

PHILIPPINE NATIONAL STANDARD

PNS/PAES 205:2015
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**Agricultural machinery – Mechanical rice thresher –
Methods of test**



BUREAU OF PRODUCT STANDARDS*

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***BUREAU OF PHILIPPINE STANDARDS**

National Foreword

The Philippine Agricultural Engineering Standards PAES 205:2015, Agricultural machinery – Mechanical rice thresher – Methods of test was approved for adoption as Philippine National Standard by the Bureau of Philippine Standards upon the recommendation of the Agricultural Machinery Testing and Evaluation Center (AMTEC) and the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development of the Department of Science and Technology (PCAARRD-DOST).

This standard cancels and replaces PNS/PAES 205:2003 (PAES published 2000).

Foreword

The revision of this national standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) under the project entitled “Development of Standards for Rice Production and Postproduction Machinery” which was funded by the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) of the Department of Science and Technology (DOST).

This standard has been technically prepared in accordance with PAES 010-2 – Rules for the Structure and Drafting of International Standards.

The word “shall” is used to indicate mandatory requirements to conform to the standard.

The word “should” is used to indicate that among several possibilities one is recommended as particularly suitable without mentioning or excluding others.

In preparation of this standard, the following documents/publications were considered:

Regional Network for Agricultural Machinery (RNAM) Test Codes and Procedures for Harvesting Machine, Technical Series No. 12:1983.

CONTENTS		Page
1	Scope	B-89
2	References	B-89
3	Definitions	B-89
4	General Conditions for Test and Inspection	B-91
4.1	Selection of mechanical rice thresher to be tested	B-91
4.2	Role of requesting party	B-91
4.3	Role of the manufacturer	B-91
4.4	Test site conditions	B-91
4.5	Suspension of test	B-91
5	Test Preparation	B-91
5.1	Running-in and preliminary adjustments	B-91
5.2	Test instruments and other materials	B-92
5.3	Test materials	B-92
6	Pre-test Observation	B-92
6.1	Verification of specifications	B-92
6.2	Test materials	B-92
7	Performance Test	B-92
7.1	Operation of the thresher	B-92
7.2	Test trial	B-92
7.3	Sampling	B-92
7.4	Data collection	B-93
7.5	Data recording and observations	B-93
8	Laboratory Analysis	B-93
9	Data Analysis	B-94
9.1	Calculation	B-94
9.2	Presentation of results	B-94
10	Test Report Format	B-94

ANNEXES

A	Minimum List of Field and Laboratory Test Equipment and Materials	B-95
B	Test Materials for Mechanical Rice Thresher	B-96
C	Specifications of Mechanical Rice Thresher	B-97
D	Sampling and Measurement for Test Material	B-100
E	Field Performance Test Data Sheet	B-102
F	Laboratory Work	B-104
G	Laboratory Grain Analysis Data Sheet	B-106
H	Formula Used During Calculations and Testing	B-108

1 Scope

This standard specifies the methods of test and inspection for mechanical rice thresher. Specifically, it shall be used to:

- 1.1** verify the mechanism, main dimensions, weight, materials and accessories of the thresher, and the list of specifications submitted by the manufacturer/supplier/dealer;
- 1.2** determine the performance of the machine;
- 1.3** evaluate the ease of handling and safety features;
- 1.4** determine the effect of threshing on grain quality through laboratory analysis and;
- 1.5** report the results of the tests.

