

PHILIPPINE NATIONAL STANDARD

PNS/BAFS 419:2025
ICS 65.060.01

Forage Chopper — Methods of Test



BUREAU OF AGRICULTURE AND FISHERIES STANDARDS
BPI Compound Visayas Avenue, Diliman, Quezon City 1101 Philippines
Trunkline: **(632) 928-8741 to 64 loc. 3301-3319**
E-mail: **bafs@da.gov.ph**
Website: **www.bafs.da.gov.ph**

Forage Chopper — Methods of Test
PNS/BAFS 419:2025
ICS 65.060.01

Copyright © 2025 by Bureau of Agriculture and Fisheries Standards

All rights reserved. The mention of specific organizations or products, does not mean endorsement or recommendation from the Bureau of Agriculture and Fisheries Standards (BAFS) in preference to others of similar nature that are not included. The BAFS encourages the reproduction and dissemination of the materials upon request. Applications for permissions to reproduce or disseminate these materials and all other queries should be addressed to the publisher

Published by:

Bureau of Agriculture and Fisheries Standards BAFS Building, BPI Compound,
Visayas Avenue, Diliman, Quezon City info.dabafs@gmail.com | bafs@da.gov.ph
(+632) 8928 8756 to 65 local 3301 – 3325

Suggested citation: Bureau of Agriculture and Fisheries Standards (BAFS)
Department of Agriculture (DA). (2025). Forage Chopper — Specifications
(PNS/BAFS 419:2025)

ISBN 978-621-455-624-3 (PDF downloadable)
ISBN 978-621-455-623-6 (Softbound/Paperback)

www.bafs.da.gov.ph

Foreword

The Department of Agriculture (DA) – Bureau of Agricultural and Fisheries Engineering (BAFE), through Review Committee Resolution No. 001, Series of 2022, endorsed to the DA – Bureau of Agricultural and Fisheries Standards (BAFS) the development of the Philippine National Standard (PNS) on Forage Chopper — Specifications (PNS/BAFS 418:2025) and Methods of Test (PNS/BAFS 419:2025). This development of PNS aimed to update the provisions of the existing standards in response to the evolving demands and practices within the agricultural and fisheries mechanization sector ensuring the standards remain practical, relevant, and aligned with current industry conditions.

In 2022, one of the key issues identified was the failure to meet the 5% maximum variation in the performance requirement. The test data of the University of the Philippines Los Baños – Agricultural Machinery Testing and Evaluation Center (UPLB-AMTEC), from 2017 to 2021, revealed that only 2% (1 out of 45) of the forage choppers tested met this criterion. This low compliance rate posed significant challenges for the DA-Regional Field Offices (RFOs) and stakeholders in implementing the standard. Due to the limited available data, the standardization work for CY 2024 was deferred and re-evaluated, prompting its commencement in the following year.

As part of the standards development process, the proposed amendment of the PNS on Forage Chopper was presented to the Philippine Council for Agriculture and Fisheries – Committee on Agricultural and Fisheries Mechanization (PCAF-CAFMech) during its Regular Meeting on April 12, 2025. The Task Force agreed to prioritize the revision of the Philippine Agricultural Engineering Standards (PAES) for Forage Chopper – (PAES 218:2004) and Forage Chopper – Methods of Test (PAES 219:2004) to the DA-BAFS. This endorsement was formalized through PCAF-CAFMech Resolution No. 14, Series of 2024. The new standard is intended to establish attainable and practical minimum requirements for forage choppers, taking into account the operational realities of stakeholders in the agricultural and fishery machinery sector, including manufacturers, fabricators, assemblers, dealers, distributors, importers, and exporters (MFADDIEs).

A Technical Working Group (TWG) was created to amend the PNS under Special Order No. 745, series of 2025 (Composition of Technical Working Groups (TWG) and Project Management Team (PMT) for the Development of the PNS for Agricultural and Fishery Products and Machinery). The TWG was composed of representatives from relevant government agencies, academe/research institutions, Civil Society Organization (CSO), and private sector organization. The draft PNS underwent an extensive series of TWG meetings and stakeholder consultations, facilitated through physical and online platforms, from February 2025 to October 2025 before their finalization and endorsement to the DA Secretary for approval. The PNS was approved on November 21, 2025.

