UNIT -V

18BBO52C-U5

SEED TECHNOLOGY -DEFINATION, OBJECTIVE AND ITS ROLE IN INCREASING AGRICULTURAL PRODUCTION

SEED TECHNOLOGY

The role of seed technology is to protect the biological entity of seed and look after its welfare.

COWAN, 1973: Defined Seed Technology as that "discipline of studies having to do with seed production, maintenance, quality and preservation".

FEISTRITZER, 1975: Seed technology as "the methods through which the genetic and physical characteristics of seeds could be improved. It involves such activities as variety development, evaluation and release, seed production, processing, storage and certification"

Seed technology includes the development of superior crop plant varieties, their evaluation and release, seed production, processing, seed storage, seed testing, seed quality control, seed certification, seed marketing, distribution and research on seed these aspects. Seed production, seed handling based on modern botanical and agricultural sciences.

NATURE:

It is a multidisciplinary science encompassing a range of disciplines such as:

Development of superior varieties

Evaluation

Release

Production

Processing

Storage

Testing

Certification/quality control

Storage

Marketing and distribution

Seed pathology

Seed entomology

Seed physiology

Seed ecology

SCOPE

India is a vast country and bestowed with varied soils and has got different agro climatic zones, enabling year round cultivation of crops. By and large, most seed crops are grown during Kharif season. However most of the vegetable crops are produced in Rabi season and they posses better quality seeds than the crop grown in kharif. Indian farmers can practice with multiple cropping systems.

The farmers can opt for different crops like cereals, pulses oil seeds, vegetables, fibre crops, etc., in all the three seasons viz., Kharif, Rabi and summer.

With the advancement of agriculture, the government of India felt that there is a need to establish Seed Technology department in Agricultural Universities and ICAR institutes in India after the recommendations and suggestions given by National Commission on Agriculture. Accordingly, the Seed technology department was initiated throughout the country with the following main objectives.

To teach seed technology course.

Research on seed production/processing/testing.

To strengthen the seed technology research.

To give training to those who are involved in seed production, processing, testing, etc.

Goals OfSeed Technology

Rapid multiplication: To increase agricultural production.

Timely supply: New varieties must be available in time.

Assured high quality of seeds: Good vigour and viability.

Reasonable price: Cost of seed must be low to reach the average farmers.

Role Of Seed Technology

Feistritzer (1975) outlined the following as roles of improved seed.

A carrier of new technologies

A basic tool of secured food supply

The principal means to secure crop yields in less favorable production areas.

A medium and rapid rehabilitation of agriculture in cases of natural disaster

Status
India is considered as a developed country as for as the seed sector is concerned. By volume of seed we produce and distribute, we surpass many (western) nations in this trade. The Indian seed industry at present consists of two national organizations (NSC and SFCI), 12 state seed corporation about 150 large size private seed companies, 19 state seed certification agencies and 86 notified seed testing labs.

Area under seed production:India

The estimated requirement by 2010 is 126.55 lakh quintals. The quantity of buffer stock under seed security programmes in India has been fixed as follows (Singh, 1990).
Certified
- Self pollinated crops 5 per cent
- Hybrids 10 per cent
- Foundation seed 25 per cent
- Breeder seed 50 per cent

Seeds
Seed Evolution and Seed Development Seed Dormancy and Seed Germination Quality seed and its importance in agriculture Seed Technology -Defination, Objective and its role Causes for varietal deterioration, Maintenance of genetic purity and principles of seed production Generation system of seed production Methods for hybrid seed production Maintenance of parental lines Seed Certification Seed Production of different crops Seed Act and Seed Rules Seed processing Seed storage Seed testing Seed marketing Seed deterioration and enhancements Synthetic seeds

Structure of Dicot and Monocot Seeds

A seed is a ripened fertilized ovule. It contains an embryonic plant, reserve food and protective coat. A new generation starts with the formation of seed. Embryo (kernel) is the future plant in miniature condition. When the seed is sown in soil a new plant appears from the embryo. In seed, metabolic activities also get suspended to pass over the unfavourable period.

The embryo in the seed is made up of embryonal axis. It contains radicle (embryonic root) and plumule (embryonic shoot). On the side, one or two embryonic leaves or cotyledons are present. In some seeds, food is stored in the endosperm.

The seeds which store their food in endosperm are called endospermic seed or albuminous seed e.g. castor been, rubber etc. The seeds which store their food in cotyledons (endosperm absent) are called non-endospermic or exalbuminous e.g. bean, gram etc.

Structure of Dicot non-endospermic seed (bean seed):

The seeds of bean like those of other legumes are formed within the pod, which is a ripened ovary. The seed is attached to the inside of the pod by the funiculus or seed stalk. When the seeds are shed, the funiculus breaks off, leaving a prominent scar, the hilum.

