

PHILIPPINE NATIONAL STANDARD

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**Agricultural machinery – Power Sprayer
for Mango – Methods of Test**



BUREAU OF PRODUCT STANDARDS

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National Foreword

This Philippine Agricultural Engineering Standards PAES 158:2011, Agricultural machinery – Power Sprayer for Mango – 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) under the project entitled “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 BPS Directives Part 3:2003 – 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:

DARE.2009. Agricultural mechanization and energy management. DARE/ICAR Annual Report 2008–2009.

Resende, J.V. and V. Silveira Jr. 2004. Air velocity profiles in air blast freezers filled with boxes of fruit pulp models. *Engenharia Térmica (Thermal Engineering)*, Vol. 3 · No. 2 · December 2004 · p. 127-133.

Sumner, P.E. 2005. Pecan orchard air blast sprayers. Department of Agricultural and Biological Engineering. The University of Georgia.

United States Patent US3774845. Orchard Sprayer.

United States Patent USD422056. Hose End Trigger Power Spray Nozzle.

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Agricultural Machinery – Power Sprayer for Mango – Methods of Test

1 Scope

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

1.1 verify the mechanism, dimensions, materials, accessories of the power sprayer and the list of specifications submitted by the manufacturer;

1.2 determine the performance of the equipment; and,

1.3 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 157:2011 Agricultural Machinery – Power sprayer for mango – Specifications

3 Definitions

For the purpose of this standard, the definitions given in PAES 157:2011 and the following shall apply:

3.1**mean diameter**

average diameter of droplets

3.2**number median diameter**

diameter which divides the number of droplets into two equal halves

3.3**sprayer range**

distance from the nozzle at which spraying could be carried out

3.4**volume median diameter**

diameter divides the volume of spray into two equal halves

4 General Conditions for Test and Inspection

4.1 Role of manufacturer or dealer

The manufacturer shall submit the operator's manual of the power sprayer and shall abide by the terms and conditions set forth by an official testing agency.

4.2 Role of the operator

An officially designated operator shall be skilled and shall be able to demonstrate, operate, adjust and repair matters related to the operation of the equipment.

4.3 Test site conditions

The site where the power sprayer shall be tested shall have a space greater than the maximum reach of the equipment as specified in the operator's manual.

4.4 Test instruments or equipment

The suggested list of minimum test materials needed to carry out the power sprayer test is shown in Annex A.

4.5 Termination of test for power sprayer

If during the test, the power sprayer encounters major component breakdown or malfunction, the test engineer shall terminate the test.

5 Test and Inspection

5.1 Verification of the manufacturer's technical data and information

This inspection is carried out to verify the mechanism, dimensions, materials and accessories of the power sprayer in comparison with the list of manufacturer's technical data and information. All data shall be recorded in Annex B.

5.2 Performance test

5.2.1 This is carried out to obtain actual data on overall performance of the equipment.

5.2.1.1 The noise emitted by the power sprayer shall be measured 50 mm away from the operator's ear level and one meter away from the source of noise. This shall be recorded in Annex C.

5.2.1.2 The fuel consumption of the engine of the power sprayer shall be obtained by measuring the volume of fuel refilled after the test. The tank shall be filled to full capacity before and after each trial.

- 5.2.1.3** Discharge rate of the power sprayer shall be obtained either by directly using a graduated cylinder and getting the time or by measuring the volume of liquid required to refill the power sprayer after spraying and getting the total time to consume the liquid. Discharge rate shall be computed in Annex D.
- 5.2.1.4** The sprayer range shall be obtained by determining the distance of the spray droplet blown from the nozzle. The operator shall measure the longest reach of the droplet from the tip of the nozzle. Wind speed in the test site shall be measured and recorded.
- 5.2.1.5** The power sprayer shall be tested for uniformity of droplet sizes. The pressure shall be set on the manufacturer's recommended setting. The power sprayer shall be allowed to pass over a series of magnesium oxide coated glass slides. The slides shall be examined under a microscope. Droplet sizes shall be recorded. In the absence of magnesium oxide coated glass slides, the tank shall be filled with a solution of dye. The spray shall pass over a series of collecting paper or glass slides. The dried paper, slides or their photographs shall be examined under a microscope. The mean diameter and percent uniformity shall be computed using the formula in Annex D. The volume median diameter (VMD) and the number median diameter (NMD) shall be obtained. The ratio of the VMD to the NMD shall be obtained
- 5.2.1.6** Condition of power sprayer after the test shall be compared to its initial condition.
- 5.2.1.7** Welded parts shall be inspected.
- 5.2.1.8** All data shall be recorded in Annex C.

