PHILIPPINE NATIONAL STANDARD

PNS/BAFS 399:2024
ICS 65.060.01

Grain Collector — Methods of Test

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Foreword

Since 2017, the University of the Philippines Los Baños (UPLB)-Agricultural Machinery Testing and Evaluation Center (AMTEC) has tested a total of 17 units of grain collector. With the emergence and increasing number of the said machinery in the Philippines, there is a need for the development of a national standard for the specifications and methods of test prior to commercialization. Hence, the UPLB-AMTEC proposed for the development of the Philippine National Standards (PNS) on Grain Collector through a presentation during the Regular Meeting of the Philippine Council for Agriculture and Fisheries (PCAF)-National Sectoral Committee on Agricultural and Fisheries Mechanization (CAFMech) last August 17, 2021. On the same year, the PCAF-CAFMech formally endorsed the proposal of the UPLB-AMTEC to the Department of Agriculture (DA)-Bureau of Agriculture and Fisheries Standards (BAFS) for prioritization through the issuance of Resolution No. 6, series of 2021 (Recommending to the BAFS the Prioritization of the Development or Revision of the PNS of Various Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development [PCAARRD]-Funded Machinery Projects).

In response, the DA-BAFS in collaboration with the UPLB-AMTEC embarked on a project entitled “Development of PNS on Grain Collector — Specifications and Methods of Test”. The development of the said standards intends to provide minimum requirements for grain collector, thereby ensuring its safety, durability, and market equity.

A Technical Working Group (TWG) was created to develop the PNS under Special Order No. 305, series of 2024 (Creation of Technical Working Group (TWG) and Project Management Team (PMT) for the Development of the PNS for Agricultural and Fishery Products and Machinery). The TWG was composed of relevant stakeholders from the government sector, academe/research institutions, private sector organizations, and Civil Society Organizations (CSO). The draft PNS underwent an extensive series of TWG meetings and stakeholder consultations, facilitated through physical and online platforms, from March 2023 to March 2024 prior to its endorsement to the DA Secretary for approval.

This document was written in accordance with the formatting and editorial rules of the Standardization Guide No. 1 (Writing the PNS) developed by the Standards Development Division (SDD) of the DA-BAFS.

Table of Contents

1 Scope

This Standard specifies the methods of test and inspection for grain collector. Specifically, it shall be used to:

a) Verify the mechanism, dimensions, materials, accessories of the machine, and the list of specifications submitted by the test applicant;
b) Determine the performance of the machine;
c) Evaluate the handling and safety features; and
d) Prepare the report for the test results.

2 Normative References

The following documents are referred to in the text in such a way that some or all of their contents constitute the requirements of this document. The latest edition of the referenced documents (including any amendments) applies.

Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2024). Grain collector — Specifications. (PNS/BAFS 398:2024).

BAFS-DA. (2024). Methods of sampling for agricultural and biosystems power and machinery — Guidelines (PNS/BAFS 391:2024).

3 Terms and Definitions

For the purpose of this Standard, the terms and definitions given in PNS/BAFS 398:2024 (Grain collector – Specifications) and the following shall apply.

3.1
bulk density
mass per unit volume including pore space of the sample, expressed in kilograms per cubic meter, kg/m^3 (BAFS-DA, 2022a)

3.2
damaged grain
grains or kernels that are damaged by mechanical means as seen by the naked eye; and that show signs of fissures, fractures, or splinters (BAFS-DA, 2019)

3.3
drying pavement
structure intended for large-scale sun drying of grains that is levelled and is usually made of concrete for relatively smooth and durable surface (International Rice Research Institute [IRRI], n.d.)
admitted term: drying floor

3.4
overall height
distance between the horizontal supporting plane surface and the horizontal plane touching the uppermost part of the machine (BAFS-DA, 2020, *modified*)

3.5
overall length
distance between the vertical planes perpendicular to the median plane of the machine, each plane touching the front and rear extremities of the machine (BAFS-DA, 2020, *modified*)

3.6
overall width
distance between the vertical planes parallel to the median plane of the machine, each plane touching the outermost point of the machine on each respective side (BAFS-DA, 2020, *modified*)

3.7
percent uncollected grains
ratio of the mass of grains left uncollected on the test plot to the total mass of initially spread grains, expressed in percent, % (Agricultural Machinery Testing and Evaluation Center [AMTEC]-University of the Philippines Los Baños [UPLB], 2023)