Just below the hilum can be seen the micropyle (Fig. 2.40) and above the hilum is the ridge formed by the raphe. The seed coats have characteristic colours which vary with different varieties of beans but are commonly with variations of brown, black and white.
Structure of Bean Seed

When the seeds are soaked in water, they swell considerably and the seed coats become soft. In this condition the seed coats are easily removed. The entire interior of the seed is occupied by the embryo and chiefly by the two fleshy cotyledons or seed leaves, which may easily be separated.

On the side of the seed, opposite the raphe is found the radicle, with its tip directed toward the micropyle, and continuous with it is the hypocotyl. The plumule has differentiated two well-defined leaves which fold over the growing tip. These become the first true leaves of the bean plant on germination.

In this seed and in all seeds of this type, there is no endosperm, this tissue having already been consumed by the developing embryo. Most of the food of the seed is stored in the two large cotyledons, which in this case never function as true leaves.

Structure of Dicot endospermic seed (castor seed):

It is broader at one end and pointed at other end with elliptical outline. The colour is mottled dark brown with hard smooth and shining testa. Tegmen is thin, white and membranous.

A soft, white spongy structure called caruncle is present at one end of the seed. It is an outgrowth of micropyle. Almost in the middle of flat side of seed a narrow like raphe present

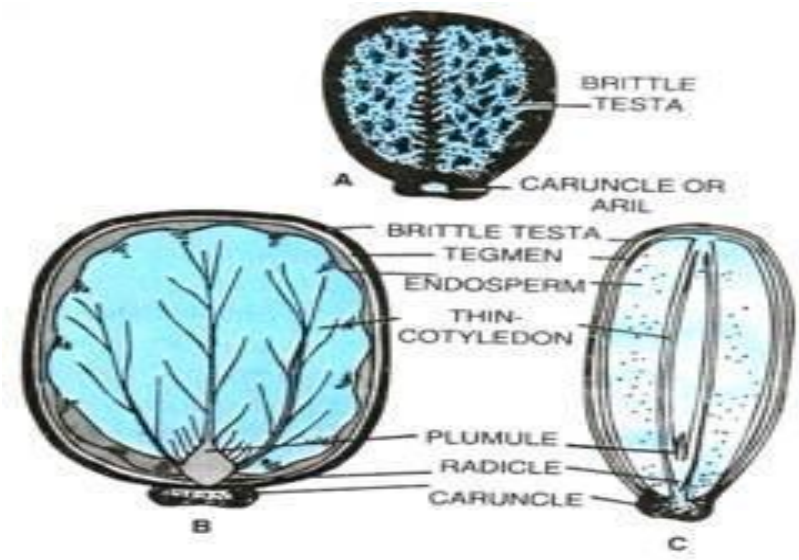


Fig. 2.41. Castor seed. **A.** External view, **B.** Seed dissected to show cotyledons **C.** V.S. seed.

Castor Seed

There are two cotyledons which are thin, oval, papery and veined. Endosperm is fleshy in which food is stored. Embedded in the endosperm embryo is present which contains an embryo axis with distinct radicle and plumule.

Structure of Monocot, endospermic grain (maize grain):

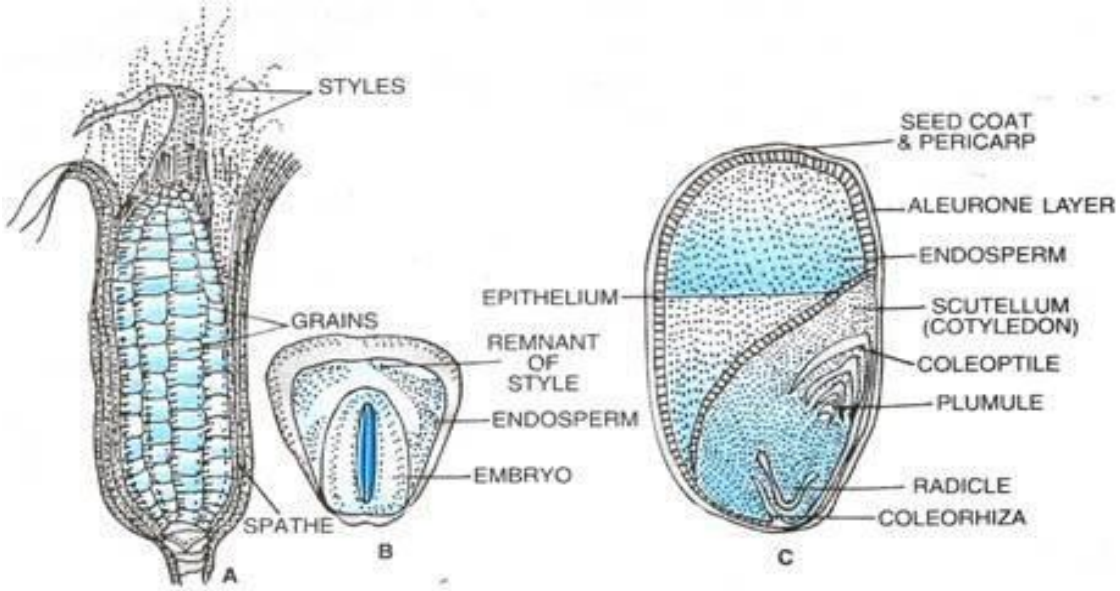


Fig. 2.42. Maize *(Zea mays)* **A.** Cob; **B.** The entire grain; **C.** L.S. maize grain.

