

Foreword

This national standard is a revision of the AMTEC Standard Procedures of Inspection and Test series of 1980 – “Seeding Equipment With or Without Fertilizing Attachment”. The pursuance of this standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) under the project entitled “Enhancing the Implementation of AFMA Through Improved Agricultural Engineering Standards” which was funded by the Bureau of Agricultural Research (BAR) of the Department of Agriculture (DA).

This standard has been technically prepared in accordance with PNS 01-4:1998 (ISO/IEC Directives Part 3:1997) – Rules for the Structure and Drafting of International Standards.

The word “shall” is used to indicate requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted.

The word “should” is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that certain course of action is preferred but not necessarily required.

Upon adoption of the Department of Agriculture (DA) as National Standard, this revised standard will supersede AMTEC Standard Procedures of Inspection and Test series of 1980.

In the preparation of this standard, the following documents/publications were considered:

Regional Network for Agricultural Machinery (RNAM) Test Codes And Procedures for Farm Machinery. Technical Series No. 12 :1983.

Stevens G.N. *Equipment Testing and Evaluation*. Overall Division, National Institute of Agricultural Engineering (NIAE), Wrest Park, Silsoe Bedford England. 1982.

All annexes in this standard are normative.

Agricultural Machinery – Seeder and Planter – Methods of Test

1 Scope

This standard specifies the methods of test and inspection for various types of seeders and planters such as manually-operated, animal-drawn and tractor power-driven drill and planter with or without fertilizer applicator. This standard is not applicable to broadcaster and wetland seeder. Specifically, it shall be used to:

- 1.1 verify the requirements specified in PAES 122 and the specifications submitted by the manufacturer;
- 1.2 determine the laboratory performance of the seeder and planter; and
- 1.3 determine the field performance of the seeder and planter.

2 References

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

PAES 122:2001, Agricultural Machinery – Seeder and Planter – Specifications

PAES 103:2000, Agricultural Machinery – Method of Sampling

3 Definitions

For the purpose of this standard the definitions given in PAES 122 and the following shall apply:

3.1**fuel consumption**

volume of fuel consumed by the engine on per hour basis

3.2

wheel slip of seeder or planter

Wheels slip is determined by the following formula:

$$\text{Wheel slip} = \frac{N_1 - N_0}{N_1} \times 100$$

where:

N_1 is the sum of the revolutions of all driving wheels for a given distance with slip, rpm

N_0 is the sum of the revolutions of all driving wheels for the same distance without slip, rpm

4 General Conditions for Test and Inspection

4.1 Seeder on Test

The seeder or planter submitted for test shall be taken from production model or series of production and shall be sampled in accordance with PAES 103.

4.2 Role of the manufacturer/dealer

The manufacturer/dealer shall submit to the official testing agency the specifications and other relevant information on the seeder. An official representative shall be appointed to conduct minor repair, handle, adjust and witness the test. It shall be the duty of the representative to make all decisions on matters of adjustment and preparation of the machine for testing. The manufacturer/dealer shall abide with the terms and conditions set forth by the official testing agency.

4.3 Running-in and preliminary adjustment

The seeder to be tested shall be run-in prior to test as recommended by the manufacturer.

4.4 Test instruments and other needs

The instruments to be used shall have been checked and calibrated by the testing agency prior to the measurements. The seeds to be used during the test shall be of varieties presently grown in the Philippines.

4.5 Suspension of Test

If during the test run, the seeder stops due to breakdown or malfunction so as to affect the seeder's performance, the test shall be suspended at the discretion of the test engineer and concurred by the company representative.

5 Test and Inspection

5.1 Verification of the Manufacturer's Technical Data and Information

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

5.1.2 A plain and level surface shall be used as reference plane for verification of dimensional seeder specifications.

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

5.2 Laboratory performance test

5.2.1 Test for metering mechanism

5.2.1.1 This is carried out to examine the performance of metering mechanism, the result of which can provide the basic data for the field performance.

5.2.1.2 This test should be conducted on the kind of seed/fertilizers of which the machine is suitable as specified by the manufacturer.

