Foreword

This standard is a pursuance of the draft PNS 403:1991 Agricultural Machinery: Mechanical Rice Thresher – Methods of Test and Inspection" initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) under the project entitled "Standardization of Postharvest Machinery Testing and Evaluation" which was funded by the Bureau of Postharvest Research and Extension (BPRE) of the Department of Agriculture (DA).

This standard was reviewed by the Study Team on Formulation of Standard for Mechanical Paddy Thresher and by the Technical Committee for Postharvest Machinery and was circulated to various private and government agencies/organizations concerned for their comments and reactions. This standard was presented to the Philippine Society of Agricultural Engineers (PSAE) and subjected to a public hearing organized by the National Agriculture and Fisheries Council (NAFC).

This standard has been technically pursued in accordance with PNS 01: Part 4:1998 – Rules for the Structure and Drafting of Philippine National Standards.

Revisions had been made to adopt various improvements in the design of the machine that may affect its performance. In this standard, coning and quartering was excluded from Annex D (Sampling and Measurement for Test Materials).

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ANNEXES

PHILIPPINE AGRICULTURAL ENGINEERING STANDARD PAES 205:2000

Agricultural Machinery – Mechanical Rice Thresher – Methods of Test

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, accessories of the thresher, and the list of specifications submitted by the manufacturer;

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 document contains provisions which through reference in this text constitute provisions of this National Standard:

PAES 04:2000Agricultural Machinery - Mechanical Rice Thresher - Specifications

3. Definitions

For the purpose of this standard, the definitions given in PAES 204:2000 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 component
an iron grill frame partly surrounding the cylinder on which the threshing elements rubs, 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 a diesel fed engine used to run the thresher

3.12
threshing output
the weight of the threshed grains collected at the grain outlet

3.13
total grain input
the sum of the weights of collected threshed grains and all threshing losses

3.14
upper concave
a 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 Role of manufacturer
The manufacturer shall submit to the official testing agency specifications and other relevant information on the mechanical paddy thresher. He/She shall abide with the terms and conditions set forth by an official testing agency.

4.2 Role of the representative 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.

4.3 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 not blow the straws and other impurities into the clean grain.

4.4 Suspension of test
If during the test run, the machine stops due to major component breakdown or malfunctions so as to affect the machine's performance, the test may be suspended with the concurrence of the official testing agency and the manufacturer's representative.

5 Test Preparation

5.1 Running-in and preliminary adjustment
Before the start of the test, the thresher should have undergone a break-in period. The thresher shall be operated at the test site by the official representative of the manufacturer for sufficient duration with and without load. During the running-in period, the various adjustments of the thresher shall be made according to the manufacturer's recommendations. (No other adjustments shall be permitted while the test is on—going).

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. Before and after each test, these instruments shall be physically checked for operation and shall be cleaned, respectively. 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. However, if the test materials is beyond the recommended characteristics, the manufacturer has the option to pursue the test.

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 is 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 run. After the test run, the threshing area shall be cleaned and then prepared for the next trial. This procedure shall be repeated for second and third trials.

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 procedure is given in Annex D.

7.4 Data collection

7.4.1 Duration of test
The duration of each test trial shall start with the feeding of the first harvested crop and ends after the feeding of the last batch. 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 5 cm 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 its capacity and after each test, the fuel consumed in L/h shall be measured by refilling the tank to the same level.

7.5 Data recording and observations
Record sheet for all data, information during the test, and other observations is 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, mechanically damaged 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 are 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

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 Conditions of the Machine

10.6 Description of the Machine

10.6.1 Fig. 1 Material Flow Diagram

10.6.2 Fig. 2 Power Transmission System

10.6.3 Fig. 3 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	Psychrometer (thermometer range: 0°C to 100°C) Accuracy: 0.5°C	1
A.1.1.3	Air Velocity Meter; Range: 0 – 30 m/s	1
A.1.1.4	Tachometer (contact type or photo electric type; Range: 0-5,000 rpm;	1
A.1.1.5	Noise Level Meter Range: 30 to 130 dB(A)	1
A.1.1.6	Timers (range: 60 minutes) Accuracy: 1/10 sec	2
A.1.1.7	Measuring Tape (capacity: 5m)	1
A.1.1.8	Camera	1
A.1.1.9	Weighing Scale Capacity: 100 kg Scale divisions: 0.5 kg	1
A.1.1.10	Graduated Cylinder (for engines) (500- mL capacity) or Watt-Hour Meter (for electric motors) 60 Hz, 220 V	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: 1 hour 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)