2 Reference

The following normative documents contain provisions, which through reference in this text, constitute provisions of this National Standard:

PNS/PAES 103:2000 Agricultural Machinery – Method of Sampling

PNS/PAES 204:2015 Agricultural Machinery - Mechanical Rice Thresher – Specifications

3 Definition

For the purpose of this standard, the definition of the terminologies given in PNS/PAES 204:2015 and the following shall apply:

3.1

actual capacity

the weight of the threshed grain collected from the main grain outlet per unit time

3.2

clean threshed grain

threshed grain with 100% purity exclusive of the empty grains and other impurities

3.3

concave clearance

the clearance between cylinder threshing elements and concave component

3.4

concave grate

concave component

an iron grill frame partly surrounding the cylinder on which the threshing elements rub, shear and/or impact the cut plants

3.5

corrected capacity

the corrected capacity of the thresher at 20% grain moisture content (wet basis), grain-straw ratio of 0.55 and 100% purity

3.6

cylinder length

the distance between the outermost points along the cylinder base axis

3.7

cylinder peripheral speed

the equivalent linear speed of the cylinder tip when running at normal operating speed, expressed in m/s

3.8

effective cylinder diameter

outside diameter generated by the outermost point of the cylinder threshing elements

3.9

grain-straw ratio

grain content

the ratio of the weight of the grains present in the panicles, to the total weight of the grain and straw in the same sample

3.10

lower concave

a semi-circular shaped wire mesh or bar grate covering the lower portion of the threshing chamber which causes the grains to separate from the panicles

3.11

primemover

an electric motor, or a gasoline or diesel fed engine used to run the thresher

3.12

running-in period

preliminary operation of the machine to make various adjustments prior to the conduct of test

3.13

threshing output

the weight of the threshed grains collected at the grain outlet

3.14

total grain input

the sum of the weights of collected threshed grains and all threshing losses

3.15

upper concave

semi-circular shaped grate at the upper portion of the threshing cylinder with louvers which assist threshing and axial movement of the straw

4 General Conditions for Test and Inspection

4.1 Selection of mechanical rice thresher to be tested

Mechanical rice thresher to be tested should be in accordance with PNS/PAES 103:2000 Agricultural Machinery – Method of Sampling.

4.2 Role of requesting party

The requesting party shall submit to the official testing agency specifications and other relevant information on the rice combine harvester. They shall abide by the terms and conditions set forth by the official testing agency.

4.3 Role of the manufacturer

An officially designated representative of the manufacturer shall operate, adjust, repair, and shall decide on matters related to the operation of the machine.

4.4 Test site conditions

The thresher shall be installed on a stable level ground on a site with sufficient working space, and shall be positioned in such a way that the wind will blow the straw and other impurities away from the clean grain.

4.5 Suspension of test

If during the test, the machine stops due to major component breakdown which is not repairable or malfunctions, the test shall be suspended.

5 Test Preparation

5.1 Running-in and preliminary adjustment

Before the start of the test, the thresher and primemover shall have undergone a running-in period. The thresher shall be operated at the test site. During the running-in period, the various adjustments of the thresher shall be made according to the manufacturer's recommendations.

5.2 Test instruments and other materials

The suggested list of minimum field and laboratory test equipment and materials needed to carry out the thresher test is shown in Annex A. These instruments should be calibrated regularly. These instruments shall be physically checked for operation before each test and shall be cleaned after each test. A checklist of instruments and materials shall be prepared to be used before departure to and from the testing area.

5.3 Test materials

The harvested crop to be used in the test shall be prepared in sufficient quantity using the procedure given in Annex B.

6 Pre-test Observation

6.1 Verification of specifications

The specifications claimed by the manufacturer and physical details given in Annex C shall be verified by the official testing agency. A stable and level surface shall be used as reference plane for verification of dimensional machine specifications.

6.2 Test materials

Harvested crop shall be collected from the test lot to determine the grain-straw ratio, moisture content of grain, straw length and grain quality. Sampling procedures are given in Annex D.

7 Performance Test

7.1 Operation of the thresher

The thresher shall be operated at the recommended speed and feed rate of the manufacturer. The same feeding rate recommended by the manufacturer shall be maintained during the test trial. After the test trial, the threshing area shall be cleaned and then prepared for the next trial.

7.2 Test trial

A minimum of two (2) test trials, with duration of at least 15 minutes per trial, shall be adopted.

7.3 Sampling

Samples shall be collected at the different outlets during each trial. Scattering loss shall be collected after each test trial. Sampling procedures are given in Annex D.