5.2.1.3 In case of hand seeder, the number of seeds delivered by one action of an operator's hand under appropriate adjustment of metering mechanism should be confirmed for each kind of seed.

5.2.1.4 In case of other seeders, they are jacked up and the drive wheel of the metering mechanisms is rotated in a number of revolutions to collect sufficient amount of seeds/fertilizer to compute for its delivery rate. The delivery rates per hectare are calculated with the weight of seeds/fertilizer from the delivery tube with the corresponding distance traveled by the seeder based on the number of revolutions of the drive wheel.

5.2.1.5 If possible, this test shall be carried out at full, half and one-eighth of the seeder's hopper capacity with three delivery rate settings – maximum, minimum and intermediate (around the mean of maximum and minimum).

5.2.2 Investigation on pattern of seed and fertilizer deposited

5.2.2.1 This is carried out to investigate the pattern of seed and fertilizer deposited by the seeder.

5.2.2.2 This test may be accomplished by running the seeder with full outfit over a greased board or a sheet of blanket or felt at the same speed as in the field. The seeds and fertilizer are trapped on the board or the sheet at the points where they fall.

5.2.3 The items to be investigated and measured shall be recorded in Annex B.

5.3 Field performance test

5.3.1 This test is carried out to obtain actual data on overall machine performance, operating accuracy, work capacity and adaptability to varied crops and field conditions.

5.3.2 This test shall be conducted for at least two test trials for each kind of seed the seeder is suitable.

5.3.3 The seeds to be used for this test should be the same as the ones used in metering mechanism test. Each test trial shall be conducted in an area of not less than 500 m² for manual seeding implement and 1,000 m² for power-operated seeders.

5.3.4 Measure at random two-meters along each row for at least ten rows planted by the seeder. For each two meter distance, measure/record the following:

5.3.4.1 depth of seeding

5.3.4.2 distance between hills (if applicable)

5.3.4.3 number of seeds planted per hill

5.3.4.4 number of missed hill

5.3.4.5 number of damaged/cracked seeds

5.3.4.6 number of hills with incorrect number of seeds delivered

5.3.5 Other items to be measured, observed and computed are:

5.3.5.1 Performance and accuracy

- a. Space of rows planted
- b. Population of seeds planted in unit area
- c. Rate of missing hill (in hill planting)
- d. Wheel slippage and sinkage
- e. Ease of handling and operation
- f. Ease of turning
- g. Ease of refilling seed or fertilizer
- h. Ease of adjustments

5.3.5.2 Work rate and labor requirement

- a. Actual traveling speed
- b. Actual operating time
- c. Time spent for turning at headland
- d. Time spent for adjustment of machine
- e. Time spent for machine trouble
- f. Working capacity (ha/h)
- g. Fuel consumption (for tractor power-driven seeders)
- h. Required number of workers

5.3.6 The items to be measured and observed shall be recorded in Annex C.

6 Data Analysis

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

7 Test Report

- 7.1 Name of testing agency
- 7.2 Test report number
- 7.3 Title
- 7.4 Summary
- 7.5 Purpose and scope of test
- 7.6 Methods of test
- 7.7 Description of the machine
 - 7.7.1 Table 1 – Machine Specifications
- 7.8 Table 2 – Laboratory Performance Test Data
- 7.9 Table 3 – Field Performance Test Data
- 7.10 Observations
- 7.11 Name and signature of test engineer

Annex A

Inspection Sheet for Seeder

Name of Applicant : _____

Address : _____

Telephone No. : _____

Name of Distributor : _____

Address : _____

Name of Manufacturer : _____

Factory Address : _____

General Information

Brand : _____ Model : _____

Serial No. : _____

Classification (hand seeder, planter, seed drill) :

Production date of seeder to be tested (if available) :

ITEMS TO BE INSPECTED

ITEMS	Manufacturer's Specification	Verification by Testing Agency
A1 Dimensions and weight of the seeder		
A1.1 Overall length, mm		
A1.2 Overall width, mm		
A1.3 Overall height, mm		
A1.4 Weight (hoppers empty), kg		
A2 Number of rows and row spacing, mm		
A3 Nominal working width, mm		
A4 Hill distance, mm (if applicable)		
A5 Seeds and their condition for which equipment is suitable		
A6 Number of fertilizer openings and fertilizers for which the equipment is suitable		
A7 Suitable field conditions		

