

From Crop fields to Global bowls: The Hidden Network of Standards Safeguarding Our Food

Suvarna Rani Ch¹, Sai Prasad S V¹, Srividhya S², Sirisha T³, Sailaja Jayasekharan B⁴

¹ICAR- Indian Institute of Rice Research, Hyderabad- 500030

² ICAR- Indian Institute of Millets Research, Hyderabad- 500030

³ICAR-Directorate of Floricultural Research, Vemagiri Village, Kadiyam Mandal, Rajahmundry/Rajahmendravaram area, Andhra Pradesh-533126

⁴ICAR – National Institute for Research on Commercial Agriculture. Rajahmundry, Andhra Pradesh - 533105.

Corresponding Author: suvarnarani90@gmail.com

Introduction: Shield through regulatory system

Every day, millions of consumers open packages of milk powder, infant formula, or fresh produce without giving safety a second thought. This trust exists because of a rigorous, interconnected ecosystem. While farmers cultivate the land and factories process the goods, an independent network of accredited laboratories acts as the ultimate filter, catching invisible chemical residues, toxins, and pathogenic contaminants before they ever reach a grocery shelf.

In today's globalized economy, the agricultural and food sectors are governed by a critical mandate: safety and reliability. For laboratories driving this industry, achieving and maintaining international standards is no longer just a regulatory hurdle—it is a powerful competitive edge. A closer look at the key pillars shaping modern agricultural testing shows how institutional standards are rewriting the rules of food safety, trade compliance, and biotechnological integrity.

Regulatory bodies for Domestic Market

Before any food item sold inside India, it must clear two powerful national watchdogs.

- **The Domestic Shield (FSSAI):** The Food Safety and Standards Authority of India sets the definitive baseline for consumer safety. Under its rules, food businesses are legally required to test their products every six months, uploading certified reports directly to the digital FoSCoS portal to prove ongoing compliance.
- **The Seal of Trust (BIS):** The Bureau of Indian Standards acts as the keeper of product integrity, stamping everyday essentials with the iconic ISI mark. For high-risk items like packaged drinking water, securing an IS/ISO/IEC 17025 certified lab report is a mandatory prerequisite to keeping that commercial seal of approval.

Gateways to Global Trade

Taking Indian agriculture to the global stage requires clearing strict international border checks. This is where specialized trade authorities step in to bridge local operations with foreign market expectations:

- **APEDA:** This authority acts as the gateway for scheduled agricultural exports, ensuring that fresh fruits and organic produce meet the precise chemical limits demanded by foreign buyers.
- **EIC:** Providing the final line of defense for outbound commodities, EIC manages pre-shipment inspections so that cargo won't get rejected at international ports.
- **MPEDA:** Focusing exclusively on the seafood sector, MPEDA runs dedicated screening programs to catch banned antibiotics and marine residues before seafood leaves the coast.

Science of standards and accreditations

A regulator's standards are only as reliable as the laboratory testing them. This technical execution rests on specialized, high-precision capabilities:

- **The Competence Benchmark (NABL):** NABL does not write food laws; instead, it evaluates the laboratories themselves. It verifies that a lab's staff, machinery, and calibration methods are accurate under the international ISO/IEC 17025 framework.
- **The Biotech Frontier:** As agricultural science advances, labs use precise GM Detection protocols to screen for modified genetic materials, ensuring transparency in food labeling. Meanwhile, modern facilities implement **ISO 20387 Biobanking** standards to preserve biological samples securely for future agricultural breakthroughs.

NABL is an autonomous third-party accreditation body (under the Quality Council of India) that evaluates whether a lab is technically capable and competent to perform specific tests.

APEDA is a statutory regulatory trade authority (under the Ministry of Commerce and Industry) that regulates and promotes the export of scheduled agricultural products. APEDA uses NABL-accredited labs to ensure export cargo meets global safety standards.

Competency, Calibration standards and proficiency testing

1. ISO/IEC 17025: Competence of Testing & Calibration Laboratories

- ISO/IEC 17025 is the gold standard framework for routine laboratory testing operations.
- **The Scope:** It specifies the general requirements for the competence, impartiality, and consistent

operation of laboratories. It governs everything from how a seed sample is stored, to how equipment is handled, to how technicians log data.

- **Role in the Ecosystem:** This is the standard your testing laboratory is actively applying for. It dictates how you perform your day-to-day tests (like pesticide residue screening or GM detection).

Table 1: Procedure for Laboratory Accreditation

Phase	Procedural Step	Core Objective	Key Timeline / Action
Phase 1: Preparation	1. QMS Implementation	Draft the Quality Manual and align lab workflows with ISO/IEC 17025 or ISO 20387 criteria.	Pre-application
	2. Proficiency Testing (PT)	Prove analytical accuracy by participating in an independent, external ISO 17043 testing round [proficiencytesting.in].	Must complete before applying
	3. Internal Audit & MRM	Run a self-check audit and hold a Management Review Meeting to patch internal errors.	Pre-application
Phase 2: Application	4. Portal Submission	File the official application with the defined testing scope, staff profiles, and processing fees.	Milestone start
	5. Adequacy Review	A NABL Lead Assessor evaluates all submitted manuals for structural gaps.	Within 30 days of filing
Phase 3: Assessment	6. Pre-Assessment	Conduct a brief initial site visit to gauge the laboratory's operational readiness.	Optional milestone
	7. Final Assessment	Peer auditors conduct an intensive on-site review of live testing, machinery calibration, and staff capabilities.	Scheduled site visit
Phase 4: Approval	8. Clearing Gaps (CAPA)	Address any flagged technical deviations or non-conformities (NCs) found by the audit team.	Strict 30-day window
	9. Committee Review	The NABL Accreditation Committee performs the final compliance evaluation.	Post-CAPA verification
	10. Official Grant	The lab receives its official certificate stamped with the globally recognized GAC/ILAC-MRA mark.	Valid for 2 Years
Phase 5: Maintenance	11. Surveillance & Renewal	Maintain the quality standard through routine, unannounced desktop or on-site surveillance checkups.	Annual Surveillance

