolog and relate to...

- Late season K deficiency in cotton is still an issue – think about it, high yielding cotton needs to feed a lot of bolls
- K improves nitrogen and other nutrient assimilation and absorption
- Associated with solid K nutrition are:
 - Improved micronaire
 - Staple length
 - Overall fiber quality

Take away? A late season application of K can make a good crop great!

