

PHILIPPINE NATIONAL STANDARD

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**Agricultural machinery – Multipurpose thresher –
Methods of test**



BUREAU OF PRODUCT STANDARDS*

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National Foreword

The Philippine Agricultural Engineering Standards PAES 263:2015, Agricultural machinery – Multipurpose 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).

PHILIPPINE AGRICULTURAL ENGINEERING STANDARD PNS/PAES 263:2015
Agricultural Machinery – Multipurpose Thresher – Methods of Test

Foreword

The formulation 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:

PAES 205:2000 – Agricultural Machinery – Mechanical Rice Thresher – Methods of Test

PAES 209:2000 – Agricultural Machinery – Power – Operated Corn Sheller – Methods of Test

Primer on Philippine Grains Standardization Program. 2002. National Food Authority. Quezon City, Philippines

Rice Postharvest Technology. 1995. The Food Agency Ministry of Agriculture, Forestry and Fisheries. Tokyo, Japan.

Rice Postproduction Technology A Technical Reference Guide. 2003. Philippine Rice Postproduction Consortium. Japan Grain Inspection Association. National Food Authority. Quezon City.

PHILIPPINE AGRICULTURAL ENGINEERING STANDARD PNS/PAES 263:2015
Agricultural Machinery – Multipurpose Thresher – Methods of Test

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1 Scope

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

- 1.1** verify the mechanism, main dimensions, weight, materials, accessories of the multipurpose 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 and shelling on grain and kernel quality, respectively through laboratory analysis; and
- 1.5** report the results of the tests.

This standard is applicable only to multipurpose thresher that could also perform corn husking and corn shelling operations.

2 References

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

PNS/PAES 102:2000 Agricultural Machinery – Operator’s Manual – Content and Presentation

PNS/PAES 262:2015 Agricultural Machinery – Multi-purpose Thresher – Specifications

3 Definitions

For the purpose of this standard the definitions given in PNS/PAES 262:2015 – Agricultural Machinery – Multi-purpose Thresher– Specifications 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

clean shelled kernel

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

3.3

concave clearance

the clearance between cylinder threshing/shelling elements and concave component

3.4

concave grate

concave component

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

3.5

corrected capacity

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

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/shelling elements

3.9

feed rate

weight of unshelled corn or unthreshed paddy fed into the thresher/sheller per unit of time

3.10

foreign matters

all matters other than corn kernels or grains such as sand, gravel, dirt, pebbles, stones, lumps of earth, clay and mud, weed seeds and other crop seeds

3.11

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

3.12

lower concave

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

3.13

oscillating screen

wire mesh or perforated sheet metal used to separate large and/or small particles

3.14

output capacity

weight of threshed/shelled kernel collected per unit of time

3.15

primemover

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

3.16

running-in period

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

3.17

threshing/shelling output

the weight of the threshed grains or shelled kernels collected at the main outlet

3.18

total losses

sum of blower, separation, unthreshed/unshelled and scattering losses, expressed in percent by weight

3.19

total grain input

total kernel input

the sum of the weights of collected threshed grains or shelled kernels and all threshing/shelling losses

3.20

upper concave

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

4 General Conditions for Test and Inspection

4.1 Role of requesting party

The requesting party shall submit to the official testing agency specifications and other relevant information on the multipurpose thresher and primemover. He/She shall abide with the terms and conditions set forth by the official testing agency. The sampled machine shall be submitted for testing.

4.2 Role of the representative of the manufacturer/supplier/dealer

An officially designated representative of the manufacturer/supplier/dealer shall operate, adjust, repair, and shall decide on matters related to the operation of the machine. Manufacturers/dealers should provide appropriate authorization documents.

4.3 Test site conditions

The machine 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 straw or the corn cobs and other impurities into the clean grain or the clean kernel.

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 performance of the machine, 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 machine should have undergone a running in period. The machine 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 machine shall be made according to the recommendation of the manufacturer.

(No other adjustments shall be permitted while the test is on-going).

