TRAINING ON ANTAM STANDARD CODE
For TESTING OF KNAPSACK MISTERS CUM DUSTERS

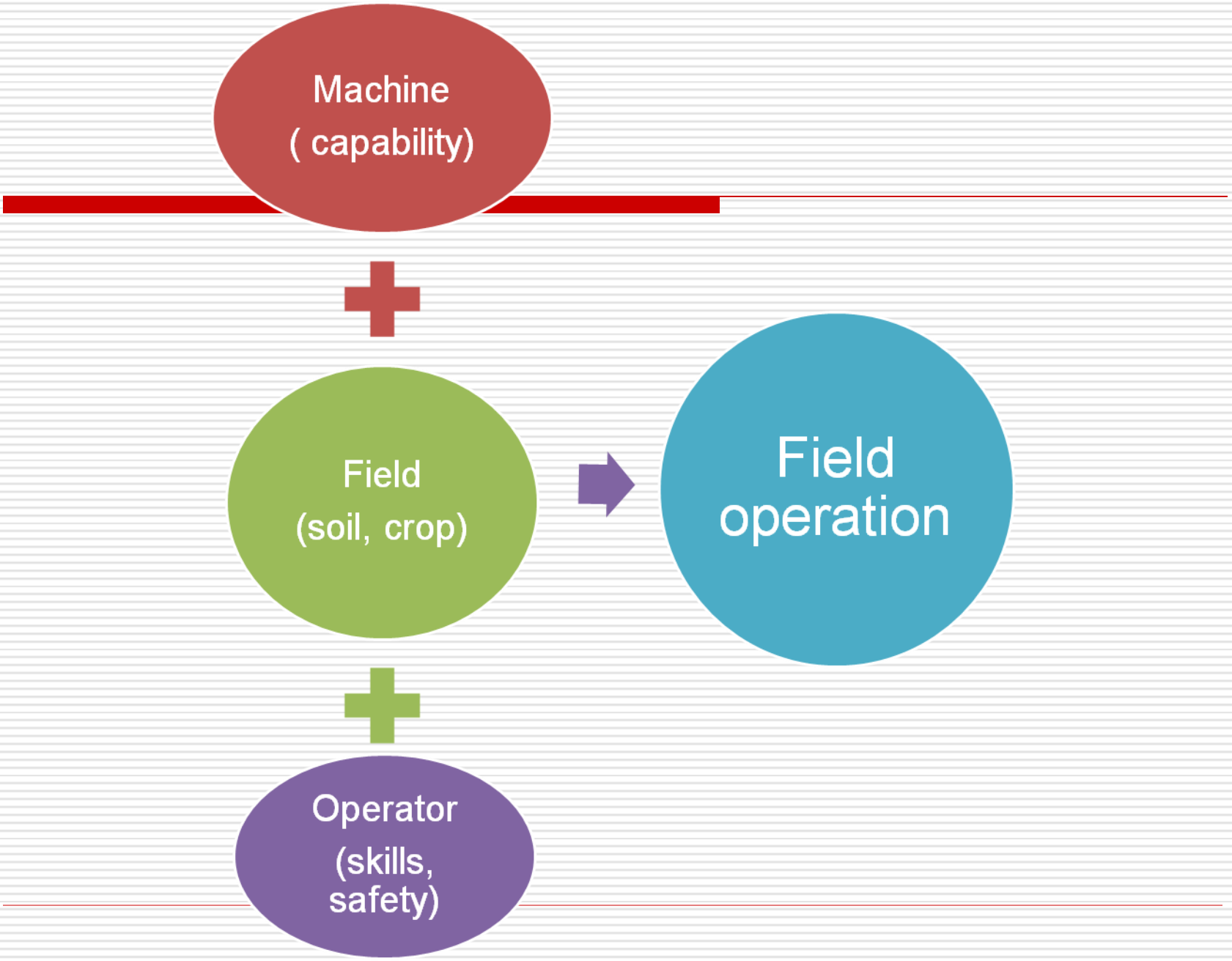
Theory 1: Farm Machinery testing- Purpose- Requirements- Standards-ANTAM Codes

