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Modifying a John Deere 9410 Combine for Plot Harvest

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Abstract
The following is a report on modifying a John Deere 9410 combine for plot harvest by adding a HarvestMaster Model 800. The modification was done at the Iowa State University Ag Engineering/ Agronomy Farm in the Ag Engineering shop. The decision to modify this combine was to replace a John Deere 4420 combine that had previously served as the plot harvest combine. Parts were becoming hard to find for the JD 4420, and the research farm currently owned a JD 9410. Parts should be available for several more years.

Disciplines
Agricultural Science | Agriculture

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Richard VanDePol, ag specialist

Introduction

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The decision to modify this combine was to replace a John Deere 4420 combine that had previously served as the plot harvest combine. Parts were becoming hard to find for the JD 4420, and the research farm currently owned a JD 9410. Parts should be available for several more years.

HarvestMaster advises the fabricator to build a holding bin similar to the HarvestMaster High Capacity Grain Gauge (HCGG) in physical size and capacity that can be opened and closed with an air cylinder similar to the HCGG. This allows the HarvestMaster to automatically control the holding bin. We decided not to follow this advice, but rather to install an air clutch on the grain supply elevator and have it controlled by the HarvestMaster automated controls.

The basic modification required that the clean grain stream be intercepted, re-routed through the HCGG, and then sent to the clean grain tank of the combine. All hardware needed to supply grain to the HCGG and transfer grain from the HCGG to the grain tank was the responsibility of the fabricator.

The decision was made to intercept the grain stream at the beginning, thus shortening the time for grain to reach the HCGG. Data (weight, moisture, and test weight) are collected at the HCGG. The data are sent to a computer in the cab (an Allegro CX) and field research software records the data. A printer is also in the cab so data can be printed. The system requires a 12-volt DC power supply and compressed air.

Materials and Methods

The combine's 12-volt system satisfied the HarvestMaster. Because the system's air needs were fairly low, a small "pancake" 110-volt AC compressor was placed in the combine. It was powered by a Vector 2500-watt power inverter connected to the 12-volt DC system. This unit also could power future needs, such as a grain sampling system.

For the HarvestMaster system to operate correctly, it requires the flow of grain to be interrupted every time the HCGG is filled. This allows the data to be acquired from the sample, and takes approximately 6 seconds. For this 6-second interval, incoming grain must be stopped and stored.

After reviewing the literature supplied by HarvestMaster, our unit was placed on the left side of the combine, just ahead of the rear axle. This location seemed to have the most space for the hardware mounting. However, this location required moving some hydraulic lines and the hydraulic system filter.

To intercept the grain flow, the combine clean grain auger door was removed and modified. The clean grain auger had several inches of flighting removed so grain would fall into a new fabricated clean grain auger that moved the grain to the left side of the combine into a modified JD 6620 clean grain elevator and up to the HCGG. The original clean grain elevator opening was sealed with a plate. This plate allowed the original shaft to remain in place, thus allowing the combine sensors to remain functional. Once grain passes through the HCGG, it drops into a second fabricated

auger that moves the grain to the right side of the combine into a second modified JD 6620 clean grain elevator that elevates it into the JD 9410 clean grain elevator and into the grain tank. To close the grain stream, a sealing plate was made to close the fabricated clean grain auger, thus creating a hopper effect at the beginning of the grain stream.

An air-operated clutch was installed on the supply side JD 6620 elevator and automatically controlled by the HarvestMaster automatic control system when operated in the "auto" mode. This arrangement stops grain flow to the HCGG for a 6-second interval while data are being collected. The grain volume of the supply side elevator serves as the "holding bin" or grain reservoir.

Drives for both the supply side auger elevator and the return auger and elevator are hydraulic motors. The power for these motors is provided by a stock hydraulic pump from John Deere, which mounts on the straw chopper drive shaft. With this arrangement, grain flow through the HarvestMaster only operates when the combine separator is engaged.

To let the combine operator know when the HCGG has completed a plot, a closed circuit camera was mounted inside the HCGG. The view is in the combine cab. The camera system also has a second camera mounted above the beginning of the clean grain stream to allow the operator to know the status of the grain supply when the air-actuated clutch stops the supply of grain to the HCGG. There is also an alarm mounted in the belly of the combine to signal when the level of grain approaches overflowing into the cleaning fan.

Because the HarvestMaster system has no method of measuring the area harvested, a Calc-an-Acre was purchased to allow the combine to measure linear distance in feet. The width of harvest is determined by the head width. These two measurements are used for an area measurement that is used to calculate yields in bushels/acre. A GPS antenna changes the Calc-an-Acre signal to a pulse that is counted and calibrated to feet. The width of head in feet multiplied by the linear feet gives square feet as a fraction of an acre. If a grain sample is required for research data, an assistant riding in the combine collects the samples. This may be automated in the future.

The combine was operated in the 2008 oat harvest, mainly to monitor all operations of the modification. Data were collected at oat harvest though the system had not been calibrated. The oat harvest was used to fine tune the mechanical operation of the modification and to get acquainted with HarvestMaster software. The combine was operated in both corn and soybean plots for the fall 2008. More than 1,200 plots were harvested and the machine performed satisfactorily. Three problems occurred. One was software, which required calling the HarvestMaster technical support. A coupler from a hydraulic motor to an elevator drive shaft was replaced. The hydraulic flow divider was replaced with a different model because the first divider was sized incorrectly for both flow and pressure. When these problems were corrected, the machine performed without problems for the remainder of harvest.

Acknowledgements

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