FIBER QUALITY AND GROSS PROFIT AS INFLUENCED BY SUB-LETHAL RATES OF 2,4-D AND YIELD ENVIRONMENT

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Abstract

The impact of sub-lethal rates of 2,4-D on cotton growth, development, and yield has been extensively documented, with increased interest recently due to the release of auxin tolerant herbicide traits in cotton (Johnson et al., 2012; Marple et al., 2008, Sciumbato et al., 2004). Specifically, the magnitude of yield loss is a function of the rate of 2,4-D cotton is exposed to and the growth stage of the crop at the time of exposure, with the nine leaf and first bloom growth stages being the most sensitive (Byrd et al., 2016; Manuchehri et al., 2019). However, the impact on cotton fiber quality and loan value appears to be unexplored. To determine the impact on these post-harvest parameters, a study was conducted in 2013, 2014, and 2015 at the Texas Tech New Deal Research Farm in Lubbock, TX. The 2,4-D susceptible variety PhytoGen 499 WRF was planted in each year of the study. Five rates of 2,4-D, simulating tank contamination or improper tank cleanout scenarios were applied at the nine leaf and first bloom growth stages, with a non-treated control (NTC) also included. The rates, representing different fractions of the full rate of 1.98 lb. ae acre^{-1} of 2,4-D choline plus glyphosate, included 0.0008, 0.008, 0.08, 0.8, and 8% of the full rate. After harvest, lint yield was determined through ginning, and fiber was classed for USDA grades and HVI fiber quality. Because of the lack of an appropriate lint cleaner on the gin, color and leaf grades were set at the base level (41 and 4, respectively). The value of fiber per pound was determined using the 2015 upland cotton loan schedule. This value was multiplied by the lint yield for determination of gross return per acre.

Due largely to differences in seasonal heat unit accumulation, 2013 was the only year in the study in which the NTC resulted in at least base level fiber quality values. In all three years the 0.8 and 8% rates resulted in yield reductions compared to the NTC, with the 0.08% rate also reducing yield in 2013 and 2014. Compared to the NTC, both micronaire and uniformity were reduced in 2013 at the 8% rate, and in 2015 at the 8 and 0.8% rates. Length was reduced by the 8% rate compared to the NTC in 2013. The 8% rate reduced fiber strength in all three years of the study compared to the NTC, but only resulted in a fiber value discount at the first bloom growth stage in 2013. Reduced micronaire was the primary driver of fiber value reductions throughout the study.

In 2013 regardless of growth stage loan value was reduced compared to the NTC when cotton was exposed to the 8% rate of 2,4-D. The interaction between growth stage and rate was significant for gross return, where 0.08, 0.8, and 8% rates reduced the return compared to the NTC when applied at the nine-leaf stage, while at first bloom return was reduced by the 0.8 and 8% rates. At both growth stages the 8% rate resulted in greatest loss with no difference between the two growth stages. The lack of fiber quality effect in 2014 was reflected in loan values, where no differences were present across all rates of 2,4-D and the NTC. However, the impact on yield resulted in decreased gross return when the 0.08, 0.8, and 8% rates were applied at either nine-leaf or first bloom, with the greatest loss resulting from exposure to 0.8% at nine-leaf and 8% at nine-leaf and first bloom. A significant growth stage by rate interaction was present for loan value in 2015, where the 8% rate was the only treatment that produced a lower loan value than the NTC, but the value at this rate at the nine-leaf stage was approximately 4.5 cents per pound lower than at first bloom. A significant interaction for gross return was also present in 2015, which was reduced compared to the NTC at the 0.8 and 8% rates at both nine-leaf and first bloom growth stages, with the greatest loss occurring with the 8% rate applied at nine-leaf. The results of this study provide evidence that the loss in fiber value and, as a result, gross profit, are greatest in years where conditions favorable for high quality fiber production are present. In

years where below base level fiber was produced by the non-treated control, there was no additional loss in fiber quality or value due to 2,4-D exposure, although gross return was still reduced due to the impact on yield.

References

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