TESTING OF AGRICULTURAL MACHINES IN THE PHILIPPINES

DELFIN C. SUMINISTRADO
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The Philippines

Land area: 30 million hectares
Agricultural: 9.7 million hectares
Crops:
- Rice, Corn, Coconut,
- Sugar Cane, Banana,
- Pineapple, Cassava, Rubber,
- Mango, Vegetables
Average landholding: less than 2 ha/farmer
Total irrigable area: 3.126 million ha
Climate: March to May, dry, hot season
- June to October, wet season
- November to February, cool and fair weather
# Mechanization of various crops

<table>
<thead>
<tr>
<th>Operation</th>
<th>Rice/Corn</th>
<th>Vegetable, legumes &amp; rootcrops</th>
<th>Coconut/Fruits/Fiber crops</th>
<th>Sugarcane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land preparation</td>
<td>Intermediate to high</td>
<td>Low</td>
<td>Low</td>
<td>Intermediate to high</td>
</tr>
<tr>
<td>Planting/transplanting</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low to intermediate</td>
</tr>
<tr>
<td>Crop care/cultivation</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low to high</td>
</tr>
<tr>
<td>Harvesting</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Threshing/shelling</td>
<td>Intermediate to high</td>
<td>Low (legumes)</td>
<td>Low (legumes)</td>
<td>Low</td>
</tr>
<tr>
<td>Cleaning</td>
<td></td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drying</td>
<td>Low</td>
<td>Low (legumes)</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Milling/ village level processing</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>
AGRICULTURAL MACHINERY TESTING AND EVALUATION CENTER

COLLEGE OF ENGINEERING AND AGRO-INDUSTRIAL TECHNOLOGY
University of the Philippines Los Baños
AMTEC was created in response to the need for an official testing agency for agricultural machinery to guide stakeholders in determining suitability of agricultural machinery under Philippine conditions.

AMTEC was established in 1977 through a Memorandum of Agreement (MOA) between the Department of Agriculture (DA) and University of the Philippines at Los Baños (UPLB).

AMTEC is administered by UPLB through the College of Engineering and Agro-Industrial Technology (CEAT).
“The AMTEC shall be the testing and evaluation arm of the DA. All agriculture and fisheries machinery to be acquired under the various programs and projects of the DA shall pass through testing by the AMTEC”

–Administrative Order No. 11, Series of 2001 of the DA
AFMech Law 2013
(RA 10601)
Article 5, Section 18 of the AFMech Law stipulates that ‘Agricultural and fisheries machinery and equipment to be sold in the market shall pass through testing and evaluation by AMTEC...’
MANDATES

PRIMARY

* To establish standard specifications, test procedures and performance indices for agricultural machinery.

* To conduct testing and evaluation of agricultural machinery under established standards.
SECONDARY

- To assess after-sales service capabilities of firms engaged in sales of agricultural machinery.
- To publish and disseminate standards and test results.
- To train students, technicians, engineers on standards development and testing of agricultural machinery.
OBJECTIVES OF TESTING

- To establish performance characteristics of agricultural and fishery machines
- To establish the general status and trend of the performance of the agricultural and fishery machines
METHODOLOGY OF TESTING
AMTEC conducts tests based on the PAES
Philippine Agricultural Engineering Standards

- Adopted by Board of Agricultural Engineering of PRC
- Adopted by DA
## PAES

<table>
<thead>
<tr>
<th>Classification</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>3</td>
</tr>
<tr>
<td>Production machinery</td>
<td>68</td>
</tr>
<tr>
<td>Postharvest machinery</td>
<td>60</td>
</tr>
<tr>
<td>Engineering materials</td>
<td>68</td>
</tr>
<tr>
<td>Agricultural structures</td>
<td>24</td>
</tr>
<tr>
<td>Slaughterhouse equipment</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>209</strong></td>
</tr>
</tbody>
</table>
# MACHINES TESTED

## MACHINES

<table>
<thead>
<tr>
<th>MACHINES</th>
<th>MACHINES TESTED (July 1977 - October 2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime Movers</td>
<td>820</td>
</tr>
<tr>
<td>Irrigation Equipment</td>
<td>543</td>
</tr>
<tr>
<td>Production Machinery</td>
<td>297</td>
</tr>
<tr>
<td>Postharvest Equipment</td>
<td>673</td>
</tr>
<tr>
<td>Grain Moisture Testers</td>
<td>15</td>
</tr>
<tr>
<td>Electric Generator Set</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2350</strong></td>
</tr>
</tbody>
</table>
MACHINES TESTED
# MACHINES TESTED

