SEED VIABILITY AND VIABILITY TESTING

Viability of a seed refers to the ability of a seed to germinate and produce a "normal" seedling. Seed viability is highest at the time of physiological maturity, though environmental conditions on the parent plant may not permit germination. After physiological maturity, the viability of seed gradually declines. The longevity of seed depends on crop species and on the environmental conditions to which they are exposed.

SEED GERMINATIN STAGES:

Irrespective of the criteria used for deciding on when seed germination has taken place, the following stages exists:

1. **Germination**

   This stage includes water imbibition and all the biochemical and physiological process that culminate in the emergence of the radical and the plumule.

2. **Underground elongation**

   At this stage of germination, elongation of both the radical and the plumule takes place at the expense of food reserve in the endosperm. The soil depth through which the plumule can emerge depends on the amount of food reserve in the endosperm.

3. **Emergence**

   It is at this stage that the aerial parts of the seedling emerge above the ground. Seedling emergence may be hypogeal if cotyledons remain below the soil surface, or epigeal if the cotyledons are forced above ground by elongation of the epicotyls.

4. **Independent growth**

The period starts with the onset of photosynthetic activity by the seedling plant. Normal functioning of the seedling is established at this stage. With large-seeded species and sprouts from vegetative

propagules, there is considerable overlap in time between parental independence and development of photosynthetic food source.

GERMINATION TEST: Germination test is most commonly used method to determine seed viability. Seed germination is the consecutive number of steps that will cause a non-dormant or active seed to imbibe water and initiate changes that led to the development of the embryo until the emergence of those essential structures which are indicative of its ability to produce a normal plant. The seed takes up water firstly by imbibition of water is accompanied by swelling of the seed, and as the fine structure of the cells is restored, the metabolic activity beings, thus, signifying the commencement of germination.

PROCEDURE

1. Select 30 seeds (beans) from the seed lot
2. Put filter paper, cotton wool or tissue paper in each of five Petri dishes.
3. Moisten the filter paper.
4. Place 10 seeds in each petri dish
5. Then moisten the seeds and cover with another petri dish
6. Place the petri dish in dark (laboratory cupboard would be adequate)

Note: by dividing each seed into five sets of 10 seeds each, you are replicating the study. Replication is necessary so as to be sure that results obtained are not due to chance.

EXERCISE 1

Observe dates of germination in each petrel dish no more of the seed lots will germinate. Note the total number of seeds that germinated, find the average and determine germination percentage of each seed lot.

Observations

Replicates	1st count (Days)	2nd count (Days)	3rd count (Days)	4th count (Days)	5th count (Days)	Total no.	% Germ.
1							
2							
3							
4							
5							

Percentage germination = $\frac{\text{Total no. of seeds that germinated}}{\text{Total no. of seeds planted}} \times 100$

DORMANCY:

A dormant but viable seed is one, which fails to germinate at a favourable temperature when supplied with water and air. Dormant but viable seed eventually germinate but only when some special condition has been satisfied, such as a particular treatment with light or low temperature.

Dormancy is therefore biologically important, providing a mechanism for dispersal of the plant. Dormancy and the breaking of dormancy ensure that the seed germinates only at a certain time of the year. Dormancy therefore preserve the seed against temporarily unsuitable conditions such as may occur during periods between seed collection and storage.

A physiologically sound seed may remain quiescent and therefore may germinate due to a lot of prevailing factor.

CAUSES OF DORMANCY:

1. Dormancy due to seed coat

Due to impermeability of seed coat to water and oxygen some seeds having hard and tough seed coat fail to absorb them and ultimately cannot germinate. Sometimes the hardness of the seed coat is the factor as found in seeds of clover and sweet pea and some other tree and non-tree legumes. In such cases germination is delayed till the seed coat is decayed in the soil as a result of bacterial action. The same is true with the seeds of some plants belonging to families Leguminosae, and Malvaceae, where there is also the mechanical barrier afforded by the seed covering to embryo emergence.

2. Dormancy due to immature embryos:

Some seeds are shed before the embryo is mature and thus are not fit to grow. Such seeds require an 'after ripening period' during which certain changes occur within the seed. It is ripening period' during which period certain changes occur within the seed. It is believed that there is some change in acidity, enzyme activity and respiratory rate or production of some growth promoting hormones or may be inactivation of some germination-inhibitor substances within seeds. Once embryo development is complete the seed then germinate without and special treatment.

