ASABE S578 JAN2007 (R2016)
Yield Monitor Performance Test Standard

American Society of Agricultural and Biological Engineers

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Yield Monitor Performance Test Standard

Developed by the ASABE Precision Agriculture Committee. Adopted by ASABE January 2007; reaffirmed January 2012; reaffirmed October 2016.

Keywords: Calibration, Flow sensor, Material flow rate, Steady state flow, Step flow, Transient flow, Yield

1 Purpose and Scope

1.1 This Standard is intended to provide the basic requirements for a uniform procedure to measure and report yield monitor accuracy. The goal is to provide a series of repeatable tests that may be used as a basis to evaluate and compare yield monitors under a wide range of operating conditions.

1.2 This Standard covers grain and bulk crop yield monitors. Because crop conditions are variable and uncontrollable, the procedure provides for laboratory testing with controlled material flow rates. The Standard includes evaluation of all sensors required for the yield monitor including moisture sensors. The Standard applies to all technologies associated with evaluating yield, mass flow, force, and volume measurements during crop harvest.

1.3 This Standard defines tests that include all components contained in the commercial yield monitor except the positioning device. Harvester inputs required for determining yield that cannot be duplicated on the test fixture are simulated to permit testing of all yield calculations.

2 Terminology

2.1 yield monitor: A system of sensors and associated electronics mounted on a harvester and used to quantify the yield for the crop being harvested on an instantaneous and averaging basis.

2.2 yield sensor (flow sensor): The sensor(s) that measure the mass or volume flow or mass accumulation of the crop in a short time interval.

2.3 test monitor: The yield monitor to be evaluated.

2.4 test run: The events necessary to record a single set of measurements.

2.5 test: All the events and data of several test runs and the test stand qualification information.

2.6 test stand: A stationary system including precision flow or load measurement system, material conveyance system and test monitor. See Figure 1.

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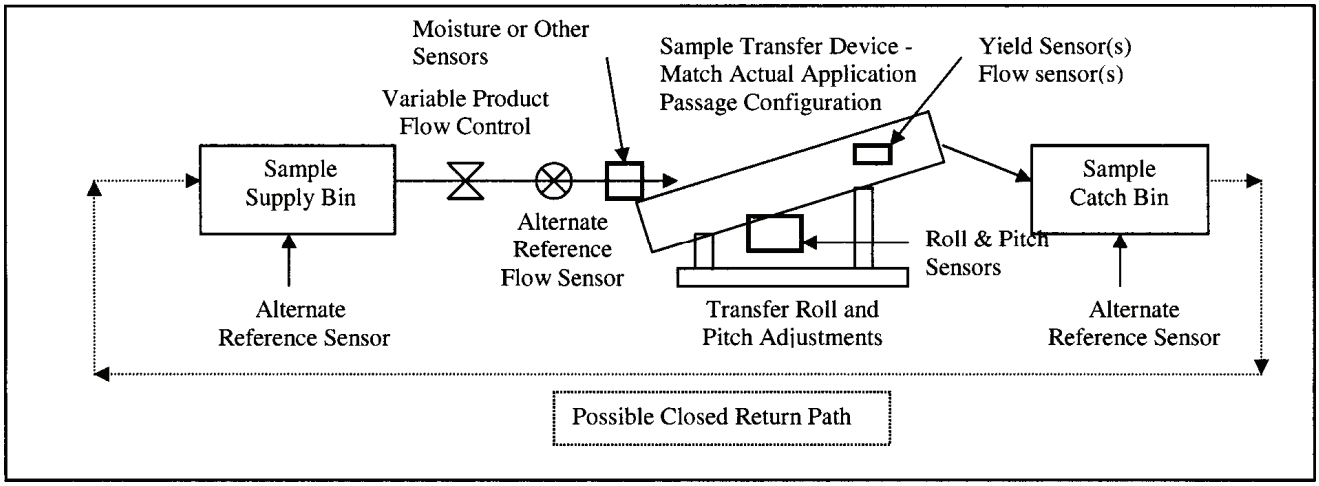

Figure 1 – Generic Test Stand Configuration

2.7 sample: A volume of crop delivered to the test stand. The sample should contain material of the same size and density as the actual crop to be harvested. Samples for varying crop moisture and crop surface conditions shall be available for test.