List of frequently tested machines by AMTEC
Source: AMTEC Test Reports (2008 to 2014)

<table>
<thead>
<tr>
<th>1. Engines (Diesel and Gasoline)</th>
<th>7. Rice Mills</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Pumps and Pumpsets</td>
<td>8. Combine Harvesters</td>
</tr>
<tr>
<td>3. 4-Wheel Tractors</td>
<td>9. Biomass Shredders</td>
</tr>
<tr>
<td>5. Corn Sheller/Huskers</td>
<td>11. Dryers</td>
</tr>
<tr>
<td>6. Threshers</td>
<td></td>
</tr>
</tbody>
</table>
4W TRACTOR

ENGINE

PUMPS/ PUMPSETS

TESTING ACTIVITIES
TESTING ACTIVITIES

HAND TRACTORS

CORN SHELLERS/ HUSKERS

THRESHERS

RICE MILLS
BIOMASS SHREDDERS

BIOMASS FURNACE

COMBINE HARVESTERS

TESTING ACTIVITIES
TESTING ACTIVITIES

RECIRCULATING DRYERS

FLAT BED DRYERS
RESULTS

- Engines

Figure 3. Performance characteristic curves of the MITSUBISHI GB220 PN-RSM gasoline engine.
## RESULTS

### Engines

<table>
<thead>
<tr>
<th>Engines</th>
<th>Excellent</th>
<th>Passing</th>
<th>Fail</th>
<th>Breakdown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline Engines</td>
<td>55 (32.7%)</td>
<td>58 (34.5%)</td>
<td>48 (28.6%)</td>
<td>7 (4.17%)</td>
<td>168</td>
</tr>
<tr>
<td>Air-cooled Diesel</td>
<td>38 (47.5%)</td>
<td>24 (30.0%)</td>
<td>16 (20.0%)</td>
<td>2 (2.50%)</td>
<td>80</td>
</tr>
<tr>
<td>Water-cooled Diesel</td>
<td>140 (61.4%)</td>
<td>61 (26.8%)</td>
<td>13 (5.70%)</td>
<td>14 (6.14%)</td>
<td>228</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>233</strong></td>
<td><strong>143</strong></td>
<td><strong>77</strong></td>
<td><strong>23</strong></td>
<td><strong>476</strong></td>
</tr>
</tbody>
</table>
Results

- Engines

Water-cooled diesel engines comparatively performed better than air-cooled diesel engines and gasoline engines.
RESULTS

• Pumps

• Based on construction, the non-self-priming centrifugal pumps had higher efficiencies compared to self-priming.

• The size of pumps is not related to efficiency.
RESULTS

- Rice threshers
RESULTS

- Fans and blowers
RESULTS

- Fans and blowers
RESULTS

• Fans and blowers
Peakefficiency range of axial flow fan is between 67%-72% but AMTEC test results showed that no axial flow fan performed higher than 25% peak efficiency.

The centrifugal fan also performed badly at 38% peak efficiency while the industrial fan data showed peak efficiency range of 69-75%.
RESULTS

• 6-ton flat bed dryer
RESULTS

• 6-ton flat bed dryer
  
  • Based on findings, further improvement of dryer design based on blower configuration, materials used, capacity, flexibility, and usability of the machine to the intended user are essential.

• In addition, there is also a necessity for the retooling and retraining of operators.
SIGNIFICANCE

THE TESTING ACTIVITY

* Gives objective and systematic assessment of the actual machine performance.
* Serves as requirement in procurement process of DA and DAR.
* Safeguards interest of farmers.
* Improves machine supplied to the market.
INFO
DISSEMINATION

- Presentations of scientific papers on meetings, conferences, and conventions
- Publications of technical papers in popular journals
- Trainings on testing and evaluation of agricultural and fishery machines
PROBLEMS

- Lack of permanent technical staff
- Old laboratory and field test equipment
- Increasing workload
..and proposed solutions

* Strengthening of AMTEC:
  * Recruitment of new staff
  * Acquisition of new equipment
  * Work towards obtaining competency level (ISO 17025)
..and proposed solutions

- Establishment of satellite testing centers
CONCLUSION

- The Government recognizes the importance of agricultural and fishery machinery testing, thus, AFMech Law (RA 10601) of 2013 stipulates the strengthening of AMTEC and supports the establishment of satellite testing centers.
As member of Asia Pacific Network for Testing of Agricultural Machinery (ANTAM), AMTEC takes part in the harmonization of the testing codes and standards of agricultural and fishery machineries.
Thank you