3.8
running-in period
preliminary operation conducted before the actual testing of the machine to make various adjustments until the operation is stable (BAFS-DA, 2020, *modified*)

3.9
test applicant
manufacturer, fabricator, inventor, direct importer, legitimate distributor, assembler, dealer, owner, or end-user of the machine (BAFS-DA, 2020, *modified*)

3.10
test plot
portion of a test site with required size and shape used for testing self-propelled machinery for land preparation, crop establishment, harvesting, and postharvest operation (BAFS-DA, 2022b, *modified*)

3.11
test site
location (e.g., field, AMTEC Test Laboratory) where the test is conducted (BAFS-DA, 2022b)

3.12
wet-basis moisture content
mass of moisture over the fresh mass of the sample, expressed in percent, % (BAFS-DA, 2019, *modified*)

4 Principle of the Test

The test shall be carried out to verify the actual specification of the Grain Collector. Its specification shall be validated with PNS/BAFS 398:2024 (Grain collector – Specifications).

5 Test Instruments and Materials

5.1 Test equipment and instruments

The suggested list of minimum field and laboratory test equipment and instruments, and materials needed to carry out the grain collector test is shown in Annex A (Minimum list of field and laboratory test equipment and materials). These instruments shall be calibrated regularly. Before and after each test, these instruments shall be physically checked for operation and shall be cleaned, respectively. A checklist of equipment and instruments, and materials to be used before departure to and from the testing area shall be prepared.

5.2 Test material

5.2.1 The grains (e.g., rice, corn, sorghum, adlai, soybean) to be used shall conform to the following:

a) Wet-basis moisture content of 13.0% to 15.0%;
b) Minimum purity of 95%; and
c) Commonly or locally grown grains of single or mixed variety.

5.2.2 The amount of test material to be supplied shall be sufficient for the required test trials, running-in, and laboratory analysis. Specifically, the amount of test material shall be sufficient for an area of 200 m^2 per test trial. Equal quantity of test material shall be used for all test trials.

5.2.3 If the test materials are not compliant with the recommended quantity and characteristics (5.2.1), the test shall not proceed.

6 General Considerations

6.1 Conditions for the test

6.1.1 Selection of grain collector to be tested

The grain collector submitted for testing shall be sampled in accordance with PNS/BAFS 391:2024 (Method of sampling for agricultural and biosystems power and machinery — Guidelines).

6.1.2 Test site conditions

The grain collector shall be tested through actual collection and bagging of grains on a cleaned drying pavement/floor. The test site should have ample provisions for material handling, temporary storage, workspace and should be suitable for normal working condition. It shall be completely dried. Adequate ventilation and lighting shall be provided especially if the test site is enclosed (e.g., warehouse, covered shed).

6.1.3 Size of test plot

The test plot shall have a minimum area of 200 m^2, shall be rectangular, and shall have sides in the ratio of 2:1. The grains shall be spread evenly over the test plot at the manufacturer's recommended thickness. If there is no manufacturer's recommended thickness, it should be tested at a range of 2 to 4 cm thick spread of grains.

6.1.4 Machine settings

The grain collector shall be tested at the manufacturer's recommended forward speed. If the machine has no manufacturer's recommended settings, it should be tested at a traveling speed of 1-2 kph.

6.1.5 Suspension/Termination of test

6.1.5.1 During the testing operation, the test may be suspended if the machine stops or cannot operate or cannot be tested due to the following (see table below).

Item No.	Conditions for Suspension
1	Minor breakdown or malfunction
2	Clogged or choked part/s of the machine
3	Absence of power source for the machine due to power outage or brownout
4	Accident and injury of the personnel/representatives of test applicant or testing agency
5	Poor and severe weather conditions that may affect the test

6.1.5.2 At such instances, the testing agency may allow the representatives of the test applicant to repair and/or replace with similar specifications an assembly of a machine and to change a test material or test plot with a new one that conforms to the recommended size, characteristics, quality, and/or conditions. The testing agency may also await such instances until they are resolved to continue the test operation.

6.1.5.3 During the testing operation, the test shall be terminated if the machine cannot continue its operation due to major malfunction, breakdown, or damage affecting performance of the machine.

6.2 Pre-test activities

6.2.1 Running-in and preliminary adjustments

The grain collector shall have undergone a running-in period before starting the test. During the running-in period, the various adjustments of the machine shall be made according to the recommendation of the manufacturer. No adjustments shall be permitted during the test.