ITEMS	Manufacturer's Specification	Verification by Testing Agency
A8 Traveling		
A8.1 Source of power		
A8.1.1 Manual		
A8.1.2 Animal-drawn		
A8.1.3 Tractor power-driven		
A8.1.3.1 Seed drill		
A8.1.3.2 Planter		
A8.2 Recommended traveling speed of equipment, kph		
A8.3 Recommended minimum drawbar output of power tiller or tractor, kW		
A9 Metering Mechanism		
A9.1 Type and method of changing delivery rate		
A9.1.1 Seed		
A9.1.2 Fertilizer		
A9.2 Source of power of metering mechanism		
A9.2.1 Ground wheel		
A9.2.2 PTO		
A9.2.3 Others		
A9.3 Recommended PTO speed, rpm (if applicable)		
A9.4 Transmission mechanism and speed ratio of metering shaft to input shaft (ground wheel or PTO shaft)		
A10 Hill-dropping mechanism		
A11 Hopper		
A11.1 Number		
A11.1.1 Seed		
A11.1.2 Fertilizer		
A11.2 Capacity, L		
A11.2.1 Seed		
A11.2.2 Fertilizer		
A11.3 Material		
A11.3.1 Seed		
A11.3.2 Fertilizer		

--	--	--

ITEMS	Manufacturer's Specification	Verification by Testing Agency
A12 Clutch for metering mechanism		
A12.1 Type		
A12.2 Location		
A13 Furrow or hole opener		
A13.1 Type		
A13.2 Material		
A14 Seed covering device		
A14.1 Type		
A14.2 Material		
A15 Location of fertilizer outlet related to seed outlet		
A15.1 Fertilizer covering device (if applicable)		
A15.1.1 Type		
A15.1.2 Material		
A16 Ground wheel		
A16.1 Diameter, mm		
A16.2 Material		
A17 Handle of animal-drawn equipment		
A17.1 Construction		
A17.2 Height of handle from ground level, mm		
A17.3 Detail of adjustment		
A18 Marking device (detail of marking)		
A19 Hitch shape and construction (in case of tractor mounted with category of three point linkage)		
A20 Safety arrangement		
A20.1 Cover		
A20.2 Power transmission		
A20.3 Other moving parts		
A20.4 Other details		
A21 Recommended traveling speed, kph		
A22 Working capacity, ha/h (given by the manufacturer)		
A23 Any other detail (special features)		

Annex B

Laboratory Performance Test Data Sheet

B1 Seed Metering

Date of test : _____

B1.1 Test condition

B1.1.1 Conditions of seeds

B1.1.1.1 Name of seed : _____

B1.1.1.2 Variety of seed : _____

B1.1.1.3 Shape : _____

B1.1.1.4 Average size of seeds : _____

Length, mm : _____

Width, mm : _____

Thickness, _____ mm :