7.4 Data collection

7.4.1 Duration of test

The duration of each test trial shall start with the first feeding of the harvested crop and ends after the final feeding. However, all discharge from the different outlets shall be included after the time cut off.

7.4.2 Noise level

The noise emitted by the machine, with or without load, shall be measured using a noise level meter both at the location of the operators and baggers. The noise, expressed in dB(A), shall be taken approximately 5cm away from the ear level of the operators and baggers.

7.4.3 Speed of components

The speed of the threshing cylinder, blower, and other driven components, with and without load, shall be measured using a tachometer, expressed in rpm.

7.4.4 Air velocity

The air velocity generated by the thresher fan, with and without load, shall be measured using an air velocity meter in m/s.

7.4.5 Fuel consumption

Before the start of each test trial, fuel tank shall be filled to 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.

7.5 Data recording and observations

Record sheet for all data, information during the test, and other observations are given in Annex E.

8 Laboratory Analysis

Laboratory analysis shall be made to determine the grain moisture content, grain-straw ratio, straw length, purity, cracked grain, broken grain and losses (blower, separation, unthreshed, and scattering). The laboratory procedures to be followed in the analysis are given in Annex F while the data sheet is given in Annex G.

9 Data Analysis

9.1 Calculation

For uniform result of output capacity due to variation in grain moisture content and grain ratio, the output capacity shall be corrected at 100% purity, 20% moisture content, and 0.55 grain-straw ratio. The formula to be used in the calculation of different test parameters is given in Annex H.

9.2 Presentation of results

Machine specifications and the results of the test shall be presented in tabular form using the data from Annexes C and E. A schematic diagram of the power transmission system and arrangement of the threshing elements shall also be included. Observations made on the machine while in operation shall be supported with photographs.

10 Test Report Format

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

10.1 Title

10.2 Summary of Results

10.3 Purpose and Scope of Test

10.4 Methods of Test

10.5 Condition of the Machine

10.6 Description of the Machine

10.6.1 Figure 1 - Material Flow Diagram

10.6.2 Figure 2 - Power Transmission System

10.6.3 Figure3 - Arrangement of Threshing Elements on the Cylinder

10.6.4 Table 1 - Machine Specifications

10.7 Results of Test

10.7.1 Table 2 - Field Performance Data

10.8 Observations (include pictures)

10.9 Names and Signatures of Test Engineers

Annex A
Minimum List of Field and Laboratory
Test Equipment and Materials

A.1	Equipment	Quantity
A.1.1	Field	
A.1.1.1	Grain Moisture Meter (duly calibrated using the standard method)Range: 12% to 30%	1
A.1.1.2	Air Velocity Meter; Range: 0-30 m/s	1
A.1.1.3	Tachometer (contact type or photo electric type; Range: 0-5,000 rpm)	1
A.1.1.4	Noise Level Meter Range: 30 to 130 db(A)	1
A.1.1.5	Timers (range: 60 minutes) Accuracy: 1/10 sec	2
A.1.1.6	Measuring Tape (capacity: 5m)	1
A.1.1.7	Camera	1
A.1.1.8	Weighing Scale Capacity: 100 kg Scale divisions: 0.5 kg	1
A.1.1.9	Graduated Cylinder (for engines) (500-mL capacity) Or Watt-Hour Meter (for electric motors) 60Hz, 220V	1 1
A.1.2	Laboratory	
A.1.2.1	Weighing Scale (Sensitivity: 0.1 g)	1
A.1.2.2	Magnifying Lens (minimum of 10 magnifications)	1
A.1.2.3	Grain Sample Cleaner	1
A.1.2.4	Grain Sampler/Divider	1
A.1.2.5	Air-oven	1
A.2	Materials	
A.2.1	Field	
A.2.1.1	Canvas Sheet (4m x 8m)	1
A.2.1.2	Nylon-Catch Bag (1.5m x 1.5m x 0.5m)	1
A.2.1.3	Nylon Net (1.5m x 1.5m)	1
A.2.1.4	Sample Bags	20
A.2.1.5	Labeling Tags which include	20
A.2.1.5.1	Date of test	
A.2.1.5.2	Machine on test	
A.2.1.5.3	Sample source	
A.2.1.5.4	Variety	
A.2.1.5.5	Trial number	