5.2 Test instruments and other needs

The suggested list of minimum field and laboratory test equipment and materials needed to carry out the machine test is shown in Annex A. These instruments should be calibrated regularly. Before and after each test, the 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 test materials to be used test shall be prepared in sufficient quantity, using the procedure given in Annex B. However, if the test materials are 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 for the paddy. Representative test samples shall also be collected from the test lot to determine its dimensions and shall be manually shelled for the determination of kernel-ear corn ratio, moisture content and control for the corn kernel quality. Sampling procedures are given in Annex D.

7 Performance Test

7.1 Operation of the machine

The machine 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. An instruction manual which conforms to PNS/PAES 102:2000 Agricultural Machinery – Operator’s Manual – Content and Presentation shall be provided. After the test run, the threshing/shelling 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 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 sample and ends after the feeding of the last sample. However, all discharge from the different outlets shall be included after the cut-off time.

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 shelling/threshing cylinder, oscillating screen shaft, fan shaft, blower, primemover and other rotating 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 fan, with or without load, shall be taken using an air velocity meter measured in m/s.

7.4.5 Fuel consumption

Before the start of each test trial, the fuel tank shall be filled to its capacity and after each test trial; the fuel consumed shall be measured by refilling the tank to the same level using a graduated cylinder measured in L/hr.

7.5 Data recording and observations

Record sheet for all data and information during the test is given in Annex E.

8 Laboratory Analysis

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

9 Data Analysis

9.1 Calculation

For uniform result of output due to variation in grain/kernel moisture content and purity, the output capacity shall be corrected at 100% purity, 20% moisture content and 0.55 grain-straw ratio if the machine was tested as thresher and 100% purity 20% moisture content if it was

used as sheller-husker. The formulas 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 in which data shall be taken from Annex C and E. A schematic diagram of the power transmission system and arrangement of the shelling 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 shall include the following information in the order given:

10.1 Title

10.2 Summary of Result

10.3 Purpose and Scope of Test

10.4 Methods of Test

10.5 Conditions of the Machine

10.6 Description of the Machine

Figure 1 – Material Flow Diagram

Figure 2 – Power Transmission System

Figure 3 – Arrangements of Threshing/Shelling Elements on the Cylinder

Table 1 – Machine Specifications

10.7 Results of Test

Table 2 – Field Performance Test Data

10.8 Observations (include pictures)

10.9 Name and Signature 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 Multipurpose Thresher

B.1 Sample Characteristics

Test materials to be used shall have the following characteristics:

Characteristics	Paddy	Corn
Variety	commonly grown locally	
Moisture Content, % wet basis	18-24	18-24
Straw Length	45-50 cm	N/A
Grain-straw Ratio	0.50-0.65	N/A
Kernel-Ear Corn Ratio	N/A	0.77-0.81

B.2 Quantity to be Supplied

The amount of test material to be supplied shall be sufficient for one hour of continuous threshing/shelling 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/shelling 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 Multipurpose 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 machine		
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 _____		

ITEM	Manufacturer's Specifications	Verification by the Testing Agency
C.5.5 Others (specify)		
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.7.4.2.1 Spacing between grills (mm)		
C.8 Feeding Table		
C.8.1 Length (mm)		
C.8.2 Width (mm)		

ITEM	Manufacturer's Specifications	Verification by the Testing Agency
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		
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		

C.20 Illustration of Transmission System

Annex D

Sampling and Measurement for Test Material

D.1 Sampling Procedures for Harvested Samples

The conditions of crop such as grain-straw ratio for paddy, ear corn dimension, kernel-ear corn ratio for corn and moisture content of grain and kernel 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/kernel 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 / Corn cob 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 for thresher, and cob and the kernels for sheller-husker, that are still attached to the panicle for paddy and cob for corn. Put them in a separate container and label them as separation loss and unthreshed/unshelled loss, respectively.

D.2.1.3 Chaff / Corn cob outlet

During the test, five samples shall be taken from the chaff / corn cob outlet for one minute per collection by using nylon net with a dimension of 1.5 m x 1.5 m x 0.5 held by two persons at both ends. These samples shall be placed in appropriate containers and labeled as blower loss.

If it is to be tested as a thresher and 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.

If it is to be tested as sheller-husker, separate the free corn kernel mixed with the cob and the kernels that are still attached to the cob. Put them in separate containers and label them as separation loss and unshelled loss, respectively.