B1.1.1.5 Weight of 1000 seeds, g : _____

B1.1.1.6 Moisture content, % wb : _____

B1.1.1.7 Bulk density, kg/L : _____

B1.1.1.8 Purity (%), uniformity of size, etc : _____

B1.1.2 Condition of grain seeder

B1.1.2.1 Metering shaft speed (adjustment, if any) : _____

B1.1.2.2 Mechanism and speed : _____

B1.1.2.3 Delivery opening adjustment : _____

B1.2 Delivery rate

Particulars	Delivery rate setting								
	Maximum quantity of seeds in hopper			Intermediate quantity of seeds in hopper			Minimum quantity of seeds in hopper		
	1	1/2	1/8	1	1/2	1/8	1	1/2	1/8
B1.2.1 Hand-operated metering (dibbler, jabber)									
B1.2.1.1 Number of seeds delivered by one hand action									
B1.2.1.2 Estimated delivery rate, kg/ha at row spacing, mm hill distance, mm									
B1.2.1.3 Rate of damaged seed by metering mechanism, %									
B1.2.2 Ground wheel-driven metering									
B1.2.2.1 Effective rolling diameter of ground wheel, m									
B1.2.2.2 Revolution of ground wheel for measuring delivery									
B1.2.2.3 Delivery for B1.2.2.2, kg									
B1.2.2.4 Delivery rate, kg/ha									
B1.2.2.5 Rate of damaged seeds by metering mechanism									
B1.2.2.5 Observations									
B1.2.3 PTO-driven metering									
B1.2.3.1 PTO speed, rpm									
B1.2.3.2 Tractor traveling speed in relation to B1.2.2.1, kph									
B1.2.3.3 Time for measuring delivery, s									
B1.2.3.4 Delivery for B1.2.2.3, kg									
B1.2.3.5 Delivery rate, kg/ha									
B1.2.3.6 Quantity of damaged seeds by metering mechanism, %									
B1.2.4 Pattern of seed deposition (line, band, hill, single seed, precision planting)									

B2 Fertilizer metering

Date of test : _____

B2.1 Test condition**B2.1.1** Conditions of fertilizer**B2.1.1.1** Kind : _____**B2.1.1.2** Name : _____**B2.1.1.3** Moisture content, % db : _____**B2.1.1.4** Bulk density, kg/L : _____**B2.1.2** Condition of grain seeder**B2.1.2.1** Metering shaft speed adjustment (if any) : _____**B2.1.2.2** Mechanism and speed : _____**B2.1.2.3** Delivery opening adjustment : _____**B2.2** Delivery rate

Particulars	Delivery rate setting								
	Maximum quantity of fertilizer in hopper			Intermediate quantity of fertilizer in hopper			Minimum quantity of fertilizer in hopper		
	1	1/2	1/8	1	1/2	1/8	1	1/2	1/8
B2.2.1 Ground wheel-driven metering									
B2.2.1.1 Effective rolling diameter of ground wheel, m									
B2.2.1.2 Revolution of ground wheel for measuring delivery									
B2.2.1.3 Delivery for B2.2.1.2, kg									
B2.2.1.4 Delivery rate, kg/ha									
B2.2.1.5 Observations									
B2.2.2 PTO-driven metering									
B2.2.2.1 PTO speed, rpm									
B2.2.2.2 Tractor traveling speed in relation to B2.2.2.1, kph									
B2.2.2.3 Time for measuring delivery, s									
B2.2.2.4 Delivery rate, kg/ha									
B2.2.2.5 Observations									
B2.2.3 Pattern of seed deposition (line, band, spaced, etc)									

Annex C

Field Performance Test Data Sheet

Items to be inspected

Particulars	Test Number			
	1	2	3	Ave.
Date of Test				
C1 Test Condition				
C1.1 Condition of seed				
C1.1.1 Name				
C1.1.2 Variety				
C1.1.3 Shape				
C1.1.4 Size				
C1.1.4.1 Length, mm				
C1.1.4.2 Width, mm				
C1.1.4.3 Thickness, mm				
C1.1.5 Weight of 1000 seeds, g				
C1.1.6 Moisture content, % wb				
C1.1.7 Bulk density, kg/L				
C1.1.8 Germination rate, %				
C1.2 Condition of fertilizer				
C1.2.1 Name				
C1.2.2 Kind				
C1.2.3 Moisture content, % db				
C1.2.4 Bulk density, kg/L				
C1.3 Condition of field				
C1.3.1 Location				
C1.3.2 Field type and soil condition				
C1.3.3 Length, m				
C1.3.4 Width, m				
C1.3.5 Area, m ²				
C1.3.6 Shape				
C1.3.7 Method of land preparation				
C1.3.8 Distribution of soil particles in seedbed				
C1.3.9 Soil moisture content, % db				
C1.3.10 Bulk density of soil, kg/m ³				
C1.3.11 Penetrometer profile and cone index in depth of seeding in in case of no-land preparation				

Particulars	Test Number			
	1	2	3	Ave.