2nd Training of Trainers on ANTAM Codes
16 - 28 October2016, Nanjing China

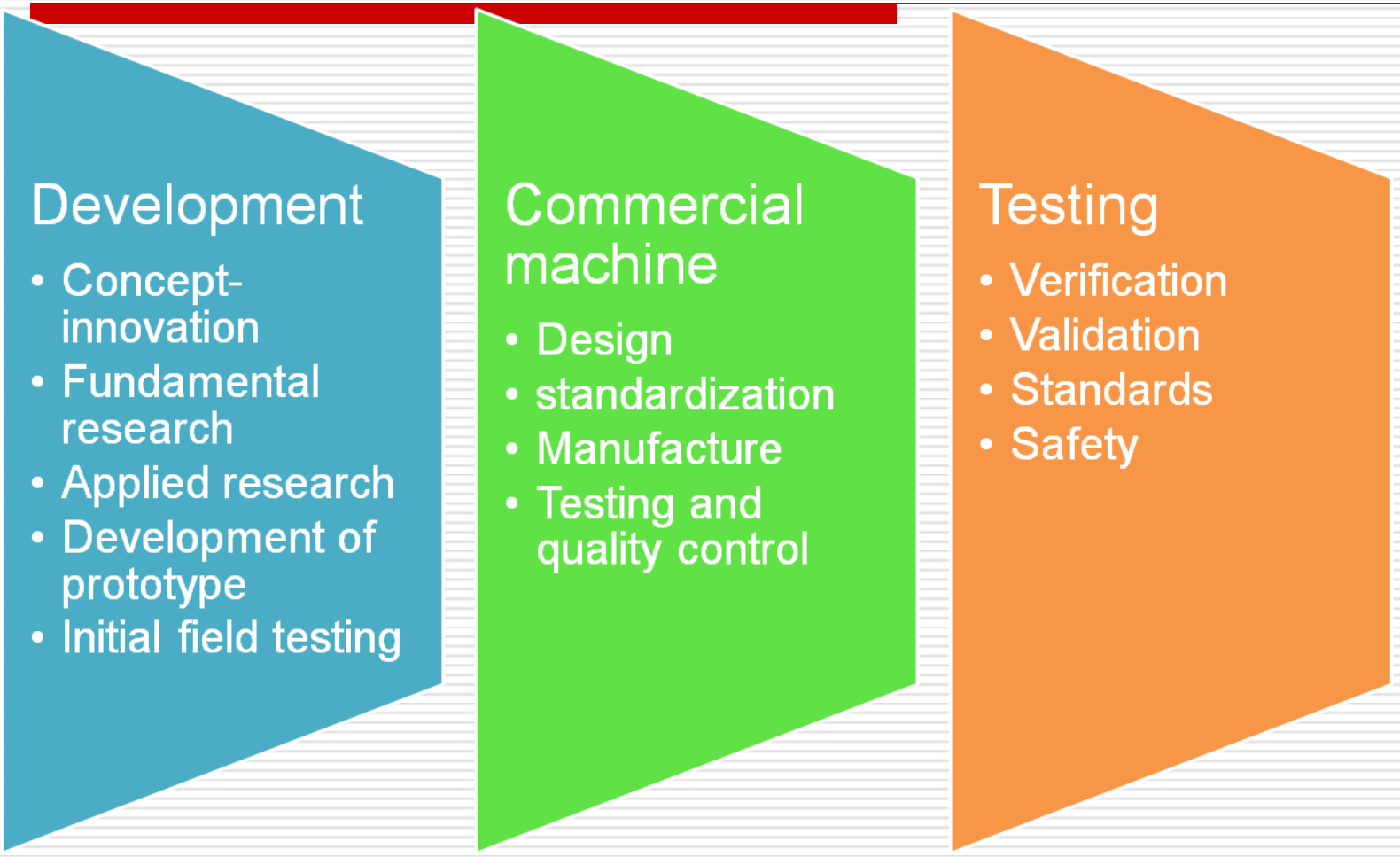
Testing and Quality

- “Testing is an infinite process of comparing the invisible to the ambiguous in order to avoid the unthinkable happening to the anonymous.” – James Bach
- Quality means doing it right even when no one is looking.” – Henry Ford
- “If you don’t care about quality, you can meet any other requirement” – Gerald M. Weinberg

Need for testing


Machine
(capability)
Field
(soil, crop)
Operator
(skills,
safety)
Field
operation

The machine


Development
• Concept-innovation
• Fundamental research
• Applied research
• Development of prototype
• Initial field testing
Commercial machine
• Design
• standardization
• Manufacture
• Testing and quality control
Testing
• Verification
• Validation
• Standards
• Safety

Testing and certification

Does not restrict innovation

- Protects IP rights

Do not restrict Design

- Does not require internal design to be made public

Does not consider technology adopted

- only final performance parameters are measured
- Reliability is tested under some test codes-India

Standard Development Organizations (SDOs) -Tractor industry

Chad Ingle 2011 CMGT 564 Strategic Standards The Catholic University of America

- The Organization for Economic Co-operation and Development (OECD),
- International Organization for Standardization (ISO),
- International Electrotechnical Commission (IEC),
- Society of Automotive Engineers (SAE)
- International, American Society of Agricultural and Biological Engineers (ASABE),
- Association of Equipment Manufacturers – Equipment Manufacturers Institute (AEM-EMI),
- Nebraska Tractor Test Laboratories (NTTL).

Standards for power tiller

- Power tillers are also called walking tractors are also under the tractor standards of ISO/ OECD.
- The power tiller was developed for preparation of rice fields, and is popular in South and South East Asia.
- India and China and Thailand have standards exclusively for Power tillers.

The Nebraska Standard

- The initial SDO for the performance standards of tractors in the United States was the Nebraska Department of Agriculture and the University of Nebraska.
- Tractor performance standards, like all standards, were born out of necessity. One of the most important characteristics to consider when purchasing a tractor is the amount of work it can perform and how much energy or fuel is required. Thus the Nebraska Tractor Test was born. Later safety and interoperability standards were established.

