How did we evaluate and approve UGMA moisture meters for official use?

• National Type Evaluation Program evaluation
• UGMA Compatibility Evaluation
National Type Evaluation Program (NTEP)

- Certifying instruments and calibrations for grain moisture, protein, oil and test weight per bushel used in commercial transactions regulated by the states.
National Conference on Weights and Measures

www.ncwm.net

- Technical Committees develop criteria and evaluation requirements
- NCWM Publication 14 Grain Moisture Meters & Near Infrared Grain Analyzers ©2015
  - Technical Policy
  - Checklists
  - Test Procedures

www.nist.gov/pml/wmd/pubs/hb44.cfm
1990 Farm Bill (incorporated into U.S. Grain Standards Act)

• Manufacturer
  • Common specifications and performance criteria
• Elevators
  • Identify devices suitable for commercial trade
  • Confidence in results
• Producers
  • Confidence in results
  • Equitable
• GIPSA
  • Opportunity to review current technology

Promote greater uniformity in commercial grain inspection to address grain quality concerns and enhance competitiveness of U.S. grain exports.
NTEP Grains

• Corn
• Durum Wheat
• Hard Red Spring Wheat
• Hard Red Winter Wheat
• Hard White Wheat
• Soft Red Winter Wheat
• Soft White Wheat
• Soybeans

• Six-Row Barley
• Two-Row Barley
• Grain Sorghum
• Long Grain Rough Rice
• Medium Grain Rough Rice
• Oats
• Sunflower Seed (Oil)
Specifications and Performance Criteria

• Basic Instrument Tests
  • Stability
  • Level
  • Power Supply
  • Humidity
  • Instrument Temperature Sensitivity
  • Sample Volume

• Calibration Performance
  • Sample Temperature Sensitivity
  • Accuracy, Repeatability and Reproducibility
  • Moisture Bias Check

• Check List

• On-going Moisture Calibration
  • Moisture and Test Weight per bushel performance requirements
NTEP: 1994 - Present
NTEP: Active Certificates of Conformance
Phase I Corn Calibration Accuracy
(Data for 30 selected corn samples)

Phase 1 Moisture Accuracy Comparison – Corn

Bias with respect to oven

Moisture Interval/Number of Samples
Phase 2 Corn Calibration Accuracy as of 2007

Moisture Meter Comparison - Corn
2004 - 2006 Crop Years

Bias with respect to oven vs. Moisture Interval/Number of Samples

- Official Meter (-0.01)
- Meter 1 (+0.03)
- Meter 2 (+0.07)
- Meter 3 (+0.08)
- Meter 4 (-0.02)

Phase 1 range
Phase 2 Corn Calibration Accuracy in 2015

Moisture Meter Comparison - Corn
2012 - 2014 Crop Years

Bias with respect to oven

Phase 1 range

Moisture Interval/Number of Samples
- Official Meter (0.02)
- Meter 1 (0.03)
- Meter 2 (0.01)
- Meter 3 (0.16)
- Meter 4 (-0.02)
- Meter 5 (0.08)
NTEP States

* Current as of 2010, provided by Scale Manufacturers Association

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NTEP in Minnesota, North Dakota and South Dakota

• Minnesota
  • NTEP Certificate required for vehicle, livestock and track scales

• North Dakota
  • Moisture or protein disputes tested by federal licensed personnel or 3rd party using USDA inspection rules (NDCC §§ 60-02-05 & 60-02.1-05)
  • Reference NIST Handbook 44 for truck scales

• South Dakota
  • [https://dps.sd.gov/licensing/weights_and_measures/](https://dps.sd.gov/licensing/weights_and_measures/)
  • NTEP Certificate required for vehicle, livestock and hopper scales
  • May inspect any moisture or protein measuring device (Ch 38-31)
Bias with respect to reference moisture

Reference Tolerances
Corn, oats, rice, sorghum, sunflower

Reference Moisture
Air Oven Limit
Like Meter Limit
Bias with respect to reference moisture

Reference Moisture

- Air Oven Limit
- Like Meter Limit
UGMA-Compatibility Criteria (1)

• NTEP Certification
  – Must be proven suitable for commercial use and legal for commercial use in NTEP states
• Documented & stable production processes
• Measurement frequency (149-150 MHz)
• Standardized test cell design
• Standardized loading method
• Standardized measurements
  – Sample dielectric constant
  – Sample mass
  – Sample temperature
UGMA-Compatibility Criteria (2)

• Tight tolerances specified for individual subsystems as well as moisture results
  – Temperature sensor
  – Mass scale
  – Dielectric constant transducer

• Must use specified mathematics

• Units’ agreement with FGIS Master system must meet tolerances in FGIS Regulations
  – +/- 0.05% M for Headquarters Standard units
  – +/- 0.15% M for other Official units
  – Mean difference on medium-moisture HRWW
UGMA-Compatibility Criteria (3)

• All UGMA-Compatible models must be able to use the same check testing process.
• A simple check testing process must ensure performance on all grains over full moisture ranges.
• Instruments must provide for efficient means of entering calibrations.
• Instruments must provide standardized output data stream for printing or networking.