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Agricultural machinery – Corn Picker – Methods of Test

BUREAU OF PRODUCT STANDARDS

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National Foreword

This Philippine Agricultural Engineering Standards PAES 257:2011, Agricultural machinery – Corn Picker – Methods of Test was approved for adoption as Philippine National Standard by the Bureau of Product Standards upon the recommendation of the Agricultural Machinery Testing and Evaluation Center (AMTEC) and the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development of the Department of Science and Technology (PCARRD-DOST).

Foreword

The formulation of this national standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) through the project "Development of Standards for Agricultural Production and Postharvest Machinery" funded by the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development – Department of Science and Technology (PCARRD – 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 the preparation of this standard, the following documents/publications were considered:

PAES 213:2004 Agricultural Machinery – Rice Reaper – Methods of Test

CONTENTS

1 Scope

This standard specifies the methods of test and inspection for the single-row side-mounted corn picker. Specifically, it shall be used to:

1.1 verify the mechanism, dimensions, materials, accessories of the corn picker 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; and

1.4 report the results of the tests.

2 References

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

PAES 103:2000 Agricultural Machinery – Methods of Sampling

PAES 203:2000 Moisture Content Determination for Rice and Corn

PAES 256:2010 Agricultural Machinery – Corn Picker – Specifications

3 Definitions

For the purpose of this standard, the definitions given in PAES 256 and the following shall apply:

3.1
actual field capacity
actual rate of being able to harvest corn in a given area per unit of time

NOTE: Total operating time which includes the time spent for turning at the headland, adjustment, repair and troubleshooting of the machine

3.2
corn (*Zea mays)*
cereal grass belonging to the Poaceae family

3.3
corn ear
fruit of the corn plant with husk

3.4
single-row side-mounted corn picker
machine attached to the side of tractor designed for picking corn

3.5
conveyance efficiency
measures the ability of the corn picker to deliver the harvested corn ear to the collecting bin

3.6
field efficiency
ratio of the actual field capacity and theoretical field capacity, expressed in percent

3.7
picking efficiency
measures the ability of the corn picker to harvest the corn ear from the corn stalk through snapping and stripping action

3.8
potential yield
maximum yield per unit area

3.9
theoretical field capacity
computed rate of harvested corn in a given area per unit time

3.10
overall height
distance between the horizontal supporting plane surface and the horizontal plane touching the uppermost part of the corn picker

NOTE: All parts of the corn picker projecting upwards are contained between these two planes.

3.11
overall length
distance between the vertical planes at the right angles to the median plane of the corn picker and touching its front and rear extremities

NOTE: All parts of the corn picker, in particular, components projecting at the front and at the rear are contained between these two planes. Where an adjustment of components is possible, it shall be set at minimum length.

3.12
overall width
distance between the vertical planes parallel to the median plane of the machine, each plane touching the outermost point of the corn picker on its respective side

NOTE: All parts of the corn picker projecting upwards are contained between these two planes.

3.13
running-in period
preliminary operation of the machine to make various adjustments prior to the conduct of the test until the operation is stable

4 General Conditions for Test and Inspection

4.1 Selection of corn picker

Corn picker selected for test shall be sampled in accordance with PAES 103.

4.2 Role of manufacturer/distributor

The manufacturer/distributor shall submit specifications and other relevant information about the corn picker and shall abide with the terms and conditions set forth by an official testing agency.

4.3 Role of the operator

An officially designated operator shall be skilled and shall demonstrate, operate, adjust, and repair as the case maybe, related to the operation of the corn picker.

4.4 Test site conditions

The corn picker shall be tested for normal operation. The site should have ample provisions for material handling, workspace suitable for normal working condition.

4.5 Test instruments

The instruments to be used shall be calibrated and checked by the testing agency prior to the measurements. The suggested list of minimum test instruments and materials needed to carry out the corn picker test is shown in Annex A.

4.6 Test materials

Corn plants shall be commonly and locally available. The maturity period of the corn plants shall be between 115 days to 120 days. The range of moisture content of corn kernel shall be 25% to 32%.

4.7 Termination of Test

If there is major component breakdown during testing, the test engineer from the official testing agency shall terminate the test.

5 Test and Inspection

5.1 Verification of the technical data and information of the manufacturer

5.1.1 This inspection is carried out to verify the mechanism, dimensions, materials and accessories of the corn picker in comparison with the list of technical data and information of the manufacturer.

