Foreword

The formulation of this national standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) and with support from Department of Agriculture.

This standard has been technically prepared in accordance with PAES 10 - 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.

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

Bautista, E.U., A. U. Khan, A. Basallo and A. Caballes. *Operation Manual: IRRI Drum Seeder for lowland Paddies.* Agricultural Engineering Department, The International Rice Research Institute (IRRI), P. O. Box 933, Manila.

Bautista, E.U. and E. C. Gagelonia. *Technology!:Rice Drum Seeder*. Philippine Council for Agriculture, Forestry, and Natural Resources Research and Development, Los Baños, Laguna.

Japan International Cooperation Agency. 1976. Text Book of Agricultural Machinery.

Kepner,R.A., R. Bainer and E.L. Barger.1978. Principles of Farm Machinery. 3rd Edition. AVI Publishing Company, Inc. Westport, Connecticut.

Regional Network for Agricultural Machinery (RNAM). 1991. Agricultural Machinery Design and Data Handbook (Seeders and Planters).

Resurreccion, A.N. 1979. Design of a Metering Device of Rootzone Granular Fertilizer Applicators. Philippine Agricultural Engineering Journal. X(4).

Smith, D.W., B.G. Sims and D.H. O'Neill. 1994. *Testing and Evaluation of Agricultural Machinery and Equipment – Principles and practices.* FAO Agricultural Services Bulletin 110.

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

All annexes in this standard are normative.

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FIGURES

ANNEXES

Agricultural Machinery – Rice Drum Seeder – Methods of Test

1 Scope

This standard specifies the methods of test and inspection for manually-operated rice drum seeder for wet field. Specifically, it shall be used to:

1.1 verify the requirements specified in PAES 143 and the specifications submitted by the manufacturer;

1.2 determine the laboratory performance of the seeder; and

1.3 determine the field performance of the seeder.

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 – Method of Sampling

PAES 143:2005, Agricultural Machinery – Drum Seeder – Specifications

3 Definitions

For the purpose of this standard the following definitions shall apply:

3.1
effective field capacity
actual rate of planting a given area per unit of time or area

NOTE: The time pertains to the actual time which includes the time spent for turning at headland, adjustment of machine and machine trouble.

3.2
damaged seed
seed distinctly injured during operation

3.3
field efficiency
ratio of effective field capacity to the theoretical field capacity

3.4
hopper capacity
maximum amount of seeds which can be loaded to the hopper

3.5
percent damaged seeds
percentage of seeds injured during operation

3.6
seeding rate
amount of seeds planted per unit time or area

3.8
theoretical field capacity
computed rate of planting a given area per unit of time or area

4 General Conditions for Test and Inspection

4.1 Seeder on Test

The drum seeder 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 repairs and adjustment 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

The instruments to be used shall have been calibrated and checked by the testing agency prior to the measurements.

4.5 Test Materials

Any seed varieties that are locally grown shall be used for testing.

The suggested minimum list of field and laboratory test equipment and materials are given in Annex A.

4.6 Termination 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 terminated by the test engineer.

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 specifications of drum seeder.

5.1.3 The items to be inspected and verified are given in Annex B.

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 for which the machine is suitable as specified by the manufacturer.

5.2.1.3 The drum seeder is jacked up and the ground wheel of the metering mechanism is rotated 10 times to collect the discharged seeds and compute for its seeding rate. The seeding rate per area is calculated based on the weight of seeds and the corresponding area covered by the seeder in 10 revolutions of the ground wheel.

5.2.1.4 This test shall be carried out at ¼, ½, and ¾ of the drum seeder's hopper capacity based on its diameter with three seeding rate settings – low, medium and high **(Figure 1).**

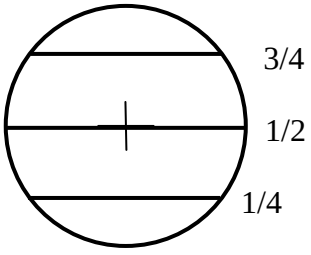

Figure 1 – Drum hopper capacity based on its diameter

5.2.2 Test for uniformity of distribution

5.2.2.1 This test is carried out to determine the uniformity of transverse and longitudinal seed distribution.

5.2.2.2 The drum seeder shall be operated at the average seeding rate setting, with the hopper half full and at the speed recommended by the manufacturer over a blanket or felt.

5.2.2.3 The seeder shall be operated for at least three passes.

5.2.2.4 Longitudinal and transverse distribution

For each pass, collect and weigh the amount of seeds distributed from each row with one-meter length for a 5-meter distance along the direction of travel (Figure 2).