This standard includes the following significant changes compared to the PAES on Forage Chopper — Methods of Test (PAES 219:2004)

1. Modification on the scope by deleting the power-driven and specifying to stationary forage chopper;
2. Modification of the terms and definition and inclusion of input capacity;
3. Inclusion of principles of test;
4. Modification of the general considerations:
 - a. Addition of the time of harvest of test materials;
 - b. Setting the number of test trials in to minimum of two; and
 - c. Reducing the sample weight collected from the output chute from 1 kg to 600 g under sampling from the output chute.
5. Modification of laboratory analysis of end products:
 - a. Addition of secondary methods in the determination of moisture content;
 - b. Deletion of the chopping efficiency under the analysis of output; and
 - c. Addition of the quality of cut.
6. Modification of Annexes (A, B, C and D); and
7. Addition of formulas such as input capacity, material recovery and quality of cut in Annex E.

This document cancels and replaces PAES 219: 2004 (Forage Chopper —Methods of Test) which has been technically revised. This document was written in accordance with the formatting and editorial rules of the Standardization Guide (SG) No. 1 (Writing the PNS) and SG No. 5 (Writing the PNS for Agricultural and Fishery Machinery and Infrastructures) developed by the Standards Development Division (SDD) of the BAFS-DA.

Table of Contents

Foreword.....	ii
1 Scope	1
2 Normative References	1
3 Terms and Definitions.....	1
4 Principles of Test.....	3
5 Test Equipment and Materials.....	3
6 General Considerations.....	3
6.1 Conditions for the test.....	3
6.2 Test materials.....	3
6.3 Pre-test activities.....	4
6.4 Termination of test.....	4
6.5 Performance test.....	4
7 Performance Test and Procedures.....	4
7.1 Performance test.....	4
7.2 Operation of the forage chopper.....	4
7.3 Test trial.....	4
7.4 Test materials to be used.....	4
7.5 Data collection.....	4
7.6 Sampling and sample handling.....	6
7.7 Laboratory analysis of end products.....	6
7.8 Data recording and observations.....	9
7.9 Analysis of output	9
7.10 Quality of cut.....	9
8 Formula.....	9
9 Test Report.....	9
Annex A.....	10
Annex B.....	11
Annex C.....	13
Annex D.....	15
Annex E.....	17
References	21

1 Scope

This Standard specifies the methods of test and inspection for stationary forage choppers. Specifically, it shall be used to:

- a. verify the mechanism, dimensions, materials, accessories of the forage chopper and the list of specifications submitted by the manufacturer;
- b. determine the performance of the machine;
- c. evaluate the ease of handling and safety features;
- d. analyze the chopped forage through laboratory analysis; and
- e. report the results of the tests.

2 Normative References

The following normative document contains provisions which through reference in this text constitute provisions of these standards:

Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). Forage chopper — Specifications (PNS/BAFS 418: 2025).

Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2022). Methods of sampling for agricultural and biosystems power and machinery — Guidelines (PNS/BAFS 391:2024).https://drive.google.com/file/d/1U942cHfs_mHJuqUu7BFk-58Zm3sySnns/view

3 Terms and Definitions

For the purpose of this Standard, the following definitions shall apply:

3.1

chopping efficiency

ratio of the total fresh weight of the output of the chopper collected at all outlets less than the weight of the uncut materials, to the total fresh weight of the output collected at all outlets of the chopper, expressed in percent, % (AMTEC-UPLB, 2004, *modified*)

3.2

forage

any crop used as silage, soilage or animal feed, usually mixed with fermenting agent (AMTEC-UPLB, 2004)

NOTE Forage crops may refer to grasses and agricultural by-products such as rice straw, stovers and other crops.

3.3**feeding table**

part of the forage chopper where the forage to be chopped are loaded (AMTEC-UPLB, 2004)

3.4**input capacity**

weight of input material processed per unit time, expressed in kilogram per hour, kg/h

3.5**output capacity**

weight of processed material collected per unit time, expressed in kilogram per hour, kg/h (AMTEC-UPLB, 2004)

3.6**overall height**

distance between the horizontal supporting surface and the horizontal plane touching the uppermost part of the forage chopper (AMTEC-UPLB, 2004)

NOTE All parts of the forage chopper projecting upwards are contained between these two planes.