Annex B
Test Materials for Mechanical Rice Thresher

B.1 Sample Characteristics

Test materials to be used shall have the following characteristics:

- | | | | |
|--------------|------------------------|---|------------------------|
| B.1.1 | Variety | : | commonly grown locally |
| B.1.2 | Grain moisture content | : | 24% maximum, wet basis |
| B.1.3 | Straw length | : | 45-50 cm |
| B.1.4 | Grain-straw ratio | : | 0.50-0.65 |

B.2 Quantity to be supplied

The amount of test material to be supplied shall be sufficient for one hour of continuous threshing operation in order to provide samples to be used for running-in prior to the actual conduct of test trials.

Approximately: 1hour x threshing capacity (kg/h)

B.3 Sample Preparation

Prepare the sample in such a way that test sample to be used for the running-in and in each test trial shall have identical characteristics in terms of moisture content, variety and date of harvest and cultural management, fertilizer input, etc. Care should be taken so as to prevent alterations of the conditions of the test samples.

Annex C
Specifications of Mechanical Rice Thresher

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

GENERAL INFORMATION

Make: _____ Brand/Model: _____
 Serial No: _____ Classification: _____
 Production date of thresher to be tested: _____
 (or Date of manufacture)

ITEM	Manufacturer's Specifications	Verification by the Testing Agency
C.1 Dimension and weight of thresher		
C.1.1 Overall length (mm)		
C.1.2 Overall width (mm)		
C.1.3 Overall height (mm)		
C.1.4 Overall weight, without engine (kg)		
C.2 Rated capacity (kg/h) range		
C.3 Component speeds (without load)		
C.3.1 Cylinder		
C.3.1.1 Shaft speed (rpm)		
C.3.1.2 Peripheral speed (m/s)		
C.3.2 Fan or blower shaft (rpm)		
C.3.3 Oscillating screen shaft (rpm)		
C.3.4 Auger shaft (rpm)		
C.4 Engine		
C.4.1 Brand		
C.4.2 Model		
C.4.3 Serial Number		
C.4.4 Make		
C.4.5 Type (cycle and ignition)		
C.4.6 Rated speed (rpm)		
C.4.7 Rated power hp(kW)		
C.4.8 Weight (kg)		
C.4.9 Starting system		
C.5 Type of power transmission system		
C.5.1 _____ to _____		
C.5.2 _____ to _____		
C.5.3 _____ to _____		
C.5.4 _____ to _____		
C.5.5 Others (specify)		

ITEM	Manufacturer's Specifications	Verification by the Testing Agency
C.6 Type of clutch system		
C.7 Threshing chamber		
C.7.1 Cylinder		
C.7.1.1 Type		
C.7.1.2 Size, LxD (mm)		
C.7.1.3 Straw-thrower paddles		
C.7.1.3.1 Number		
C.7.1.3.2 Material		
C.7.1.3.3 Other features		
C.7.2 Cylinder teeth		
C.7.2.1 Type		
C.7.2.2 Size (mm)		
C.7.2.3 Number		
C.7.2.4 Distance between teeth (mm)		
C.7.2.5 Arrangement		
C.7.2.6 Material used		
C.7.2.7 Means of attachment		
C.7.2.8 Others		
C.7.3 Cylinder cover		
C.7.3.1 Shape		
C.7.3.2 Material		
C.7.3.3 Louver		
C.7.3.3.1 Number		
C.7.3.3.2 Inclination with respect the vertical axis (degrees)		
C.7.4 Concave		
C.7.4.1 Lower concave		
C.7.4.1.1 Material		
C.7.4.1.2 Spacing between grills		
C.7.4.1.3 Clearance between concave and cylinder teeth (mm)		
C.7.4.1.4 Stripper bars		
C.7.4.1.4.1 Number		
C.7.4.1.4.2 Location		
C.7.4.1.4.3 Material		
C.7.4.2 Upper concave		
C.7.4.2.1 Material used		
C.7.4.2.2 Spacing between grills (mm)		
C.8 Feeding Table		
C.8.1 Length (mm)		
C.8.2 Width (mm)		
C.8.3 Height from the ground (mm)		