6.2.2 Verification of specifications

The specifications claimed by the manufacturer and other physical details given in Annex B (Specifications of grain collector) shall be verified by the testing agency. A stable and level surface shall be used as reference plane for verification of dimensional machine specifications.

6.2.3 Preparation of the grain collector for testing

The grain collector shall be checked to ensure that it has been assembled and installed in accordance with the instruction of the manufacturer. It shall be tested according to the manufacturer’s specifications.

6.2.4 Sampling of test materials

The test material conditions including source, variety, and grain dimensions, bulk density, moisture content and purity shall be obtained and recorded. Representative test samples shall be collected from the test material for analysis. Sampling procedure is shown in Annex C (Sampling procedures).

7 Performance Test and Procedures

7.1 Performance test

7.1.1 Operation of the grain collector

The grain collector shall be operated with load at the test site by the official representative of the test applicant using the recommended settings (see Subsections 6.1.3 [Thickness of spread of grains] and 6.1.4 [Traveling speed]). As part of the test, the testing agency shall make all measurements and shall take the prescribed samples. After each test trial, the grain collector and area shall be cleaned and then prepared for the next test trial. This procedure shall be repeated for the succeeding test trials. No other adjustments shall be permitted during the test.

7.1.2 Test trial

A minimum of two (2) test trials shall be conducted.

7.1.3 Sampling

Random representative test samples shall be collected by the testing agency for the analysis of the mechanically damaged grains. Sampling procedure is shown in Annex C (Sampling procedures).

7.1.4 Data collection

7.1.4.1 Duration of test

The duration of each trial shall start when the grain collector begins to collect grains laid on the test plot and shall end once the last drop of grains from the grain outlet is collected in the container. This shall also be referred to as the total operating time.

7.1.4.2 Traveling speed

a) Outside the longer side of the test plot, mark two (2) points (A, B) approximately in the middle of the test plot as shown in Figure 1 to mark the traveling distance. These two points should be 10 m apart. On the opposite side, mark another two (2) points (C, D) in similar position and distance so that all four (4) points form corners of a rectangle, parallel to at least one long side of the test plot.

b) Calculate speed from the time required for the grain collector to travel the distance between the assumed line connecting two (2) points on opposite sides AC and BD. The reference point of the grain collector should be selected for measuring the time.

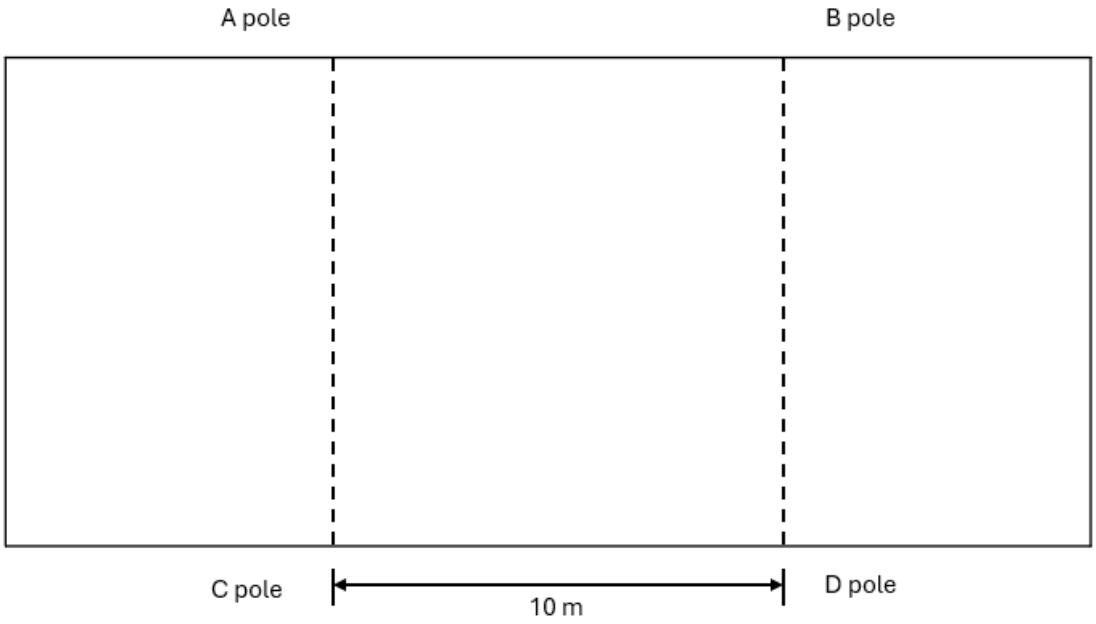

Figure 1. Measurement of operating/traveling speed (adapted from AMTEC-UPLB, 2023)

7.1.4.3 Collecting capacity

The total operating time, total nonproductive time, and mass of collected grains shall be recorded. The total nonproductive time shall include time for turning, unloading of bag filled with grains, refilling of bags, and adjustments, among others. Collecting capacity shall be calculated using the formulas in Annex D (Formulas used during calculations and testing).