5.1.2 A plane level surface shall be used as reference plane for verification of the dimensional specifications of the corn picker.

5.1.3 The items to be inspected and verified shall be recorded in Annex B.

5.2 Field Performance test

5.2.1 This is carried out to test the field performance of corn picker.

5.2.2 Initial data on the corn field such as width, length and number of corn plants per square meter shall be recorded.

5.2.3 Test conditions

Picking operation shall be done in fields of not less than 1500 m^2 (500 m^2 per test trial). The plot shall be rectangular in shape with sides in the ratio of 2:1 as much as possible.

5.2.4 Field operation

5.2.4.1 The corn picker shall be tested using field operational pattern as shown in Figure 1.

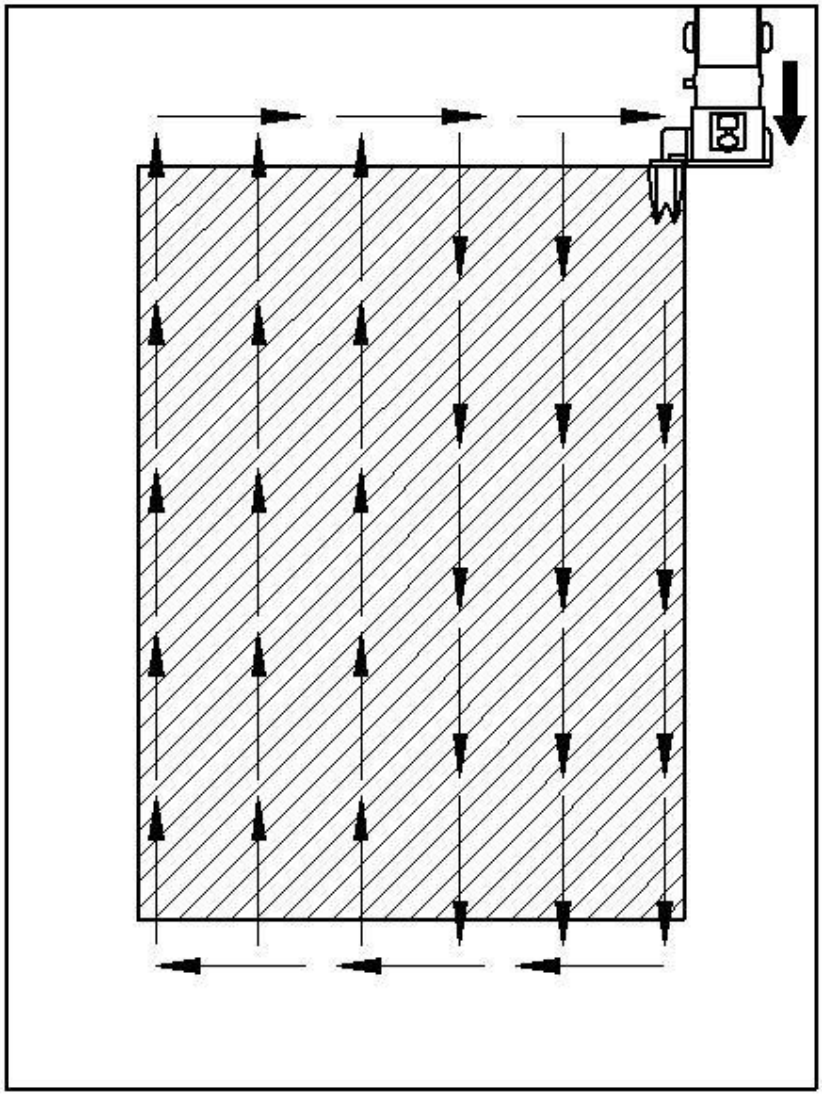

Figure 1. Recommended operational pattern

5.2.4.2 All the peripherals of test area should be manually harvested to provide space for initial operation and space for turning.