D.3 Collection of Scattered Grains/Kernels

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

Provisions shall be provided for the collection scattered grains/kernels 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, within three days they should be air-dried 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. : _____
 Test Engineers: _____
 Test Specimen: _____

Date : _____
 Location : _____

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				

ITEM	Trial			
	1	2	3	Ave.
E.2.4 Operating time (min)				
E.2.5 Threshed grains (kg)				
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 / Ear Corn Dimensions

Straw length and ear corn dimensions 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 (Tested as Thresher)

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.a and H.1.b. The average of the three samples shall be taken as the grain-straw ratio.

F.3 Measurement of Kernel-Ear Corn Ratio (Tested as Sheller-Husker)

In measuring the kernel-ear corn ratio, take at least ten representative samples of ear corn. Take the weight of each ear corn and manually shelled the kernels. Determine the weight of the kernel for each ear corn then compute for the kernel-ear corn ratio.

F.4 Purity Determination

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

F.5 Determination of Losses

F.5.1 Blower loss

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

F.5.2 Separation loss

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

F.5.3 Unthreshed/Unshelled loss

Unthreshed grains / unshelled kernels collected at the straw/corn cob outlet shall be hand threshed or hand shelled and weighed. The total weight and time of collection of the grains/kernels from the straw/corn cob outlet shall be taken and recorded for the computation of unthreshed / unshelled loss (Annex H.5.4).

F.5.4 Scattering loss

Grains/kernels scattered around the machine 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 (Annex H.5.5).

F.6 Determination of Net Percent Cracked Grains

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

F.7 Determination of Percent Broken Grains

Three samples from machine-threshed/shelled grains/kernels shall be taken for analysis. Each sample shall consist of 100 grams. Separate those grains/kernels that were broken crushed or dehulled (partially or fully) and weigh. Compute for the percentage of broken damaged grains/kernels (Annex 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 (Tested as Thresher)

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

G.1.3 Kernel-Ear Corn Ratio (Tested as Sheller-Husker)

Sample No.	Weight of Ear Corn (g)	Weight of Kernel (g)	Kernel-Ear CornRatio
1			
2			
3			
Average			

G.2 Grain/Kernel 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/Kernels (g)													
Purity (%)													

G.2.2 Loss Determination

Trial No.	Blower Loss		Separation Loss		Unthreshed/ Unshelled 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								
3c								
Ave.								
Gen. Ave.								

G.2.3 Shelling/Threshing Efficiency/Recovery Determination

Trial No.	Blower Loss		Separation Loss		Unthreshed/ Unshelled 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.a Grain-Straw Ratio (R) (Tested as Thresher)

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

where:

W_g is the weight of grain, g

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

H.1.b Kernel-Ear Corn Ratio (R) (Tested as Sheller)

$$Rc = \frac{W_k}{W_c}$$

where:

W_k is the weight of kernel, g

W_c is the weight of ear corn, g

H.2 Fuel Consumption (FC), 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 threshed/shelled 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, if tested as Thresher)
 (at 100% purity, 20% moisture content, if tested as Sheller-Husker)

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

$$C_S = \frac{100 - MC_o}{100 - MC_m} \times P \times C_o$$

where:

- C_C is the corrected capacity (Thresher), kg/h
- C_S is the corrected capacity (Sheller-Husker), 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
- P is the kernel purity, %

H.4 Purity (P), %

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

where:

- W_u is the weight of uncleaned grain/kernel, g
- W_c is the weight of cleaned grain/kernel, g

H.5 Losses

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

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

H.5.2 Blower loss (B_1)

- a) Amount

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

- b) Percentage

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

H.5.3 Separation loss (S₁)

a) Amount

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

b) Percentage

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

H.5.4 Unthreshed/Unshelled loss (U₁)

a) Amount

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

b) Percentage

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

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

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

H.6 Threshing/Shelling Cylinder Efficiency (T_c), %

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

or

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

H.7 Threshing/Shelling Recovery (T_r), %

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

H.8 Cracked Grains (C_g), %

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

H.9 Broken Grains (B_g), %

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

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