UNITED NATIONS
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CSAM

ANTAM STANDARD CODE FOR TESTING OF PADDY TRANSPLANTERS

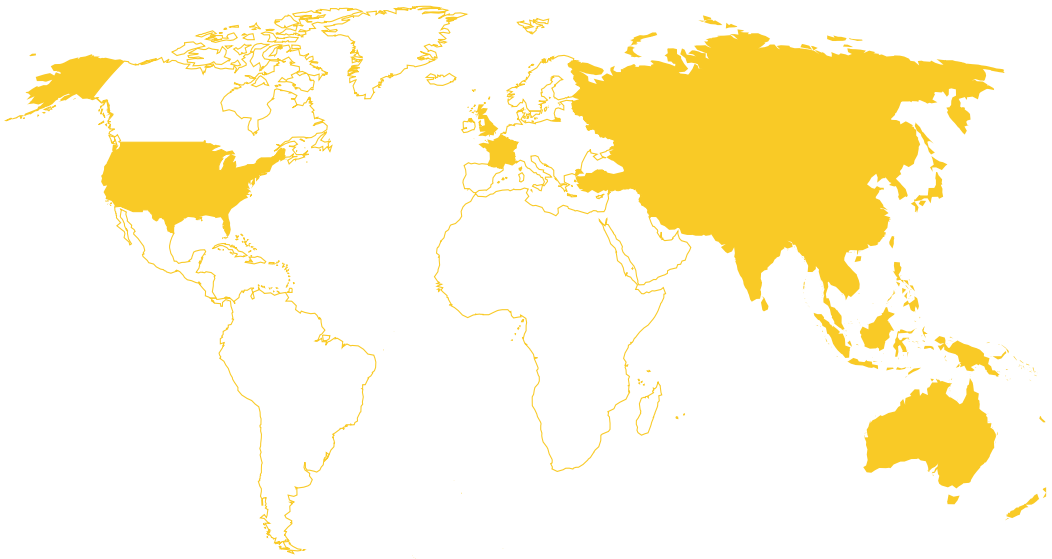
003-2018

ANTAM
Asian and Pacific Network for Testing of Agricultural Machinery

The Centre for Sustainable Agricultural Mechanization (CSAM), is a regional institution of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), based in Beijing, China. CSAM started operations in 2004, building on the achievements of the Regional Network for Agricultural Machinery (RNAM) and the United Nations Asian and Pacific Centre for Agricultural Engineering and Machinery (UNAPCAEM). CSAM serves the 62 members and associate members of ESCAP.

The vision of CSAM is to achieve production gains, improved rural livelihood and poverty alleviation through sustainable agricultural mechanization for a more resilient, inclusive and sustainable Asia and the Pacific.

The Secretariat of the Asian and Pacific Network for Testing of Agricultural Machinery (ANTAM) is based at CSAM. CSAM is the executing agency of ANTAM. The ANTAM Secretariat assists and coordinates the operation of the network, and provides necessary logistical and administrative support.



The shaded areas of the map indicate ESCAP members and associate members

ANTAM STANDARD CODE
FOR TESTING OF PADDY TRANSPLANTERS[1]

Centre for Sustainable Agricultural Mechanization

United Nations Economic and Social Commission for Asia and the Pacific

003-2018

September 2018

[1] Rice Transplanters are to be considered the same machines as Paddy Transplanters for the purpose of this Code

Acknowledgments

The Asian and Pacific Network for Testing of Agricultural Machinery (ANTAM) Standard Code for Testing of Paddy Transplanters was prepared under the supervision of the Centre for Sustainable Agricultural Mechanization of the United Nations Economic and Social Commission for Asia and the Pacific (CSAM-ESCAP). The current version of the Code is based on the first edition published in August 2015 and modified based on technical negotiations conducted with designated national counterparts from 2015 to 2018.

The consultation process in 2018 started in March and was concluded at the 4th Meeting of the Technical Working Groups (TWGs) of the Asian and Pacific Network for Testing of Agricultural Machinery (ANTAM) held on June 25-28, 2018 in Georgetown, Penang, Malaysia. The Code has been developed with contributions from: Anwar Hossen; Zhang Xiaochen; Allimuthu Surendrakumar; Takashi Fujimori; Mohd Shahril Shah bin Mohamad Ghazali; Shabbir Ahmad Kalwar; Romulo Esteban Eusebio; Jeong Seong lim; Anuradha Wijethunga; Yuttana Khaehanchanpong; and Ngo Van Phuong. The ANTAM Test Code on Paddy Transplanters was formulated by referring to standards developed by the International Organization for Standardization (ISO), Regional Network for Agricultural Machinery (RNAM) and by merging relevant national standards from China, and India to reflect unique regional conditions.

Special thanks go to the ANTAM Focal Points in the Philippines, Malaysia and China, namely Dr. Aurelio Delos Reyes Jr., Mr. Mohd Taufik Bin Ahmad and Ms. Han Xue, for the important support provided during the organization of ANTAM meetings in their respective countries.

The contribution of the Italian Agency for Agricultural Mechanization (ENAMA), the Technical Reference Unit of ANTAM, which has provided technical peer review and guidance to the overall development of ANTAM, is gratefully acknowledged. A note of appreciation is also due to other collaborating partners of ANTAM, including the Food and Agriculture Organization of the United Nations, OECD, the United Nations Industrial Development Organization and all ANTAM Focal Points (Appendix I) in member countries for their continuous support to and active involvement in ANTAM.

At CSAM, the process of development of the Code was coordinated by Camilla Stelitano under the supervision of Anshuman Varma, Programme Officer and the overall guidance of Li Yutong, Head of CSAM. Dr. Singh Surendra provided final reviews and editing of the Code and Mr. Wei Zhen contributed to the layout and design of the publication.

Foreword

The Asian and Pacific Network for Testing of Agricultural Machinery (ANTAM) is an initiative led by the Centre for Sustainable Agricultural Mechanization (CSAM) of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). In support of the 2030 Agenda for Sustainable Development, the ANTAM network develops regional standards to promote the use of safe, efficient and environmentally sound agricultural machinery in the Asia-Pacific region.