It is one seeded fruit called caryopsis or grain because pericarp (fruit wall) is fused with testa (Fig. 2.42).

Maize (Zea mays)

Each grain is made up of following parts:

1. Seed coat:

It is the outer brownish layer of the grain. In this, seed and fruit wall are fused together.

2. Endosperm:

It comprises the major part of grain and is filled with reserve food.

It is composed of two regions:

a. Outer single layered aleurone layer mainly made up of aleurone proteins.

b. Inner starchy endosperm. It is separated from embryo by a layer called epithelium.

3. Embryo:

It contains a single lateral cotyledon called scutellum and embryo axis with plumule and radicle are at its two ends. Root cap protects the tip of radicle. Radicle is surrounded by a protective sheath called coleorhiza. Plumule is also protected by a covered sheath known as coleoptile.

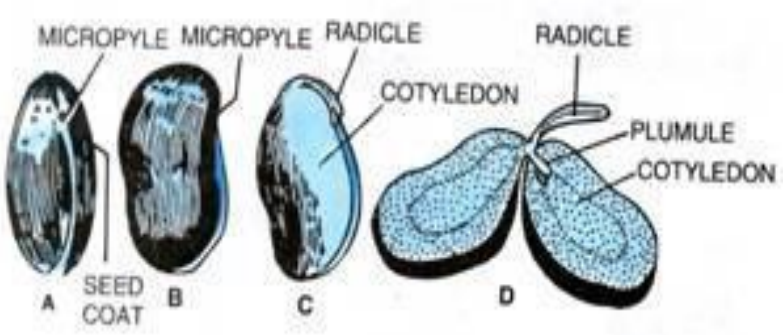


Fig. 2.40. Structure of Bean Seed, A. Entire seed in side view, B. Entire seed in micropylar view, C. Seed coat removed, D. Cotyledons of the embryo split open.

Seeds Type # 1. Orthodox Seeds:

Orthodox seeds are long-lived seeds and can be successfully dried to moisture contents as low as 5% without injury and are able to tolerate freezing. Orthodox seeds are therefore, also termed as desiccation tolerant seeds. In-fact, the life span of orthodox seeds

can be prolonged with low moisture content and freezing temperatures. Ex-situ conservation of orthodox seeds is therefore, not problematic.

Orthodox seeds are exemplified by most annual and biennial crops and Agroforestry species which are relatively small-seeded (in comparison to unorthodox seeds). Orthodox seeds include for example, Citrus aurantifolia, Capsicum annum, Hamelia patens, Lantana camera, guava (Psidium guajava), Cashew (Anacardium occidentale) and most grains and legume type

The longevity or life span of orthodox seeds may vary from over a year to many hundred years depending upon the particular species and storage conditions. A notable example of a long-lived orthodox seed which survived accidental storage followed by controlled germination as mentioned earlier, is the case of 2000 years old Judean date palm seed which was successfully sprouted in 2005. However, the upper survival time limit of properly stored orthodox seeds remains unknown.

Seeds Type # 2. Recalcitrant Seeds (Unorthodox Seeds):

Recalcitrant seeds are remarkably short-lived which cannot be dried to moisture content below 20-30% without injury and are unable to tolerate freezing. Recalcitrant seeds are therefore, also termed as desiccation sensitive seeds. Recalcitrant seeds are difficult to be successfully stored and their ex-situ conservation is problematic.

It is because of their high moisture content that encourages microbial contamination and results in more rapid seed deterioration. Secondly, storage of recalcitrant seeds at freezing temperatures causes the formation of ice-crystals which disrupt cell membranes and causes freezing injury. Therefore, the plants that produce recalcitrant seeds must be stored in growing phase (i.e., as growing plants) rather than as seeds and propagated vegetatively.

Recalcitrant species belong to trees and shrubs of mostly tropics and also of temperate areas which are moist and some plants which grow in aquatic environment. Some common examples of plants that produce recalcitrant seeds (which are generally larger than orthodox seeds) include, avocado, cacao, coconut, jackfruit, lychee, mango, rubber, tea, some horticultural trees, and several plants used in traditional medicine.

The longevity or life span of recalcitrant seeds is remarkably very short. Seeds of Acer saccharinum, Zizania aquatica, Salix japonica and S. pierotti lose their viability within a week if kept in air. Seeds of several other species remain viable only for a few weeks and months to less than a year.