3.7**overall length**

distance between the vertical planes at the right angles to the median plane of the forage chopper and touching its front and rear extremities (AMTEC-UPLB, 2004)

NOTE All parts of the forage chopper, 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.

3.8**overall width**

distance between the vertical planes parallel to the median plane of the machine, each plane touching the outermost point of the forage chopper on its respective side (AMTEC-UPLB, 2004)

NOTE All parts of the forage chopper projecting sideways are contained between these two planes.

3.9**prime mover**

electric motor or internal combustion engine used to run the forage chopper (AMTEC-UPLB, 2004)

3.10**running-in period**

preliminary operation of the machine to make various adjustments prior to the conduct of test until the operation is stable (AMTEC-UPLB, 2004)

4 Principles of Test

The test shall be carried out to verify the actual specifications of Forage Chopper. Its specifications shall be validated with PNS/BAFS 418:2025 (Forage Chopper— Specifications).

5 Test Equipment and Materials

The test shall be carried out using the suggested minimum list of test equipment and materials in Annex A (Minimum list of test equipment and materials). The test equipment to be used shall be calibrated regularly, physically checked for operation, and shall be cleaned before and after each test.

6 General Considerations**6.1 Conditions for the test****6.1.1 Test site conditions**

The forage chopper shall be tested as installed for normal operation. The site should have ample provisions for crop handling, temporary storage and workspace.

6.1.2 Selection of forage chopper to be tested

The forage chopper shall be sampled for testing in conformance with PNS/BAFS 391:2024 (Methods of sampling for agricultural and biosystems power and machinery — Guidelines) or other suitable method of selection validated by the testing authority.

6.2 Test materials

6.2.1 Test materials to be used shall be commonly or locally grown.

6.2.2 The forage crops should be freshly harvested and tested within 8 to 24 hours after collection.

6.2.3 The amount of test material to be supplied shall be at least 75 % of input capacity of forage chopper.

6.3 Pre-test activities

6.3.1 Running-in and preliminary adjustment

The forage chopper should have undergone a running-in period before the start of the test. Various adjustments of the forage chopper shall be made according to the recommendation of the manufacturer. No other adjustments shall be permitted while the test is on-going.

6.3.2 Verification of specifications

6.3.2.1 This inspection is carried out to verify the mechanism, main dimensions, materials and accessories of the forage chopper in comparison with the list of specifications.

6.3.2.2 A plain and level surface shall be used as reference plane for verification of forage chopper's dimensional specifications.

6.3.2.3 The items to be inspected and verified shall be recorded using the form in Annex B (Specifications of forage chopper).

6.4 Termination of test

The test shall be terminated by the test engineer if during the test trials, the machine stops due to major component breakdown or malfunctions.

7 Performance Test and Procedures

7.1 Performance Test

The performance test is carried out to obtain actual data on overall machine performance using Annex C (Performance test data sheet).

7.2 Operation of the forage chopper

The forage chopper shall be operated at the recommended settings of the manufacturer and the setting shall be maintained during the test trial. After the test trial, the chopping area shall be cleaned and then prepared for the next test trial. This procedure shall be repeated for the succeeding test trials.

7.3 Test trial

A minimum of two test trials, with duration of at least 15 minutes per trial, shall be adopted. If there is a considerable discrepancy between the results of the first and second trials, an additional trial shall be performed to verify the data.

7.4 Test materials to be used

Test materials to be used for the running-in and for each test trial shall be the same. Initial data of the crop conditions such as type of forage, variety/species, source and dimensions of forage shall be recorded.

7.5 Data collection

7.5.1 Duration of test

The duration of each test trial shall commence at the start of the chopping operation and end after feeding of the last batch and shall be recorded as operating time

7.5.2 Noise level

The noise level, expressed in decibel [dB(A)], shall be measured 50 mm away from the operator's ear using a sound level meter. For each data on the location to be taken, there shall be a minimum of five observations. Before collecting data, it should be ensured that the operations and other functional characteristics of the machine have stabilized. The time of recording shall be properly spaced during the whole duration of the test trial.