ITEM	Manufacturer's Specifications	Verification by the Testing Agency
C.8.4 Dimension of feeding port, L x W (mm)		
C.8.5 Mode of attachment		
C.8.6 Material		
C.9 Oscillating Screen/Sieve		
C.9.1 Length (mm)		
C.9.2 Width (mm)		
C.9.3 Size of perforations (mm)		
C.9.4 Length of stroke (mm)		
C.9.5 Angle of inclination (degrees)		
C.9.6 Material		
C.10 Blower/Aspirator		
C.10.1 Type		
C.10.2 Total Length		
C.10.3 Diameter		
C.10.4 Number of blades		
C.10.5 Size of inlet port (mm)		
C.10.6 Material		
C.10.7 Adjustment (if any)		
C.11 Auger		
C.11.1 Pitch (mm)		
C.11.2 Length (mm)		
C.11.3 Overall diameter (mm)		
C.11.4 Minimum clearance from housing		
C.11.5 Material		
C.12 Grain Chute		
C.12.1 Angle of inclination		
C.12.2 Material		
C.13 Transport device		
C.13.1 Type		
C.13.2 Size		
C.13.3 Adjustment (if any)		
C.14 Chassis		
C.14.1 Material		
C.15 Safety device(s), if any		
C.16 Minimum labor requirement		
C.17 Adjustment (s)		
C.18 Tools available with machine		
C.19 Other special features		

C20 Illustration of Transmission System

Annex D Sampling and Measurement for Test Material

D.1 Sampling Procedures for Harvested Paddy

The conditions of crop such as grain-straw ratio and moisture content of grain to be used in each test trial shall be taken using “representative samples”, which represent the different conditions of the test lot. This can be done by taking samples, each at the top, middle and bottom of the pile. Samples representing the materials for each test trial shall be placed in appropriate containers for laboratory analysis.

D.2 Sampling from Different Outlets

D.2.1 During each test trial, samples shall be collected from different outlets to be analyzed in the laboratory for losses, purity and grain quality. 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. The sampling procedures shall be undertaken at the following thresher outlets:

D.2.1.1 Main grain outlet

Using a plastic bag or an appropriate container, collect four or more samples of approximately 0.5 kg each from the outlet. A final sample of approximately 1.5 kg shall be taken to the laboratory for analysis.

D.2.1.2 Straw thrower outlet

In the collection of sample in this outlet, use a rectangular box-shaped nylon catch with a dimension of 1.5 m x 0.5 m open at one end of the small side. Five samples shall be collected from this outlet with five-second duration per collection. Separate the free grain mixed with the straw and the grains that are still attached to the panicle. Put them in a separate container and label them as separation loss and unthreshed loss, respectively.

D.2.1.3 Chaff outlet

During the test, five samples shall be taken from the chaff outlet for one minute per collection by using a nylon net, with a dimension of 1.5 m x 1.0 m, held by two persons at both ends. These samples shall be placed in appropriate containers and labeled as blower loss.

If there is an outlet chute whose function is to collect and recycle the chaff materials, the amount of grains being recycled and the blower loss shall be taken separately. This can be achieved by following the sampling procedures discussed in the preceding paragraph.

However, at the outlet chute, a plastic bag or any appropriate container shall be used to collect three samples. These samples shall be placed in appropriate containers and labeled as recycled sample.

D.3 Collection of Scattered Grains

For testing purposes, scattered grains shall be gathered since these grains are part of the total grain input. Spread canvas sheets around the threshing floor area to catch these grains after each test trial. Place the collected grains in appropriate containers and label them as scattered grains.