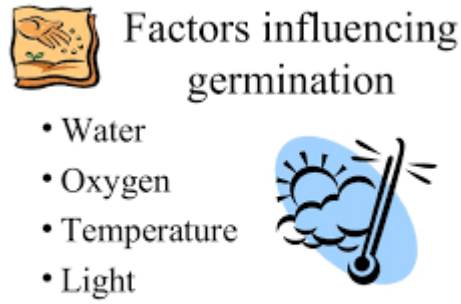
Germination of a Seed

Germination means the development of a seed into a new plant. All seeds do not germinate. Only those which get suitable conditions grow into new plants. The conditions necessary for a seed to germinate are:

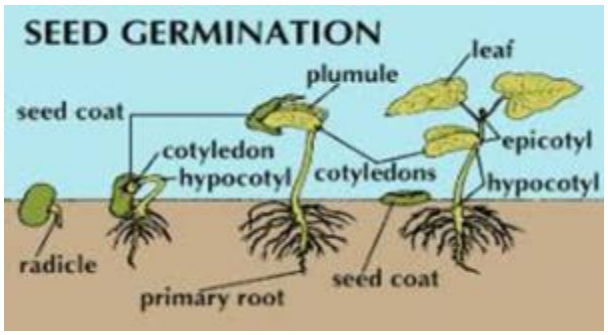
Air to breathe.

Water to make the seed coat soft. This enables the baby plant to break the seed coat open and come out.

Warmth to make its cells active.



Germination occurs in following stages:
The seeds absorb water through the seed hole. The cells of the embryo start dividing and increasing in size.
The seed coat breaks open and the root (radical) sprout and grows downwards.
Then the shoot (plumule) start growing upwards, which later produces stem and leaves.
When the seedling grows green leaves, it starts making its own food.
By this time, cotyledons dry up and fall. The seedling then develops into a new plant.



Germination of seed (Source: Shutterstock)

Dispersal of Seed

Plants are fixed to the ground. They cannot move from place to place. If all the seeds of a plant fall and germinate near it, they will not get favourable conditions for growth. Therefore, it is necessary for them to get scattered and grow away from the parent plant. The scattering of seed for growing away from their parent plant is called *dispersal of a seed*.
There are some natural agents that help in scattering the seeds away from the parent plant. These are wind, water, animals and by the explosion of fruits. Some seeds and fruits develop a special structure that helps them in dispersal.

Parthenocarpy

2 mins read

1. Wind

Seeds that are small in size and light in weight are dispersed by wind. Cotton, Madar, and dandelion seeds are dispersed by wind. They have fine, long hair around them. So, they are easily carried away by the wind.

Seed dispersal by wind (Source: Shutterstock)

2. Water

Seeds of plants growing in water or near water bodies are dispersed by water. These seeds are light in weight and are able to float in water. The spongy fruit of lotus and fibrous outer covering of coconut make them light. This helps a seed float on water and move long distances.

Dispersal by water (Source: Shutterstock)

3. Animals

Many fruits and seeds are spread by animals, birds, and humans. Humans and animals eat fruits and throw away their seeds. These grow into a new plant. Squirrels collect nuts and bury them. When the conditions become favourable, these nuts grow into new plants.

Birds eat fruits sometimes the seeds come out in their droppings undigested. Some seeds get stuck to their beaks while eating fruits. When they rub their beaks, the seeds fall down and later on grow into new plants.

Seed dispersal by animals (Shutterstock. com)

4. Explosion of fruits

Pods of some fruits like peas, beans, and balsam burst open or explode when dry, thus scattering their seeds.

The factors affecting seed germination.

Some of the important factors are: (1) External factors such as water, oxygen and suitable temperature. (2) Internal factors such as seed dormancy due to internal conditions and its release.

I. External Factors:

(i) Water:

A dormant seed is generally dehydrated and contains hardly 6-15% water in its living cells. The active cells, however, require about 75-95% of water for carrying out their metabolism. Therefore, the dormant seeds must absorb external water to become active and show germination. Besides providing the necessary hydration for the vital activities of protoplasm, water softens the seed coats, causes their rupturing, increases permeability of seeds, and converts the insoluble food into soluble form for its translocation to the embryo. Water also brings in the dissolved oxygen for use by the growing embryo.

(ii) Oxygen:

Oxygen is necessary for respiration which releases the energy needed for growth. Germinating seeds respire very actively and need sufficient oxygen. The germinating seeds obtain this oxygen from the air contained in the soil. It is for this reason that most seeds sown deeper in the soil or in water-logged soils (i.e. oxygen deficient) often fail to germinate due to insufficient oxygen. Ploughing and hoeing aerate the soil and facilitate good germination.

(iii) Suitable Temperature:

Moderate warmth is necessary for the vital activities of protoplasm, and, therefore, for seed germination. Though germination can take place over a wide range of temperature (5-40°C), the optimum for most of the crop plants is around 25-30°C. The germination in most cases §tops at 0°C and 45°C.