7.5.3 Speed of components

The speed of the rotating shafts of the major components of the forage chopper shall be taken using a tachometer.

7.5.4 Fuel/Power consumption

The fuel tank shall be filled to its capacity, before the start of each test trial. The tank shall be refilled using a 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. In case an electric motor is used as a prime mover, a multimeter shall be used to measure electric energy consumption.

7.5.5 Determination of chopping efficiency

All uncut or partially cut forage material discharged from the output chute shall be manually collected and weighed, after the test trial. The weight shall be recorded for analysis. The chopping efficiency shall then be computed using the following formula in Annex E (Formula used for calculation and testing).

7.6 Sampling and sample handling

7.6.1 Sampling for test materials

Twenty representative samples shall be randomly taken for each test trial which represents the different conditions of test materials in the bulk. The dimensions of the test materials such as length, width and diameter shall be measured.

NOTE Representative samples are randomly selected from a batch, samples are expressed in pieces.

7.6.2 Sampling from output chute (Sample collection)

During each test trial, three samples each, weighing 600 g shall be randomly collected from the output of the forage chopper to be analyzed in the laboratory. The 300 g of the 600 g sample shall be used for laboratory analysis and the other 300 g shall be used for reference purposes or for an eventual second check in case of review.

7.6.3 Handling of samples

All samples to be taken to the laboratory shall be placed in resealable containers and properly labeled.

7.7 Laboratory Analysis of End Products

Laboratory analyses shall be made to determine moisture content, length of cut and quality of cut of the forage chopper. The laboratory test data sheet to be used is given in Annex D (Laboratory test data sheet).

7.7.1 Sample preparation and sorting

From the final 1.8 kg composite sample, three sets of 100 g shall be randomly selected. Each 100 g sample shall be manually sorted to separate clear-cut pieces or shredded pieces, based on visual assessment of the cut quality. The weight of the clear-cut portion from each 100 g sample shall be recorded.

7.7.2 Determination of moisture content

The determination of moisture content shall be taken using the oven-dry method as provided below.

7.7.2.1 Oven-dry method

For each test trial, select three representative samples weighing at least 100 g of chopped materials and place in the moisture can. The moisture can shall be sealed to ensure that no moisture is lost or gained by the sample between

the time it was collected and when it is weighed. The initial weight shall be recorded.

7.7.2.2 The sample shall be dried in the oven with a temperature of $103\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ for 24 hours.

7.7.2.3 After removing the samples from the oven, the moisture can with the sample should be placed in a desiccator and allowed to cool to the ambient temperature.

7.7.2.4 The moisture can plus the dried sample should be weighed. The final weight should be recorded. The moisture content shall be calculated using Equation E.1 in Annex E (Formula used for calculations and testing).

7.7.2.5 Secondary methods

In addition to the forced-air oven method, moisture content may be estimated using secondary methods. These methods provide rapid, on-site measurements but must be periodically calibrated against the oven-dry method to ensure accuracy.

7.7.2.5.1 Heat-type moisture testers

Determine moisture content by drying a sample with heated air and measuring weight loss, similar to a small oven. These are best for rapid field use but may be affected by ambient conditions.

A fixed amount of wet forage is placed in the tester, heated air passes through the sample, and moisture evaporates. The tester measures the weight loss to estimate moisture content.

7.7.2.5.2 Koster forage moisture tester

Operates on a principle similar to an oven with an electrical heating element and fan, a sample container, and a scale. Heated air is forced upward through the sample, evaporating water during drying.

The drying time is approximately 30 minutes, depending on sample type and moisture level. The unit operates on a standard 110-volt electrical outlet and is suitable for use in protected outdoor environments. It is recommended for samples with moisture content ranging from 20% to 90%.

7.7.2.6 Other heat-type testers

Provides rapid estimates and are useful when many samples need testing. Commercial units generally require 25 to 35 minutes per test.

7.7.2.6.1 Electronic moisture meters

Determines the moisture content by measuring an electrical property of the forage (conductance or capacitance) that changes as moisture content changes. These are fast and portable but rely on calibration curves.

A probe or sensor is inserted into the forage. The meter measures conductance or capacitance and displays a moisture content reading or provides a reference table.