The 2030 Agenda for Sustainable Development recognizes eradicating poverty in all its forms as the greatest human challenge. The 17 Sustainable Development Goals (SDGs) advocate for multisectoral, coordinated action to integrate the three dimensions of sustainable development: the economic, social and environmental. Eradicating poverty (SDG 1) and hunger (SDG 2) occupy central stage in the work of ESCAP-CSAM. The important contribution of mechanization to agricultural productivity has long been recognized by experts[2]. Nevertheless, the factors that influence the diffusion of mechanization, in particular for developing and least developed countries, involve multiple sub-sectors such as farmers' access to capital, infrastructure development, manufacturing capacity and import regulations. To tackle this complex and interconnected set of issues the public sector can play a crucial role by implementing regulations that, in a time and cost-effective manner, assist stakeholders in overcoming economic and other practical impediments to the diffusion of mechanized agriculture. Testing and certification of agricultural machinery is recognized as one of the most effective public interventions in support of the diffusion of mechanization[3].

The certification released after testing is a written assurance for farmers, retailers, importers and manufacturers that testifies to the stated specifications of a given machine. This aspect is particularly important because according to several experts[4], the constraints in the introduction, use and export of agricultural machinery can be attributed to lack of quality, design, and production techniques. Since the quality of the same type of machine manufactured by different firms can vary greatly, farmers are reluctant to invest in unknown technology without assurance of quality or efficiency. The variations in quality amongst the same type of machinery can be minimized by following standard design and production techniques. In addition, the presence of a recognized certification, issued after testing, can help farmers in determining the comparative performance of machines available in the market and the public sector as well as financial institutions in allocating financial support for the purchase of reliable equipment.

Agricultural machinery testing Codes are among the key elements of a well-functioning certification system. The ANTAM Codes for testing of agricultural machinery draw upon national standards of ESCAP member States and major international requirements for agricultural machinery testing. They aim to help our stakeholders in identifying sustainable, affordable and environmentally sound machinery. The fourth version of the ANTAM Codes that we are presenting in 2018, builds upon the work conducted since 2015 and incorporates important feedback received from our member States to integrate their needs into one standard able to serve the unique agricultural characteristics of countries in the Asia-Pacific region.

Li Yutong
Head
Centre for Sustainable Agricultural Mechanization

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[2] FAO (2013) *Mechanization for Rural Development: A review of patterns and progress from around the world- Integrated Crop Management Vol. 20-2013;* Plant Production and Protection Division of the Food and Agriculture Organization of the United Nations; Rome, Italy.
[3] World Bank (2017) *Enabling the Business of Agriculture 2017*; Washington, DC, World Bank.
[4] Mehta M L; Verma S R; Misra S K; Sharma V K. 2016. Testing and Evaluation of Agricultural Machinery. Vedams eBooks [P] Ltd. New Delhi

Method of Operation[5]

The Annual Meeting shall adopt the Test Codes by consensus amongst ANTAM participating countries.

The Technical Working Groups (TWGs) of ANTAM develop, review and revise ANTAM Codes based on the decisions adopted at the Annual Meeting of ANTAM.

The ANTAM Test Codes are updated by the TWGs through technical negotiations led by CSAM. The content of the Codes is finalized and agreed upon by consensus amongst all TWGs members at the annual meetings of the TWGs.

The ANTAM Test Code on Paddy Transplanters was formulated by referring to previous ANTAM Standards, standards developed by the International Organization for Standardization (ISO), Regional Network for Agricultural Machinery (RNAM) and by merging relevant national standards from China, India, and Japan to reflect unique regional conditions. As specified in the Terms of Reference of the TWGs, members are responsible for selecting and providing relevant references to national and international standards. All selected standards are subject to revision and considered the most updated edition as per documents provided by TWGs members. All documents provided by national standards agencies are copyrighted.

Implementation of ANTAM Test Codes is voluntary. Member countries can use ANTAM Test Codes in their entirety or refer to parts of the Code to integrate them with procedures applied in national testing stations. ANTAM Test Codes apply only to the equipment described in the Codes. Thus, any testing station from an ANTAM member country is welcome to use the test Codes assuming it has adapted testing equipment, facilities and skilled personnel as necessary.

Participating national testing stations are responsible for using the Codes to carry out the tests and complete the test report. Each testing station shall certify that ANTAM Codes are followed and that the test report complies with ANTAM Test Codes and procedures. ANTAM strongly encourages the implementation of round robin tests[6]among testing stations in order to ensure that test reports are supported by a quality assurance process.

The test report shall be verified by the ANTAM Secretariat prior to its release. The ANTAM Secretariat shall work with the Technical Reference Unit (TRU), an independent third party elected by member countries at the Annual Meeting, to check the technical contents of the report to ensure strict compliance with ANTAM testing methodologies.

Upon approval and validation of the test report by the ANTAM Secretariat, the ANTAM logo may be used on the tested machinery. The ANTAM Secretariat will then release the test report on its website.

The ANTAM Test Codes are designed to guide member countries in the application of standards for testing of agricultural machinery. The Codes provide information only and do not constitute formal legal advice. The ANTAM Secretariat assumes no liability for actions undertaken in reliance on the information contained in the Codes.

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[5] In reference to the Terms of Reference of ANTAM and the Terms of Reference of ANTAM Technical Working Groups adopted by the Annual Meeting on December 9, 2016.

[6]Measurement system analysis technique, where independent technicians perform the tests in different stations. Such interlaboratory activity is encouraged to compare discrepancies in results, if any, and determine the reproducibility of test methods.

*The current Code is subject to revision and adoption by the 5th Annual Meeting of ANTAM to be held in November 2018 in Indonesia.

TESTING OF PADDY TRANSPLANTER

1. SCOPE

This Test Code covers the terminology, general guidelines and tests to be conducted on self-propelled walk behind and riding type paddy transplanters with mat type seedlings. It also covers methodology for verification of machine specifications, performance, evaluation, safety measures, data collection and test report format.

