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CAPTURING SMALL-PLOT HARVEST WEIGHTS USING 2 AND 4 ROW LOAD-CELL MODIFIED PICKERS

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Abstract

The desire to cut costs and improve efficiency and accuracy was the prerequisite for initiating cotton picker conversions at Phytogen Seed Company. In this report, we describe the development of an improved and cost effective system to harvest yield plots for the two cotton breeding programs in North America. An agricultural engineer was hired to design/convert a two-row picker, creating the first, functional prototype. An additional two-row picker was converted the following year, based on the original prototype. That same year a four-row picker was designed/converted to capture greater cost-savings, efficiency, and accuracy. The four-row system was developed based on an unrelated structural design from the original two-row prototype. The four-row system allows for harvesting two plots simultaneously, yet independent of each other. The two-row system eliminates five to seven working bodies, completing the same tasks in the same amount of time with an increased level of safety and accuracy. Conversely, the four-row system eliminates five to seven working bodies, completing the same tasks nearly three fold quicker than the original plot-harvest system. The original harvest system, using a bagger-picker, is out-dated for yield plot harvest, but remains a superior system for harvesting seed increases. With the development of the two- and four-row load-cell systems, resources were shifted to harvesting seed increases with the bagger-picker rather than spending excessive time, energy, and costs on harvesting yield plots. The converted systems have increased safety, efficiency, accuracy, and cost-savings by replacing the bagger-picker function with respect to harvesting yield plots. The systems were estimated to pay for themselves within one year of operation.

Introduction

The advent of cotton pickers has revolutionized cotton harvest by providing tools for efficient harvest of production cotton. Modifications to commercial production pickers are necessary to allow for production on a micro scale, yet maintaining efficiency established by commercial cotton pickers. The traditional conversion of commercial cotton pickers, used by most all seed companies and research entities, is to remove the picker basket of a two-row machine and build a standing/storage platform in its place. Chutes are added to carry the seedcotton to an area where the cotton is bagged in mesh bags. The mesh bags are then tagged with a corresponding plot number to allow for tracking of plot weights. The mesh bags are removed from the platform of the picker, weighed on a scale, weights are hand-recorded, and then the mesh bags are carried into a cotton trailer and seedcotton is removed. Small seed increases are performed in a similar manner with the exception of removing the seedcotton from the mesh bags into the cotton trailer. Potential problems that may exist when performing this task on yield plots with the bagger-picker system include: mislabeled mesh bags, handwritten errors (data transfer), excessive labor costs, excessive physical labor, large number of mesh bags and tags, and an increased level of liability.

With advancing technology in our favor, a new and improved method of weighing yield plots was developed. Load-cells, traditionally used on large weigh systems (10000 to 120000 pound range), were developed to weigh in increments of one-tenth of a pound. This set the stage for developing a stationary weigh system on a commercial cotton picker to weigh yield plots, eliminating the need for employees to collect seedcotton in tagged, mesh bags.

Materials and Methods

Two-Row Cotton Pickers

The prototype two-row machine was based on a commercial John Deere 9920. The second picker designed was a commercial John Deere 9930. An additional fan was added to the commercial picker to allow more air volume to transport the seedcotton from the external weigh-box to the main picker basket. Additional hydraulic solenoids were added to energize hydraulic cylinders that open and close the weigh-box, lift and lower an air flap to divert air from the weigh-box, and to energize a paddle wheel to feed the seedcotton to the air duct that blows the seedcotton into the main picker basket. Internal chutes were designed using 16-gauge sheet metal to carry the seedcotton through the lid of the main picker basket into the external weigh-box. The weigh-box was constructed using perforated metal to allow for air to escape once seedcotton is dropped into the weigh-box. A WEIGH-TRONIX weigh system was also installed on each picker to capture and record

weights. The WEIGH-TRONIX weigh system included four load-cells, wiring, junction box, and a computer monitor with data storage capabilities.

Four-Row Cotton Picker

The prototype four-row machine was based on a commercial Case-IH 2155. An additional solenoid body was purchased to energize hydraulic cylinders that open and close two weigh-boxes located inside the main picker basket and lift and lower an air flap to divert air from the weigh-boxes. The additional solenoid body also energizes two auger motors to move seedcotton away from the weigh-boxes to allow for greater capacity. Internal chutes were designed using 16-gauge sheet metal to carry the seedcotton to the weigh-boxes. The weigh-boxes were constructed using perforated metal to allow for air to escape once seedcotton is dropped into the weigh-box. A WEIGH-TRONIX weigh system was also installed on each picker to capture and record weights. The WEIGH-TRONIX weigh system included eight load-cells (four for each box), wiring, two junction boxes, and a computer monitor with data storage capabilities. Video cameras and monitors were added to enable viewing operations in the picker basket without adjusting your view when harvesting the yield plots.

Download

The WEIGH-TRONIX computer system has a printer attached that prints the data every time the computer records a plot. The computer system has the capability to store 1000 plots. HyperTerminal interfaces with the WEIGH-TRONIX computer system to download plot data that can be transported into Microsoft Excel. Once downloaded, the data from the WEIGH-TRONIX system can be erased or remain stored into the computer system.

Results and Discussion

The John Deere 9920, two-row prototype harvested yield plots in 1999 (MS), 2000 (CA), and 2001 (CA). The weigh-box was enlarged on the prototype in 2001 to provide larger capacity for Acala yields in California. 500 plots per day can be harvested with the two-row prototype when harvesting an average of 1200 pounds of lint per acre. 300 plots per day can be harvested with the two-row prototype when harvesting an average 1850 pounds of lint per acre. Conversely, the four-row prototype can harvest 1200 plots per day when harvesting and average 1200 pounds of lint per acre. The four-row prototype has not yet been tested in California.

The two-row machines work well under all conditions, especially when harvesting single rows. The four-row machine is a far superior system with respect to upkeep, simplicity of the system, and ability to harvest a large number of plots. The four-row limitations are that the yield plots must be two-row plots and transporting the four-row machine requires an escort and permits.

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