2.8 sample reference measurement system: A precision measurement system used as a standard to compare to the yield monitor.

2.9 additional terminology: Refer to ANSI/ASAE S343.3 FEB04, Terminology for Combines and Grain Harvesting for additional terminology.

3 Essential Elements of a Test Stand

3.1 Sample supply bin. The bin or holding tank with flow regulation to provide varying flow and rate of flow change.

3.1.1 Stand shall be capable of providing flow delivery rate of sample to yield (flow) sensor of 0 to 110% of maximum expected harvester flow rates.

3.1.2 Stand flow rate changes from 0 to 100% crop flow rate, shall minimally occur within 3 seconds.

3.1.3 Sample Transfer Device is the conveyor system that moves the crop from the Supply Bin, through the Yield (flow) sensor(s) to the Catch Bin.

3.1.4 Test stand components shall minimize crop losses in transport and transfer test materials at the same rates as delivered by the Product Flow Control system without any accumulation.

3.1.5 There shall be either zero or very consistent back flow or rolling back of the crop in the transport system.

3.2 Yield (Flow) sensor mounting

3.2.1 Mount sensor(s) according to manufacturer's specifications. Document any mounting deviations from the manufacturer's specifications.

3.2.2 Presentation of sample material to the yield (flow) sensor shall be the same as that in the harvester. This includes dimensions for sample transfer device flow passages. Document any deviations in sample presentation to the test sensor.

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3.2.3 Use the same mounting and drive configuration as field installation to mimic the vibration that yield (flow) sensor experiences while operating on the harvester.

3.2.4 If known and reproducible, shock loading to yield (flow) sensor should mimic field conditions on the harvester.

3.3 Sample bin for reference measurement. The precision measuring system that is used for comparison with the yield monitor.

3.3.1 Sample weight may be measured either before or after the Yield (flow) sensor. The location of the measurement of the sample weight should be selected to minimize flow variation.

3.3.2 Resolution of the reference measurement sensor shall be at least twice the yield (flow) sensor resolution.

3.3.3 Reference system calibration shall be traceable to a recognized measurement standards organization.

3.3.4 Calibration for the reference system shall have been certified within the previous 12 months.

3.3.5 Total batch weight and batch weight determined from integration of the metered flow rate shall correlate within 1.0% for the calibrated Sample Reference Measurement System.

3.3.6 Measurement frequency of the Sample Reference Measurement system shall be 10 times the measurement frequency of the yield (flow) sensor. Exceptions shall be noted.

3.4 Sample removal. The removal of the sample from the yield (flow) sensor.

3.4.1 Sample may be removed in any desired manner but shall have volume capability greater than the maximum flow expected for the test.

3.4.2 Removal system shall not change the quality of the sample nor alter its characteristics since the sample may be used multiple times. Sample reuse quality is defined in 4.6.

3.4.3 Sample removal is not applicable to mass accumulation yield measurement systems.

3.5 Test fixture slope adjustment

3.5.1 Test fixture shall be capable of two degrees of freedom for the sample delivery to the Yield (flow) sensor and sensor.

3.5.2 Pitch adjustment should be capable of ± 10° or 18%.

3.5.3 Roll should be capable of ± 10° or 18%.

3.6 Test environmental conditions

3.6.1 Temperature. Record test ambient temperature to determine if sensitivity to temperature change exists.

3.6.2 Moisture. Record ambient relative humidity if yield (flow) sensor is sensitive to humidity.

3.6.3 Vibration simulation. Test stand mounting shall match operating rigidity. No specific data records required. Deviations from the actual field system should be noted.

3.6.4 Wind loading. This factor, although affecting some yield monitors, in not included in this test.

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