5.3 Test trial

There shall be at least three (3) trials to conduct the test.

6 Test Report

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

- 6.1** Title
- 6.2** Summary
- 6.3** Purpose and Scope of Test
- 6.4** Methods of Test
- 6.5** Description of the Machine

Table 1 – Machine Specifications

6.6 Results and Discussions

6.7 Observations (include pictures)

Table 2 –Performance test data

6.8 Name(s), signature(s) and designation(s) of test engineer(s)

Annex A

Suggested Minimum List of Test Equipment

Items	Quantity
A.1 timer accuracy: 0.10 s	1
A.2 anemometer	1
A.3 fuel consumption	
graduated cylinder capacity, 1000 mL	1
A.4 droplet size analysis microscope glass slides collecting paper magnesium oxide coated glass slides dye solution	1 as needed as needed as needed as needed
A.5 noise level meter	1

Annex B
(informative)

Specifications of Power sprayer

Name of Applicant/ Distributor: _____

Address: _____

Tel No: _____

GENERAL INFORMATION

Name of Manufacturer: _____

Make: _____

Classification: _____

Serial No: _____ Brand/Model: _____

Production year: _____

Testing Agency: _____ Test Engineer: _____

Date of Test: _____ Location of Test: _____

Items to be inspected

ITEMS	Manufacturer's Specification	Verification by the Testing agency
B.1 overall dimensions		
B.1.1 height, mm		
B.1.2 length, mm		
B.1.3 width, mm		
B.2 chemical tank		
B.2.1 material		
B.2.2 thickness, mm		
B.3 chemical tank cover		
B.3.1 material		
B.3.2 gasket		
B.3.2.1 material		
B.3.2.2 thickness, mm		
B.3.3 capacity, L		
B.4 spray hose		
B.4.1 material		
B.4.2 thickness, mm		
B.4.3 length, mm		
B.5 lance		
B.5.1 material		
B.5.2 thickness, mm		
B.5.3 length, mm		
B.6 nozzle		
B.6.1 diameter, mm		
B.6.2 material		
B.7 prime mover		
B.7.1 type		
B.7.2 power rating, kW		

ITEMS	Manufacturer's Specification	Verification by the Testing agency
B.7.3 type of starting		
B.7.4 revolutions per minute		
B.8 mounting		
B.8.1 type of mounting		
B.9 width of spray, m		
B.10 sprayer range, m		
B.11 angle of spray, deg		
B.12 pump		
B.12.1 operating pressure		
B.12.2 type		

ANNEX C

Performance Test Data Sheet

Items to be measured and Inspected

C.1 Test site conditions	Remarks
C.1.1 area, m ²	
C.1.2 wind speed, kph	

C.2 Power sprayer performance				
Items	Trials			Ave.
	I	II	III	
C.2.1 Noise level, dB				
C.2.2 Fuel consumption, mL				
C.2.3 Max. height reach, m				
C.2.4 Discharge rate, Lpm				
C.2.5 Sprayer range, m				
C.2.6 Width of spray, m				

C.2.7 Droplet size analysis										
Sample	I	II	III	IV	V	VI	VII	VIII	IX	X
Diameter, mm										
Mean diameter, mm:										
Percent uniformity, %:										
Volume median diameter, mm:										
Number median diameter, mm:										
VMD/NMD:										

C.3 Other observations	Remarks
C.3.1 ease of use *	
C.3.2 type of filtration system*	
C.3.3 detached welded parts	
C.3.4 loosened bolts	
C.3.5 miscellaneous:	

* rating: 1 – very good 4 – poor
 2 – good 5 – very poor
 3 – satisfactory

ANNEX D

Formula Used During Calculation and Testing

D.1 Discharge rate

$$Q = \frac{V}{t}$$

where:

- Q discharge rate of the power sprayer, Lpm
- V total volume of liquid required to refill the power sprayer, L
- t total time required to consume the liquid, min

D.2 Percent uniformity of droplet size

$$\% u = \frac{|D_m - D_p|}{D_m} \times 100$$

where:

- $\% u$ percent uniformity, %
- D_m mean diameter, mm
- D_p actual diameter, mm

Philippine Agricultural Engineering Standards

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

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