Items to be inspected

ITEMS	Manufacturer's Specification	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 (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)		
C.6 Type of clutch system		

ITEMS	Manufacturer's Specification	Verification by the Testing Agency
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		
C7.4.1.4.3 Material		
C.7.4.2 Upper concave		
C.7.4.2.2 Material used		
C.7.4.2.3 Spacing between grills (mm)		
C8 Feeding Table		
C.8.1 Length (mm)		
C.8.2 Width (mm)		
C.8.3 Height from the ground (mm)		
C.8.4 Dimension of feeding port, L x W (mm)		
C.8.5 Mode of attachment		

ITEMS	Manufacturer's Specification	Verification by the Testing Agency
C.8.6 Material		
C.9 Oscillating Screen/Sieve		
C.9.1 Length (mm)		
C.9.2 Width (mm)		
C9.3 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 Palay

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 condition of the harvested palay on the pile. 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 a duration of about 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 are not to be immediately analyzed, they should be air-dried and if necessary, treat the samples with chemicals such as insecticide in order to prevent the samples from possible damage. 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 Run

Data shall be taken for the following: 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 full capacity 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 paid to keep the tank horizontal and not to leave empty space in the tank.

Annex E
Field performance Test Data Sheet

Test Trial No. : _____ Date : _____
Test Engineers : _____ Location : _____
Test Specimen : _____

ITEMS TO BE MEASURED AND INSPECTED

ITEMS	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)				
E.2.6 Threshing capacity (t/h)				
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 H1. 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 H4.

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. (see sub-clause H5.2)

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. (see sub-clause H5.3)

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 shall be taken and recorded for the computation of unthreshed loss. (see sub-clause H5.4)

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. (see sub-clause H5.5)

F.5 Determination of Net Percent Cracked Grains

Three samples each 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 (see sub-clause H8).

F.6 Determination of Percent Mechanically-Damaged Grains

Three samples form 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 mechanically damaged grains (see sub-clause H9).

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 gms

ITEMS	Trial 1				Trial 2				Trial 3				Gen. Ave.
	1	2	3	Ave.	1	2	3	Ave.	1	2	3	Ave.	
Cleaned (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)
1 a								
b								
c								
Ave.								
1 a								
b								
c								
Ave.								
1 a								
b								
c								
Ave.								
Gen. Ave								

G.2.3 Threshing Efficiency/Recovery Determination

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

Annex H
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 (F_C), L/h

$$F_c = \frac{F_1}{T_o}$$

where:

F_1 is the amount of fuel consumed, L
T_O 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_O is the duration of operation, h

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

$$C_c = \frac{100 - MC_o}{100 - MC_m} \text{ x } \frac{R_m}{R_o} \text{ x } C_o$$

where:

C_C is the corrected capacity, kg/h
C_O 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), %

$$P = \frac{W_c}{W_u} \text{x} 100$$

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

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

b) Percentage

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

H.5.3 Separation Loss (S_1)

a) Amount

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

b) Percentage

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

H.5.4 Unthreshed Loss (U_1)

a) Amount

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

b) Percentage

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

H.5.5 Scattering loss (S_C l), %

$$S_c l, \% = \frac{\text{Weight of clean scattered grains, kg}}{\text{Cleaned threshed grain, kg} + \text{Summation of all losses, kg}} \text{ x } 100$$

H.6 Threshing Cylinder Efficiency (T_e), %

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

or

= 100% - Unthreshed loss (%)

H.7 Threshing Recovery (T_r), %

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

H.8 Cracked grains (C_g), %

$$C_g = \frac{\text{Number of cracked grains}}{\text{100 grain sample}} \text{ x } 100$$

H.9 Mechanically damaged grain (D_g), %

$$D_g = \frac{\text{Weight of mechanically damaged grains, g}}{\text{100 gram sample}} \text{ x } 100$$