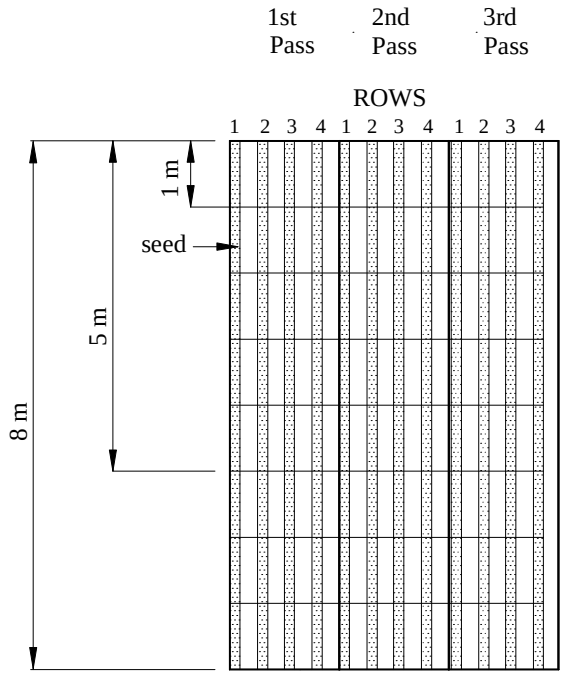

Figure 2 – Measurement of uniformity of distribution

5.2.3 The result of the test shall be presented in a histogram and the standard deviation shall be computed.

5.2.4 The items to be investigated and measured shall be recorded in Annex C.

5.3 Field Performance Test

5.3.1 This is carried out to test the field performance of the drum seeder.

5.3.2 The test shall be carried out on wet land. The conditions of the field shall be recorded.

5.3.3 Test Conditions

5.3.3.1 Size of the Area per Trial

Seeding operation shall be done in fields of not less than 250 m^2 and shall be rectangular in shape with sides in the ratio of 2:1 as much as possible. The depth of wet field shall not exceed 12 cm.

5.3.3.2 Operational Pattern

Field capacity and field efficiency are influenced by field operational pattern which is closely related to the size and shape of the field, and the kind and size of the attached implement. The non- working time should be minimized as much as possible using the recommended field operational pattern shown in Figure 2.

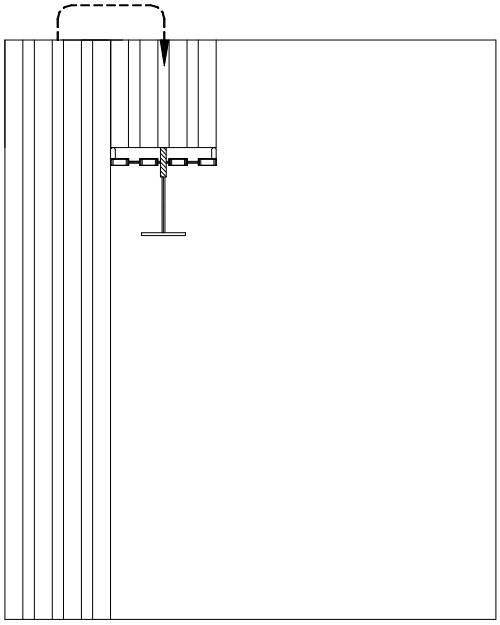

Figure 3 – Recommended field operational Pattern

5.3.3.3 Traveling Speed

A traveling speed of 1 kph to 2 kph shall be maintained during operation.

5.3.3.4 Test Trials

The test shall be conducted with at least three test trials.

5.3.4 Measurement of Performance Parameters

5.3.4.1 Pulse Rate Determination

This test shall be carried out to test the ergonomics of the design (i.e. ease of operation). The pulse rate of the operator before and after operation shall be measured and recorded.

5.3.4.2 Field Capacity Determination

5.3.4.2.1 Measurement of Operating Speed

Along the length of the test plot, two poles 15 m apart (A, B) are placed approximately in the middle of the test run. On the opposite side, two poles are also placed in a similar position, 15 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 (**Figure 4).** The speed will be calculated from the time required for the drum seeder to travel the distance (15 m) between the assumed line connecting two poles on opposite sides AC and BD. The easily visible point of the machine should be selected for measuring the time. The starting position shall be at least 2 m from poles A and C to stabilize speed before measuring and recording data.