7.7.2.6.2 Conductance meter

Measure the ability of the forage to conduct electricity. Conductance increases as moisture content increases.

7.7.2.6.3 Capacitance meter

Measure the ability of the forage to alter the electric field between two charged plates. Capacitance also increases with moisture content.

7.7.2.6.4 Delmhorst meter

Measure moisture content of windrowed or baled, in a bale chamber. This consists of a probe and a readout, with attachments including a handle, a short pin prod for windrow samples, a long probe for hay bales, and a contact sensor for bale chambers. The probe or sensor contains two electrodes for conducting electricity. Digital or dial indicators include “read” and “adjust” buttons. Suitable for hay only (not silage) with 5 to 50% moisture content.

7.7.2.6.5 Portable electronic moisture meters

Measure and provide a moisture content reading in about 4 minutes. It is best used for unfermented forage with 25 to 80% moisture content. However, results depend on proper probe contact and calibration.

7.7.3 Moisture probe

7.7.3.1 In testing for windrow samples, the representative sample shall be taken by collecting small quantities of forage crop from several different locations in a 5 to 10 gallon pail. In testing for baled samples, the probe shall be inserted perpendicular to the stems to ensure a good contact between the sensor and the forage crop.

7.7.3.2 The short pin prod will be used to probe the forage crop. The handle should be pressed to the retaining screw in the handle which contacts the palm of the hand.

7.7.3.3 By pressing the read button, the moisture reading shall be displayed. The forage crop in the container shall be mixed. The process shall be repeated. at least 10 readings.

7.8 Data recording and observations

The record sheet for all data and information during the test is given in Annex C (Performance test data sheet).

7.9 Analysis of output (Sample preparation and sorting)

In each test trial, three 30 pcs. of chopped products shall be randomly taken from the outlet. The length of each piece in the samples shall be measured to get the following:

- a. average length of cut;
- b. coefficient of variation; and
- c. percent error of cut (% error).

7.10 Quality of cut

Three sets of cut forage samples, each weighing 100 g, shall be randomly collected from the output of the forage chopper after each test trial. Each 100 g sample shall be manually sorted to separate clear-cut samples from shredded-cut samples based on visual inspection. The weight of the clear-cut portion from each sample shall be recorded. The measurement of the quality of cut shall be recorded using Annex D (Laboratory test data sheet).

8 Formula

The formulas provided in Annex E (Formula used for calculations and testing) shall be used.

9 Test Report

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

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

Annex A
(Informative)

Minimum list of equipment and materials

	Test equipment and materials	Quantity
A.1	Test equipment and instruments	
A.1.1	Field	1
A.1.1.1	Tachometer (contact type or photoelectric type) Range: 0 rpm to 5,000 rpm	1
A.1.1.2	Digital Timers (range: 60 minutes) Accuracy: 0.1 sec	2
A.1.1.3	Tape measure (with maximum length of 5 m)	1
A.1.1.4	Noise level meter Range: 30 dB(A) to 130 dB(A)	1
A.1.1.5	Weighing scale (capacity: 100 kg) Scale divisions: 500 g	1
A.1.1.6	Graduated cylinder (for engines) (500 mL capacity) multi-meter (for electric motors) 60 Hz, 220 V	1
A.1.1.7	Camera	1
A.1.1.8	Triple beam balance	1
A.1.1.9	Caliper (resolution: 0.01 mm)	1
A.1.2	Laboratory	
A.1.2.1	Weighing Scale (Sensitivity: 0.01 g)	1
A.1.2.2	Air oven	1
A.1.2.3	Desiccator with desiccants	1
A.1.2.4	Caliper (resolution: 0.01 mm)	1
A.1.2.5	Aluminum moisture can	9
A.2	Test materials	
A.2.1	Resealable sample bags	9
A.2.2	Labeling tags which include:	9
A.2.2.1	Date of Test	
A.2.2.2	Forage chopper on test	
A.2.2.3	Sample source	
A.2.2.4	Variety/ Species	
A.2.2.5	Trial Number	

Annex B
(Informative)