II. Internal Factors:

(iv) Seed Dormancy Due to Internal Conditions and Its Release:

In some plants the embryo is not fully mature at the time of seed shedding. Such seeds do not germinate till the embryo attains maturity. The freshly shed seed in certain plants may not have sufficient amounts of growth hormones required for the growth of embryo. These seeds require some interval of time during which the hormones get synthesized.

The seeds of almost all the plants remain viable or living for a specific period of time. This viability period ranges from a few weeks to many years. Seeds of Lotus have the maximum viability period of 1000 years. Seeds germinate before the ending of their viability periods.

In many plants, the freshly shed seeds become dormant due to various reasons like the presence of hard, tough and impermeable seed coats, presence of growth inhibitors and the deficiency of sufficient amounts of food, minerals and enzymes, etc.

Seed Dormancy

It is the resting stage (or) survival mechanism of the seed because dormancy delays germination, therefore it is of great importance and effectiveness as a survival mechanism.

According to Amen (1963) dormancy is definedas "endogenously controlled but environmentally imposed and it is the temporarily suspension of growth accompanied by reduced metabolic activity and relatively independent of ambient environmental conditions.

According to Simpson (1965) seed dormancy is defined as failure of viable seed to germinate at specified length of time in a set of environmental conditions, later evoke germination when the restrictive state of seed is removed naturally or artificially.

Based on Amen (1963) definition, the dormancy can be classified into two
A. Innate dormancy / Primary dormancy
B. Secondary dormancy

A. Innate dormancy / primary dormancy

It is the state of the seed itself or dormancy induced in the seeds at the time of dispersal from the mother plant i.e. the dormancy may be induced before maturity, during maturity and after maturity but before seed is dispersed from mother plant.

B. Secondary dormancy

Secondary dormancy can take place only in a matured and imbibed seed by certain environmental conditions, which are unfavourable to germination. (e.g.) Spring wheat and winter barley, the secondary dormancy could be imposed by

Exposure of dry barely seed to temperature between 50 and 90 0 C
Storage of winter barely for seven days in high moisture containers at 20 0 C.
Storage of spring wheat for one day at high moisture content in airtight containers at 50 0 C.
Placement of seed under water and in darkness for 1 to 3 days at 2 0 C.
Induction of secondary dormancy was possible one and half months after physiological maturity. Secondary dormancy in Spring wheat could not be broken by two weeks of storage. However, it was completely broken by treatment with 0.1% GA3, 0.5 to 1.0 % Ethanol, low temperature stratifications, removal of pericarp and storage at 20 0 C.

Secondary Dormancy Mechanism

Imposition of blocks of crucial points in the metabolic sequence that leads to germination.

An unfavourable balance of growth promoting versus growth inhibiting primary dormancy (coat imposed dormancy)

In many species seed dormancy is imposed by the structures surrounding the embryo (seed coat), which may include glumes, palea and lemma (grasses, the pericarp, perisperm and endosperm). The embryos in these cases are non dormant one.

Primary dormancy is further classified into endogenous and exogenous.

Exogenous dormancy is due to the seed coat factor either due to presence of inhibitors or hard seed nature. It is further classified into,

Physical – Dormancy is due to the hard seed coat which prevents the entry of water and sometimes gaseous exchange is also prevented. e.g. Hard seeds of pulses, acacias. Prosopis, sapota etc.,

Chemical – Presence of some inhibitors in the seeds coat which prevents the germination

Mechanical – restriction of the growth of protruding radicle due to structure. (e.g.) inadequate space in the seeds of Terminalia sp.

Endogenous dormancy – Dormancy due to embryo. May be the presence of inhibitors , immature embryo or combination of both. It is further classified into

Morphological – Due to immature embryo, which is not able to putforth germination even under favourable conditions (e.g.) Apple

Physiological – Due to arrest of the metabolic activity in the seeds due to presence of some inhibitors like ABA, coumarines, phenols etc.,

Morphophysiological – Combination of immature embryo with inhibitors.

Secondary Dormancy

Whose germination is inhibited , fail to recover even when the inhibitory factor is removed. Adoptive mechanism to pass the adverse environmental condition.

Types of secondary dormancy

Thermo – Dormancy due to temperature

Skoto – Light; Photo – Quality of light and Osmotic – stress or high osmotic stress prevents germination

According to Harper (1977) dormancy may be classified into following,

Nature of origination i. innate ii. Induced iii. Enforced

Time of origin i. Primary ii. Secondary

Location of dormancy i. Exogenous ii. Endogenous iii. Combined

Advantages of dormancy

Storage life of seed is prolonged

Seed can pass through adverse situation

Prevents the in situ germination.

Disadvantages

Long periods of time needed to overcome dormancy (for uniform germination)

Contributes to longevity of weed seed.

