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SEED DORMANCY AND METHODS TO BREAK THE DORMANCY

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Dormancy is the arrested growth and development and reversible rest period of plant organs, either of seed or of any vegetative part. Dormancy is not an, absolute block to germination but an adaptation of avoids unfavorable environmental conditions for a period of time.

TYPES OF DORMANCY:

1. Primary (Innate) dormancy a) Exogenous dormancy b) Endogenous dormancy c) Combination dormancy

2. Secondary (Induced) dormancy

3. Environmental (Enforced) dormancy

1. **Primary Dormancy:** This dormancy may be due to the presence of some germination inhibitors such as physiological immature embryo, rudimentary embryo and mechanical resistant seed coats prevent entry of water and gases.

a. Primary Exogenous Dormancy. Exogenous dormancy is imposed upon the seed from factors outside the embryo including the seed coat and/or parts of the fruit. This type of dormancy is commonly referred to as physical dormancy or hard seeds.

b. Primary Endogenous Dormancy. Seeds with endogenous dormancy fail to germinate because of factors within the embryo. These factors can be either physiological or morphological.

c. Primary Combinational Dormancy. Seeds with combinational dormancy have both physical and physiological dormancy. To relieve dormancy the seed coat must be scarified to permit imbibitions, and then exposure to chilling stratification can release the seed from physiological dormancy.

2. **Secondary Dormancy.** In nature, primary dormancy is an adaptation to control the time and conditions for seed germination. However, if the environment is unfavorable for germination, the seeds may enter secondary dormancy. Secondary dormancy can be induced by high temperature, non-appropriate light exposure, or lack of oxygen. The most common cause of secondary dormancy in nature is from light exposure.
3. **Environmental dormancy.** Some seeds have dormancy thrust upon them due to conditions of deficient oxygen, excess CO_2, cold temperature, ethylene etc. induced by man or in nature. In such dormancy, limitations of environment prevent non dormant viable seeds from germinating and germination occurs as soon as seeds are freed from the limiting conditions. When non dormant seeds are stored under dry conditions, the seeds are forced to remain dormant and bring such seeds to the surface with favorable environment may terminate enforced dormancy, Tomar,2011.

CAUSES OF SEED DORMANCY

1. **Properties of seed coats-**

- Physical impermeability of seed coat to water.
- Low permeability of seed coat to gases.

- Mechanical resistance by the seed coats.
- Inhibitory action of substance within the seed coat.

2. Under development of the embryo-

- Physiological conditions of the embryo itself.
- Immature embryo.
- Presence or formation of the germination inhibitors within the seed.
- Seed requiring stimulus from host plant e.g. orobanche seeds.

3. Temperature-

- High temperature responsible for dormancy while low temperature is useful for breaking dormancy.
- The low temperature can depress the inhibitors.
- Amino acid level is also increased due to low temperature conditions which reduce dormancy.

4. Light-

- Some seeds are light insensitive, others may be promoted or inhibited by it.
- Depending upon the wavelength of light, others have absolute requirement of light and photoperiod.

5. Water-

- It is absolutely required for breaking the dormancy.
- In some desert plants, the seed coat contain large amount of osmotic materials which can be restrict the amount of water entering the embryo through osmotic means. Thus exposure of seed to ample amount of rain removes the osmotic materials and increase germination.
- Similarly drying can also relieve dormancy in some seeds e.g. tomato, lima bean and some garden seeds.
- Excessive water also prevent germination due to lack of sufficient O_2, Tomar,2011.

METHODS TO OVERCOME DORMANCY:

There are many methods to treat seeds to overcome dormancy. Some of the important ones are described below:-

1. Cold water treatment:

Some seeds need lots of water so that they germinate at the same time. Others have certain chemicals inside them, which inhibit germination and which must be removed before the seed can germinate. The cold-water treatment is a good method to treat such seeds. The seeds of Pine, Aonla,Kachnar, Kala siris, Khair etc. can be treated in this way. Put the seeds in water, five times the volume of seeds. Let the seeds soak for1-2 days, changing the water every 12 hours. Discard any seeds that float to the top. All swollen seeds are fit for immediate sowing. Umamahesh, 2012.