5.2.5 Measurement of performance parameters

5.2.5.1 Operating speed

Outside the long boundary of the test plot, two poles 20 m apart (A, B) are placed approximately in the middle of the test run (Fig. 2). On the opposite side also two poles are placed in similar position, 20 m apart (C, D) so that all four poles form corners of a rectangle, parallel to at least one long side of the test plot. The speed will be calculated from the time required for the picker to travel the distance (20 m) between two poles on opposite sides AC and BD. The easily visible point of the picker should be selected for measuring the time

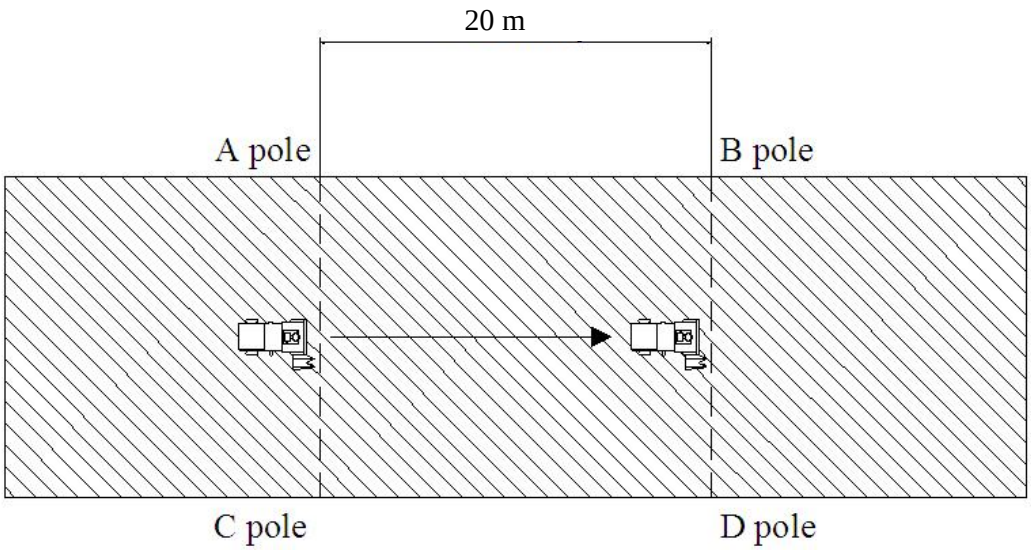

Figure 2. Measurement of operating speed

5.2.5.2 Noise level measurement

The noise emitted by the machine shall be measured approximately 50 mm away from the ear level of the operator using a noise level meter

5.2.5.3 Fuel consumption

Before the start of each test trial, the fuel tank shall be filled to its capacity. After each test trial the tank shall be refilled using graduated cylinder. The amount of refueling is the fuel consumption for the test. When filling up the tank, keep the tank horizontal so as not to leave empty space in the tank.

5.2.5.4 Total operating time

Total operating time shall be measured once the picker starts to harvest up to the last corn. The total operating time shall be inclusive of time for adjustments and turning.

5.2.5.5 Potential yield

Before the test run, randomly select 10 corn plants within the test plot and manually count the corn ears. The number of corn ear per 10-corn plants shall be the value for potential yield

5.2.5.6 Picking efficiency

After the test run, 3 rows with 10 corn plants per row shall be selected randomly within the test plot and the corn ear remaining in the stalk after picking shall be manually collected, counted and labeled. The average number of corn ear picked per 10-corn plants shall be the value of picking efficiency.

5.2.5.7 Conveyance efficiency

After the test run, 3 rows with 10 corn plants per row shall be selected randomly within the test plot and the corn ear detached from stalk and fallen on ground during picking shall be manually collected, counted and labeled. The average number of corn ear conveyed per 10-corn plants shall be the value of conveyance efficiency.

5.2.5.8 Measure the turning time of the corn picker.

5.2.5.9 All data and information shall be recorded in Annex C.

5.2.6 Test trial

There shall be a minimum of three test trials.

6 Laboratory Analysis

Laboratory analysis shall be made to determine the grain moisture content. The laboratory test data sheet is given in Annex D.

6.1 Moisture content

6.1.1 This shall be taken using air oven method.

6.1.2 For each test trial, randomly obtain three-100g of corn kernels and place in the moisture can. Ensure that no moisture is loss or gained by the sample between the time it was collected and when it is weighed in a moisture can. Weigh and record all the initial weights.

6.1.3 Dry the samples in the oven with a temperature of 103 °C ± 1 °C for 72 hours.

6.1.4 After removing the samples from the oven, sample container with samples should be placed within a desiccator and allowed to cool to the ambient temperature.