While raising a crop it is very difficult to maintain the population in the field with dormant seed lot

Location and cause for dormancy in certain species

Classification of seed dormancy

S.No Types Causes Embryo character Pre-treatment

1 Physical Seedcoat impermeable Fully developed, non-dormant Scarification (Mechanical and acid)

2 Physiological Physiological inhibiting mechanism of germination in the embryo Fully developed dormant Seed soaking in growth regulators (GA3, Ethrel, and chemical solutions (KNO3, Thiourea)

3 Combinations 1+2 Fully developed dormant Scarification followed by chemical treatment

4 Morphological Under developed embryo Under developed non-dormant Cold stratification

5 Morpho-physiological Under developed embryo, physiological Under developed dormant Stratification followed by chemical soaking.

Dormancy breaking treatments

Physical dormancy

I. Scarification

i. Acid ii. Mechanical iii. Physical treatment – hot water treatment

1. Scarification

Any treatments may be physical or chemical that weakens or softens the seed coat is known as scarification. This method is more applicable to Malvaceae and Leguminaceae group of seeds.

a) Acid scarification

By using concentrated H_2SO_4 @ 100 ml/kg of seed for 2-3 minutes treatments dormancy can be overcome in the above group of seeds. The duration of treatment will vary and it depends on type and nature of seed coat.

E.g. Tree crops 1-3 hours, Rose seeds, treat the seed partially with acid and then given with warm stratification.

b) Mechanical scarification

Seeds are rubbed on a sand paper or with a help of mechanical scarifier or by puncturing on seed coat with the help of needle to enhance / increase the moisture absorption by seeds.

E.g. Bitter gourd for sand scarification, sand and seed 2:1 ratio should be followed. Rub against hard surface of seed for 5 to 10 minutes.

2. Hot water treatments

It is effective in case of leguminous tree crop seeds. The seeds should be soaked in boiled water for 1-5 minutes for 60-80 minutes. Some crops like Bengal gram and Groundnut, hot water treatment for more than 1 minute is found injurious to seed.

Top

3. Stratification treatment

When seed dormancy is due to embryo factor, seeds can be subjected to stratification treatments.

a) Cold stratification

Incubate the seed at low temperature of 0-5 0 C over a moist substratum for 2-3 days to several months. It depends on the nature of seed and kind of dormancy. (e.g.) Cherry and oil palm seeds.

b) Warm stratification

Some seeds require temperature of 40-50 0 C for few days e.g. paddy. In case of oil palm it requires temperature of40-50 0 C for 2 months for breaking dormancy. Care should be taken during the treatment and moisture content of seed should not be more than 15%.

4. Leaching of metabolites (Inhibitors)

The seeds can be soaked in water for 3 days. But once in 12 hours fresh water should be changed to avoid fermentation or seeds can be soaked in running water for a day to leach out the inhibitors. (e.g.) Coriander (Coumarin), Sunflower (Hydrocyanic acid)

5. Temperature treatments

a) Low temperature treatments

Plants which grow in temperate and cooler climates, require a period of chilling for breakage of dormancy.

E.g. Apple seed dormancy can be released by low temperature treatment by storing the seeds at 5 0 C.

b) High temperature treatment

Normally high temperature treatments are exhibited by early flowering "winter " annuals.

E.g. Blue bell (Hyacinthoides nonscripta). Their seeds are shed in early summer and do not germinate until they have been exposed to the heat during high summer.

c) Alternate temperature treatments

Most of the plant species which grow in temperate and cool temperate regions require alternate temperature for breakage of dormancy (e.g.) Bull rush (Typha).

d) Fire treatment

Many shrubs and trees of sub tropical and semi-arid regions have extremely hard seeds in which the seed coat is very impervious to water. Dormancy in such seeds is clearly coat imposed, and maybe broken by exposure to extreme heat such as fire.

E.g. Seeds of Calluna vulgaris - dormancy is broken by fire.

6. Light and phytochrome

light phytochrome

7. Promoters - inhibitors concept

For regulation of germination the promoters and inhibitors present in the seed should be in a balanced manner.

• GA helps in translocation of food reserve materials to active site of meristematic activity. GA also helps in cell division.

• Cytokinin is a natural endogenous hormone which controls germination through DNA to RNA transcription system.

• Abscisic acid is an inhibitor that can prevent germination by affecting RNA synthesis.

promotor

8. Seed Treatment with Growth Regulators/Chemicals

If the endogenous dormancy is due to the presence of inhibitors, we can apply growth regulators at the low level to break dormancy.

GA & Cytokinin and kinetin can be used at concentration of 100-1000 ppm to break dormancy. GA is light substituting chemical. KNO3 2% can be used for breaking the dormancy of light requiring seeds (e.g.) Oats, Barley and Tomato.

Thiourea can be used for breaking dormancy for both light and chilling treatment requiring seeds (e.g.) lettuce - thiourea @ 10-2 to 10-3 M is used.