Paddy transplanters that are already for commercial production or already in production should be tested with reference to this Code.

2. REFERENCES

The complete list of references to the existing international standards that have been incorporated to this text is provided in **Annex A**. The list includes standards developed by International Organization for Standardization (ISO), the Regional Network for Agricultural Machinery (RNAM), ANTAM and national standards practiced by member countries. The selection of publications, the editions indicated were provided by the various national representatives. All selected standards are considered recent as per documents provided.

All documents provided from the various national standards agencies are copyrighted.

3. TERMINOLOGY

3.1 Paddy transplanting

Technique of placing paddy seedlings from one location to another. The first location may be specially prepared nursery in controlled or uncontrolled conditions or normal paddy field.

3.2 Paddy transplanter (Rice transplanter)

Machine, which is used to perform paddy seedlings transplanting.

3.3 Walk behind type transplanter

Machine, where the operator has to walk behind to operate it.

3.4 Riding type transplanter

Machine, where the operator can sit on the machine to operate it.

3.5 Mat type seedlings

The paddy seedlings that are raised on thin layer of soil either being prepared in the paddy field or in the nursery box as mat.

3.6 Seedlings density

It indicates the number of seedlings per unit area on the mat.

3.7 Leaf stage of seedlings

Leaf stage indicates the number of leaves or height of the seedling. (Seedlings, average between 3 to 6 leaves suitable for machine transplanting).

3.8 Total missing hills

Nonexistence of seedlings in any planting point due to floating, buried and missing hills.

3.8.1 Floating hills

Seedlings that remain afloat on the water after transplanting.

3.8.2 Buried hills

Seedlings that remain in the soil layer after transplanting.

3.8.3 Missing Hills

Nonexistence of seedlings in any planting point due to inability of the planting finger to pick the seedlings

3.9 Continuous missing hills

More than 2 missing hills in succession in same row.

3.10 Damaged seedling

Seedlings which have had some damages during picking, planting and other machine operations.

3.11 Soil hardness[7]

The soil hardness at transplanting operation is expressed with the depth of penetration of a drop type cone penetrometer and called "cone depth". The apex angle of the cone should be 45 degrees and weight is about 135 grams. Cone penetrometer should drop from a height of 1.0 meter from the soil surface, without standing water to the tip of the cone. After penetrating, the depth should be measured from the tip of the cone to the soil surface in centimeters (RNAM 1983).

3.12 Theoretical field capacity

This is calculated by multiplying the working width of the machine and the average operational speed of the machine. Results should come as area per unit time.

3.13 Actual field capacity or rate of work

Area transplanted by the machine during total operating time. Results should come as area per unit time

3.14 Field efficiency

Ratio between actual field capacity and theoretical field capacity, expressed as a percentage.

3.15 Transplanting speed

The forward speed of the transplanter during seedlings transplanting.

4. GENERAL GUIDELINES

4.1 Conditions for Checking of Dimensions

The transplanter shall be placed on a firm horizontal surface. Unless otherwise stated by the manufacturer/applicant, the transplanter shall be stationary with its wheels and standard components in the positions they would be, if the transplanter was travelling in a straight line.

[7] Soil hardness refers to the top soil surface layer.

4.2 Running-in

The manufacturer/applicant shall run-in the transplanter before the test, under his responsibility and in accordance with his usual instructions. The running-in shall be carried out in collaboration with the testing authority. If this procedure is impracticable due to the transplanter being an imported model, the testing authority may itself run-in the transplanter in accordance with the procedure prescribed or agreed to with the manufacturer/applicant.

The place and duration of the running-in shall be reported in the Performa given in **Annex B**.

4.3 Servicing and Preliminary Setting after Running-in

4.3.1 After completion of running-in, servicing and preliminary settings should be done according to the printed literature supplied by the manufacturer/applicant. The following may be carried out, wherever applicable considering the machine should be in ordinary condition:

a) Change of the engine oil;
b) Change of air cleaner oil (if provided with an oil bath type air cleaner);
c) Change of transmission oil;
d) Change of hydraulic oil;
e) Change of oil and fuel filters (if required);
f) Greasing/oiling of all the lubricating points;
g) Tightening the nuts and bolts;
h) Checking and adjustments of belts and chains;
i) Checking and adjustment of safety devices, if any;
j) Any other checking or adjustment recommended by the manufacturer after the running-in period, and included in the printed literature of the transplanter

4.3.2 Repairs and Adjustments during tests

All repairs and adjustments made during the tests shall be reported, together with comments on any practical defects or shortcomings in **Annex B**. This shall not include those maintenance jobs and adjustments which are performed in conformity with the manufacturer's recommendations stated in the manual.

4.4 Fuels and Lubricants

Fuels and lubricants to be used from the range of products commercially available in the country where the equipment is tested and shall conform to the minimum standards approved by the transplanter manufacturer. If the fuel or lubricant conforms to a national or international standard, it shall be mentioned, and the standard stated (OECD Code 2-2017).

5. Measuring Tolerances

The measuring apparatus shall be such that the following items shall have the tolerances within the limits shown in Table 1.

Table 1. Accuracy requirements of measurement

Parameters	**Tolerances**
a) Rotational speeds (rpm)	±0.5 percent
b) Time (s)	±0.2s
c) Distance (m or mm)	±0.5 percent
d) Force(N) and torque (Nm)	±1.0 percent
e) Acceleration (m/s^2)	+ 1.0 percent
f) Mass (kg)	±0.5 percent
i) Temperature of fuels etc. (°C)	±2 °C
j) Wet and dry bulb temperature (°C)	± 0.5 °C
k) Fuel consumption (overall for the apparatus used): 1) Engine test (kg) 2) Rotary shaft test (kg) 3) Drawbar test (kg)	 ± 1.0 percent ± 1.0 percent ± 2.0 percent
l) Angle (°)	± 0.5 °

6. Tests

6.1 Tests to be conducted on paddy transplanter are given below:

- Checking of specifications
- Safety requirements
- Parking brake test
- Noise test
- Water proof test
- Field performance test

7. CHECKING OF SPECIFICATIONS

7.1 Specification Sheet

7.1.1 The "manufacturer/supplier" (here after "applicant") shall supply the specifications of the paddy transplanter as per the **Annex C**, and any other information required by the testing authority, to carry out the tests. The applicant should also supply the technical literature such as operational and maintenance manual, service manual and parts catalogue (4.1 IS 9935:2002).

