# EFFECT OF POTASSIUM TIMING AND SOURCE ON COTTON LINT QUALITY AND YIELD

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## ABSTRACT

The importance of potassium (K) is numerously documented as it's essential for photosynthesis, stomatal regulation, enzyme activation and chlorophyll development. While a majority of cotton production occurs in the southwest portion of Oklahoma, producers from south to northwest are implementing rotations of cotton and wheat. In the western portion of the state soil pH becomes increasingly alkaline [whereas areas in wheat production are predominantly acidic]. Although K becomes more available in alkaline soils not all of K is plant available and could be tied up amongst soil textures of various pore sizes. In acidic conditions commonly found in areas of wheat production K becomes insoluble and unavailable for plant uptake. With the combination of acidic conditions and the intricate role of potassium, it's apparent previous methods of supplying K should be observed and enhanced if necessary. In addition, K levels have proven to fluctuate with soil temperatures, a phenomenon also observed among soil textures. Various types of fertilizer products containing K are available to producers, of which the sources and additives may impact their availability to a cotton crop.

## INTRODUCTION

The importance of potassium (K) is numerously documented, as it contributes to photosynthesis, stomatal regulation, enzyme activation, and chlorophyll development (Reddy *et al.*, 2000). Traditional practice of Oklahoma producers is to apply the entire K requirement as a preplant application, which could be found ineffective due to the complexity of K interactions within the soil solution, making proper management challenging.

In the soil solution potassium can be described in terms of mineral, exchangeable, and non-exchangeable, the concentration of K is affected by equilibrium reactions, meaning only a portion of K is available for crop uptake. Mineral and exchangeable K forms are readily available for plant uptake, while non-exchangeable K is fixed between clay minerals making it unavailable to plants. The release of non-exchangeable K occurs when the levels of mineral and exchangeable K are decreased by crop removal or K loss through leaching (Mouhamad *et al.*, 2016). This fluctuation in available K through interaction of clay minerals or effects of equilibrium reactions demonstrates the necessity for refined K recommendations.

In consideration of the complexity of K fertilization and economic return, it is possible the sole preplant application may not always be sufficient as significant demand occurs during reproductive stages, as set bolls become sinks for K. Within the plant K is essential for its role in fiber development. During fiber development K is utilized to regulate turgor pressure to promote fiber elongation if deficient turgor pressure decreases causing shorter fibers and poor lint quality (Oosterhuis, 2002).

## MATERIALS AND METHODS

This study was conducted during the 2018, 2019 and 2020 growing seasons at the Cimarron Valley Research Station near Perkins, OK. In 2018 two granular sources of potassium were utilized, muriate of potash (0-0-50) and aspire (0-0-58-.5) which consisted of trace amounts of boron. For the 2019 and 2020 growing seasons an additional source in the form of foliar fertilizer (0-0-29) was incorporated. Applications occurred during two timings (preplant and pinhead square), with rates of 30, 60 lbs $ac^{-1}$ and a split application of 30/30 lbs $ac^{-1}$, and 1 gal $ac^{-1}$ for foliar applications. Granular fertilizer was spread by hand while foliar application occurred using a backpack $CO_2$ sprayer. Cotton lint was collected using a John Deere 482 stripper, and samples were cleaned using a Mitchell field cleaner and ginned using an Eagle 10 saw cotton gin. Lint quality analysis was conducted by Texas Tech University Fiber & Biopolymer Research Institute. This experiment utilized a RCBD with four replications, with five treatments in 2018, and 10 treatments in 2019 and 2020.

## RESULTS AND DISSCUSSION

This study was conducted during the 2018, 2019, and 2020 growing seasons at the Cimarron Valley Research Station near Perkins, OK., of those three years yield was not found to be significantly different among treatment application rates, products, or timings.  Not included in the results section is the fiber quality data, fiber quality was collected during the 2020 growing season and indicated no significant differences in response to potassium fertilization. Further research is necessary to determine adequate timing, rate, and product effectiveness.