3 Dormancy due to chemical inhibitors: The seeds present inside the juicy fruits such as *Azadiracta indica, Mileci exelca, Gmelina arborea*, oranges and tomatoes do not germinate while in the fruit where plenty of liquid is present. It is due to the presence of germination-inhibitory substances. Coumaruins and parascorbic acids are known to cause such inhibitions.

4. Dormancy requiring for after-ripening in dry storages:

At the time of harvesting, seeds of many plants are dormant but they do not require any special treatment to overcome dormancy. Simply keeping them under dry storage conditions at normal temperature over a period ranging from a few weeks to several months, overcome dormancy. Many of common cereals such as barley, rice, oats\, wheat etc show this type of dormancy.

5. Dormancy requiring chilling treatment

Many seeds of temperate species show dormancy, which is overcome by chilling. Simple examples of this category are the freshly harvested seeds of apple, rose and peach which will not germinate if planted under moist conditions at 20^0C but will germinate, if planted under moist conditions at 0-5^0C for several weeks and then transferred to warmer conditions.

6. Dormancy due to light sensitivity:

The germination of many seed is affected by light. Such seeds are said to be photoblastic. The seeds in which germination is stimulated by light are called positively photoblastic seeds e. g *Alilicia excels*, *Amarathus reflexus,Digitalis purpurea, lycopersicum esculentum, Nicotiana tabacum* etc. whereas those in which germination is inhibited by light are negatively *photoblastic e. g Silene armeria, Nemophala insignis etc.*

Practical 2b: Seed dormancy

Dormancy is the state in which growth is temporarily suspended. A dormant but viable seed is one which fail to germinate even when conditions are optimum for germination. Dormant but viable seed eventually germinate but only when some special condition has been satisfied, such as a particular treatment with light or low temperature. This is an important survival mechanism in plants. The causes of dormancy are varied and include:

i) Rudimentary embryos

ii) Physiologically immature embryo (inactive enzymes)

iii) The presence of germination inhibitor

iv) Mechanically resistant seed coat

v) Impermeable seed coat

i) and ii) may require a period of after-ripening. The third category includes seed coats that can be leached with water to remove the chemical inhibitor and thus allows germination. This feature adapts a specie not to germinate until considerable moisture is present in its environment. Fourth and fifth categories resist the ready diffusion of oxygen, carbon dioxide and water. In legumes and some grasses, this may be referred to as hard seed. This type of dormancy can be broken by SCARIFICATION before planting to permit better water uptake, germination and stand establishment.

Mechanical scarification involves rubbing the seeds against an abrasive surface. Excessive or careless scarification may damage the seed. Methods of scarification include the following seed treatments.

a) Shaking with sand;

b) Cutting with knife;

c) Rasping with a file;

d) Rubbing with emery cloth or sand paper;

e) Soaking in concentrated sulphric acid or alcohol.

All of these treatments are design to weaken the hard seed coat so that water may be taken up more readily.

A **ACID TREATMENT**

i) Place the concentrated sulphuric acid (95%) in a beaker.

ii) Place 10 seeds of *Leucaena leucophala*

iii) Immerse the seeds until covered.

iv) Allow the seeds to soak for 5 minutes.

v) Remove the seeds from the acid and wash in cool running water for 5 to 10 minutes to remove all acid.

vi) Stir the seed carefully during rinsing.

vii) Dry seeds

viii) Plant in germinating bags provided (other seeds are *Centrosema* spp, *Stylosanthes gracilis* and cotton- *Gossypium* spp)

B **HOT WATER TREATMENT**

Select 10 seeds from *Leucaena leucocephala* and small quantity of *Corchorus olitorus* (ewedu) and put them in polyethylene bags. Heat water to near boiling and submerge the seed lots. Remove from water and allow to cool. Then air dry the seeds. Plant the treated seeds in soil-filled polythene bags. Also plant untreated seeds in germinating bags as control. Compare the results obtained in A and B.

EMERY CLOTH TREATMENT

Select 50 seeds of the following species Calopogonium, green grain, centrosema, lima bean seed, soybean and maize. Rub 25 seeds of each specie between two pieces of emery cloth. Germinate seeds, both treated and untreated of each specie in Petri dishes with cotton or filter papers, and observe the effect of scarification. Conduct this experiment in four replicates.

Exercise

Items	**Species**	**% germination**	
		Control	Scarified
1	Soybean		

2	Green grain		
3	Calopogonium		
4	Centrosema		
5	Lima bean seed		
6	Maize		