7.1.4.4 Uncollected grain

After each test trial, grains left on the test plot shall be collected and weighed to determine the percent uncollected grains.

7.1.4.5 Collecting efficiency

The mass of initially spread grains and the mass of grains collected shall be determined and recorded. Collecting efficiency shall be calculated using the formula in Annex D (Formulas used during calculations and testing).

7.1.4.6 Fuel consumption

Before the start of each test trial, the fuel tank shall be filled to a certain marked level. After each test trial, the tank shall be refilled using a graduated cylinder. The amount refilled is the fuel consumption for the test. When filling up the tank, keep the machine in a level position.

7.1.4.7 Power requirement

Use a power meter to measure the voltage, current, and the total electric power requirement of the grain collector. There shall be three (3) sets of data with a minimum of five (5) observations per set taken with and without load.

7.1.4.8 Noise level

The noise emitted by the grain collector during field test shall be measured using a sound level meter at the location of the operator/s. The noise level, expressed in decibel [dB(A)], shall be measured 50 mm away from the ear level of the operator/s.

7.1.4.9 Thickness of spread

Randomly choose at least ten (10) areas within the test plot and measure the thickness of spread at those selected areas using a steel tape or a caliper.

7.1.5 Data recording and observations

Record sheet for all data and information during the test is given in Annex E (Performance test data sheet). Necessary observations to be taken and other parameters during the performance test shall be recorded in this sheet.

7.2 Laboratory analysis

Laboratory analysis shall be made to determine the test material conditions such as dimensions, bulk density, moisture content, and purity; and performance parameter including net mechanically damaged grains. The laboratory procedures for the analyses are given in Annex F (Laboratory analysis procedure), while the data sheets to be used are given in Annex G (Laboratory analysis data sheet).

7.3 Presentation of results

Grain collector specifications and the results of the test shall be presented in tabular form in which data shall be taken from Annexes B (Specifications of grain collector) and E (Performance test data sheet). Photos of the test plot, the actual conduct of testing, and the grain collector with labeled parts shall also be included. Observations made on the grain collector while in operation shall be supported with photographs.

8 Formula

The formula to be used during calculations and testing are given in Annex D (Formulas used during calculations and testing).

9 Test Report

The test report shall include the following information in the order given:

a) Name of accredited testing agency;
b) Test report number;
c) Title;
d) Summary of results;
e) Purpose and scope of test;
f) Methods of test;
g) Description of the grain collector;
h) Specifications;
i) Results;
j) Observations (include pictures, illustrations, diagrams etc); and
k) Names, signatures, and designation of test engineers.

Annex A
(Informative)

Minimum list of field and laboratory test equipment and materials

Equipment/instrument/material		Quantity
A.1	**Field test**	
A.1.1	Timers Maximum resolution: 0.1 sec	2
A.1.2	Weighing scale Minimum capacity: 100 kg Maximum scale divisions: 0.2 kg	1
A.1.3	Measuring tape (at least 50 m)	1
A.1.4	Steel tape (at least 5 m)	1
A.1.5	Sound level meter Range: 30 to 130 dB(A)	1
A.1.6	Graduated cylinder Capacity: 1000 mL	1
A.1.7	Clamp-on AC/DC Power Meter	1
A.1.8	Portable moisture meter (duly calibrated using the standard method)	1
A.1.9	Digital camera	1
A.1.10	Vernier caliper Accuracy: 0.025 mm	1
A.1.11	Sample bags	10
A.1.12	Labeling tags which include: Date of test Machine on test Crop Variety Sample source Trial number	10
A.2	**Laboratory test**	
A.2.1	Analytical balance Sensitivity: 0.01 g	1
A.2.2	Air oven	1
A.2.3	Aluminum moisture can	6
A.2.4	Desiccator and desiccants	1
A.2.5	Bulk density tester/meter	1
A.2.6	Grain caliper Accuracy: 0.025 mm	1
A.2.7	Vernier caliper Accuracy: 0.025 mm	1
A.2.8	Portable moisture meter (duly calibrated using the standard method)	1