Ethrel can be used for breaking the dormancy of cotton seed. The dormancy in cotton seed is due to the presence of ABA in pericarp of seed.

Nitrogenous compounds like Thiourea, Hydroxylamine, Nitric acid, Nitrtate, can also be used for breaking dormancy.

Sulphidral compounds like 2 mercapto ethanol and 2,3 dimercapto ehtanol can also be used.

Plant products like strigol (root exudation from striga parasite host plant) can also be used for breaking the seed dormancy.

Top

Infra red radiation treatment

Infra red rays can be passed on to the seeds and dormancy can be released.

Pressure treatment

Dormant seeds can be kept in autoclave and required pressure can be employed for breaking dormancy.

Magnetic seed treatment

Seeds can be kept in the magnetic field for about 1 to 10 days for breaking dormancy

Seed Replacement Rate (SRR)

Definition

Seed Replacement Rate is the percentage of area sown out of total area of crop planted in the season by using certified/quality seeds other than the farm saved seed.

Seed Replacement Rates for Agricultural crops in Tamil Nadu (2008)

The low replacement rate in groundnut indicates that farmers used the crop retained for seed purpose or obtained it from fellow farmers. However these seeds need not be of poor quality. The lateral exchange of seeds among the farmers may also help in diffusing new varieties faster. The low SRR adopted by government should be increased as proposed shown in table for proper diffusion of varieties / hybrids from seed production centres.

At public sector level, the NSC, SFC and State Seed Corporations are producing quality seeds and distributing to the farming community. The quality seeds produced in government owned seed farms and farmers holdings under seed farm agreement condition are being distributed through Agricultural Extension Centres to the farming community. The seed multiplication programme is handled by the Agricultural and Horticultural Departments in their State Seed Farms. There are certain practical difficulties in the production of quality seeds in government owned farms by the Agriculture and Horticulture departments, which are now responsible for non-availability of adequate quantities of seed materials to the farmers.

The Tetrazolium test FOR SEED VIABILITY

Stained barleyTetrazolium salt stains all living tissue in the seed embryo red, thus enabling trained analysts to determine the seeds viability or otherwise. The tetrazolium test is used to give a quick estimate of germination potential. The result of a tetrazolium test will generally predict the germination test result closely, however the tetrazolium test will not

detect certain types of abnormalities nor will it give any indication of disease levels, chemical damage or dormancy.

The tetrazolium test should be used when seeds have to be sown shortly after harvest or to detect the presence of sprouting and various types of harvesting and/or processing damage (heat damage, mechanical damage, insect damage). The tetrazolium test is not suitable for carry over seed.

The following are the species for which our lab offers the tetrazolium test:

Barley

Wheat

Oat

Rye

Triticale

For tree seeds, please contact the laboratory on 01 6157521

Test times

For cereals the test time is one working day from the initiation of the test. Delays in processing may arise during peak times

Standards

There are no prescribed standards for tetrazolium tests and seed cannot be certified on the basis of a tetrazolium test alone. It is generally recommended that in order to be confident of achieving a germination standard of 85% in barley, wheat & oats the tetrazolium test should achieve a result of 94% or above. This is provided that a suitable fungicide is used to control seed born diseases and that there is no chemical damage present on the seed.

Tetrazolium test reports

The tetrazolium test report states the number of seeds found to be viable. In addition, where present, the report will state separately the number of heat damaged seeds and sprouted seeds.

For example viable seeds = 90%, 2% heat damage 2% sprouted. This means that 90% of seeds were found to be viable and of the remaining 10% of non-viable seeds 2% were non-viable as a result of heat damage and 2% were not viable as a result of sprouting.

SEED PROCESSING

The process of removal of dockage in a seed lot and preparation of seed for marketing is called seed processing. The price and quality of seed is inversely related to dockage, which should not exceed a maximum level permitted for different crops for seed certification.
Due to the operation of processing the level of heterogeneity of seed lot gets narrowed down.
The heterogeneity occurs in a seed lot due to following reasons:

Variability in soil for fertility, physical, chemical and biological properties
Variability in management practices (irrigation, application of nutrients etc.)
Variability in ability of the seedling for utilizing the inputs
Variability in pest and disease infestation
Position of pod or fruit in a plant or the position of seed in a pod.
Principle of seed processing: the processing operation carried out based on the principle of physical differences found in a seed lot.