Specifications of Forage Chopper

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

GENERAL INFORMATION

Brand and Model: _____ Make: _____
 Serial No: _____ Type: _____
 Country of Manufacture/Origin : _____
 Testing Agency: _____
 Date Manufactured: _____ Date of Test: _____

ITEMS	Manufacturer's Specification	Verification by the Testing agency
B.1 Main structure		
B.1.1 Overall dimensions, mm		
B.1.1.1 Length		
B.1.1.2 Width		
B.1.1.3 Height		
B.1.2 Weight, without prime mover, kg if applicable		
B.2 Chopping assembly		
B.2.1 Type		
B.2.2 Dimension, D x W, mm		
B.2.3 Cutting device		
B.2.3.1 Type		
B.2.3.2 Dimension, L x W x t, mm		
B.2.3.3 No. of blades		
B.2.3.4 Means of attachment		
B.2.3.5 Materials		
B.3 Feeding table		
B.3.1 Dimension, L x W, mm		
B.3.2 Height from the ground, mm		
B.3.3 Dimension of feeding inlet, L x D, mm		
B.3.4 Material		
B.4 Output chute		
B.4.1 Dimension, L x W, mm		

B.4.2	Height from the ground, mm		
B.4.3	Dimension of outlet opening, L x D, mm		
B.4.4	Material		
B.5	Main frame		
B.5.1	Dimension, L x W, mm		
B.5.2	Material		
B.6	Prime mover		
B.6.1	Engine		
B.6.1.1	Brand		
B.6.1.2	Model		
B.6.1.3	Serial Number		
B.6.1.4	Type (stroke/ignition)		
B.6.1.5	Rated power, kW		
B.6.1.6	Rated speed, rpm		
B.6.1.7	Cooling system		
B.6.1.8	Starting system		
B.6.1.9	Weight, kg		
B.6.2	Electric motor		
B.6.2.1	Brand		
B.6.2.2	Model		
B.6.2.3	Serial Number		
B.6.2.4	Type		
B.6.2.5	Rated power, kW		
B.6.2.6	Rated speed, rpm		
B.6.2.7	Electric service required		
B.6.2.8	Line voltage, V		
B.6.2.9	Maximum load current, A		
B.6.2.10	Frequency, Hz		
B.6.2.11	Weight, kg		
B.7	Transport wheel		
B.7.1	Number of transport wheel		
B.7.2	Dimensions, D x W, mm		
B.8	Other components (as applicable)		
B.9	Power transmission system		
B.9.1	Prime mover to chopping assembly		
B.9.1.1	Prime mover		
B.9.1.2	Chopping assembly		
B.9.1.3	Belt size		
B.9.2	Chopping assembly to feed roller		
B.9.2.1	Chopping assembly		
B.9.2.2	Feed roller		
B.9.2.3	Belt size		
B.10	Safety feature		
B.11	Special feature		

Annex C
(Informative)

Performance test data sheet

Test Trial No: _____

Data: _____

Test Engineer: _____

Location: _____

Assistants: _____

Test Specimen: _____

Test Requested by: _____

Manufacturer: _____

ITEMS	Trial 1	Trial 2	Trial 3	Average
C.1 Conditions of test sample				
C.1.1 Forage Name				
C.1.2 Variety/Species (if applicable)				
C.1.3 Source				
C.1.4 Length of forage, mm				
C.1.5 Diameter of forage, mm (if applicable)				
C.1.6 Width of forage, mm (if applicable)				
C.2 Operating time, h				
C.3 Weight of input, kg				
C.4 Weight of output, kg				
C.5 Input Capacity, kg/h				
C.6 Output Capacity, kg/h				
C.7 Material Recovery, %				
C.8 Chopping efficiency, %				
C.9 Speed of components, rpm				
C.10 Primemover				
C.10.1 Without load				
C.10.2 With load				
C.11 Chopping shaft				
C.11.1 Without load				
C.11.2 With load				
C.12 Noise level, db(A)				
C.13 Main/ Feeding Operator				
C.13.1.1 Without load				
C.13.1.2 With load				
C.14 Output collector/ Bagger				
C.14.1 Without load				
C.14.2 With load				
C.15 Fuel consumed, mL				
C.16 Fuel consumption, L/h				
C.17 Power Requirements				
C.17.1 Voltage, V				