Tractor Testing - Nebraska-law

- The performance of tractors have changed over years.
- Nebraska tractor test law was effective from July 15, 1919and the first successful test was in 1920.
- Over 2000 tractors tested in Nebraska since 1920

- The test routine embodied the following:
- Drawbar work from one-third to full load for twelve hours
- Brake horsepower test at rated load and speed for two hours
- Brake horsepower test at load varying from maximum to no load with all engine adjustments as in the previous test to show fuel consumption and speed control
- Brake horsepower test at maximum load for one hour to show maximum horsepower and behaviour of tractor on the belt and its fuel consumption
- Drawbar horsepower test at rated load for ten hours,
- Maximum drawbar horsepower test with series of short runs with increasing load until excessive wheel slippage occurs

OECD Code

- **OECD approved the first Standard Code for the testing of tractors in 1959 At the moment, 9 Codes are in force (1 on performance, 1 on noise, 7 on ROPS/FOPS)**
- Agricultural machines are of two categories
  - Normal machines- No compulsory examination
  - ROPS, FOPS, PTO guards- compulsory testing required

OECD Test Code

- The first Standard Code for the Official Testing of Agricultural Tractors was approved on 21 April 1959, by the Council of the OEEC) which became the OECD.
- This Code has since been extended to cover forestry tractors and other features of performance, safety and noise
- More than 2 750 tractor models have received performance test approval since the Codes were established in 1959
- More than 10 800 variants of tractors were tested for noise measurement at the driving position, or in most cases, for the driver's protection in case of tractor roll-over.

The OECD Test Code

OECD TRACTOR CodeS –February 2016

- Governments have shown interest to deregulate industrial policies
- Businesses wish to introduce quality assurance methods of the ISO 9000 type.
- The test Code is of significant importance since it enables the concept of "one tractor-–one description–one test“
- It is a means to simplify existing international trade procedures, to establish specifications and basic performance criteria and to ensure a minimum of quality for the traded material.
- The Codes bring transparency thereby contributing to increase the extent of the agricultural machinery market.

- The OECD is not competent for direct type approval or commercialisation of tractors.
- The full text of the OECD Tractor Codes (English and French) are available on line at the following address: *www.oecd.org/tad/tractor*

OECD testing facility

OECD Test facilities

SZZPLS, J.S.C. –Testing of tractors
and their protective structures

Issues Addressed in the Ag. Mech. Standards

Ettore Gasparetto, Domenico Pessina - *Past and present of agricultural machinery standardisation*

Safety	Performance	Road traffic safety
		

Ergonomics	Environment	Electronics
		

OECD & Nebraska Codes

- In 1988 the United States joined the OECD tractor Codes. Many of the OECD tractor performance Codes or standards were developed from the Nebraska Tractor Test Codes
- The reciprocity between OECD and Nebraska Tractor Test Codes greatly reduced the number of redundant test being performed, as the same tractors were being marketed to multiple countries. The synchronization of testing has influenced other areas outside performance including Roll Over Safety Protective Structure (ROPS) testing, noise at the operator ear test, and hydraulic power test.

ISO standards

ISO 3463, *Tractors for agriculture and forestry – Roll-over protective structures – Dynamic test method and acceptance conditions*,

ISO 5700, *Tractors for agriculture and forestry – Roll-over protective structures – Static test method and acceptance conditions*,

ISO 12003-1, *Agriculture and forestry tractors – Narrow-track wheeled tractors – Part 1 : Front mounted roll-over protective structures*,

ISO 12003-2, *Agriculture and forestry tractors – Narrow-track wheeled tractors – Part 2 : Rear-mounted rollover protective structures*

ISO- OECD

OECD and ISO recognized the benefits of transparency in the development of agricultural tractor testing procedures., and

ISO/TC 23/SC 2 and OECD have established a bilateral relationship in an effort to create dual-designated ISO/OECD standards that can be used globally

Agrl. Machinery standards in China

- **Chinese Academy of Agricultural Mechanization Sciences (CAAMS) established in 1956, In charge of Ag machinery standards in China since 1956**
- **The technical management agency of ISO/ TC23 in 1985**
- **National Agricultural Machinery Standardization Technical Committee (SAC/TC 201) was established in CAAMS in 1993**
- **National Low-speed Vehicle Standardization Technical Committee**
- **(SAC/TC 234) was founded in 1998**
- **More than 1200 National Standards and professional standards were developed by CAAMS**

Standards of Agricultural Machinery in China Dr. Shujun Li ,President Chinese Academy of Agricultural Mechanization Sciences (CAAMS)

POWER TILLER TEST -India

- Performance evaluation of power tiller is conducted in accordance with IS:9935-2002 as amended from time to time. A power tiller is put into the following tests and evaluation:

Indian tests-Lab Tests

IS:9935-2002

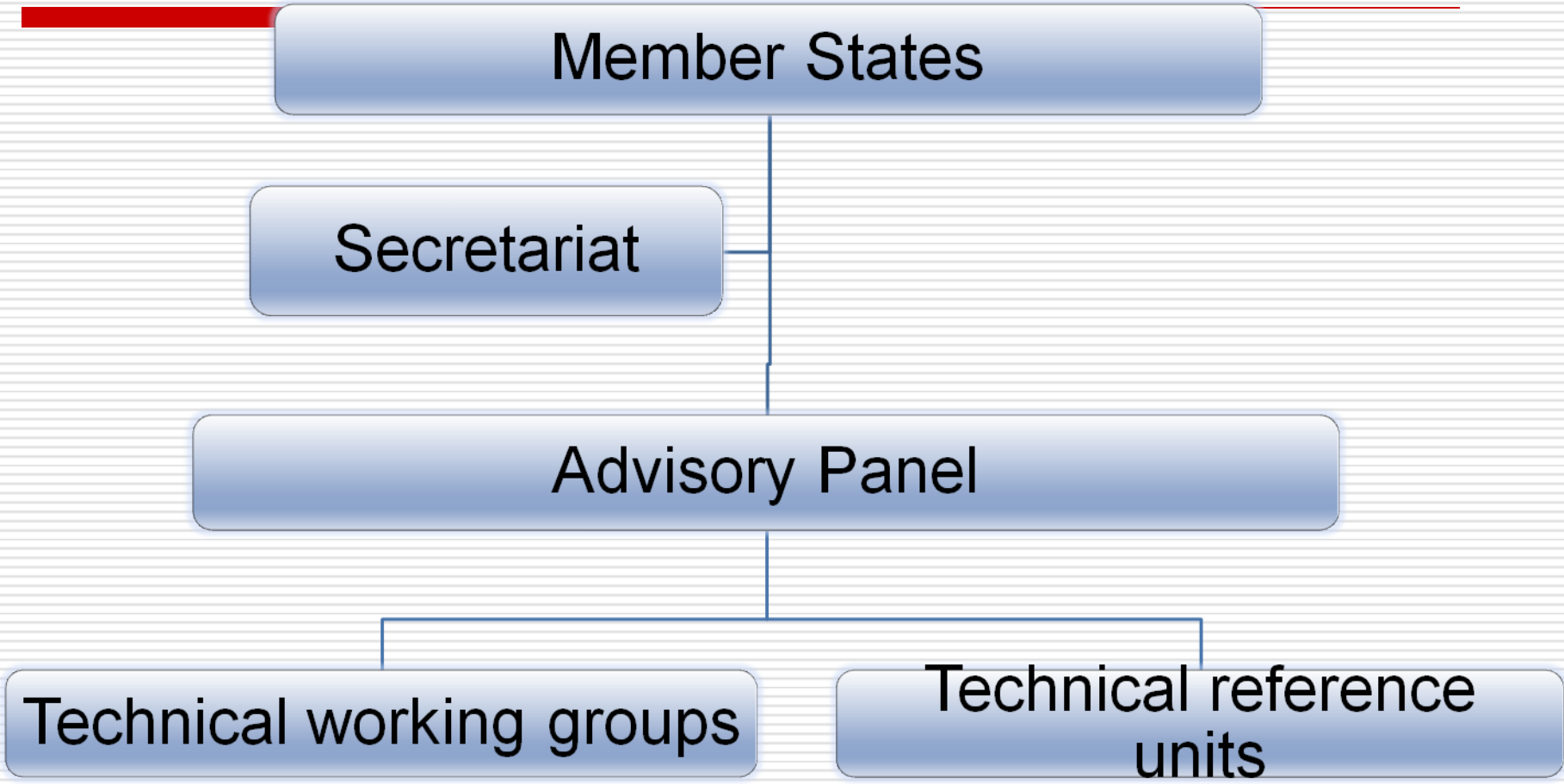
- Specification checking.
- Engine performance test.
- Rotary shaft performance test.
- Drawbar performance test.
- Parking brake test.
- Noise measurement.
- Air cleaner oil pull over test.
- Mechanical vibration measurement.
- Turning ability test.
- Chemical composition test and wear characteristics test of rotavator blades.

Indian tests-Field Tests

IS:9935-2002

- For Initial commercial tests & batch test 35 hrs., of field tests with the following implements
  - Mould board ploughing (20 hrs. for I.C.T. only) dryland
  - Dry rotavation (35 hrs. for I.C.T. & 35 hrs. for Batch tests)
  - Puddling under actual field condition (15 hrs for I.C.T. & Batch test both)
  - Haulage test
  - Components and assembly inspection : to assess the wear, breakdowns, etc.

ANTAM


Member States
Secretariat
Advisory Panel
Technical working groups
Technical reference units

Objectives of ANTAM

Sandro Liberatori Natascia Maisano

2nd Meeting of ANTAM Technical Working Groups 10th May 2016, Bangkok, Thailand

- Forge a common definition and understanding of standards for sustainable agricultural machinery
- Promote mutual recognition of testing through harmonization and adoption of harmonized region-wide testing Codes and procedures
- Improve existing testing facilities of participating countries
- Reduce social costs of production and use of unsafe and inefficient agricultural machinery
- Facilitate intraregional trade of sustainable agricultural machinery

Objectives of testing

- Elimination of poor quality products
- Guiding appropriate choice and use
- Supporting development and improvement
- Facilitating trade both domestically and abroad
- Securing labour safety and hygiene
- Promoting environmental conservation and energy saving

TWGs and ANTAM Codes

- Established in February 2015 and include experts from 13 countries i.e. Bangladesh, Cambodia, China, France, India, Indonesia, Malaysia, Pakistan, Philippines, Russia, Sri Lanka, Thailand and Vietnam.