Provisions shall be provided for the collection scattered grains with maximum distance of 1.0 m away from the base of the machine.

D.4 Handling of Samples

All samples to be taken to the laboratory shall be placed in appropriate containers and properly labeled. If the samples cannot be analyzed, they should be air-dried within three days in order to preserve the samples. If the sample is to be used for determining moisture content, it must be kept in dry and airtight containers.

D.5 Other Measurements Required During the Test Trial

The following data shall be gathered: speed of rotating components, air velocity, and noise level at the location of the operators and baggers. For each data to be taken there shall be a minimum of five observations. These shall be taken without and with load. Before taking of data, it should be ensured that the feed rate, speed and other functional characteristics have stabilized. The time of sampling shall be properly spaced during the whole duration of the test trials. For air velocity, measurement shall be taken in at least six measuring points. The test engineer shall decide on the location of the measuring points, which will provide him with a good estimate of the blower's air velocity.

D.6 Measurement of Fuel Consumption

To get the amount of fuel consumed, the tank shall be filled to a certain marked level before the test.

After the test, fill the tank with measured fuel to the same level before the test. When filling up the tank, careful attention shall be made to keep the tank at the same position as the first measurement.

Annex E
Field Performance Test Data Sheet

Test Trial No. : _____ Date : _____

Test Engineers: _____ Location : _____

Test Specimen: _____

ITEMS TO BE MEASURED AND INSPECTED

ITEM	TRIAL			
	1	2	3	Ave.
E.1 Crop Condition				
E.1.1 Variety				
E.1.2 Days after harvest				
E.1.3 Straw length (mm)				
E.1.4 Grain moisture content (%)				
E.1.5 Grain-straw ratio				
E.2 Performance test				
E.2.1 Speed of components (rpm)				
E.2.1.1 Primemover				
E.2.1.1.1 Without load				
E.2.1.1.2 With load				
E.2.1.2 Threshing cylinder shaft				
E.2.1.2.1 Without load				
E.2.1.2.2 With load				
E.2.1.3 Fan shaft				
E.2.1.3.1 Without load				
E.2.1.3.2 With load				
E.2.1.4 Oscillating screen shaft				
E.2.1.4.1 Without load				
E.2.1.4.2 With load				
E.2.1.5 Grain auger shaft				
E.2.1.5.1 Without load				
E.2.1.5.2 With load				
E.2.2 Fan air velocity (m/sec)				
E.2.2.1 Without load				
E.2.2.2 With load				
E.2.3 Noise level [dB(A)]				
E.2.3.1 Feeder				
E.2.3.1.1 Without load				
E.2.3.1.2 With load				
E.2.3.2 Bagger				
E.2.3.2.1 Without load				
E.2.3.2.2 With load				
E.2.4 Operating time (min)				
E.2.5 Threshed grains (kg)				

ITEM	TRIAL			
	1	2	3	Ave.
E.2.7 Fuel time (min)				
E.2.8 Fuel consumed (L)				
E.2.9 Fuel consumption (L/h)				

E.2.10 Observations:

E.2.10.1 Ease of transporting the machine

E.2.10.2 Adjustments such as belt tensions, clearance, air velocity and others

E.2.10.3 Safety features

E.2.10.4 Presence of grains that are blown back at the feeding port during threshing operation

E.2.10.5 Ease of cleaning the cylinder and concave

E.2.10.6 Ease of cleaning the fan and housing assembly

E.2.10.7 Labor requirement

E.2.10.8 Failure or abnormalities that shall be observed on the thresher or its component parts during and after the threshing operation.

E.2.10.9 Others

Annex F Laboratory Work

F.1 Measurement of Straw Length

This shall be taken using at least ten representative samples of cut plants and measuring the length from the point of cut to the tip of the panicle.