C.17.2 Current, A				
ITEMS	Trial 1	Trial 2	Trial 3	Average
C.17.3 Power, kW				
C.17.4 Minimum labor requirement				

C.17 Observations

C.17.1 Ease of loading

C.17.2 Ease of cleaning parts

C.17.3 Ease of adjusting and repair of parts

C.17.4 Ease of transporting the machine

C.17.5 Safety

C.17.6 Vibration

Annex D
(Normative)

Laboratory test data sheet

Machine Tested: _____

Analyzed by: _____

D.1 Moisture Content Determination (Oven Method)

Item	Trial 1			Trial 2			Trial 3			Average
Initial weight, g										
weight of can, g										
Final Weight, g										
Final weight + can, g										
Moisture content, %										
General Average										

D.2 Length of Cut

Cut setting: _____

Sample	Length of sample, mm									Average
	Trial 1			Trial 2			Trial 3			
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										

Sample	Length of sample, mm									
	Trial 1			Trial 2			Trial 3			Average
22										
23										
24										
25										
26										
27										
28										
29										
30										
Average Length of cut										
Average Coefficient of Variation, %										
Percent Error										

D.3 Observations on the quality of cut

Item	Trial 1			Trial 2			Trial 3			Average
Weight of sample, g (100 g)										
Clear cut, g										
Shredded cut, g										
Clear cut, %										
Shredded cut, %										

Annex E
(Normative)

Formula used for calculations and testing

E.1 Moisture content

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

where:

$MC_{wetbasis}$ is the moisture content, %
 W_i is the initial mass of the sample, g
 W_f is the final mass of the sample, g

E.2 Input capacity

$$Ci = \frac{W_i}{T_o}$$

where:

Ci is the input capacity, kg/h
 W_i is the weight of input materials, kg
 T_o is the time of operation, h

E.3 Output capacity

$$Co = \frac{W_p}{T_o}$$

where:

Co is the output capacity, kg/h
 W_p is the weight of total output materials, kg
 T_o is the time of operation, h

E.4 Chipping efficiency

$$Ce = \frac{W_o - W_{uc}}{W_o} \times 100$$

where:

Ce is the chopping efficiency, %
 W_{uc} is the weight of uncut materials, kg
 W_o is the weight of total output materials, kg

E.5 Coefficient of variation

$$Cv = \frac{S}{\bar{x}} \times 100 \quad (5)$$

$$\bar{x} = \frac{\sum x}{n} \quad (6)$$

$$S = \sqrt{S^2} \quad (7)$$

$$S^2 = \frac{\sum (x - \bar{x})^2}{n - 1} \quad (8)$$

where:

Cv is the coefficient of variation, %
 S is the standard deviation
 S^2 is the variance
 x is the value of observation
 \bar{x} is the mean of x
 n is the number of observations

E.6 Percent error of cut

$$E = \left| \frac{\bar{x} - x_o}{x_o} \right| \times 100$$

where:

E is the error, %
 \bar{x} is the mean of length of cut

x_o is the set of values based on the length of cut setting

E.7 Fuel consumption

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

where:

F_C is the fuel consumption, L/h
 F_1 is the amount of fuel consumed, L
 T_o is the total time of operation, h

E.8 Material recovery

$$M = \frac{O}{I} \times 100$$

where:

M is the material recovery, %
 O is the output materials, kg
 I is the input materials, kg

E.9 Quality of cut

E.9.1 Clear-cut

$$Cc = \frac{W_c}{W_t} \times 100$$

where:

C_c is the clear-cut, %
 W_c is the weight of clear-cut samples, g
 W_t is the weight of samples, g

E.9.2 Shredded cut

$$Cs = \frac{W_s}{W_t} \times 100\%$$

where:

- C_c is the shredded cut, %
 W_c is the weight of shredded cut samples, g
 W_t is the weight of samples, g