7.1.2 The information given by the applicant in the specification sheet shall be verified by the testing authority and reported. The details of the components and assemblies, which do not conform to the relevant ANTAM standards shall also be reported. The adequacy or otherwise of the literature shall be indicated (7.1 IS 9935:2002).

7.2 Manual

The applicant shall submit operation, maintenance and service manuals. The operational manual shall include schematic diagrams of levers, switches and other parts with functional description and instruction on all adjustments necessary for operation of the transplanter, assembly and disassembly for cleaning and routine inspection, replacements of parts, safety precautions to be taken during operation and handling and spare parts list with part no (number) in the manual. Manuals shall comply with ISO 3600:2015, GB/T 20864-2007 or IS 8132:1999 standards and contain information on main technical details of the engine including its filters and other accessories, technical details on transplanting spacing, speeds, planting depths, plants per hill, number of cuts per tray and contact details of manufacturer and supplier.

7.2.1 Conditions for Checking Overall Dimensions

While checking the dimensions of transplanter, the conditions laid down in 4.1 of the general guidelines shall be followed.

7.2.2 Mechanisms

Power transmission, transplanting and floating mechanism should be specially examined or investigated during the beginning of the test (GB/T 20864-2007, Japan 2015).

8. ENGINE

Testing center should verify the engine parameters from 2.1 to 2.17 of Annexure C, either from manufacturer data or by testing of the engine in the testing center.

9. SAFETY REQUIREMENTS

9.1 The exposed transmission and rotating parts should have protective cover (GB 10395.9, Japan 2015).

9.2 The position and the direction of the exhaust port shall avoid the operator and helpers who are supposed to stand on the machine.

9.3 The operator work floor should be flat and non-slip (GB 10395.9, Japan 2015).

9.4 The row marker should have locking mechanism.

9.5 The operation symbols should be pasted near the key controls. There should be a minimum gap of at least 25mm between the control levers (GB 10395.9, Japan 2015).

9.6 The pedal should have non-slip surface and easy to clean.

9.7 The positive pole of the battery should have the protective cover to prevent the short circuit.

9.8 Riding type transplanters should be equipped with footsteps on both sides.

9.9 All exposed sharp edges and corners must have smooth finish.

9.10 Transplanters should be equipped with a front side (head lights) and a rear side light, which is optional.

9.11 Dangerous moving parts must be indicated by safety signs and should be illustrated in the operating manual.

9.12 Riding type transplanters should be equipped with a reverse horn.

9.13 The observations shall be recorded in Annex-D

10. PARKING BRAKE TEST

10.1 General

The performance of the parking brake shall be based on the ability to hold the transplanter stationary, facing up and down on slopes

10.2 Procedure

Riding type transplanters shall be parked with parking brake applied, on a hard-dry slope of 18 percent facing uphill and downhill slopes. Transplanter may be in unload condition with transplanting assembly in up position. The movements of the braked wheel should be observed for at least 5 minutes. (ANTAM 001-2017)

10.3 Data shall be recorded in Annexure E1

11. NOISE TEST

11.1 The noise level shall be measured at the operator's ear level during field performance test..

11.2 The noise shall be measured with instrument and expressed in decibels (dB(A)) set on slow level.

11.3 The test area shall be a flat open space. There shall be no obstacle likely to reflect significant sound, such as building, solid fence, tree or other vehicle for a distance of at least 20 m from the tested machine (ANTAM 002-2017).

11.4 The air temperature shall be in the range from +10 to 40 ºC and the wind velocity shall not exceed 5 m/s at the operator's position.

11.5 The ear side noise of the operator shall be no more than 90 dB(A) in operating condition at maximum speed (GB/T 20864-2007).

11.6 The data shall be recorded in Annex-E2

12. FIELD TEST

12.1 General

12.1.1 The objective or purpose of this test is to determine the actual performance of the machine in field conditions. It includes field efficiency, transplanting accuracy, and uniformity of transplanting.

The applicant should supply the transplanter with standard accessories and in a condition as generally offered for sale. The transplanter shall be new and should not be given any special treatment or preparation for test (ANTAM 002-2017).

12.1.2 Operator of the machine during the test: The operator should be knowledgeable on the operation of the machine. It could be from the applicant or from the testing authority.

12.1.3 Test site conditions: The transplanter shall be tested in a proper field condition. The field shall be prepared for transplanting operation and shall have an area of at least 1000 m^2. It shall have a rectangular shape with ratio of1:2.5

12.1.4 Test Instruments/Equipment. The test instruments shall be calibrated. The list of test instruments used to carry out transplanter test shall be presented in **Annex F**.

12.1.5 Initial data to be gathered

12.1.6 The date and actual location of test shall be recorded.

12.1.7 Seedlings Conditions shall be obtained as follows:

- Age of seedlings (Days)
- Variety
- Plant density[8] (No. of plants per cm^2)
- Leaf stage (No. of leaves)
- Height of seedlings (mm)
- Thickness of seedling mat (mm)

12.1.8 The actual field condition shall be obtained as follows:

- Area (L x W) (m^2)
- Soil Type[9]
- Soil hardness [Cone depth (mm)], (Drop cone test)
- Depth of hard pan (mm)
- Depth of water[10] (mm)
- Qualitative assessment[11] (leveling, stubble)

Method of tillage

Method of puddling

12.2 Performance Data

12.2.1 The following transplanter settings shall be recorded before the test:

- Distance between hills (mm)
- Depth of planting (mm)
- Number of seedlings per hill

12.2.2 The actual performance shall start by operating the transplanter in the field. The following shall be gathered to calculate actual field capacity, field efficiency, and percentage of slippage and fuel consumption.

