

April 2021

Seed Quality Evaluation

C. C. Baskin

Follow this and additional works at: <https://scholarsjunction.msstate.edu/seedtechpapers>

Recommended Citation

Baskin, C. C., "Seed Quality Evaluation" (2021). *Seed Technology Papers*. 178.
<https://scholarsjunction.msstate.edu/seedtechpapers/178>

This Text is brought to you for free and open access by Scholars Junction. It has been accepted for inclusion in Seed Technology Papers by an authorized administrator of Scholars Junction. For more information, please contact jshedd@library.msstate.edu.



SEED QUALITY EVALUATION

Charles Baskin



SEED TECHNOLOGY LABORATORY
MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE, MISSISSIPPI



SEED QUALITY EVALUATION

By
Charles C. Baskin
Assistant Agronomist

In order for agriculture to make advances, farmers must have at their disposal high quality seed.

In order for the seed industry to provide high quality seed there must be good methods of evaluating seed quality.

In order to properly evaluate seed quality we must first know what factors affect seed quality.

I. Factors Affecting Seed Quality

A. Time of harvest

1. Immature seed will be low in quality.
2. Seed allowed to remain in the field too long after maturity will be reduced in quality.

B. Mechanical Damage

1. Any mechanical damage will reduce the quality of the seed. The greater the damage the greater the reduction in quality.

C. Insects and Diseases

1. Infestation by either reduces seed quality.

D. Moisture Content

1. Seed may be physiologically mature, but not dry enough to store and retain their quality.

E. Genetic Compliment of the Seed

F. Storage Conditions

II. Standard Germination

- A. The % Germination is an indication of quality, the number of normal seedlings produced in a standard germination test. Seeds that produce 90% normal seedlings would be preferred to seed that produce 50% normal seedlings.

III. Purity Analysis

- A. The amount of inert matter, the number of weed seed present, the number of other crop seed present -- all reflect the quality of a lot of seed.

IV. Seed Vigor

- A. Another indication of seed quality is vigor. Vigor may be defined as the degree of aliveness of a seed. Two lots of seed may perform equally well in standard germination, but not perform equally well in the field. This difference in field performance is due to the differences in vigor.

Vigor differences may be genetic or physiological or both.

V. Vigor Testing

- A. There are two general methods which may be used to attempt to evaluate vigor of seeds.
1. Direct methods in which adverse field conditions are simulated.
 2. Indirect methods in which certain physiological attributes of the seed are measured or certain structural characteristics of the seedlings observed.

Both have advantages and disadvantages. One test may apply better to a given situation than another.

B. Direct Vigor Test

1. Corn Cold Test - as previously mentioned, this test attempts to simulate adverse field conditions, excessive moisture and low temperatures, that seed might be subjected to in the early part of the planting season.

(a) Deep Soil Method: A mixture of sand and soil is used this test. The soil is taken from a field that has a previous history of corn being grown. The soil is screened to remove crop residue and lumps. A mixture of sand and soil is prepared. The proportions of the mixture may vary but should be constant throughout the test. A specified amount of the mixture is then placed in containers. Seeds are planted approximately 1 inch deep. Moisture is adjusted to 60% or 70% of saturation of the soil. The containers are then placed at approximately 50° F. for a specified period, after which they are moved to warmer temperatures for emergence. The number of seedlings emerging are counted. The vigor index is the % emergence.

(b) Hoppe Method: In this test, germination towels are prepared as for standard germination. The seed are then covered with approximately 1/4 to 1/2 inch of a sand-soil mixture prepared as in the deep soil test. This is covered with a third towel, rolled, and placed at the same temperature schedule as for the deep soil method.

(c) Cold Test for Other Crops: The cold test vigor evaluation method may be used for other crops as well as corn. A cold test for cotton has been developed here at the Seed Technology Laboratory and is used in seed evaluation.

(d) Total Growth of Plants: This test involves dry or fresh weights of clipped tops or entire plants at a given period of time after planting. Plants are grown under specified conditions. Differences in weights indicate vigor differences.

In all soil test seed must be treated with a fungicide to retard soil microbial activity in order to measure the vigor of the seed.

C. Indirect Vigor Test

Indirect test measure vigor per se rather than simulating field conditions.

1. Tetrazolium techniques have been worked out with several kinds of seed where a numerical score is given based on the observed staining pattern and shade of straining are used to determine the rating given the seed. An entire sample is rated one seed at a time. The average numerical score is calculated. This gives an index that may be used to compare one lot with another. This method requires much study of staining patterns and shades of straining by the individual, to be proficient and accurate in evaluations.

2. **Differential Permeability:** This method is based on the premise that highly vigorous seed are less permeable than are less vigorous seed. The seeds are placed in a solution of known electrical conductivity for a specified period of time. After soaking, the solution is drained and its electrical conductivity is due to electrolyte diffusion into the water.
3. **Speed of Germination:** This test is based on the premise that vigorous seeds germinate faster than non-vigorous seed. Seed are planted as for a standard germination test. Plantings are checked on a 24 hour basis, and when shoot or root growth reaches a predetermined length the seedling is removed. The vigor index is calculated by multiplying the number of seedlings removed by the reciprocal and number of days in the germinator.
4. **Respiration:** The ratio of oxygen consumption to carbon dioxide evolution, respiration quotient, RQ , is a indication of vigor. A low RQ , near one (1) indicates a high level of vigor, as the RQ increases, the vigor decreases.
5. **Stress Methods:**
 - (a) **Moisture:** This technique involves both excessive moisture and insufficient moisture. Insufficient moisture: Insufficient moisture involves using various osmotic concentrations of salts, such as mannitol.

- (b) Temperature: By using temperature higher or lower than optimum, a measure of vigor may be obtained. Germinating cottonseed at 20° C. is an example. Seeds are removed when the radicle reaches one (1) inch in length in 30 days. Only a vigorous seed will produce a 1 inch radicle.
- (c) Moisture and Temperatures: The warm test for peas, uses higher than optimum (30° C.) and higher than optimum (70% of saturation) moisture.
- (d) Rapid Aging: This method is being researched here at the Seed Technology Laboratory. It combines high temperatures (40° to 45° C.) and 100% relative humidity. Seed are allowed to remain in this environment for a specified number of hours depending on the kind of seed. Then they are planted and evaluated as in standard germination.
- (e) Chemical Soaks: Seed may be soaked for a specific number of hours in a specific strength solution of NH_4Cl , then planted and evaluated as in standard germination. The number of normal seedlings is the vigor index.
- (f) Physical Stress: The brick gravel test involves planting seeds below a layer of brick-gravel to exert physical pressure on the germinating. Emergence indicates vigor.

- (g) Pathological: Some research has been done with innoculating seeds with pure cultures of pathogenic organisms.
- (h) Others: Various other tests have been used in research work, pretreatments to induce weakening or killing in low vigor seeds prior to planting under standard germination conditions, application of vacuum treatments, etc., have been used.

VI. Comparison of Direct and Indirect Test

A. Direct tests are very difficult to standardize. Soil is used in most of these tests, composition and microbial content of field soils are impossible to regulate.

A lot of seed of known high vigor of the kind in question must be planted as a comparison. The direct test gives a more relative indication of field performance.

B. Indirect tests are easier to standardize since most of the factors involved are non-living entities and may be accurately controlled, Results are more relative than realistic as far as field performance is concerned.