References

- Agricultural Machine and Testing Evaluation Center (AMTEC)-University of the Philippines Los Baños (UPLB). (2004). Forage chopper — Methods of test (PAES 219: 2004). <https://amtec.uplb.edu.ph/wp-content/uploads/2019/07/paes-218.pdf>
- Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2025). Forage chopper — Methods of test (PNS/BAFS 419:2025).
- International Organization for Standardization (ISO). (2021). Equipment for harvesting-Forage Harvesters-Part 1: Vocabulary (ISO 8909-1:2021) <https://www.iso.org/obp/ui/en/#iso:std:iso:8909:-1:ed-2:v1:en>
- International Organization for Standardization (ISO). (2021). Equipment for harvesting-Forage Harvesters-Part 2: Specification of characteristics and performance (ISO 8909-1:2021) <https://www.iso.org/obp/ui/es/#iso:std:iso:8909:-2:ed-2:v1:en>
- International Organization for Standardization (ISO). (2021). Equipment for harvesting-Forage Harvesters-Part 3: Test methods <https://www.iso.org/standard/77757.html>
- Mulatu, Y. (2021). Design, fabrication and performance evaluation of animal feed chopping machine. *African Journal of Agricultural Research*, 17(8), 1155-1160. <https://academicjournals.org/journal/AJAR/article-full-text-pdf/7B27FB667597>
- Slocombe, J., Price, R., & Lomas, L. (2008). Determining forage moisture concentration, Kansas State University https://bookstore.ksre.ksu.edu/pubs/determining-forage-moisture-concentration_MF2833.pdf
- Wallau, M., & Vendramini, J. (2019). Methods of forage Moisture Testing: SS-AGR-178/AG181, rev. 6/2019. *EDIS*, 2019(3). <https://doi.org/10.32473/edis-ag181-2019>

**Department of Agriculture (DA)
Bureau of Agriculture and Fisheries Standards (BAFS)**

**Technical Working Group (TWG) for the Philippine National Standard (PNS) on
Forage Chopper — Methods of Test**

Chairperson

Santiago, Marife, ABE
Valencia, Ronnie, ABE

**Center of Agri-Fisheries and Biosystems Mechanization (BIOMECH)-
University of the Philippines Los Baños (UPLB)**

Vice Chairperson

Andres Tuates, Jr., PhD
Suan, Christ Russel, ABE

**Philippine Center for Postharvest Development and Mechanization
(PHilMech)- DA**

Members

- | | | | |
|----|--|----|---|
| 1 | Aying, Fatima, ABE | 11 | Ella, Jervee, ABE |
| 2 | Ignacio, Ma. Cristine, PhD
Agricultural Machinery and Testing
Evaluation Center (AMTEC)-UPLB | 12 | Jardin-Milare, Triniza, ABE
DA RFO-CALABARZON |
| 3 | Del Rosario, Neal, ABE
Central Luzon State University
(CLSU) | 13 | Mora, Peter Paul, ABE |
| 4 | Gallegos, Ralph Kristoffer, PhD | 14 | Tuberon-Millano, Katrina, ABE
DA RFO-Bicol |
| 5 | Zubia, Omar, PhD
Institute of Agricultural and
Biosystems Engineering (IABE)-
UPLB | 15 | Orbeta, Ronald, ABE |
| 7 | Atienza, Carlo
Bureau of Agricultural and Fisheries
Engineering (BAFE)- DA | 16 | May-as, Bea Khessa Czarina, ABE
DA RFO- Northern Mindanao |
| 8 | Melendez, Peachie, ABE | 17 | Falic, Ma. Eden, ABE |
| 9 | Talaro, Niña Mae, ABE
Philippine Council for Agriculture
and Fisheries (PCAF)-DA | 18 | Tamayo, Rodolfo
Agricultural Machinery
Manufacturers and Distributors
Association (AMMDA), Inc. |
| 10 | Vanguardia, Redentor, ABE
Philippine Carabao Center (PCC)-DA | | |

Management Team

Lanuza, Alpha, DVM
Hernandez, Gari Pellinor, DVM
Marimla, Clark Gerald, ABE
Villacentino, Sheila Mae
Olarde, Madellaine, ABE

Advisers

Mandigma, Mary Grace, PFT



BUREAU OF AGRICULTURE AND FISHERIES STANDARDS

**BPI Compound, Visayas Avenue, Vasra, Quezon City 1128 Philippines
T/ (632) 928-8741 to 64 loc. 3301-3319
E-mail: bafs@da.gov.ph
Website: www.bafs.da.gov.ph**