COMPARISON OF ON-BOARD HARVESTER SCALE SYSTEMS TO GROUND SCALE SYSTEMS IN COTTON YIELD MEASUREMENTS

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Abstract

Variety selection continues to be one of the most important decisions that growers make each year. As such, growers rely on replicated trial data as a resources of variety performance information. In order to provide valid and credible data, yield measurements should be as precise as possible. Replicated variety trials include small-plot OVT and large-plot on-farm trials. In small-plot OVT, yields are generally measured by harvesting all seedcotton within a plot, and weighing it using a precise scale. In large-plot on-farm trials, substantially larger quantities of seedcotton are harvested from each plot and are generally weighed using large platform scales (10-lb precision), on-board scales in boll buggies (1-2 lb precision) or individual automotive scales (1-2 lb precision). In recent years, the newer model round-bale pickers have been equipped with a scale system that measures hydraulic pressure when the round-bale is ejected onto the bale handler. If precise, this system could be used to weigh seedcotton in each plot within on-farm variety trials with greater efficiency and less equipment than the current methods used. The objective of this research was to determine if the on-board scale system in round-bale harvesters is as precise as the current automotive scales used to assess variety performance in large-plot replicated trials.

The NC On-Farm Cotton Variety Evaluation Program evaluates the top 2 varieties of each major seed brand annually across 15-17 trials in producers' fields, with a total of 10 varieties and 4 replicates in each trial. Two cooperators in the program utilized pickers equipped with the on-board scale system during 2020. Both trials were irrigated and were used to compare yield measurements of seedcotton weight per plot, seedcotton yield per acre, and lint yield per acre to that of automotive scales, which are more commonly used in yield measurements of on-farm large-plot cotton variety trials.

The relationship between the on-board scales and automotive scales in measuring seedcotton weight per plot, seedcotton yield per acre, and lint yield per acre was evaluated for 10 varieties at Location 1. In all cases, there was a very high correlation between the on-board scale and automotive scale measurements of plot weight (0.9892), seedcotton yield (0.9751), and lint yield (0.9801) although the magnitude of these measurements was clearly different between the two scale systems (6 to 11%, with the on-board scale system always estimating higher values than the automotive scales). Albeit a rather weak relationship between the percent difference in scale measurements and yield, there appeared to be a trend suggesting that the difference among the scale measurements were greater when measuring lower weights (plot weight=0.4012, seedcotton yield/A=0.2801, lint yield/A=0.2044). Most importantly, the lint yield ranking of the 10 varieties, and the varieties performing within the statistically highest group, were both identical when measuring weights via automotive scales and on-board scales, although the magnitude of these measurements was always greater for the on-board scale system. The same comparisons were evaluated at Location 2. In all cases, there was a very high correlation between the on-board scale and automotive scale measurements of plot weight (0.9691), seedcotton yield (0.9694), and lint yield (0.9745) although the magnitude of these measurements was clearly different between the two scale systems (16 to 24%, with the on-board scale system always estimating higher values than the automotive scales). The relationship between the percent difference in scale measurements and yield observed at Location 1 was not observed at Location 2. At Location 2, the precision of the on-board system did not appear to be dependent on weight or magnitude of quantity (plot weight=0.0262, seedcotton yield/A=0.0088, lint yield/A=0.0112), however the on-board scales at this location estimated weights and yields noticeably greater than at Location 1 (10 to 13 percentage points greater error at Location 2). Most importantly, the lint yield ranking of the 10 varieties at Location 2 was moderately influenced (yield of one variety was estimated by the on-board scales to be 2 ranks higher than what the automotive scales measured), and the varieties performing within the statistically highest group were identical when measuring weights via automotive scales and on-board scales. Again, at Location 2, the magnitude of these measurements was always greater for the on-board scale system and to a greater degree than what was observed at Location 1.

In conclusion, the varieties performing with the statistically highest yielding group were estimated with equal precision using the on-board scale system and validated by the automotive scales at both locations. However, the potential for error to influence variety yield ranking is apparent but seldomly occurred. Additionally, the on-board scale system consistently over-estimated plot weights and yield per acre at both locations, however there was a range in the percent error within each trial, and across locations. If the sources of error could be corrected, there is potential for the on-board scale systems to be used in on-farm large-plot variety trials.

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