- Time of transplanting
- Total operation time (h)
- Average operating speed (km/h)
- Effective working width (mm)
- Wheel slippage (without and with load) (percent)
- Noise level at operator's ear level (db(A))
- Fuel consumed (kg or liter)

12.2.3 Transplanting Pattern. Only one transplanting pattern shall be followed either Pattern A or Pattern B depending on the location and specific requirements of region.

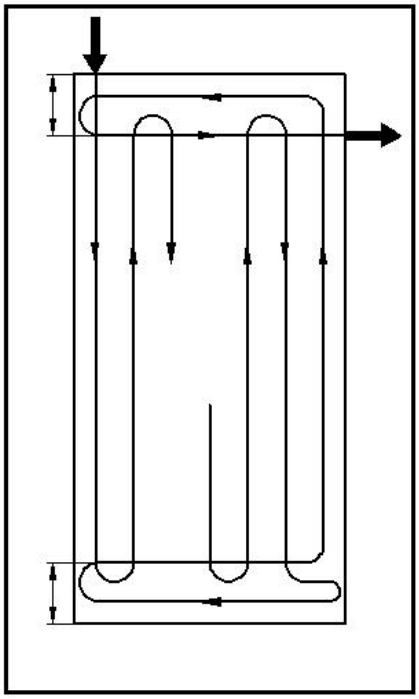
12.2.4 Testing authority should mention in the report the actual pattern used in test.

[8]Please randomly sample 3 seedling mats and take 5 measurements of seedling number per cm^2 for each seedling mat. Report the average number of seedling per cm^2 in **ANNEX F**.

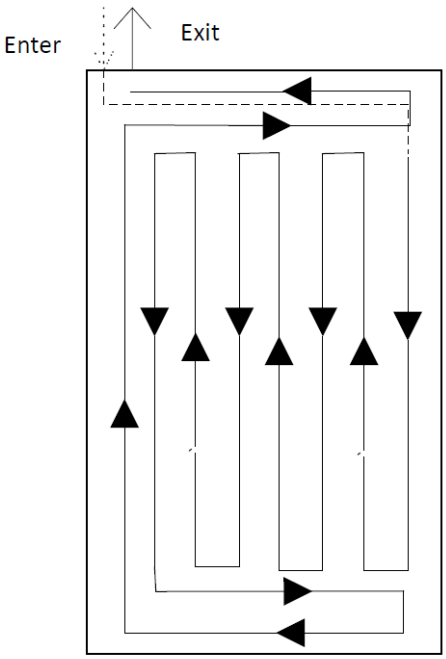
[9]Please provide specific soil physical properties including bulk density, clay percentage in addition to the soil type **ANNEX F**.

[10]To be collected after cone depth data measurement is completed.

[11]A brief description of the measurement method of field levelness and stubble shall be provided in the test report **ANNEX F**.



Pattern A



Pattern B

12.2.5 The transplanting time, including non-productive time, shall start as soon as the seedlings are transplanted in the field and end when the transplanter stopped planting.

12.2.6 The total time of operation shall start as soon as the engine started and ends as soon as the engine stopped.

12.3 Average operating speed

The transplanter shall be operated at the 80-85 percent of maximum transplanting speed. The operating speed shall be determined by putting two poles 20 m apart (A, B) on the length of the test field approximately in the middle of the test run (Figure 1). On the opposite side two poles are also 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 transplanter to travel the distance (20 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 to 5 m from poles A and C to stabilize speed before measuring and recording data (RNAM 1983). Ten measurements are to be made to obtain the average speed.

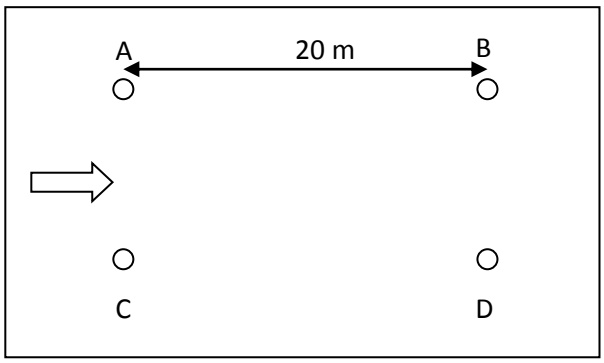


Figure 1: Layout of poles

12.4 Wheel Slippage

The distance travelled shall be measured at 10 revolutions of the driving wheels at level field in dry condition. A visible mark shall be placed on the wheels for obtaining the number of revolutions. During transplanting the distance for ten revolutions of the driving wheel shall also be obtained. In both conditions, same speed of the transplanter shall be maintained (RNAM 1983).

12.5 Uniformity of transplanting

Five sampling areas shall be randomly selected in the field as shown in Figures 2 and 3). It shall be of five, - one-meter length in succession and covers the rows of transplanter.