C1.4 Condition of operation				
C1.4.1	Row spacing, mm			
C1.4.2	Seeding rate, kg/ha			
C1.4.3	Depth of seeding, mm			
C1.4.4	Fertilizing rate, kg/ha			
C1.5 Condition of metering mechanism				
C1.5.1	Metering shaft speed adjustment (if any)			
C1.5.2	Delivery opening adjustment			
C1.6 Condition of power source				
C1.6.1	Draft animal			
C1.6.1.1	Breed			
C1.6.1.2	Number			
C1.6.2	Power tiller or tractor			
C1.6.2.1	Make and model			
C1.6.2.2	Rated engine horsepower, kW			
C1.6.2.3	Rated drawbar horsepower, kW			
C1.6.2.4	Gear shift setting			
C1.6.2.5	PTO speed, rpm (if used)			
C1.6.2.6	Speed of rotary tiller, rpm (if used)			
C2 Field Performance				
C2.1	Actual operating time, min			
C2.2	Time lost owing to			
C2.2.1	Turning at headland, min			
C2.2.2	Adjustment, min			
C2.2.3	Refilling of seed/fertilizer, min			
C2.2.4	Repair, min			
C2.3	Actual area covered, m ²			
C2.4	Effective working width (no. of rows x row spacing), m			
C2.5	Traveling speed, kph			
C2.6	Effective field capacity, ha/h			
C2.7	Field efficiency, %			
C2.8	Travel pattern			
C2.9	Width of headland, m			
C2.10	Wheel slip, %			
C2.11	Fuel consumption a. L/h b. L/ha			
C2.12	Depth of seeding, mm			
C2.13	In case of hill planting a. Distance between hills ,mm b. Number of seeds per hill c. Missing hills, %			
C2.14	In case of drill No. of seeds sown per area			

C2.15 Comments and observations on the following:

C2.15.1	Ease of operation in traveling straight path	<hr/> <hr/> <hr/>
C2.15.2	Ease of turning	<hr/> <hr/> <hr/>
C2.15.3	Ease of refilling seed and fertilizer	<hr/> <hr/> <hr/>
C2.15.4	Ease of replacing and adjusting the parts	<hr/> <hr/> <hr/>
C2.15.5	Safety features	<hr/> <hr/> <hr/>
C2.15.6	Failure or abnormalities that may be observed on the tractor or its component parts	<hr/> <hr/> <hr/>
C2.15.7	Others	<hr/> <hr/> <hr/>

Annex D

Formulas Used During Calculations and Testing

D1 Field Performance Test

D1.1 Delivery Rate

D1.1.1 Nominal working width, W , (m)

$$W = n \times d_r$$

where: W is the nominal working width, m
 n is the number of rows
 d_r is the row spacing, m

D1.1.2 Ground wheel-driven machine

D1.1.2.1 Effective diameter of ground wheel under load

$$D_e = \frac{d}{\pi \times N}$$

where: D_e is the effective diameter, m
 N is the number of revolutions, rpm
 d is the distance for a given N , m

D1.1.2.2 Delivery rate

$$Q = \frac{L \times 10,000}{\pi D_e \times N \times W}$$

where: Q is the delivery rate, kg/ha
 L is the delivery for a given N , kg

D1.1.2 PTO-driven machine

$$Q = \frac{L \times 10,000}{v \times t \times W}$$

where: Q is the delivery rate, kg/ha
 L is the delivery for a given N , kg
 v is the tractor speed, m/s
 t is the time for measuring delivery, s

D1.2 Effective Field Capacity, efc , (m²/h)

$$efc = \frac{A}{t}$$

where: A is the area covered, m^2
 t is the time used during the operation, hr

D1.3 Theoretical Field Capacity, tfc , (m^2/h)

$$tfc = 0.36 (w \times v)$$

where: w is the nominal working width, m
 v is the speed of operation, m/s

D1.4 Field Efficiency, ε_f , (%)

$$\varepsilon_f = \frac{efc}{tfc} \times 100$$

where: efc is the effective field capacity, m^2/h
 tfc is the theoretical field capacity, m^2/h

D1.5 Fuel Consumption, FC , (L/h)

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

where: V is the volume of fuel consumed, L
 t is the total operating time, h