Physical difference	Suitable machineries
Seed size – varied from small to bold	Air screen cleaner cum grader
Density- ill filled, immature to well Matured light weight to dense seed	Specific gravity separator
Shape – round to oval and different shapes	Spiral separator
Surface texture – smooth to wrinkled and rough	Roll mill / dodder mill
Colour of the seed – light color to dark colors	Electronic color shorter
Conductivity of seed – low to high	Electronic separator

Requirement in seed processing

There should be complete separation
There should be minimum seed loss
Upgrading should be possible for any particular quality
There should be have more efficiency
It should have only minimum requirement
Types of materials removed during seed processing

Inert materials
Common weed seeds
Noxious weed seeds
Deteriorated seeds
Damaged seeds
Other crop seeds

Other variety seeds
Off-size seeds
Sequence of operation in seed processing

Sequence of operations are based on characteristics of seed such as shape, size, weight, length, surface structure, colour and moisture content. Because each crop seed possesses individually seed structure. Therefore, sequence of operation will be applied proper equipments. However, It is also involved stages following as
Drying
Receiving
Pre-cleaning
Conditioning
Cleaning
Separating or Upgrading
Treating (Drying)
Weighting
Bagging
Storage or Shipping

The flow charts illustrating the types of materials removed from harvested produce during processing.

Harvested seed

Receiving The field run produce after threshing is received in the processing plant.

Seed movement /basic steps in seed processing plant

SEED STORAGE

Seeds must be stored in a way which maintains their viability for long periods. Seeds left at ambient temperatures and relative humidities will lose their viability quickly whilst seeds stored in conditions of low moisture content and temperature will retain their viability for longer periods. Accessions held in a genebank are valuable and represent plants which are no longer available or which are endangered in their natural environment. These seeds must be conserved in the genebank for use in plant breeding in the fu
STEP 1. CHECK THE NUMBER OF SEEDS IN THE ACCESSION

1. Weigh the seeds of each accession.

2. Convert the weight of seeds to seed number, using the thousand seed weight of each accession for an accurate conversion. An approximate conversion can be done on a species basis by using the approximate weights given in Appendix 2 of Cromarty, Ellis and Roberts (1982).

3. For accessions containing mixtures of genotypes, the sample size should be at least 4000 seeds. For genetically uniform accessions, the sample size should be at least 3000 seeds.

4. If the sample contains more than the required number of seeds, proceed to storage.

5. If the sample contains less than the required number of seeds, either proceed directly to regeneration (See Section X) or store the seeds temporarily in the genebank and regenerate at the earliest opportunity.

Notes and Examples

An approximate inter-conversion of seed number and weight can be done easily using the thousand seed weight.
Example for Sorghum (1000 seed weight = 17 g)

100 g contains:
These are minimum sample sizes for the start of storage and if both space and seeds are available, more seeds should be held.

Regenerate as soon as possible. Seeds processed and stored under good conditions will not loose viability before regeneration.
Equipment
Coarse balance
STEP 2. DETERMINE WHERE THE SEEDS SHOULD BE LOCATED
1. Check the inventory data file of the genebank to find the next available space where a container can be located.

2. When seeds from the same regeneration cycle of the same accession are stored in several containers, keep all the containers of the accession together.

3. Make a list of where each accession will be placed.
Notes and Examples
The storage arrangements will vary among genebanks. The most important point is to know exactly where to locate each accession within the store.
Equipment
Racks
Trays, boxes or drawers
Coldroom or freezer
STEP 3. PLACE IN THE SEED STORE
1. Place the container into the seed store in the listed location.
STEP 4. ENTER THE DATA INTO THE DATA BASE

1. Fill in the data on the location and date of storage of each accession and each container into the data file.

2. Record the date of the next monitoring test for germination in the data file. This date will be determined by the curator after considering the viability and moisture content of the seeds, storage conditions and the IBPGR recommendations.

Notes and Examples

A code can be used to locate an accession within the store. Each unit can be identified by a number or letter in the store. The code can indicate the number or the letter of the freezer, store, rack, basket or drawer, etc.
Example:

A010201 could be used to indicate the location as:

Colour codes can also be a quick and easy way to locate accessions. A colour can be used for each rack, shelf or species. This both speeds up the work in the coldroom and makes it easy to spot errors. Owing to the very cold temperatures, the faster that one can locate accessions in the cold room the better.
Arrangement of your seed store
SEED CERTIFICATION

It is a legally sanctioned system for quality control and seed multiplication and production. It involves field inspection, pre and post control tests and seed quality tests.

Purpose of seed certification

To maintain and make available to the farmers, through certification, high quality seeds and propagating materials of notified kind and varieties. The seeds are so grown as to ensure genetic identity and genetic purity.

Eligibility for certification of crop varieties

Seeds of only those varieties which are notified under section 5 of the Seeds Act, 1966 shall be eligible for Certification.

Breeder seed is exempted from Certification. Foundation and Certified class seeds come under Certification.

Breeder seed is produced by the plant breeder which is inspected by a monitoring team consisting of the breeder, representative of seed certification agency (DDA), representative of NSC (Deputy Manager) & nominee of crop co-ordinator (s – 11). The crops shall be inspected at appropriate stage.

Phases of seed certification or Seed certification procedures

1. Receipt & Scrutiny of application
2. Verification of seed source
3. Field inspection
4. Post harvest supervision of seed crops
5. Seed sampling & testing
6. Labelling, tagging, sealing and grant of certificate.