- Tasked to develop, review ANTAM Codes and provide technical guidance to the work of ANTAM.

- Three TWGs, i.e. power tillers, powered knapsack misters cum dusters, and rice transplanters.

TWGs and ANTAM Codes

- The ANTAM Codes draw upon major international guidelines and standards formulated by FAO, ISO and OECD, and merge popular Codes and practices that are widely used by participating countries to reflect salient regional features.
- The Codes are drafted by the TWGs and presented for adoption to the ANTAM annual meeting.
- ANTAM Codes are regularly updated to reflect member countries needs and major technological changes.

Out comes of the 2nd TWG

- Review and update of ANTAM Codes and test reports
- ANTAM Standard Test Codes on Power tillers
  - vibration test (Pakistan)
  - rotary shaft test (Bangladesh)
  - waterproof test (Cambodia, Philippines, Thailand)
  - update test report
- ANTAM Standard Test Codes on Powered Knapsack Misters cum Dusters
  - review and update the existing testing methodologies
  - acceptable limits
  - update test report
- Simplified ANTAM test reports

- The ANTAM Codes draw upon major international guidelines and standards formulated by FAO, ISO and OECD, and merge popular Codes and practices that are widely used by participating countries to reflect salient regional features.

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- ANTAM Codes are regularly updated to reflect member countries needs and major technological changes.

Challenges

- Enhance engagement with regional intergovernmental organizations, ASEAN, SAARC, farmers organizations and the private sector to facilitate implementation of and raise awareness on the Codes
- Mutual recognition arrangement
- Appointment of ANTAM Certified Testing Stations

FAO and Machinery Standards

- FAO recognized the role of Selection, testing and evaluation of agricultural machinery
- A panel of experts examined the issues in 1992
- Two publications
  - Testing and evaluation of agricultural machinery and equipment-Principles and practices Bulletin 110
  - Selection, testing and evaluation of agricultural machinery and equipment- Theory- Bulletin 115

Standards referred to in

ANTAM 001 2016

Standards No.	Title
GB/T 6229-2007	Test Methods for Walking Tractors
IEC 651-1979	Sound Level Meters
IS 12036:1995	Agricultural Tractors-Test Procedures-Power Test for Power Take-off
IS 12180-1:2000	Tractors and Machinery For Agriculture and Forestry -- Noise Measurement- Method of Test: Part: 1: Noise at the Operator's Position - Survey Method
IS 12226:1995	Agricultural Tractors -- Power Tests for Drawbar -Test Procedure (First Revision)
IS 9935:2002	Power Tiller -- Test Codes
ISO 4251-1:2005	Tyres (Ply Rating Marked Series) and Rims for Agricultural Tractors and Machines -- Part 1: Tyre Designation and Dimensions, and Approved Rim Contour
ISO 5353:1995	Earth-Moving Machinery and Tractors and Machinery for Agriculture and Forestry -- Seat Index Point
JB/T 7282-2004	Types and Specifications of Oils for Tractors
OECD Code 2-2014	OECD Standard Code for the Official Testing of Agricultural and Forestry Tractor Performance
PNS/PAES 117:2000	Agricultural Machinery-- Small Engine- Method of Test
SNI 0738:2014	Quality Standard and Testing Method of Two-wheel Tractors
TIS 1350-1996	Walk-behind tractors
TIS 787-2008	Small size water cooled diesel engines

Objectives of testing center- CFMTTI

- Results of testing :
  - To accesses suitability
  - To determine comparative performance
  - To aid development of machinery
  - Guiding farmers in the proper selection
  - Form basis for standard specifications to be used by the manufacturers and distributors.
  - For recommending financial assistance.

- To carry out trials on machinery and implements which have proven successful in other region of the world with a view to explore the possibility of their introduction in the country.
- To assist Bureau of Indian Standards in the formation of various standards on agricultural implements and machines.

Relevant standards

Sl.No	Code	Number
1	ANTAM Standard Code For Testing of Power Tillers	001-2016
2	Power tiller - Test Code- (2nd Revision)	IS 9935:2002
3	Method For Noise Measurement of Agricultural Tractors	IS : 12180 – 1987- Reaffi. 1995
4	OECD standard Code for the official measurement of noise at the driving position(s) on Agricultural and Forestry Tractors	Code 5 July 2012
5	OECD Standard Code For The Official Testing Of Agricultural And Forestry Tractor Performance	Code 2 July 2012
6	Tractors and machinery for agriculture And forestry - noise measurement method Of test Part 1 noise at the operator1s position - survey method	IS 12180 (Part 1) : 2000 ISO 5131 : 1996
7	Tractors and machinery for agriculture And forestry - noise measurement method Of test Part 2 noise emitted when in motion *(first revision)*	IS 12180 (Part 2) : 2000 ISO7216 : 1992
8	*Indian standard* electroacoustics — level meters Part 1 specifications	**IS 15575 (Part 1) :2005** **IEC 61672-1 (2002)** (Superseding IS 9779: 1981)
9	Agricultural tractors - axle power Determination-test procedures	IS14414:1996
10	Guidelines for Field performance and haulage Tests of power tillers	IS : **9980 –** 1988