6.1.5 Weigh the moisture can with the dried sample. Record the final weight. Calculate the moisture content using formula in Annex E.

7 Formula

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

8 Test Report

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

8.1 Title

8.2 Summary of Results

8.3 Purpose and Scope of Test

8.4 Methods of Test

8.5 Condition of the Machine

8.6 Description of the Machine

Table 1 – Machine Specifications

8.7 Results and Discussions

8.8 Observations (include pictures)

Table 2 – Performance test data

8.9 Names, signatures and designation of test engineers

Annex A

Suggested Minimum List of Field and Laboratory Test Instruments and Materials

A.1	**Instruments**	**Quantity**
A.1.1	**Field**	
A.1.1.1	Digital Tachometer	1
A.1.1.2	Digital timers (Accuracy: 0.1 sec.)	2
A.1.1.3	Tape measure (with maximum length of 5m)	1
A.1.1.4	Noise level meter Range: 30 dB(A) to 130 dB(A)	1
A.1.1.5	Graduated cylinder (at least 1000 mL capacity)	1
A.1.1.6	Marking pegs	
A.1.1.7	Digital camera	1
A.1.1.8	Vernier caliper (0.05mm accuracy, 200 mm length)	1
A.1.1.9	Steel tape (length 50 m)	
A.1.2	**Laboratory**	
A.1.2.1	Air oven	1
A.1.2.2	Desiccators	1
A.1.2.3	Weighing scale (sensitivity: 0.1 g)	1
A.1.2.3	Aluminum moisture can	
A.2	**Materials**	
A.2.1	Labeling tags which include	
A.2.1.1	Date of test	
A.2.1.2	Corn picker on test	
A.2.1.3	Sample source	
A.2.1.4	Variety	
A.2.1.5	Trial number	

Annex B

Specifications of Corn Picker

Name of Applicant/ Distributor: _____
Address: _____
E-mail Address: _____
Tel No: _____
Name of Manufacturer: _____
Address: _____
Tel No: _____

GENERAL INFORMATION

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

Items to be inspected

ITEMS	Specifications of the Manufacturer	Verification by the Testing Agency
B.1 Machine structure		
B.1.1 Material(s) of construction		
B.1.2 Overall Dimensions, mm		
B.1.2.1 length		
B.1.2.2 width		
B.1.2.3 height		
B.2 Picking Section		
B.2.1 Material(s) of construction		
B.2.2 Capacity, ha/h		
B.2.3 Dimensions, mm		
B.2.3.1 length		
B.2.3.2 width		
B.2.3.3 height from ground		
B.3 Conveyor		
B.3.1 Material(s) of construction		
B.3.2 Dimensions, mm		
B.3.2.1 length		
B.3.2.2 width		
B.3.2.3 height from ground		
B.4.1 Engine		
B.4.1.1 Brand		
B.4.1.2 Model		

B.4.1.3 Serial number		
B.4.1.4 Type (stroke/ignition)		
B.4.1.5 Rated power, kW		
B.4.1.6 Rated speed, rpm		
B.4.1.7 Cooling system		
B.4.1.8 Starting system		
B.4.1.9 Weight, kg		
B.5 Running Parts		
B.5.1 Tire, kind		
B.5.2 Tire, size		
B.6 Safety Features (enumerate):		
B.7 Special Features (enumerate):		

Annex C

Performance Test Data Sheet

Test Trial No. _____Date: _____
Test Engineer: _____Location: _____
Assistants: _____ Test Specimen: _____
Test Requested by: _____Manufacturer: _____

	Trials			Ave
C.1 Crop Condition	**I**	**II**	**III**	
C.1.1 Variety				
C.1.2 Date of planting				
C.1.3 Row spacing between hill				
C.1.4 Recommended period of maturity				
C.1.5 Average plant height (at least 8 observations)				
C.1.6 Plant population/m^2 (at least 8 observations)				
C.2 Field Condition				
C.2.1 Location of the test field				
C.2.2 General topography (undulating/leveled)				
C.2.3 Area test field				
C.2.4 Shape of field				
C.2.5 Soil type				
C.3 Test Condition				
C.3.1 Date of test				
C.3.2 Total operating time, min				
C.3.3 Time, min				
C.3.3.1 Turning				
C.3.3.2 Adjustments				
C.3.3.3 Minor repair				
C.3.3.4 Others (specify)				
C.3.4 Operating speed, m/s				
C.3.5 Fuel consumed, L				
C.3.6 Engine time of operation, min				
C.3.7 Fuel consumption rate, L/h				
C.3.8 Noise level, db(A)				
C.3.9 Picking efficiency (average of 3 observations), kg				
C.3.10 Conveyance efficiency (average of 3 observations), kg				