Annex B
(Informative)

Specifications of grain collector

Name of Applicant : _____
Address : _____
Tel. No. : _____

Name of Manufacturer : _____
Address : _____
Tel. No. : _____

GENERAL INFORMATION

Make : _____ Type : _____
Serial No. : _____ Brand/Model : _____
Date of Manufacture : _____
Testing Agency : _____ Test Engineer : _____
Location of Test : _____ Date of Test : _____

Item		Manufacturer's Specification	Verification by the Testing Agency
B.1	**Main structure**		
B.1.1	**Overall dimensions, mm**		
B.1.1.1	Length		
B.1.1.2	Width		
B.1.1.3	Height		
B.1.2	Mass, without prime mover, kg		
B.2	**Collecting capacity, kg/h**		
B.3	**Ground clearance, mm**		
B.4	**Collecting system**		
B.4.1	**Collecting head assembly**		
B.4.1.1	Type		
B.4.1.2	Dimensions, L × W, mm		
B.4.1.3	Collecting width, mm		
B.4.1.4	Materials of construction		
B.4.2	**Conveyor assembly**		
B.4.2.1	Type		
B.4.2.2	Dimensions, L × W, mm		
B.4.2.3	Materials of construction		

Item		Manufacturer's Specification	Verification by the Testing Agency
B.4.3	**Fan**		
B.4.3.1	Type		
B.4.3.2	Dimensions, mm		
B.4.3.3	Number of blades		
B.5	**Bagging system**		
B.5.1	**Grain outlet**		
B.5.1.1	Dimensions, mm		
B.5.1.2	Height from the bag platform, mm		
B.5.1.3	Location		
B.5.1.4	Materials of construction		
B.5.2	Bag mounting frame		
B.5.2.1	Dimensions, L x W, mm		
B.5.2.2	Location		
B.5.2.3	Materials of construction		
B.5.3	**Bag platform**		
B.5.3.1	Dimensions, L x W, mm		
B.5.3.2	Materials of construction		
B.6	**Main frame**		
B.6.1	Dimensions, L x W, mm		
B.6.2	Materials of construction		
B.7	**Prime mover**		
B.7.1	**Engine**		
B.7.1.1	Brand		
B.7.1.2	Model		
B.7.1.3	Serial number		
B.7.1.4	Manufacturer		
B.7.1.5	Type		
B.7.1.6	Rated power, kW		
B.7.1.7	Rated speed, rpm		
B.7.1.8	Fuel type		
B.7.1.9	Cooling system		
B.7.1.10	Starting system		
B.7.2	**Electric motor**		
B.7.2.1	Brand		
B.7.2.2	Model		
B.7.2.3	Manufacturer		

Item		Manufacturer's Specification	Verification by the Testing Agency
B.7.2.4	Serial number		
B.7.2.5	Rated power, kW		
B.7.2.6	Rated speed, rpm		
B.7.2.7	Electric service required (single-phase or three-phase)		
B.7.2.8	Voltage, V		
B.7.2.9	Current, A		
B.7.2.10	Frequency, Hz		
B.8	**Safety features**		
B.9	**Special features**		

Annex C
(Normative)

Sampling procedures

C.1 Sampling Procedures for Input Test Material

The condition of the test material shall be determined using three (3) samples which represent the different conditions of the material in bulk. This is done by randomly taking samples at the top, middle, or bottom portions of the different bags of the input grains. Half of the sample shall be used for laboratory analysis and the other half shall be used for reference purposes or for eventual second check in case of review.

C.2 Sampling from Grain Outlet

During each test trial, three (3) samples shall be collected at equal interval from the grain outlet which shall be analyzed in the laboratory for mechanically damaged grains. The minimum amount of sample to be taken shall be twice as much as what is needed for a particular analysis. The excess sample shall be used for reference purposes or for an eventual second check in case of review.

C.3 Handling of Samples

All samples to be taken to the laboratory shall be placed in appropriate containers and shall be properly labeled. If the sample is to be used for determining moisture content, it must be kept in dry and airtight containers. Care should be taken so as to prevent alterations in the conditions of the test samples.