2. ISO 17034: Competence of Reference Material Producers (RMPs)

- ISO 17034 is the strict standard governing the organizations that manufacture Certified Reference Materials (CRMs).
- **The Scope:** To ensure a testing machine is reading data correctly, it must be calibrated using a "perfect standard"—a substance with a scientifically certified, unshakeable chemical or biological profile. ISO 17034 ensures that companies manufacturing these standards do so with absolute precision and traceability.
- **Role in the Ecosystem:** An ISO/IEC 17025 testing lab must buy its calibration standards from an ISO 17034 accredited producer. For example, when

calibrating a PCR machine for GM detection, the lab uses a certified DNA matrix made by an ISO 17034 accredited producer to ensure the machine detects genetic modifications accurately.

3. ISO/IEC 17043: Competence of Proficiency Testing Providers

- The international standard governing the bodies that design and distribute Proficiency Testing (PT) schemes.
- **The Scope:** It outlines the strict statistical and operational requirements for organizations that build "blind tests" for laboratories. A PT provider must guarantee that all blind samples sent to participating peer labs are identical and that the final scoring metrics (Z-scores) are statistically flawless.

Role in the Ecosystem: To get accredited under ISO/IEC 17025, a testing lab is legally required to participate in PT rounds. The lab must select a PT scheme run by an ISO/IEC 17043 accredited provider to ensure the "exam" it is taking carries official weight with NABL.

Tested Once, Accepted Everywhere

Historically, an exporter had to undergo separate, costly testing in every country they wanted to sell to. Today, the global trade environment operates under a streamlined principle: Accredited Once, Accepted Everywhere.

Through the Global Accreditation Cooperation (Global ACI) alliance, national bodies trust each other's evaluations. Because India's NABL is a prominent member of this international framework, a test report issued by an accredited laboratory in Hyderabad or Mumbai carries the exact same regulatory weight at customs docks in Hamburg, Tokyo, or New York—slashing red tape and accelerating global commerce.

References:

- Agricultural and Processed Food Products Export Development Authority. (2026). Laboratory recognition scheme for export promotion. Ministry of Commerce and Industry, Government of India. apeda.gov.in [APEDA]
- ANSI National Accreditation Board. (2023). ISO/IEC 17043:2023 - Main changes and expectations. ansi.org [ANAB ISO 17043 Updates]
- Bureau of Indian Standards. (2026). Laboratory Recognition Scheme (LRS) & product certification schemes. Ministry of Consumer Affairs, Food & Public Distribution, Government of India. bis.gov.in [BIS Portal]
- Export Inspection Council. (2026). Pre-shipment inspection and certification rules. Ministry of Commerce and Industry, Government of India. eicindia.gov.in [Export Inspection Council Archive]
- Food Safety and Standards Authority of India. (2026). Food Safety Compliance System (FoSCoS) and lab testing mandates. Ministry of Health and Family Welfare, Government of India. fssai.gov.in [FSSAI FoSCoS]

- International Organization for Standardization. (2016). General requirements for the competence of reference material producers (ISO Standard No. 17034:2016). iso.org [ISO 17034:2016 Standard]
- International Organization for Standardization. (2017). General requirements for the competence of testing and calibration laboratories (ISO/IEC Standard No. 17025:2017). iso.org
- International Organization for Standardization. (2018). Biotechnology – Biobanking – General requirements for biobanking (ISO Standard No. 20387:2018). iso.org
- International Organization for Standardization. (2023). Conformity assessment – General requirements for the competence of proficiency testing providers (ISO/IEC Standard No. 17043:2023). iso.org
- Marine Products Export Development Authority. (2026). National Residue Control Plan (NRCP) for aquaculture exports. Ministry of Commerce and Industry, Government of India. mpeda.gov.in [MPEDA Portal]
- National Accreditation Board for Testing and Calibration Laboratories. (2026a). General information brochure & international recognition matrices (ILAC/APAC MRA) (NABL Publication No. 100). Quality Council of India. nabl-india.org [NABL India, NABL Introduction, NABL Accreditation Process Scope, NABL APAC]
- National Accreditation Board for Testing and Calibration Laboratories. (2026b). Specific criteria for quality management system in integrated assessments (NABL Publication No. 127). Quality Council of India. nabl-india.org
- Proficiency Testing India. (2026). Proficiency testing schemes for food, seed, and water matrix inter-laboratory comparisons. PT Provider Frameworks. proficiencytesting.in [ISO 17043 PT]

more competitive.