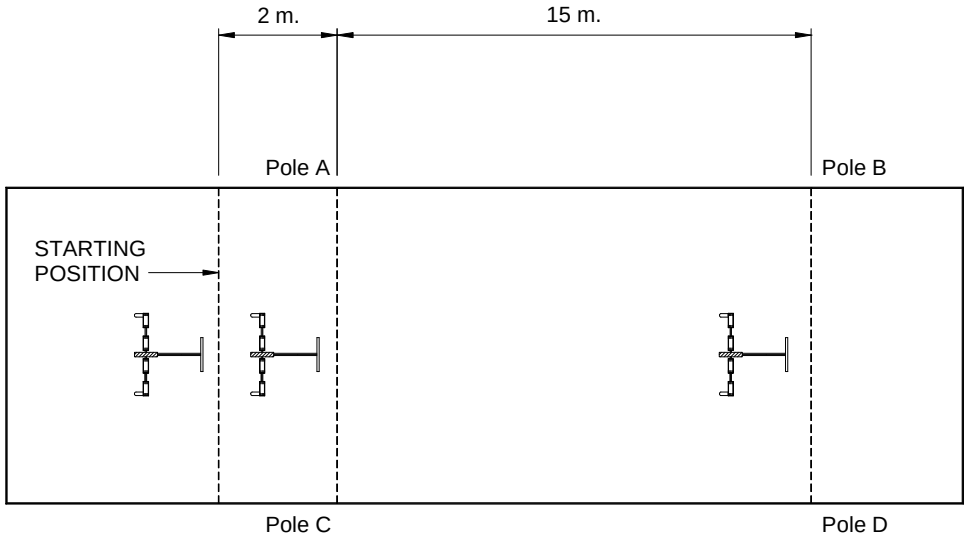

Figure 4 – Measurement of Operating Speed

5.3.4.2.2 Total Operating Time, Turning time and other losses

Total operating time shall be measured once the drum seeder started to operate up to the time it finished the test area. Time losses for adjustment, turning and machinery breakdown shall be deducted from the total operating time.

6 Data Analysis

The formulas to be used are given in Annex E.

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 and specifications of the seeder

7.8 Results of laboratory and field test

7.9 Name and signature of test engineers

Annex A
(Informative)

Suggested Minimum List of Field and Laboratory Test Equipment and Materials

Items	Quantity
A1 Equipment	
A1.1 Field Equipment	
A1.1.1 Timers Range: 0 to 60 minutes Accuracy: 1/10	2
A1.1.2 Steel tape, 50 m and 5 m	2
A1.1.3 Digital camera	1
A1.1.4 Triple beam balance	1
A1.1.5 Pulse meter	1
A2 Materials for Field Test	
A2.1 Marking pegs	10

Annex B
(Informative)

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. : _____

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

ITEMS TO BE INSPECTED

ITEMS	Manufacturer's Specification	Verification by Testing Agency
B1 Dimensions and weight of the seeder		
B1.1 Overall length, mm		
B1.2 Overall width, mm		
B1.3 Overall height, mm		
B1.4 Weight (hoppers empty), kg		
B2 Nominal working width, mm		
B3 Number of rows and row spacing, mm		
B4 Seeds for which the machine is suitable		
B5 Suitable field conditions		
B6 Metering Mechanism		
B6.1 Adjusting ring		
B6.1.1 Number		
B6.1.2 Dimension, mm		
B6.1.3 Material		
B6.2 Source of power of metering mechanism		
B6.2.1 Ground wheel		
B6.2.1.1 Number		
B6.2.1.2 Diameter, mm		
B6.2.1.3 Material		
B6.2.2 Others		

ITEMS	Manufacturer's Specification	Verification by Testing Agency
B7 Drum Hopper		
B7.1 Number		
B7.2 Diameter, mm		
B7.3 Material		
B7.3 Hole setting		
B7.3.1 Number		
B7.3.2 Diameter, mm		
B7.4 Capacity, Kg		
B8 Furrow opener, (if applicable)		
B8.1 Type		
B8.2 Material		
B9 Skids (if applicable)		
B9.1 Material		
B9.2 Dimension, mm		
B10 Handle		
B10.1 Construction		
B10.2 Material		
B10.3 Height of handle from the ground		
B10.4 Detail of Adjustment		
B11 Marking device (detail of marking)		
B12 Other details (special and safety features)		
B12.1 Material		
B12.2 Diameter, mm		
B12.3 Thickness, mm		
B13 Recommended traveling speed, kph		

Annex C
(Informative)

Laboratory Performance Test Data Sheet

C1 Seed Metering

Date of test :_____

C1.1 Test condition

C1.1.1 Conditions of seeds
C1.1.1.1 Name of seed : _____
C1.1.1.2 Variety of seed : _____
C1.1.1.3 Shape : _____
C1.1.1.4 Average size of seeds : _____
Length, mm : _____
Width, mm : _____
Thickness, mm :_____
C1.1.1.5 Moisture content, % wb : _____
C1.1.1.6 Bulk density, kg/L : _____