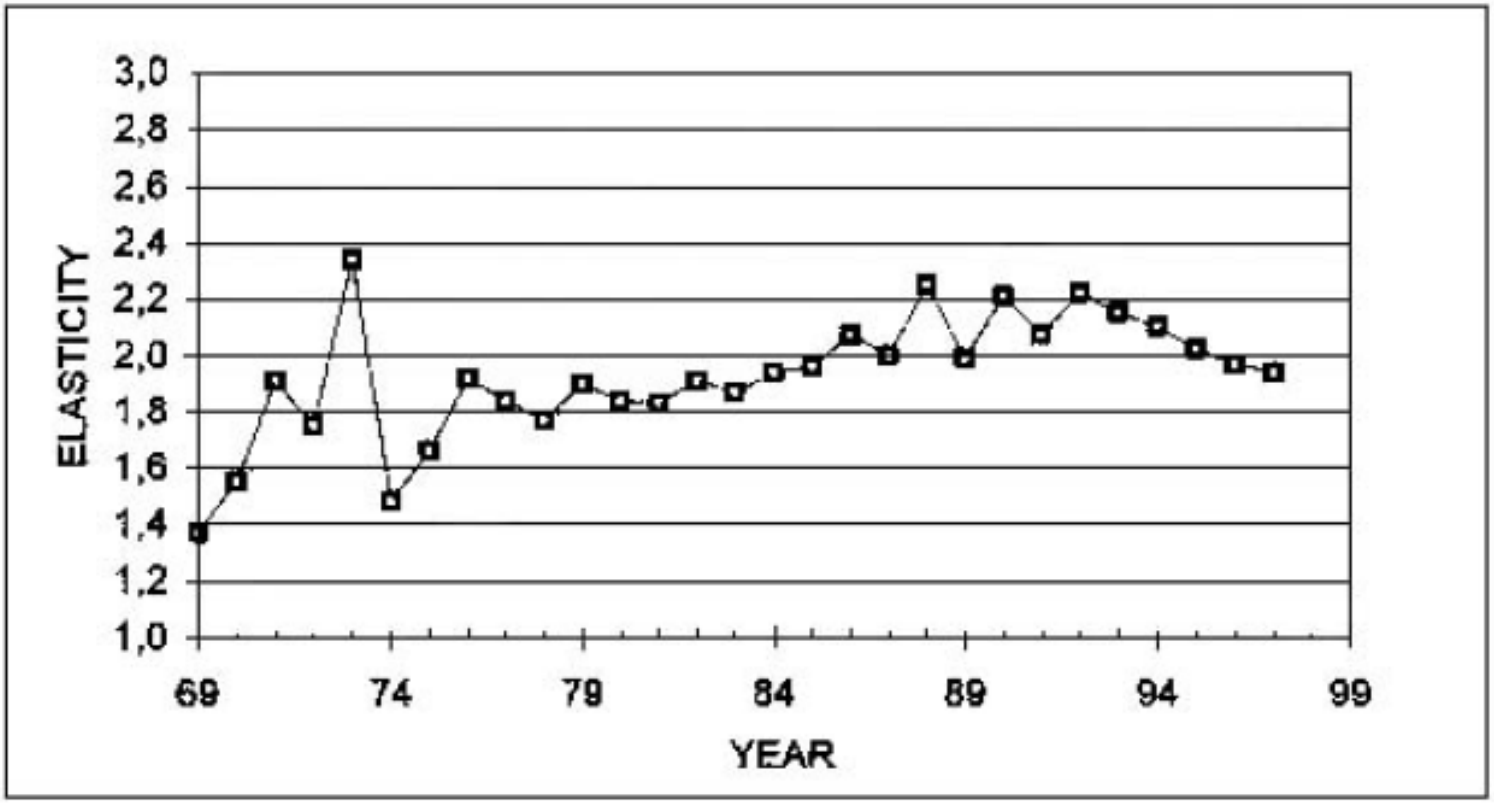
Transition of structure and performance on tractors

Source: Generality of the official testing system for agricultural machinery
by ***Hiroyuki Takahashi,*** JAPAN,

