THE EFFECT OF GIN SAMPLING FREQUENCY ON COTTON VARIETY TRIAL RESULTS

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Abstract

The NC On-Farm Cotton Variety Evaluation Program was established in 2015 in order to establish a means of evaluating variety performance at the farm level across the state. This program effectively evaluates variety stability across a broad range of yield environments which encompasses soil types, geographical regions, rainfall/drought severity patterns, planting dates, tillage methods, row spacings, plant populations, and many other factors. In recent years, varieties increasingly enter the marketplace with little to no prior performance data, and by the time growers are accustomed to when, how, and where to plant new varieties, and how to manage them, the varieties exit the marketplace and are replaced by newer ones. This on-farm program effectively captures a broad range of yield environments within a single year so that varieties can not only be evaluated for performance, but to also understand yield stability and the type of environment in which a variety might be competitive, which drastically shortens the learning curve.

Being a large-plot on-farm program, precise ginning is needed to effectively and accurately assess variety performance. Additionally, lint percentage (which is used to calculate lint yields per acre), and fiber quality characteristics need to mirror what a producer would observe from their local commercial gin, therefore larger seedcotton samples are collected for ginning in on-farm large-plot trials, whereas smaller samples are commonly ginned using a small table-top gin for small-plot variety trials. These larger seedcotton samples are ginned in a scaled-down gin equipped with seedcotton cleaning and lint cleaning capabilities, which provides very similar lint percentages and fiber properties as would be observed from commercial gins. Lint percentage can often drastically affect lint yields; therefore, precision is warranted and desired. Shipping and ginning costs for larger samples can also be rather expensive, which raises the question as to whether or not a sample should be submitted for every plot, versus submitting one sample for each variety and using the lint percentage of that sample to be applied to all other plots of the same variety. The objectives of this research were to compare and contrast results for ginning a single sample (collecting one seedcotton sample from each variety in one replicate only) to multiple samples (collecting seedcotton samples for each plot in all replicates).

The 2020 NC On-Farm Cotton Variety Evaluation Program consisted of eight trials across multiple regions of North Carolina. These trials consisted of 10 varieties (two from each major brand) replicated four times at each location. Ginning samples consisted of seven to eight pounds of seedcotton per plot, which were shipped to the University of Tennessee Microgin in Jackson, TN. Variety ranking and the varieties within the statistically highest yielding group were evaluated within each trial and across trials, and stability (frequency in which a variety was withing the statistically highest yielding group) was evaluated across trials. Statistical significance was determined using Fisher's Protected LSD at $p \leq 0.1$.

As expected, using single samples (from only one replicate) affected yields for all replicates except the replicate from which the sample was collected. Initial observation of the distribution of the percent difference in yields from single samples relative to using multiple samples (samples collected for all plots) illustrated a range of +(-)5 percent with relative equal frequency of positive and negative percent differences, however, 73 percent of observations were within +(-) 2.5 percent. This suggests that any error from lint yield calculations using single samples would be small compared to using multiple samples. Yield environment, as described as the trial average yield, had little to no influence on the range of error across all ten varieties, however some trials demonstrated and smaller range than others across varieties. This effect appeared to be random and was not common in high yield vs low yield environments, or vice versa. All trials resulted in rather equal proportions of positive and negative error values, and

this varied slightly from trial to trial. When comparing the absolute value of the percent difference in yield in single samples compared to multiple samples, four trials clearly resulted in a statistically narrower range of error compared to single-most trial with the greatest range of error, and this did not appear to be related to yield environment but was random. Similarly, two varieties resulted in a statistically narrower range of error compared to the variety with the greatest range of error, but again, this effect appeared to be random. In addition to plot yields, the percent difference in yield of single samples compared to multiple samples did not appear to be related to trial LSD, CV, Variety or Trial Location in terms of lint percentage, trash, and leaf grade.

Most importantly, understanding of the effects single vs. multiple samples on variety ranking, statistical significance, and stability across trials was needed. When comparing single vs. multiple samples on variety ranking across trials, the top four varieties nor the bottom two varieties' ranking was affected when single samples were used. Single samples resulted in a ranking change for the remaining four varieties, but by no more than one ranking for each variety, which in essence means that using single samples caused the four varieties to change ranking by one rank only. Additionally, these varieties performed in the middle of the stability chart, meaning that they were not the most consistent performers in many trials. In six of the eight trials, the varieties that performed within the statistically highest yielding group, nor the highest yielding variety in each, was identical when using single samples compared to multiple samples. The value for lint yield per acre was changed in nearly all instances, but only by a small amount. In the remaining two trials, single samples resulting in fewer varieties yielding within the statistically highest yielding group but did not affect the ranking of varieties substantially within these two trials. As such, stability values (percent of trials in which a variety performed in the statistically highest yielding group, within the top 3, within the top 2, or was the number one variety in the trial) was reduced minimally. Therefore, it was concluded that single samples could be used for large-plot on farm variety evaluations versus multiple samples, with little to no effect on variety ranking or statistical significance. Naturally, greater precision could be achieved by using multiple samples, but the use of multiple samples did not appear to change variety trial results drastically. If only a few trials were to be evaluated, it would likely be best to use multiple samples, or in instances when a sample is lost or a problem during ginning occurs. However, costs could be reduced substantially with little effect on yield results if singles samples are used when evaluating variety performance in several trials, but samples are not lost, do not encounter problems at the gin, and do not have an unusually high or low trash content.

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