Annex D
(Normative)

Formulas used during calculations and testing

D.1 Average Grain Size or Dimension

$$\bar{x} = \frac{\sum x_j}{n}$$

where:

$\bar{x}$ is the average size or dimension, mm
x_j is the dimension (length, width, thickness, diameter) of individual sample, mm
n is the total number of samples

D.2 Bulk Density

$$\rho_b = \frac{M_s}{V_s}$$

where:

ρ_b is the bulk density, kg/m^3
M_s is the mass of sample, kg
V_s is the volume of sample, m^3

D.3 Purity

$$P = \frac{W_c}{W_u} \times 100$$

where:

P is the purity, %
W_c is the mass of clean sample, kg
W_u is the mass of unclean sample, kg

D.4 Collecting Capacity

$$C_c = \frac{W_{gc} \times P}{T - T_n}$$

where:

C_c is the collecting capacity, kg/h
W_{gc} is the total mass of grains collected, kg
P is the purity, %
T is the total operating time, h
T_n is the total nonproductive time, h

D.5 Fuel Consumption

$$F_c = \frac{F_v}{T_e}$$

where:

F_c is the fuel consumption, L/h
F_v is the volume of fuel consumed, L
T_e is the total operating time of engine, h

D.5.1 Specific fuel consumption (grain collection fuel efficiency)

$$SFC = \frac{F_c}{W_{gc}}$$

where:

SFC is the specific fuel consumption, L/kg-h
F_c is the fuel consumption, L/h
W_{gc} is the total mass of grains collected, kg

D.6 Percent Uncollected Grains

$$\%U_c = \frac{U_c}{W_{gi}} \times 100$$

where:

$\%U_c$ is the percent uncollected grains, %
Uc is the mass of uncollected grains, kg
W_{gi} is the total mass of grains initially spread, kg

D.7 Collecting Efficiency

$$E_c = \frac{W_{gc}}{W_{gi}} \quad (1)$$

or

$$E_c = 100 - \%U_c \quad (2)$$

where:

E_c is the collecting efficiency, %
W_{gc} is the total mass of grains collected, kg
W_{gi} is the total mass of grains initially spread, kg
$\%U_c$ is the percent uncollected grains, %

D.8 Wet-basis Moisture Content

$$MC, \%_{wb} = \frac{M_0 - M_1}{M_0} \times 100$$

where:

$MC, \%_{wb}$ is the wet-basis moisture content of sample, %
M_0 is the initial mass of the sample, g
M_1 is the mass of the dried sample, g

D.9 Net Mechanically Damaged Grains

$$ND_g = \frac{D_0 - D_1}{100\ grain\ sample} \times 100$$

where:

ND_g is the is the net mechanically damaged grains, %
D_0 is the number of damaged grains before collecting and bagging operation
D_1 is the number of damaged grains after collecting and bagging operation

D.10 Operating/Traveling Speed

$$S_o = \frac{3.6 \times D_t}{T_t}$$

where:

S_o is the operating or traveling speed, kph
D_t is the traveling distance, m
T_t is the traveling time, s

Annex E
(Informative)

Performance test data sheet

Test Trial No. : _____ Date : _____
Test Engineers : _____ Location : _____
Assistants : _____ Machine : _____
Test Applicant : _____ Manufacturer : _____

Item		Trial 1	Trial 2	Trial 3	Ave
E.1	Condition of test materials				
E.1.1	Crop				
E.1.2	Source				
E.1.3	Variety				
E.1.4	Dimensions of grain, mm				
E.1.4.1	Length				
E.1.4.2	Width/Diameter				
E.1.4.3	Thickness				
E.1.5	Bulk density, kg/m^3				
E.1.6	Moisture content, $\%_{wb}$				
E.1.7	Purity, %				
E.2	Test conditions				
E.2.1	Dimensions of test plot				
E.2.1.1	Length, m				
E.2.1.2	Width, m				
E.2.1.3	Area, m^2				
E.2.1.4	Thickness of spread, mm				
E.3	Field performance				
E.3.1	Mass of grains initially spread, kg				
E.3.2	Mass of actual grains collected, kg				
E.3.3	Total operating time, h				
E.3.4	Total nonproductive time				
E.3.4.1	Unloading of filled bags, h				
E.3.4.2	Refilling of bags, h				
E.3.4.3	Others, h				
E.3.5	Traveling speed, kph				
E.3.6	Collecting capacity, kg/h				

