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Seed Testing in India: Ensuring Quality Seed for Sustainable Agriculture

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Seed is one of the most important agricultural inputs because the quality of planting material directly influences crop establishment and production. In India, where agriculture covers a wide range of crops, climates, and production systems, ensuring reliable seed quality is especially important. A seed may look healthy externally, but its actual quality can only be understood through systematic testing. Seed testing is a scientific process used to evaluate important characteristics of a seed lot. It helps determine whether the seed meets prescribed standards for parameters such as physical purity, germination, moisture content, and, where applicable, seed health and other quality attributes. In India, seed testing supports quality control and helps provide farmers with dependable information about planting material.

What Is Seed Testing?

Seed testing refers to the examination of a representative sample from a seed lot using standardized laboratory procedures. The objective is to obtain reliable information about the quality of the lot rather than judging individual seeds only by appearance. A seed-testing laboratory can assess different characteristics according to the crop, purpose of testing, and applicable standards. The results help seed producers, processors, regulators, traders, and farmers understand the quality status of the seed. Proper sampling is essential because a laboratory result can represent the whole lot only when the submitted sample is collected and handled appropriately.

Objectives of Seed Testing in India

The major objective of seed testing is to provide dependable information about seed quality and to support the regulation and quality assurance of seed offered for agricultural use. Testing can help identify whether a seed lot satisfies relevant minimum standards and can also assist in quality control during seed production, processing, storage, and marketing. Seed testing is useful for detecting problems that may not be visible to the naked eye. A seed lot can contain inert matter, other crop seeds, weed seeds, damaged seeds, or seeds with reduced germination capacity. Laboratory examination provides measurable information that supports better decisions throughout the seed supply chain.

Major Seed Quality Parameters

Several parameters are commonly examined in seed testing. Physical purity indicates the proportion of the sample that consists of pure seed and identifies unwanted components such as inert matter, other crop seeds, and weed seeds. Germination testing determines the percentage of seeds capable of producing normal seedlings under prescribed test conditions. Moisture content is another important parameter because excessive moisture can accelerate

deterioration and reduce storage life. Seed viability and vigor may also be evaluated when appropriate methods are available. In addition, seed health testing can be used for detecting particular pathogens or health-related problems when required. The importance of each test varies with crop and purpose. Therefore, seed quality should be considered as a combination of several characteristics rather than a single test result.

Germination Testing

Germination testing is one of the most familiar forms of seed quality evaluation. A specified number of seeds are placed under controlled conditions of moisture, temperature, and other environmental factors. After the prescribed testing period, normal seedlings are counted and the result is expressed as a percentage. The test provides an estimate of the seed lot's ability to produce normal seedlings under the conditions of the test. It is particularly useful when comparing seed lots and checking whether a lot meets the relevant quality standard. However, laboratory germination results should be interpreted together with field conditions because actual emergence can also be affected by soil moisture, temperature, pests, diseases, and other environmental factors.

Physical Purity and Moisture Testing

Physical purity testing separates and identifies the different components present in a seed sample. The analyst determines the proportion of pure seed and records other components such as inert matter, other crop seeds, and weed seeds. This information is important because unwanted material reduces the useful seed content of a lot. Moisture testing determines the amount of water present in the seed. Appropriate moisture levels are important for safe handling and storage. Seeds stored with excessive moisture can deteriorate more rapidly, particularly when storage temperature is also unfavorable. Accurate moisture measurement therefore supports decisions about storage and seed-lot management.

Seed Testing Laboratories in India

India has an established network of seed-testing facilities associated with the seed-quality-control system. These laboratories undertake prescribed tests on seed samples submitted for quality evaluation. Their work supports seed certification, quality control, research, and other official or commercial requirements depending on the laboratory and applicable rules. Laboratory staff require appropriate equipment, standardized methods, trained personnel, and proper documentation. Maintaining consistency is important because seed-testing results are used for regulatory and commercial decisions. Standardized procedures and quality-assurance practices help make results more reliable and comparable.

Role of Seed Testing in the Indian Seed Sector

Seed testing connects seed production and marketing with measurable quality standards. It supports the work of seed producers and processors by identifying quality problems and helping them improve seed lots before distribution. For regulatory agencies, testing provides technical evidence for quality-control activities. For farmers, reliable seed quality information can reduce uncertainty when purchasing planting material. Good-quality seed does not guarantee a high yield by itself, but it provides a stronger starting point for crop establishment. When combined with appropriate agronomic practices, quality seed can contribute to uniform stands and efficient use of agricultural resources.

Sampling: The Foundation of Accurate Testing

A laboratory can produce a meaningful result only when the sample accurately represents the seed lot. For this reason, sampling is a critical part of seed testing. Samples must be collected using appropriate procedures and handled carefully to avoid contamination, moisture changes, or loss of identity. The sample is given a clear identification so that the laboratory result can be linked to the correct seed lot. Careful documentation from sampling through testing and reporting strengthens traceability and reduces the possibility of errors. In practical terms, accurate sampling is just as important as accurate laboratory analysis.

Challenges in Seed Testing in India

India's large agricultural area and diverse crop production create substantial demand for reliable seed testing. Maintaining adequate laboratory capacity, trained personnel, modern equipment, and consistent procedures can be challenging, particularly when testing requirements increase during peak seed-production and marketing periods. Another challenge is ensuring that seed quality is maintained after testing. Storage, transportation, packaging, and handling can influence seed condition before it reaches the farmer. Therefore, seed testing should be considered part of a broader quality-assurance system rather than the only safeguard for seed quality.

Modern Technologies and Future Scope

The future of seed testing in India is closely connected with improved laboratory technologies, digital record keeping, automated image analysis, and faster analytical methods. Digital systems can improve sample tracking and reporting, while advanced instruments may help laboratories process samples more efficiently. Research in seed physiology, molecular methods, and seed-health diagnostics may also expand the range of quality information available to seed producers and regulators. The long-term goal is to make testing accurate, efficient, transparent, and accessible while maintaining scientifically sound standards.

Conclusion

Seed testing is an essential component of India's seed-quality system. By evaluating characteristics such as physical purity, germination, moisture content, and other relevant parameters, seed testing laboratories provide objective information about the quality of seed lots. A strong seed-testing system benefits the entire agricultural sector—from breeders and seed producers to regulators, dealers, and farmers. Continued investment in trained personnel, laboratory infrastructure, standardized procedures, digital traceability, and modern testing technologies can further strengthen seed quality assurance in India. Ultimately, reliable seed testing helps farmers begin crop production with greater confidence in the planting material they use.

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