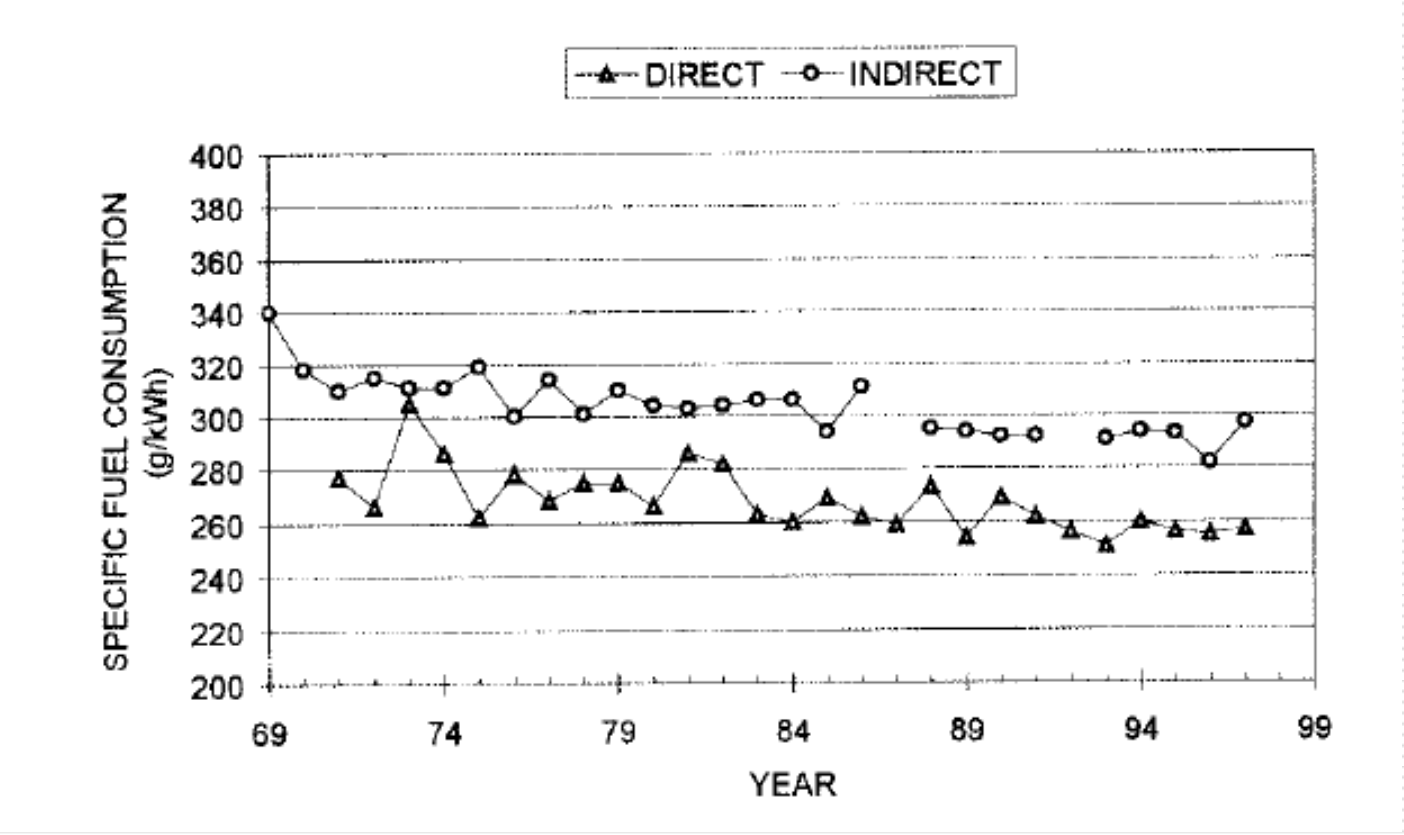
- Structure
  - Improvements in waterproofing
- About 24 % of tractors tested my Japan failed in water proof test during 1974-84
- Improvements in ease of handling
- Foot plate (Driver floor space)
- Power shift transmission
- Improvements in the handling of implements
- Improvements in maneuverability of levers and pedals
- Safety equipment

Elasticity

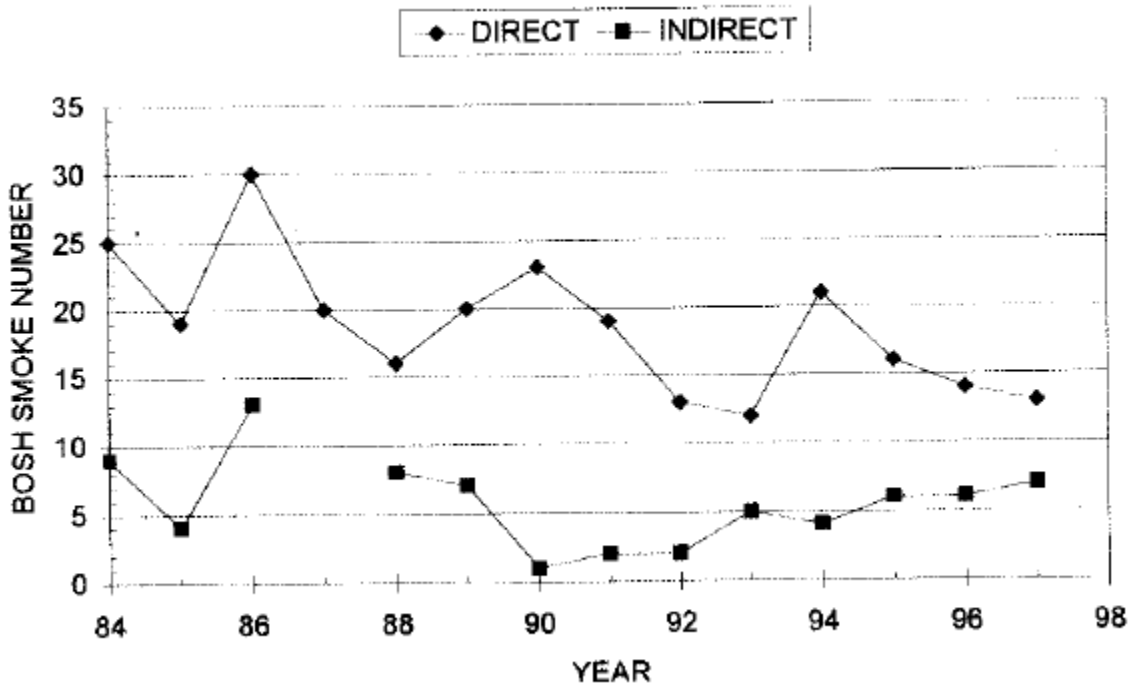
$$Elasticity = \left[\frac{Maximum\ Torque}{Torque\ at\ Max\ Power}\right] \times \left[\frac{\mathrm{Re}v\ at\ Max\ Power}{\mathrm{Re}v\ at\ Max\ torque}\right]$$



