Effects of Potassium on Crop Maturity

Crop stress caused by too little K can exhibit itself in many ways...increased incidence of diseases...lodging in corn and other crops...less winterhardiness in forage legumes and grasses...and premature "cutout" in cotton. Potassium stress on corn, for example, will result in the accumulation of high sugar content in the stalks by midseason. Apparently, the low K levels in the sap prevent the normal translocation of sugar to ears, disrupting the growth cycle and preventing normal grain development. Potassium, then, has a direct influence on crop maturity because the grain never develops.

Potassium (K) influences crop maturity in different ways. It speeds silking in corn, but lengthens time of grain fill, thus increasing yield potential. Higher moisture at harvest in an adequate K environment indicates K stretches the growing season in corn. Potassium deficiency delays maturity in soybeans. With adequate K, cotton yields are increased by extending the boll-filling period and preventing premature senescence or "cutout". The effects of K on maturity of fruits and vegetables are variable.

Research has shown that application of starter fertilizers containing nitrogen (N), phosphorus (P) and K hastens the maturity of corn from a few days to as much as a week. In addition, adding the nutrient that is in shortest supply advances maturity, whether it is applied through the planter or broadcast. The greater the yield and growth response to the nutrient, the more maturity is hastened.

Potassium hastened silking in corn in a Kentucky study. It reduced days from emergence to silk, **but delayed maturity** by as many as five days. The net effect was an increase of seven days in time of grain development...and higher yields. Results are shown in **Table 1**.

Other studies have shown that K hastens silking, but most show that it does not shorten the total production cycle. In other words, there is a longer grain filling period.

The percent of ears silked on a given date can give an exaggerated impression of maturity differences from fertilizer applications. Data in **Table 2** illustrate the point. Results were taken from the northern Corn Belt.

The plot that was only 25 percent silked on August 5 was probably 90 percent silked about three or four days later, approximately the difference in maturity indicated by the moisture contents of 40.9 percent and 39.2 percent.

Illinois research showed that corn silk emerged sooner when K was added to a medium K soil. The conclusions were that the K influence on silking could boost corn yield by lengthening the grain filling time. Adequate K helps prevent pollen shed and silking times from getting mismatched during hot, dry weather when silking is often delayed. Results are shown in **Table 3**.

Even with earlier silking, K can delay maturity if it does influence the length of time for grain fill. In an Ohio study, optimum

Adequate K nutrition offers benefits in development and maturity of corn, soybeans and other crops.

TABLE 1. Potassium increases number of grain development days for corn.

K_2O rate, lb/A	Days from emergence to silk	Days from emergence to maturity	Days of grain development	Yield, bu/A
0	83	138	55	142
60	81	142	61	155
240	80	142	62	170

TABLE 2. Relationship between silking date and corn grain moisture.

Percent silked on August 5	Percent moisture at harvest
25	40.9
80	40.4
90	39.2

TABLE 3. Potassium hastens corn silking.

K_2O rate, lb/A	% of plants silked
0	14
50	34
100	38
200	67

N and K rates increased yields, improved N utilization efficiency, and tended to increase grain moisture at harvest...an indication of an extended period of grain fill and a definite effect on maturity, **Figure 1**.

The tendency for added K to increase moisture content may have an indirect effect on physiological maturity as well. Studies have shown that low K causes early death of corn plant tissue, allowing stalk rot to kill the plant prematurely.

Soybeans can suffer from delayed maturity because of K starvation. When K is low, plants are usually stunted. Leaves show yellowish margins, and both leaves and stems remain green after normal plants have matured and dropped their leaves.

Other Ohio studies comparing combinations of low, medium, and high soil tests of P and K showed no significant interactions between these two nutrients on corn or soybean grain moisture (maturity). High soil test K levels ***reduced*** soybean grain moisture from 14.3 to 13.1 percent at harvest, and yields were increased by almost 10 bu/A (**Figure 2**).

The overall influence of K on cotton maturity ranges from speeding it up to no effect to a delay. Many of these differences can be related to the level of N nutrition and imbalances with K. Similar to disease and K nutrition effects in corn, low K can result in an increase in foliar leaf spot diseases in cotton, premature defoliation, and reduced yields. In Louisiana on a low K, acid soil, K had no effect on first harvest yields without lime. But when dolomitic lime was applied, K increased both first harvest and total yields (**Table 4**).