2. Hot water treatment:

This method is used for the treatment of seeds with hard seed coat such as *Cassia, Sesbania* and *Albizia.* Seeds should never be stored on the ground**.** Boil a volume of water; five times the volume of the seeds. Let the water coolfor ten minutes and soak the seeds in hot water. Discard any seed that floats to the top. Keep the seeds in this water for two days or until most of them have swelled. Change the water every day with cold water. Once the seeds swell, sow them immediately.

3. Boiling water treatment:

This method is applied to the seeds that have a very hard seed coat, such as *Acacia* and *Prosopis* species. Boil a volume of water five times the volume of seed. Take the pot of water off the fire and soak the seed immediately. Leave the seed in water for only one to two

minutes. After two minutes replace the hot water with cold and let the seed kept soaked in the cold water for 2-3 days or until they swell, changing the water every day. Once the seeds swell, sow them immediately.

4. Wet and dry treatment or weathering:

This method is applied for species with very hard seed coat such as Teak. Soak the seed in cold water for 48 hours. Spread them in the sun thereafter to dry at least for 48 hours. Repeat this process 5 to 8 times before sowing in the germination beds.

5. Acid Scarification:

Very hard coated seeds like *Prosopis* and certain *Acacias* can also be treated with acid to break the hard test a (seed coat).Soak the seed in 20% sulphuric acid for one hour. Drain acid and wash seed thoroughly three to four times with clean water. The seed can be sown thereafter.

Proper precautions should be taken while handling the acid. Use only ceramic or glass containers for handling the acid. The workers should always wear protective clothing and gloves.

6. Mechanical Scarification:

It is the process of breaking, scratching, or altering the seed coat mechanically to make it permeable to water and gases. But, care should be taken to ensure that the embryo is not damaged. Impermeable seed coats can be broken mechanically with files, sand paperand electric needle (hot wire).

For large quantities filling seeds with sharp gravel-stones in a rotatory drum having abrasive disks on inner side is very useful e.g. *Acacia catechu, Acacia nilotica, Albizia spp. Cassia fistula, Delonixregia, Elaeocarpusspp, Sapindusspp,* and *Terminalia arjuna*

7. Stratification:

In many species of temperate regions, such as *Abies, Acer, Prunus and Juglans, walnut* dormancy can be overcome by keeping the seeds at low temperatures (generally 1ºC to 5ºC) with abundant aeration and moisture for periods varying from 30- 120 days. Alternating temperatures treatments (like day& night) may also be required for some species. After stratification, seeds are immediately sown. Sometimes seeds are kept in sand or soil under snow in the nurseries for natural stratification, Bose *et al*., 2012

8. Light Requirements:

Providing illuminated white light (Eight hours light 750-1230 lux from cool white lamp) to the hydrated seeds can terminate dormancy of many tree species.

9. Use of Hormones and chemicals:

A number of chemicals (Thiourea and Hydrogen peroxide etc.) and hormones (Gibberellins, Cytokinins and Ethylene) in different concentrations can also be used to treat dormancy. Application of 200-1000 ppm GA_3 is recommended for enhance the germination in most of the seeds.

10. Cow dung slurry treatment:

Sometimes fruits of species like *Terminalia chebula* (Harar) and *Meliaazedarach* (Bakain) are mixed with cow dung slurry and kept in pits for about7-14 days to remove the thick seed coat. This also helps to overcome dormancy.

11. Shell cracking:

Seeds of species like tropical *Simarouba* (Ash) or *Zizyphus* (Ber) can be cracked using a piece of wood or light hammer before sowing.

12. Other species specific treatments:

Some species require specific treatments to seeds for initiation of germination.

• *Atriplex* (salt bush) seeds are washed for 1 to 2 hours in cold water to remove salt from the seeds.

• Horizontal shaking of *Acacia farnesiana* seeds with glass pieces gives up to 30% germination in 43 days as against 2 % when no treatment is given.
• *Acacia cariacea* is pre-treated by manual nicking, Umamahesh, 2012.

IMPORTANCE OF SEED DORMANCY:

Dormancy is useful in-

- A form of plant dispersal and multiplication.
- A limit to the time at which seeds germinated for completion of their life cycle under unfavorable conditions.
- The capacity of extending the longevity of the seed.
- The means of survival with a high level of tolerance to adverse conditions.
- Determining the location of germination.
- Provide a scientific basis for raising better crop.
- Helps to control the storage life of seeds.
- Control the weeds.

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