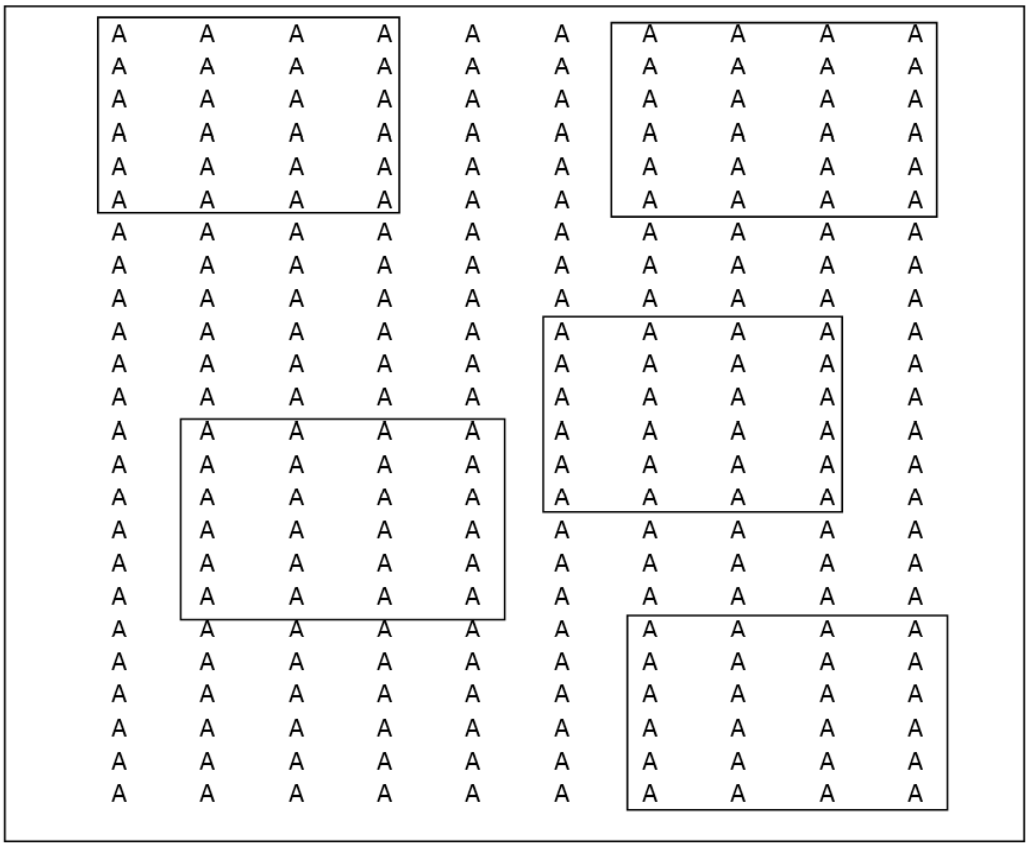


Figure 2: Sampling area for four rows transplanter

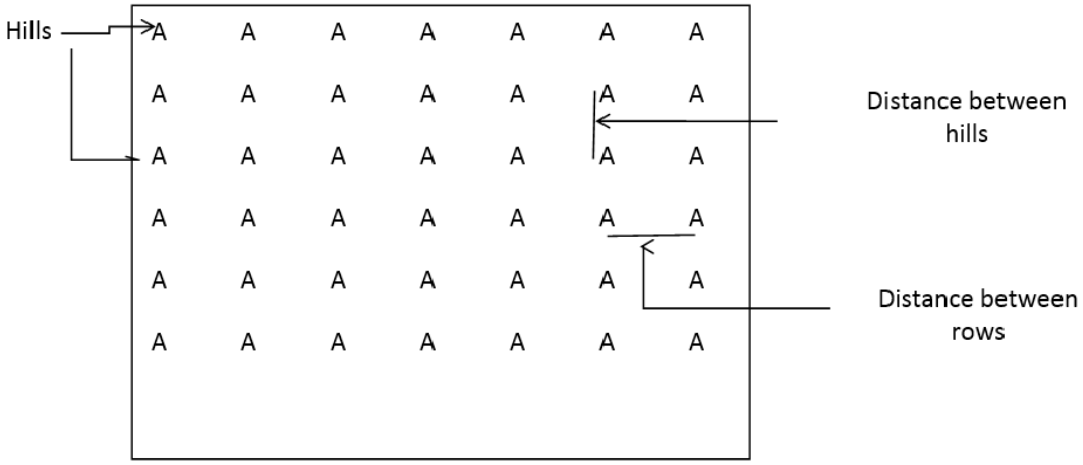


Figure 3: One sampling area

12.5.1 From the sampling areas, the following shall be determined:

- Total number of hills required for the sample area.
- Distance between hills (mm)
- Number of seedlings per hill
- Standing angle of plants
- Depth of planting (mm)

- Missing hills
- Continuous missing hills
- Buried seedlings
- Floating seedlings
- Damaged seedlings

12.5.2 The mean and coefficient of variation of the following shall be computed:

- depth of planting (mm),
- distance between hills (mm), and
- number of seedlings per hill.

12.6 Fuel Consumption

The volume and weight of fuel consumed shall be obtained by refilling method. The fuel tank of the engine shall be filled to full level and shall be refilled after the test. The amount of fuel refilled shall be the amount of fuel consumed.

12.7 Trials

At least three trials shall be conducted.

12.8 Termination of the test

If during the test, the transplanter encounter major breakdown that will prevent the transplanter to perform transplanting operation, the testing authority with the concurrence from the manufacturer shall terminate the test.

13. WATERPROOF TEST

13.1 General

The paddy transplanter is classed as "water proof paddy transplanter," if after the test described below, there is no water penetration into axle, seals and planting system and there is no abnormality in functioning of working parts (4.9.1 OECD Code 2-2014).

13.2 Test Conditions for waterproof test

13.2.1 Test Bed

The test shall be conducted in a testing water bath

13.2.2 Water Level

The water level shall be adjusted to the height of the centre line of the front wheel axle with the paddy transplanter in a horizontal position. All planting arms of the paddy transplanter must be fully immersed under water

The paddy transplanter shall be set on the roller bed (or on a similar device) where the paddy transplanter remains safely fixed during the test.

13.3 Test Procedure

13.3.1. General Provisions

13.3.1.1 The setting gear position shall be maximum range which the transplanter has, and engine rpm shall be about 90% of the rated rpm operated continuously for 10 hours.

13.3.1.2 “Planting Depth" lever shall be kept in "Maximum Planting Depth" position to have maximum penetration of the planting fork and Plant to Plant distance shall be kept in minimum distance to have maximum number of planting stokes.

13.3.1.3 The transplanter shall be operated under the normal condition without carrying seedlings, but 5.5 kg weight shall be replaced for each row to be loaded on the seedling board in place of seedling.

13.3.1.4 If there is leakage of oil from the axle shaft to the water prior to the completion of test, then the test shall be terminated. The paddy transplanter shall then be removed from the testing bath and be cleaned

13.3.1.5 The paddy transplanter shall be left in a place free from rain or snow for sufficient time to dry before being finally checked.

13.3.1.6 Axle and planting portion shall then be disassembled and any evidence of water penetration into them shall be stated in the test report.