Item		Trial 1	Trial 2	Trial 3	Ave
E.3.7	Percent uncollected grains				
E.3.8	Collecting efficiency, %				
E.3.9	Noise level, dB(A)				
E.3.10	Fuel consumption rate, L/h				
E.3.11	Power consumption, kW				
E.4	Laboratory analysis				
E.4.1	Net mechanically damaged grains, %				

E.5 Number of operators

_____

E.6 Cleaning of parts

_____
_____

E.7 Adjusting and repairing of parts

_____
_____

E.8 Transporting the machine

_____
_____

E.9 Handling and stability when the machine is working and turning

_____
_____

E.10 Failures or abnormalities of the machine or its component parts during and after the operation

_____
_____

E.11 Other remarks

_____
_____

Annex F
(Normative)

Laboratory analysis procedure

F.1 Determination of Grain Bulk Density

F.1.1 Bulk density of grain samples shall be measured using a bulk density tester/meter.

F.1.2 Fill the bulk density meter's measuring cup with samples at a standard height. Level the heap above the cup using a blunt ruler. Weigh the samples inside the cup and record the resulting mass. Replicate these steps three (3) times.

F.1.3 Calculate the bulk density using the formula in Annex D.

F.2 Determination of Grain Purity

F.2.1 Randomly take three (3) 500 g samples from the representative samples of the material.

F.2.2 Clean each sample to remove the impurities using an aspirator. Weigh the clean sample and record the resulting mass. Calculate the purity using the formula in Annex D.

F.3 Grain Moisture Content Determination by Air Oven Method

F.3.1 Randomly obtain three (3) 100 g of representative samples and place them in moisture cans. Ensure that no moisture is lost or gained by the sample between the time it was collected until it is weighed in a moisture can. Weigh and record all the initial masses.

F.3.2 Dry the samples in the oven with the recommended temperature (e.g., 105 °C) and duration (e.g., 72 hours) or until constant mass is attained.

F.3.3 After removing the samples from the oven, place the moisture can with samples in a desiccator and allow them to cool in the ambient temperature.

F.3.4 Weigh the moisture can with the dried sample. Record the final mass. Calculate the moisture content using the formulas in Annex D.

F.4 Grain Moisture Content Determination by Moisture Meter

F.4.1 Randomly obtain at least five (5) representative samples. Ensure that no moisture is lost or gained by the sample between the time it was collected until its moisture content is determined.

F.4.2 Measure the moisture content of the samples using a calibrated moisture meter.

F.5 Determination of Net Mechanically Damaged Grains

F.5.1 Obtain three (3) samples from each input test material sample and grain outlet sample. Each sample shall consist of 100 grains.

F.5.2 Inspect each sample for grains with fissures, fractures, or splinters as a result of machine operation. Count these grains.

F.5.3 The net mechanically damaged grains shall be taken as the difference between the number of damaged grains obtained before and after collecting and bagging as presented in the formula in Annex D.

F.6 Measurement of Average Grain Size or Dimension

F.6.1 Randomly take at least ten (10) pieces of samples from the representative samples of the material.

F.6.2 For each sample, measure the largest dimensions (e.g., diameter, length, width, thickness) using a caliper. Record the measurement to the nearest 0.01 mm.

Annex G
(Informative)

Laboratory analysis data sheet

G.1 Determination of Grain Bulk Density

Sample no.	Bulk density, kg/m^3
1	
2	
3	
Average	

G.2 Determination of Grain Purity

Initial mass of samples (uncleaned) = 500 g

Item	Trial 1				Trial 2				Trial 3				Gen. Ave
	1	2	3	Ave	1	2	3	Ave	1	2	3	Ave	
Cleaned samples, g													
Purity, %													

G.3 Moisture Content (% wet basis) Determination of Input Test Material by Air Oven

Item	Trial 1	Trial 2	Trial 3	Ave
Initial mass, g				
Final mass, g				
Moisture content, $\%_{wb}$				

G.4 Moisture Content (% wet basis) Determination of Input Test Material by Moisture Meter

Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Ave

G.5 Determination of Net Mechanically Damaged Grains

Test Trial No.	Number of Damaged Grains								
	Before collecting and bagging				After collecting and bagging				Difference
	1	2	3	Ave	1	2	3	Ave	
1									
2									
3									
Ave									

G.6 Measurement of Average Grain Size or Dimension

Dimension	Trial										Ave
	1	2	3	4	5	6	7	8	9	10	

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