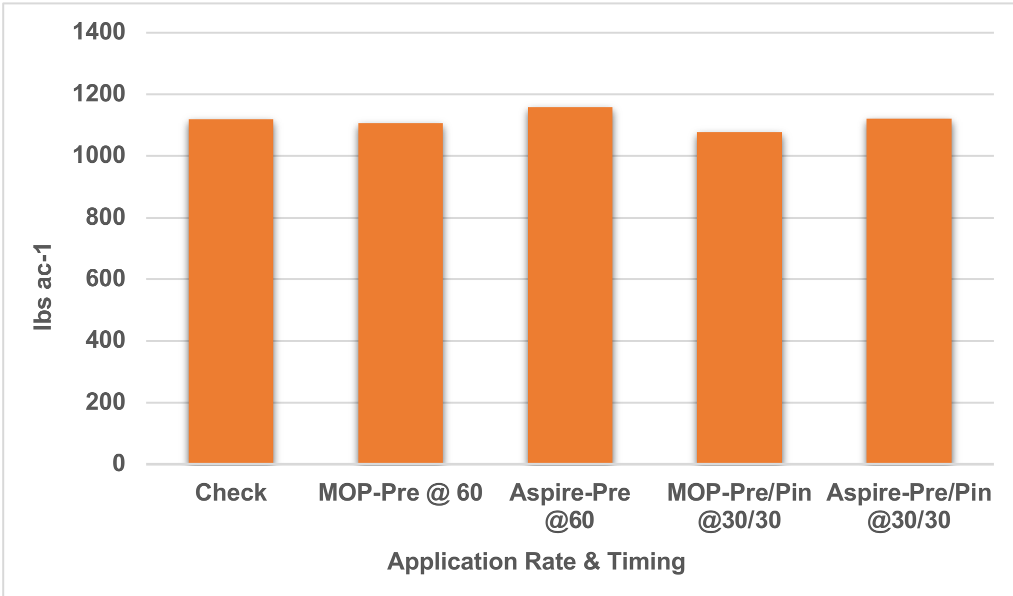


*Figure 1. Shows 2018 lint yield data for the perkins location across all treatments. The unfertilized check is included to indicate the lack of reponse to timing and rate of potassium fertilization. Pre indicates the timing of application while the @ denotes the rate of ferilizer used.*

| TRT | Product | Timing | Rate |
|---|---|---|---|
| *1* | CHECK | - | - |
| *2* | MOP | Pre | 30 |
| *3* | Asprie | Pre | 30 |
| *4* | MOP | Pre | 40 |
| *5* | Aspire | Pre | 60 |
| *6* | MOP | Pre-Pin | 30/30 |
| *7* | Aspire | Pre-Pin | 30/30 |
| *8* | Foliar | Pin | 1 gal ac-1 |
| *9* | MOP/Fol | Pre-Pin | 30-1 gal ac-1 |
| *10* | MOP/Fol | Pre-Pin | 60-1 gal ac-1 |

*Table 1. Contains treatment infromation including product, timing, and rate of application to be used with figures 2 and 3 for the 2019 and 2020 lint yield.*

