

Germination Test: To Grow a Quality Seed

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SUMMARY

Among all the standard quality measurements of seed lots, none is more predominant than the potential germination of the seeds. The main object of laboratory testing of seed germination is to assess seed quality or viability and to predict performance of the seed and seedling in the field. For testing seeds, a notified laboratory under Seed Act or ISTA's qualified laboratory must test seed processed for sale. The ultimate aim of testing the germination in seed testing laboratory is to obtain information about the planting value of the seed sample and by inference the quality of the seed lot. In addition, the laboratory germination results are also required for comparing the performance potential or superiority of the different seed lots.

INTRODUCTION

In seed testing germination means the emergence and development from the seed embryo of those essential structures which, for the kind of seed tested indicate its ability to develop into a normal plant under favorable, conditions in soil. The seedlings devoid of an essential structure; showing weak or unbalanced development; decay or damage affecting the normal development of seedling are not considered in calculating the germination percentage. The most common tests are the cold germination test, accelerated aging test, the tetrazolium test and warm germination test. Each test is designed to assess various qualities of the seed (Bonner 1974).

Germination Testing Procedure

The most common test is a warm germination test because it is needed by seed laws to appear on the label. The percentage of germinating seed must be printed on the label of the seed if it is to be sold as seed. It reflects the field emergence potential of a seed lot under ideal planting conditions. Usually 400 seeds are placed under moist conditions from each seed lot on blotters, rolled towels, or sand and maintained about 75° to 85° F for about seven days in most of the cases. At the end of this period the seedlings are categorized normal, abnormal, or diseased, and dead or hard seeds. The percentage of germination is calculated from the number of normal seedlings out of total number of seeds evaluated. The method of testing germination is discussed below.

Requirements of Germination

Seeds require certain conditions for normal germination. The most important requirements are Substrata, Moisture, Temperature and light.

- **Substratum:** Suitable substrata for seed germination include paper towel, blotter paper, filter paper, cotton, sand and soil. Paper and sand are most widely used currently. Paper is easy to handle, versatile and cheap. Sand has the advantage of being inexpensive and reusable but it should be sterilized before use.

- **Moisture:** The seed is planted on a moist substratum. Seed are kept damp by keeping them in chambers where the relative humidity is maintained at 90-95% and in most cases covering them with paper toweling or blotters. They may be placed on paper or enclosed in dishes.
- **Temperature-** The seeds of most agricultural plants germinate somewhere in the temperature range of 10° C -35° C. The preferred temperature usually bears some relationship to the conditions under which the plant normally grows. The prescribed temperature for germination of agricultural, vegetable or horticultural seeds, provided in the Rules for Seed Testing can be broadly is classified into two groups, viz. constant temperatures and alternate temperatures.
- **Constant Temperature:** Wherever, the constant temperatures are prescribed or recommended for the germination tests, the tests must be held at the specific temperature during the entire germination period.
- **Alternate Temperature:** Wherever, the alternating temperatures prescribed, the lower temperature should be maintained for 16 hours and the higher for 8 hours; a gradual changeover lasting 3 hours is usually satisfactory for non-dormant seeds. However, a sharp changeover lasting 1 hour or less, or transfer of test to another germinator at lower temperature may be necessary for seeds, which are likely to be dormant.
- **Light-** A few seeds prefer to germinate in darkness, many are indifferent and some require light. Under the situations where light is essential for germinations, tests should be exposed to the natural or artificial source of light (with cool fluorescent light) for at least 8 hours in every 24 hours cycle.

Carrying Out the Test

The working sample or germination test consists of 400 seeds from pure seed fraction and randomly drawn either manually or with the help of counting devices. Testing of 400 seeds are recommended on all seed control and seed certification samples; however, only two hundred seeds may be tested for service samples. The seeds are counted and evenly spaced on the substratum by hand, a vacuum counter or a counting board. They are then put into germinators for a period of time which varies from species to species (see International Rules for Seed Testing). First and second counts are usually taken with paper tests; however, only a single final count is made with sand tests. At the first and subsequent counts the seedlings which fulfill normal seedling conditions are removed, counted and discarded. All hard seed, diseased and abnormal seedlings, ungerminated seed are left until the final count when their number is recorded. Diseased seeds and seedlings which may affect healthy seeds may be removed before the final count.

Evaluation of Germination Test

The germination test need to be evaluated on the expiry of the germination period, which varies according to the kind of seed. However, the seed analyst may terminate the germination test on or before the final count day or extend the test beyond the period depending on the situation. First and second counts are usually taken in case of Top of Paper (TP) and Between Paper (BP) media; however a single final count is made in case of sand tests. At the first and subsequent counts only normal and dead seeds (which are source of infection) removed and recorded. In evaluating the germination test the seedling and seeds are categorized into normal seedlings, abnormal seedlings, dead seeds, fresh ungerminated and hard seeds.

1. **Normal Seedlings:** Seedlings which show the capability for continued development into normal plant when grown in good quality of soil under favorable conditions of water supply, temperature and light. It is necessity to separate normal seedling, which are counted in the percentage germination, from any abnormal seedlings .

2. Abnormal Seedlings: Abnormal seedlings are those, which do not show the capacity for continued development into normal plants like damaged seedlings, deformed seedlings and decayed seedlings.
3. Dead Seeds: Seeds which are neither hard nor dormant or have not produced any part of a seedling.
4. Fresh Ungerminated Seeds: Seeds, other than hard seeds which have imbibed moisture but have failed to germinate and may be dormant.
5. Hard Seeds: Seeds in which the seed coat is unusually hard and impermeable to moisture and which is thus slow in germinating unless treated mechanically or chemically.

Calculation and Expression of Result

Results are expressed as percentage by number. It is expressed as the average number of seeds that germinate over the five-day and 10-day time period. Germination percentage is calculated by the following formula (Hosseini *et al.*, 2013):

$$\text{Germination percentage (\%)} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds}} \times 100$$

When four 100-seed replicates of a test are within the maximum tolerated range the average represents the percentage germination to be reported on the Analysis Certificate. The average percentage is calculated to the nearest whole number. The total % of all the category of seeds (normal, abnormal, dead, hard & fresh ungerminated) should be 100.

Retesting

The result of a test shall be considered unsatisfactory and shall not be reported and a second test shall be made by the same or an alternative method, under the following circumstances:

- When dormancy is suspected (fresh ungerminated seeds).
- When the result may not be reliable because of phytotoxicity or spread of fungi or bacteria.
- When there is difficulty in deciding the correct evaluation of a number of seedlings.
- d) When there is evidence of errors in test conditions, seedling evaluation or counting.
- When the range for the 100-seed replicates exceeds the maximum tolerated range.

Reporting of Result

The above mentioned items shall be entered in the appropriate space of the analysis certificate.

CONCLUSION

Germination is one of the most foremost criteria of seed quality, because it affects crop establishment and therefore the yield and quality of the future harvest. A reliable assessment of germination quality is imperative to ensure that the users of seed lots get the extent of quality they expect.

REFERENCES

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