F.2 Measurement of Grain Content

In measuring the grain-straw ratio, take three representative samples of approximately 500 grams each of cut plants from the test materials. For each sample, manually thresh the grains from the panicle. Determine the weight of the grain and the straw separately. Record and calculate the grain-straw ratio using the formula in Annex H.1. The average of the three samples shall be taken as the grain-straw ratio.

F.3 Purity Determination

Take 500 g from the final sample taken from the main grain outlet. Clean the grains to remove the impurities and other foreign matters. The clean grain shall be weighed and recorded. The percent purity is calculated using the formula in Annex H.4.

F.4 Determination of Losses

F.4.1 Blower loss

Five samples shall be taken at the chaff outlet to collect grains mixed with the chaff. Each sample shall be cleaned and weighed. The total weight of the clean grains and the total time of collection shall be recorded for the computation of blower loss. (H.5.2)

F.4.2 Separation loss

Five samples shall be taken at the straw outlet to collect loose grains mixed with the straw. The total weight of the clean grains collected and the total time of collection of the five samples shall be taken and recorded for the computation of separation loss. (H.5.3)

F.4.3 Unthreshed loss

Unthreshed grains collected at the straw outlet shall be hand threshed and weighed. The total weight and time of collection of the grains from the straw outlet shall be taken and recorded for the computation of unthreshed loss. (H.5.4)

F.4.4 Scattering loss

Grains scattered around the thresher with a maximum distance of 1.0 m away from the base of the machine, shall be collected after each trial, cleaned and weighed for the determination of scattering loss. (H.5.5)

F.5 Determination of Net Percent Cracked Grains

Three samples from manually threshed and machine threshed grains shall be taken for analysis. Each sample shall consist of 100 grains. These grains shall be manually dehulled and inspected for the presence of fissures. The net percent cracked grains shall be taken as the difference between the values obtained from the manual and machine-threshed grain samples (H.8).

F.6 Determination of Percent Broken Grains

Three samples from machine-threshed grains shall be taken for analysis. Each sample shall consist of 100 grams. Separate those grains that were broken crushed or dehulled (partially or fully) and weigh. Compute for the percentage of brokendamaged grains (H.9).

Annex G
Laboratory Grain Analysis Data Sheet

Machine Tested: _____ Analyzed by : _____
Date of Test: _____ Date Analyzed: _____

G.1 Crop Conditions

G.1.1 Moisture Content, (% w.b.)

Average			

G.1.2 Grain-Straw Ratio

Sample No.	Weight of Grain and Straw (g)	Weight of Grain (g)	Grain-Straw Ratio
1			
2			
3			
Average			

G.2 Grain Analysis

G.2.1 Purity Determination

Initial Weight of Samples (uncleaned) = 500 grams

ITEM	Trial 1				Trial 1				Trial 1				Gen. Ave.
	1	2	3	Ave.	1	2	3	Ave.	1	2	3	Ave.	
Cleaned Grains (g)													
Purity (%)													

G.2.2 Loss Determination

Trial No.	Blower Loss		Separation Loss		Unthreshed Loss		Scattering Loss	
	Duration:		Duration:		Duration:		Duration:	
	Sample Wt. (g)	Total (kg)	Sample Wt. (g)	Total (kg)	Sample Wt. (g)	Total (kg)	Sample Wt. (g)	Total (kg)
1a								
1b								
1c								
Ave.								
2a								
2b								
2c								
Ave.								
3a								
3b								

Trial No.	Blower Loss		Separation Loss		Unthreshed Loss		Scattering Loss	
	Duration:		Duration:		Duration:		Duration:	
	Sample Wt. (g)	Total (kg)	Sample Wt. (g)	Total (kg)	Sample Wt. (g)	Total (kg)	Sample Wt. (g)	Total (kg)
3c								
Ave.								
Gen. Ave.								