Specific fuel consumption trends



Exhaust smoke



Noise

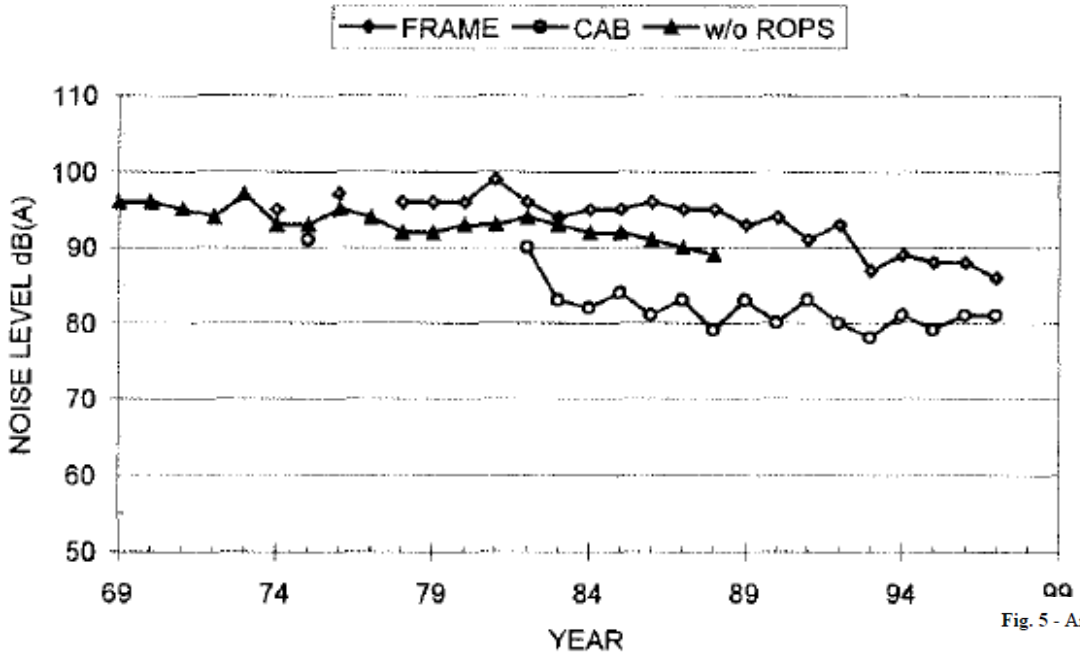
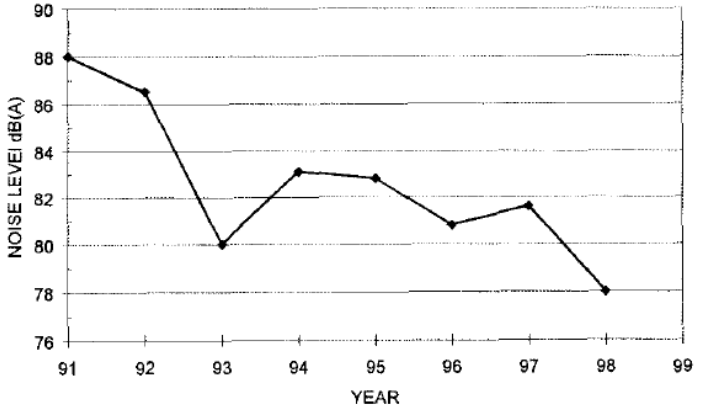


Fig. 5 - Ambient noise level



Reference

- STÁTNÍ ZKUŠEBNA ZEMĚDĚLSKÝCH, POTRAVINÁŘSKÝCH A LESNICKÝCH STROJŮ, a.s. (http://en.szzpls.cz/w/szzpls/files/p05e0614_traktory_oecd.pdf)
- OECD standard Codes for the official testing of agricultural and forestry tractors –General Texts

Have tractors improved?

We thought it would be interesting to take a look at the two most important performance features of tractors and compare those of years ago to today's models. Below is a table that averages the ratings for six of the most common 100 hp tractors sold in Canada.

Remember that cutting noise by 10 decibels reduces by half the noise perceived by the human ear. That's because noise is measured on a logarithmic scale—the measurements are not linear.

	Average 1975	Average 1995	Per Cent Change 1975 - 1995
Specific Fuel Consumption @ Rated rpm (hp hours/gal)	14.93	17.40	16.5
			Decrease in Noise
Noise at Operator's Ear [dB(A)]	88.36	78.4	9.96 or 68.23%