Proper K fertilization in Mississippi increased lint yield, with proportionately more of the yield developing later in the season. The effect was similar among four varieties which represented a range in earliness (**Table 5**).

Recent soil and foliar K fertilization research with no-till cotton in Tennessee showed that adequate soil-applied K reduced

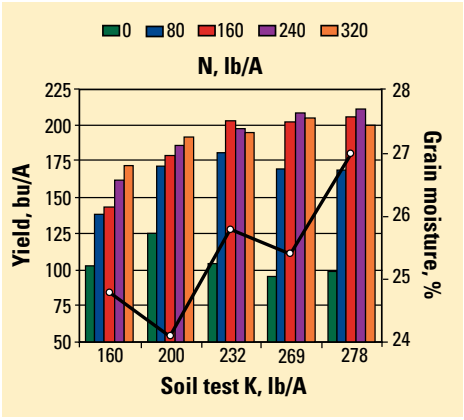

Figure 1. Effect of K and N on corn grain yields and moisture content (4-year average).

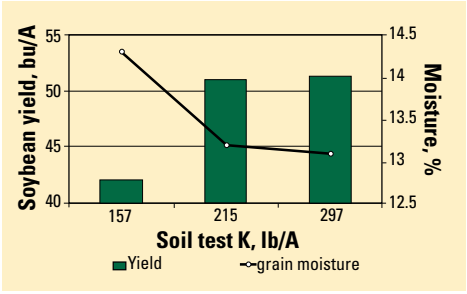

Figure 2. Effect of K levels on soybean grain yields and moisture (4-year average).

the percent first harvest from 80 percent down to 65 percent (**Table 6**), yet increased the first harvest yield by 68 percent and doubled total lint yield on a low K soil. Some cotton producers mistakenly believe that K delays maturity. Instead, K increases the first harvest yields, the second harvest yields, and total lint yields by allowing plants to take full advantage of soil moisture, sunlight and other plant nutrients. Extension of the boll filling period as a result of improved K nutrition would have little potential for negative economic consequence except in the most northern reaches of the cotton production belt in North America.

In the more northerly regions with short growing periods, appropriate cultivar selection and timely planting can enhance the ability to capture potential yield benefits from adequate K nutrition, before a killing frost arrests boll development.

The effects of K on maturity of fruit and vegetable crops vary. In one study, K increased early harvest and total yields of tomatoes, but had no effect in another study. Adequate K has been shown to reduce premature drop of tomatoes and citrus fruits. There may be a slight early season advantage from K on cauliflower. But high K rates have delayed maturity of broccoli, **Table 7**.

In a North Carolina study, K increased yields and hastened the maturity of blueberries. Early maturity of fruits and vegetables almost always offers the advantage of higher prices in the marketplace. BC

TABLE 4. Potassium and lime increase first harvest and total yields of seed-cotton.

K_2O rate, lb/A	First harvest yield, lb/A	Total yield, lb/A
No lime		
0	684	1,008
64	685	1,194
Dolomitic lime		
0	1,057	1,283
64	1,400	1,920

TABLE 5. Cotton lint yield and percent harvests at two K fertilization rates, averaged among four varieties (2-year average).

K_2O rate, lb/A	Lint yield, lb/A	% at first harvest	% at 2 weeks after first harvest	% at 4 weeks after first harvest
0	876	34	34	32
100	960	29	34	36

TABLE 6. Potassium effects on earliness of no-till cotton.

K treatment, lb K_2O/A		Lint yield, lb/A			Proportion in 1st harvest, %
Soil-applied	Foliar-applied	1st harvest	2nd harvest	Total	
0	0	411	103	514	80
0	17.6	623	192	815	76
120	0	694	359	1,053	65
120	17.6	648	362	1,010	64

TABLE 7. Effect of K on the number of broccoli terminals mature by midseason.

K_2O rate, lb/A	Terminals mature by midseason		
	Location 1	Location 2	Location 3
0	147	139	148
85	124	127	130
170	142	116	142
225	102	134	119