C1.1.2 Condition of grain seeder
C1.1.2.1 Mechanism and speed : _____
C1.1.2.2 Adjusting ring : _____

C1.2 Seeding Rate

Particulars	Seeding Rate								
	¾ hopper capacity			½ hopper capacity			¼ hopper capacity		
	low	med	high	low	med	high	low	med	high
C1.2.1 Ground wheel-driven metering									
C1.2.1.1 Effective diameter of ground wheel, m									
C1.2.1.2 No. of Revolution of ground wheel									
C1.2.1.3 Amount discharge from C1.2.1.2, kg									
C1.2.1.4 Seeding rate, kg/ha									
C1.2.1.5 Weight of damaged seeds, kg									
C1.2.1.6 Row spacing, mm									
C1.2.1.7 Observations									

C1.3 Uniformity of Distribution

Particulars		1st Pass				2nd Pass				3rd Pass			
		Row 1	Row 2	Row 3	Row 4	Row 1	Row 2	Row 3	Row 4	Row 1	Row 2	Row 3	Row 4
Weight of seed distributed, kg	First: 1 m length												
	Second: 1 m length												
	Third: 1 m length												
	Fourth: 1 m length												
	Fifth: 1 m length												

Annex D
(Informative)

Field Performance Test Data Sheet

Items to be inspected

Particulars	Test Number			
	1	2	3	Ave.
Date of Test				
D1 Test Condition				
D1.1 Condition of seed				
D1.1.1 Name				
D1.1.2 Variety				
D1.1.3 Shape				
D1.1.4 Ave Size				
D1.1.4.1 Length, mm				
D1.1.4.2 Width, mm				
D1.1.4.3 Thickness, mm				
D1.2 Condition of field				
D1.2.1 Location				
D1.2.2 Field type and soil condition				
D1.2.3 Length, m				
D1.2.4 Width, m				
D1.2.5 Area, m^2				
D1.2.6 Shape				
D1.2.7 Method of land preparation				
D1.3 Condition of operation				
D1.3.1 Row spacing, mm				
D1.3.2 Seeding rate, kg/ha				
D1.4 Condition of metering mechanism				
D1.4.1 Seed rate adjusting ring				
D2 Field Performance				
D2.1 Actual operating time, min				
D2.2 Time lost owing to				
D2.2.1 Turning at headland, min				
D2.2.2 Adjustment, min				
D2.2.3 Refilling of seed, min				
D2.2.4 Repair, min				
D2.3 Actual area covered, m^2				
D2.4 Effective working width, m				
D2.5 Traveling speed, kph				
D2.6 Effective width of seeding of one row unit for one run, cm				
D2.7 Labor requirement				
D2.7.1 No. of laborers				
D2.7.1.1 Pulse before operation				
D2.7.1.2 Pulse after operation				
D2.7.2 Total man-hour during test, man-h				
D2.8 Effective field capacity, ha/h				
D2.9 Field efficiency, %				
D2.10 Travel pattern				

D2.11 Observations

A minimum of three persons (test engineer, manufacturer's representative and the operator) shall rate the following observations.

Items	**Rating***				
	1	**2**	**3**	**4**	**5**
D2.11.1 Uniformity of distribution					
D2.11.2 Ease of refilling seed					
D2.11.3 Ease of handling and stability when machine is working and turning					
D2.11.4 Ease of making adjustments and repairs					
D2.11.5 Safety features					
D2.11.6 Durability of part (based on wear of soil-working parts, visible deformation, etc)					
D2.11.7 Other observations _____ _____					

* 1 – Very Good
  2 – Good
  3 – Satisfactory
  4 – Poor
  5 – Very Poor

Annex E
(Informative)

Formulas Used During Calculations and Testing

E1 Laboratory Performance Test

E1.1 Uniformity of Distribution

E1.1.1 Standard Deviation, STDV

$$STDV = \sqrt{\frac{n\sum x^2 - \left(\sum x\right)^2}{n(n-1)}}$$

where: STDV is the standard deviation
n is the number of samples
x is the weight of sample

E2 Field Performance Test

E2.1 Seeding Rate

E2.1.1 Nominal Working Width, *W*, (m)

$$W = n \text{ x } d_r$$

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

E2.1.2 Ground Wheel-Driven Machine

E2.1.2.1 Effective diameter of ground wheel under load

$$D_e = \frac{d}{\pi \text{ x } N}$$

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

E2.1.2.2 Seeding Rate

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

where: Q is the seeding rate, kg/ha

L is the delivery for a given N, kg

E2.2 Effective Field Capacity, *efc*, (m^2/h)

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

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

E2.3 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

E2.4 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