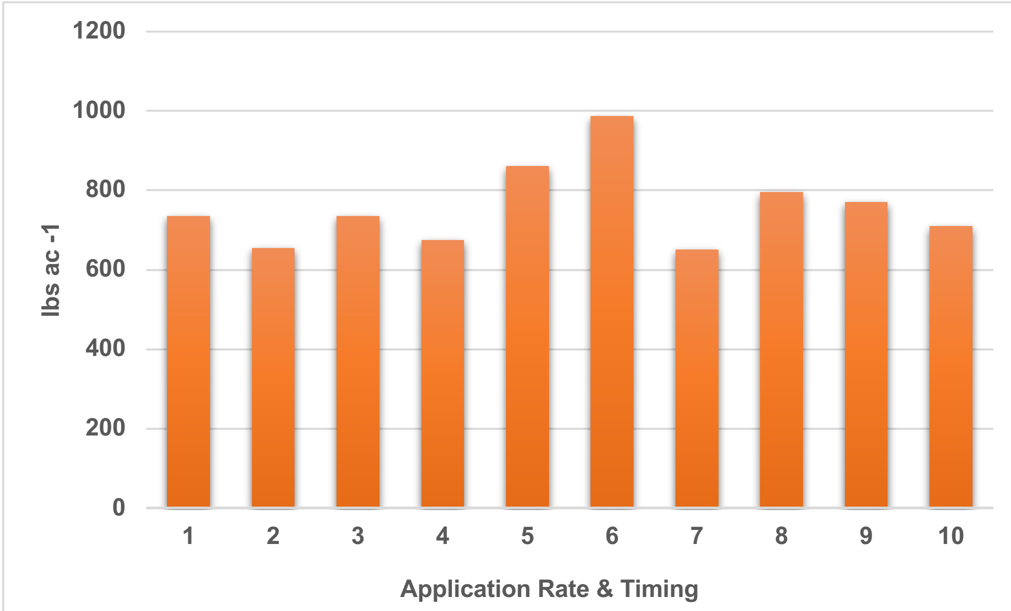


*Figure 2. shows 2019 lint yield data for the perkins location across all treatments. The unfertilized check is included to indicate the lack of reponse to timing and rate of potassium fertilization. Numbers denote treatments, the use of table 1 is required to determine the product, rate, and timing.*

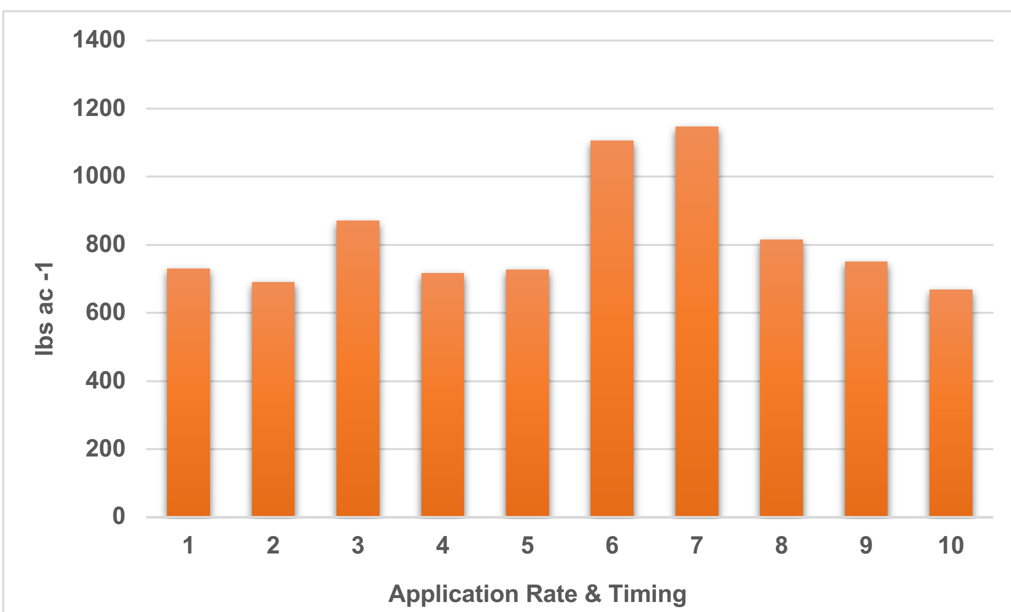


*Figure 3. shows 2020 lint yield data for the perkins location across all treatments. The unfertilized check is included to indicate the lack of reponse to timing and rate of potassium fertilization. Numbers denote treatments, the use of table 1 is required to determine the product, rate, and timing.*

## REFERENCES


Mouhamad, R., A. Atiyah and M. Iqbal, 2016. Behavior of potassium in soil: A mini review. Chemistry International, 2(1): 58-69.

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