13.3.1.7 Data shall be recorded in Annexure E.

ANNEX A: LIST OF CITED STANDARDS

Standards No.	**Title**
ANTAM 001-2016	Asian and Pacific Network for Testing of Agricultural Machinery Standard Code for Testing of Power Tillers
ANTAM 002-2016	Asian and Pacific Network for Testing of Agricultural Machinery Standard Code for Testing of Misters-Cum-Dusters
GB/T 6229-2007	Test Methods for Walking Tractors
IS 8132:1999	Tractors and Machinery for Agriculture and Forestry, Powered Lawn and Garden Equipment – Operator's Manuals – Content and Presentation
IS 9935:2002	Power Tiller – Test Codes
ISO 3600:2015	Tractors, machinery for agriculture and forestry, powered lawn and garden equipment-operators manuals-content and presentation
ISO 5353:1995	Earth-Moving Machinery and Tractors and Machinery for Agriculture and Forestry–Seat Index Point
RNAM 1983	RNAM Technical series no 12, April 1983
GB/T 6243-2003	Rice transplanter –Testing methods
GB/T 20864-2007	Rice transplanter –Specification
Japan 2015	National Test Code for Rice Transplanter (revised September 30, 2015

**ANTAM = Asian and Pacific Network for Testing of Agricultural Machinery*

GB/T = Chinese Standards

IS = Indian Standards

ISO = International Organization for Standardization

RNAM= Regional Network for Agricultural Machinery

ANNEX B: PERFORMA FOR SELECTION, RUNNING-IN AND REPAIRS

B-1 NAME OF THE MANUFACTURER

B-2 ADDRESS

B-3 SUBMITTED FOR TEST BY

B-4 SELECTED BY

B-5 PLACE OF RUNNING-IN

B-6 DURATION AND SCHEDULE OF RUNNING-IN

B-7 REPAIRS AND ADJUSTMENTS MADE DURING RUNNING-IN

ANNEX C: Specification sheet for Paddy Transplanter

No	Description	Manufactures specification	Verification by the testing agency
1.0	**General**		
1.1	Name and address of the manufacturer (s)		
1.2	Name and address of the applicant		
1.3	Type (walk behind / riding)		
1.4	Make/brand		
1.5	Model		
1.6	Number of rows		
1.7	Serial number		
1.8	Year of manufacture		
1.9	Country of origin		
2.0	**Engine**		
2.1	Type (gasoline/diesel)		
2.2	Make/brand		
2.3	Model		
2.4	Country of Manufacture		
2.5	Serial number		
2.6	**Number of cylinders and capacity**		
2.7	Rated speed (rpm)		
2.8	Power at rated speed (kW)		
2.9	Maximum power (kW)		
2.10	Specific fuel consumption (g/kWh) @ maximum power		
2.11	Maximum torque (Nm)		
2.12	Fuel tank capacity (liter)		
2.13	Type of fuel filter		
2.14	Type of cooling system and coolant capacity		
2.15	Type of air cleaner		
2.16	Starting system Type Aids for cold starting Any other devices provided for easy starting		
2.17	Type of silencer		
3.0	Electrical system		
3.1	Voltage (Volts) Details of head lights (number and watt) Battery specification (Volts)		
3.2	Charging system (alternator/dynamo)		
4.0	**Seedling rack**		
4.1	Material		

4.2	Width(mm)		
4.3	Height (mm)		
4.4	Mat feeding type (Manual or automatic)		
5.0	**Planting arm and fork**		
5.1	Type of planting arm (rotary or cranking)		
5.2	Number of arms		
5.3	Material of fork		
5.4	Length of fork (mm)		
5.5	Width of fork (mm)		
6.0	**Floater**		
6.1	Material		
6.2	Center floater (L x W x T) (mm)		
6.3	Outer floater (L x W x T) (mm)		
6.4	Number of floaters		
7.0	**Wheel**		
7.1	Material		
7.2	Width (mm)		
7.3	Diameter (mm)		
8.0	**Handle / Steering Wheel**		
8.1	Width/diameter (mm)		
8.2	Type of grip for prevention of slipping		
8.3	Material of grip		
9.0	**Power transmission system**		
9.1	Type		
9.2	Number of forward and reverse speeds		
9.3	Parking brake (Type)		
10.0	**Operator's seat details**		
10.1	Type		
10.2	Adjustable (yes or no) (Up-down; forward – backward)		
11.0	**Overall dimension**		
11.1	Length (mm)		
11.2	Height (mm)		
11.3	Width (mm)		
11.4	Ground clearance (mm)		
12.0	**Weight**		
12.1	Total mass (kg)		
13.0	**Number of racks for spare seedling trays**		
14.0	**Technical literature**		
14.1	Operator's manual		
14.2	Service Manual		
14.3	Parts catalogue		
14.4	Safety Precautions		
15.0	**Horn (Front and rear)**		

ANNEX D: Safety requirements

Safety Protection (Yes – Y, No – N, Not Applicable – NA)

No.	Requirement	Observation Y / N / NA	Remarks
1.	The exposed transmission parts, rotating parts should have protective cover		
2.	The position and the direction of the exhaust port shall avoid the operator and helpers who are supposed to stand on the machine.		
3.	The operator work floor should be flat and non-slip		
4.	The row marker should have locking mechanism.		
5.	The operation symbols should be pasted near the key controls		
6.	There should be a minimum gap of at least 25mm between the control levers		
7.	The pedal should have non-slip surface and easy to clean.		
8.	The positive pole of the battery should have the protective cover to prevent the short circuit.		
9.	Riding type transplanters should be equipped with footsteps on both sides.		
10.	All exposed sharp edges and corners must have smooth finish		
11.	Transplanters should be equipped with a front side (head lights) and a rear side light, which is optional		
12.	Dangerous moving parts must be indicated by safety signs and should be illustrated in the operating manual		
13.	Riding type transplanters should be equipped with a reverse horn		

ANNEX E: Data sheet for Laboratory tests of Paddy transplanters

E-1 Parking Brake Test		
Transplanter mass (kg)		
Slope (%):		
Observations	Transplanter parked Facing up slope	Transplanter parked Facing down slope
Whether rolling of braking wheels noticed	Yes/No	Yes/No
Efficacy of brakes	Yes/No	Yes/No