G.2.3 Threshing Efficiency/Recovery Determination

Trial No.	Blower Loss		Separation Loss		Unthreshed Loss		Scattering Loss		Total	
	wt.	%	wt.	%	wt.	%	wt.	%	Output (kg)	Input (kg)
1										
2										
3										
Average										

Annex H
(informative)

Formula Used During Calculations and Testing

H.1 Grain-straw ratio (R)

$$R = \frac{W_g}{W_s}$$

where:

W_g is the weight of grain, g

W_s is the weight of sample (grain and straw), g

H.2 Fuel consumption (FC), L/h

$$FC = \frac{F_1}{T_T}$$

where:

F_1 is the amount of fuel consumed, L

T_T is the time of operation, h

H.3 Capacity

a) Actual capacity (C_a), kg/h

$$C_a = \frac{W_c}{T_o}$$

where:

W_c is the weight of threshing output, kg

T_T is the time of operation, h

b) Corrected capacity (C_C), kg/h (at 100% purity, 20% moisture content and 0.55 grainstraw ratio)

$$C_C = \frac{100 - MC_o}{100 - MC_m} \times \frac{R_m}{R_o} \times C_a$$

where:

C_C is the corrected capacity, kg/h

C_a is the actual capacity, kg/h

MC_o is the observed moisture content, %

MC_m is the grain moisture content, at 20%

R_o is the observed grain-straw ratio

R_m is the standard grain-straw ratio of 0.55

H.4 Purity (P), %

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

where:

W_u is the weight of uncleaned grain, g

W_c is the weight of cleaned grain, g

H.5 Losses

H.5.1 Summation of all losses (L_T), kg

$$L_T = \text{Blower loss} + \text{Separation loss} + \text{Unthreshed loss} + \text{Scattering loss}$$

H.5.2 Blower loss (B_1)

a) Amount

$$B_1, \text{ kg} = \frac{\text{Weight of blown clean grain, kg}}{\text{Duration of collection, h}} \times \text{duration of operation, h}$$

b) Percentage

$$B_1, \% = \frac{\text{Blower loss, kg}}{\text{Cleaned threshed grain, kg} + \text{Summation of all losses, kg}} \times 100$$

H.5.3 Separation Loss (S_1)

a) Amount

$$S_1, \text{ kg} = \frac{\text{Weight of separated clean grain, kg}}{\text{Duration of collection, h}} \times \text{duration of operation, h}$$

b) Percentage

$$S_1, \% = \frac{\text{Separation loss, kg}}{\text{Cleaned threshed grain, kg} + \text{Summation of all losses, kg}} \times 100$$

H.5.4 Unthreshed Loss (U_1)

a) Amount

$$U_1, \text{ kg} = \frac{\text{Weight of unthreshed clean grain, kg}}{\text{Duration of collection, h}} \times \text{duration of operation, h}$$

b) Percentage

$$U_1, \% = \frac{\text{Unthreshed loss, kg}}{\text{Cleaned threshed grain, kg} + \text{Summation of all losses, kg}} \times 100$$

H.5.5 Scattering loss (S_{c1}), %

$$S_{c1}, \% = \frac{\text{Weight of clean scattered grains, kg}}{\text{Cleaned threshed grain, kg} + \text{Summation of all losses, kg}} \times 100$$

H.6 Threshing Cylinder Efficiency (T_c), %

$$T_c, \% = \frac{\text{Cleaned threshed grains, kg} + \text{Blower loss, kg} + \text{Separation loss, kg} + \text{Scattering loss, kg}}{\text{Cleaned threshed grain, kg} + \text{Summation of all losses, kg}} \times 100$$

or

$$= 100 - \text{Unthreshed loss, \%}$$

H.7 Threshing Recovery (T_r), %

$$T_r, \% = \frac{\text{Cleaned threshed grains, kg}}{\text{Cleaned threshed grain, kg} + \text{Summation of all losses, kg}} \times 100$$

H.8 Cracked grains (C_g), %

$$C_g, \% = \frac{\text{Number of cracked grains}}{100 \text{ grain sample}} \times 100$$

H.9 Broken grains (B_g), %

$$B_g = \frac{\text{Weight of broken grains, g}}{100 \text{ gram sample}} \times 100$$

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