C.3.16 Actual field capacity, ha/h				
C.3.17 Theoretical field capacity, ha/h				
C.3.18 Field efficiency, %				
C.4 Minimum labor requirements				

C.5 Evaluate the following observations:

Items	**Observations**
C.5.1 Ease of handling and stability when machine is working and turning	
C.5.2 Ease of operation	
C.5.3 Ease of repairing of parts	
C.5.4 Ease of adjusting parts	
C.5.5 Ease of transporting the picker	
C.5.6 Safety	

C.6 Other Observations:

_____
_____
_____
_____
_____
_____
_____

Annex D

Laboratory Test Data Sheet

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

D.1 Potential yield

Plant No.	Number of Corn Ear
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total	

D.2 Moisture Content, (% w.b.)

Sample No.	Moisture Content, %
1	
2	
3	
4	
5	
Average	

D.3 Loss Determination

D.3.1 Picking Loss

Plant No.	Number of undetached corn ear per 10-corn plants		
	Row 1	Row 2	Row 3
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Total			
Average			

D.3.2 Conveyance loss

Row* No.	Number of corn ear fallen on the ground which are detached from stalk during picking operation per 10-corn plants
1	
2	
3	
Average	

*****10 corn plants per row

D.4 Other observations:

_____
_____
_____
_____
_____
_____
_____

Annex E

Formula Used During Calculations and Testing

E.1 Actual Field Capacity

$$FC_A = \frac{A_T}{T_o}$$

where:

FC_A = actual field capacity, ha/h
A_T = area covered during test, ha
T_o = total operating time, h

E.2 Theoretical Field Capacity

$$FC_T = \frac{A_T}{T_o - T_{NP}}$$

where:

FC_T = theoretical field capacity, ha/h
A_T = area covered during test, ha
T_o = total operating time, h
T_{NP} = non-productive time, h (time for adjustments and turning)

E.3 Field Efficiency

$$E_F = \frac{FC_A}{FC_T} \times 100$$

where:

E_F = field efficiency, %
FC_A = actual field capacity, ha/h
FC_T = theoretical field capacity, ha/h

E.4 Picking Efficiency

$$e_p = 100 - L_p$$

where:

$$L_P = \frac{\text{average } N_{cus}}{\text{average } N_{py}} \times 100$$

where:

e_p = picking efficiency, %
L_P = picking loss, %
N_{cus} = number of corn ear undetached from stalk after picking operation, # of corn ear
N_{PY} = potential yield, # of corn ear

E.5 Conveyance efficiency

$$e_c = 100 - L_c$$

where:

$$L_c = \frac{N_{DC}}{N_{PY} - N_{CUS}} \times 100$$

where:

e_c = conveyance efficiency, %
L_c = conveyance loss, %
N_{DC} = number of uncollected detached corn ear during operation, # of corn ear
N_{PY} = potential yield, # of corn ear
N_{CUS} = number of corn ear undetached from stalk after picking operation, # of corn ear

E.6 Total Machine Efficiency

$$e_{TM} = \frac{L_p + L_c}{L_p \times L_c} \times 100$$

where:

e_{TM} = total machine efficiency, %
L_P = picking loss, %
L_c = conveyance loss, %

E.7 Fuel Consumption Rate

$$Fr = \frac{Fc}{Te}$$

where:

Fr = fuel consumption rate, L/h
Fc = amount of fuel consumed, L
Te = engine operating time, h

E.8 Moisture Content

$$MC_{wb} = \frac{W_i - W_f}{W_i} \times 100$$

where:

MC_{wb} = moisture content, %
Wi = initial weight of the sample, g
Wf = final weight of the sample, g

Philippine Agricultural Engineering Standards

AMTEC-UPLB – PCARRD Project: "Development of Standards for Agricultural Production and Postharvest Machinery"

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