E-2 Data sheet for Noise measurement

MEASURMENT POSITION					Operator Ear Level	
E.2.1 Brief Description of the Silencing System						
E.2. Sound Level Meter 1) Type: 2) Make: 3) Model:						
E.2.3 Date of Test						
E.2.4 Background Noise Level (dB(A))						
E.2.5 Atmospheric Conditions a) Ambient Temperature (°C) b) Wind velocity (m/s) c) Atmospheric Pressure (kPa) d) Relative humidity (Percent)						
E.2.6 Test Data for Operator Ear Level						
No.		*Travelling Speed (km/h)*	Engine Speed (rpm)		*Ear (Left/Right)*	*Sound Level (dB(A))*
(1)	*(2)*	*(3)*	*(4)*	*(5)*		*(7)*
1						
2						
3						

E-3. DATA SHEET FOR WATERPROOF TEST

Sr. No.	Components	Ingress of Water	Oil leakage
1	Axle	Yes/No	
2	Clutch housing	Yes/No	
3	Planting assembly	Yes/No	
4	Hydraulic parts		

Any abnormalities observed:

ANNEX F: Data Sheet for Field Tests of Paddy Transplanters

Location									
Date and Time									
Ambient condition (Humidity, Temperature, Wind velocity, Atmospheric pressure)									
Seedlings condition									
Age of seedlings (Days)									
Variety									
Average seedling density (No. of plant/cm^2)									
Sample 1									
Sample 2									
Sample 3									
Leaf stage (No. of leave)									
Height of seedlings (mm)									
Thickness of seedling mat (mm)									
Soil type of seedling mat (mm)									
Root length (mm)									
A. Test Field Condition									
A.1 Dimensions									
Length (m)									
Width (m)									
Area (m^2)									
A.2 Soil hardness [cone depth (mm)] (Drop cone test)									
A.3 Depth of hard pan (mm)									
A.4 Depth of Water (mm)									
A.5 Qualitative Assessment (soil type, levelness and stubble)									
B. Machine settings									
B.1 Distance between hills (mm)									
B.2 Depth of planting (mm)									
B.3 Number of seedlings per hill									
B.4 Other settings									
C. Field Performance									
C.1 Transplanting time (h)									
C.2 Total operation time (h)									
C.3 The distance covers for 10 revolutions of driving wheel (m)									
Without load	.								
With load									
C.4 Noise level [db(A)]									
Left									
Right									

C.5 Traveling time for ____20 m distance (s)									
C.6 Non-productive time (s)									
C.7 Fuel consumed (g or ml)									
C.8 Number of passes									
C.9 Distance between hills (mm)									
Mean									
Coefficient of variation									
C.10 Number of seedlings/hill									
Mean									
Coefficient of variation									
C.11 Standing angle with respect to vertical (°)									
Mean									
Coefficient of variation									
C.12 Number of missing hills @ one sampling area									
Mean									
Coefficient of variation									
C.13 Number of buried seedlings @ one sampling area									
Mean									
Coefficient of variation									
C.14 Number of floating seedlings @ one sampling area									
Mean									
Coefficient of variation									
C.15 Number of damaged seedlings @ one sampling area									
Mean									
Coefficient of variation									
C.16 Items to be computed									
C.16.1 Actual field capacity (ha/h)									
C.16.2 Theoretical field capacity (ha/h)									
C.16.3 Field efficiency (percent)									
C.16.4 Operating speed (km/h)									
C.16.5 Effective working width (m)									
C.16.6 Percent wheel slippage									
C.16.7 Fuel Consumption (kg/ha or liter/ha)									

Hourly Fuel Consumption (kg/h or liter/h)	

FORMULA TO BE USED

1. Actual field capacity (AFC) (ha/h)

$$AFC = \frac{A_t \text{ (ha)}}{T_t \text{ (h)}}$$

Where; A_t = transplanted area (ha)
T_t = Transplanting time (h)

2. Theoretical field capacity (TFC) (ha/h)

$$TFC = W_{at} \text{ (m)} \times S \text{ (km/h)}/10$$

Where; W_{at} = Actual transplanting width (m)
S = Average operating speed (km/h)

3. Field efficiency (E_f) (percent)

$$E_f = \frac{AFC \times 100\%}{TFC}$$

4. Effective working width (W_{eff}) (m)

$$W_{eff} = \frac{\text{Width of the field}}{\text{Number of passes}}$$

5. Coefficient variation = (SD/Mean)*100

SD is Standard Deviation

$$S.D. = \sqrt{\frac{(x-\bar{x})^2}{n-1}}$$

$$\text{6.1 Fuel consumption} = \frac{\text{Fuel consumed (kg or liter)}}{\text{Transplanting area (ha)}}$$

$$\text{6.2 Hourly Fuel consumption (kg/h, L/h)} = \frac{\text{Fuel consumed (kg or L)}}{\text{Time of operation (h)}}$$

Appendix I: ANTAM Focal Points

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Mr. Muhamad Iqbal	Indonesia
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Mr. Mohd Khusairy Khadzir	Malaysia
Mr. Liaqat Ali Shahid	Pakistan
Mr. Darwin Aranguren	Philippines
Dr. Vadim Pronin	Russia
Mr. Janaka Hemachandra	Sri Lanka
Dr. Anuchit Chamsing	Thailand
Mr. Le Huy Phuong	Vietnam

Technical Working Group on Powered Knapsack Misters-Cum-Dusters

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Dr. Douzals Jean-Paul	France
Dr. Panna Lal Singh	India
Mr. Azmy Ulya	Indonesia
Mr. Kawase Yoshiyuki	Japan
Mr. Mohd Fazly Bin Mail	Malaysia

Dr. Hafiz Sultan Mahmood	Pakistan
Mr. Pavel Ishkin	Russia
Ms. Ayesha Herath	Sri Lanka
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Mr. Nguyen Tuan Anh	Vietnam

Technical Working Group on Paddy Transplanters

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