SST 623 SEED PROCESSING AND STORAGE (2+1)

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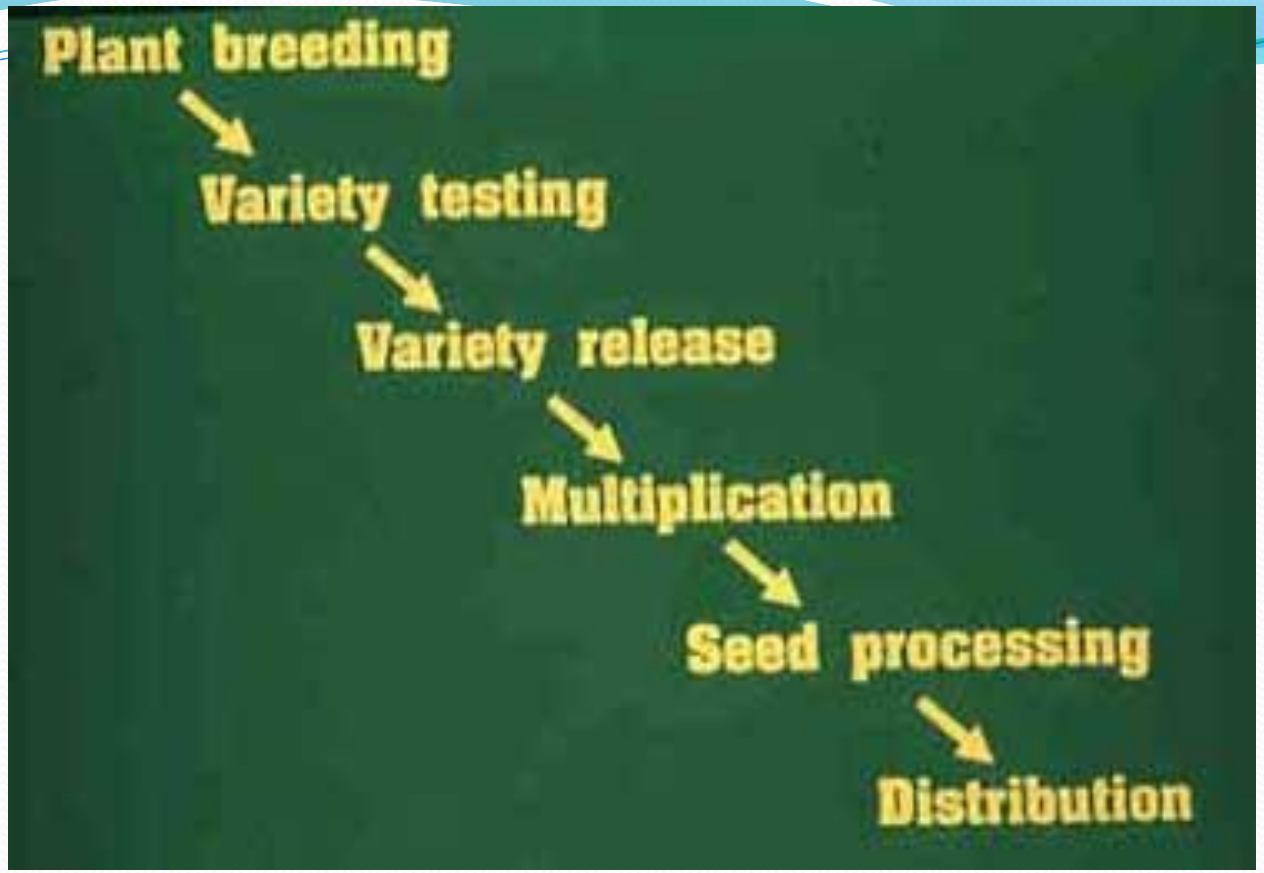

The process of removal of dockage in a seed lot and preparation of seed for marketing is called seed processing

Post harvest factors affecting seed quality

- Method of harvesting and threshing / extraction
- Moisture content of the harvested seed
- Method of drying
- Temperature and duration of drying
- Conditions of processing machine
- Condition of packing and storage

Harvesting

Factors

- Maturity status
- Moisture content
- Method of harvest
- Machine factors

Threshing / Extraction

Dry processes

- Manual threshing (rubbing, beating, flailing, rolling, walked on)
- Mechanical threshing (machines)
- Special extraction (shelling, Decortication)

Wet processes

- Manual (scooping, maceration, crushing)
- Mechanical (crushing)
- Fermentation
- Chemical (acid, alkali)

Dry seed separation methods

Agricultural crops	methods	Horticultural crops	methods
Paddy	Thresher, Beating	Chilly,	Beating, Chilly seed extractor
Sorghum Cumbu	Thresher, Beating	Bhendi	Beating, Manual splitting
Millets	Trampling by cattle	Ridge gourd	Cutting from one side
Maize	Maize Sheller	Sponge gourd	Cutting from one side
Cotton	Ginning machine	Snake gourd	Cutting from one side
Pulse	Pulse Thresher, Beating	Brassicas Radish	Rubbing
Groundnut	Groundnut Decorticator	Amaranthus	Beating
Rape seed Mustard	Flailing, Trampling by animals & Tractors	Onion	Flailing
Sunflower	Sunflower Thresher, Rubbing, Beating	Beans	Rolling, Seed extractors
Sesame	Shaking or Beating	Coriander	Beating
Castor	Beating	Carrot	Flailing

Factors affecting efficiency / Seed quality

- Threshing method
- Moisture content
- Maturity status of fruit
- Concentration of chemical
- Duration

SEED EXTRACTION AND THRESHING

Seed Extraction

Separation and release of seed from its enclosing structure

Applicable : Multi seeded fruit

Not applicable: One seeded dry fruit

Dry : Threshing

Wet : Extraction

Methods

Dry: 1. Manual 2. Mechanical

Manual

1. **Rubbing**
2. **Beating**
3. **Flailing**
4. **Walked on**
5. **Rolling**

Advantages

- It is relatively cheap, easy and makes use of surplus local labour.
- It can be usually adopted for high value vegetable seeds.
- Mechanical admixtures can be avoided.

Disadvantages

- It will take more time when compared to mechanical extraction.
- It can be adopted for smaller quantity of produce only.

Mechanical extraction:

- using threshers (LCT).
- Care should be taken to avoid mechanical injury and varietal admixtures

Advantages

- Extraction is quicker than manual method.
- Labour requirement will be lesser when compared to manual extraction.

Disadvantages

- Mechanical admixture.
- Mechanical damage.

Precautions

- Machine should be properly cleaned to avoid mechanical admixtures.
- The speed of the cylinder and the distance of the cylinder should be properly adjusted to avoid

Dry seed separation

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Rape seed Mustard	**Flailing, Trampling by animals & Tractors**	**Onion**	**Flailing**

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Sesame	**Shaking or Beating**	**Coriander**	**Beating**
Castor	**Beating**	**Carrot**	**Flailing**

Wet extraction

- Manual method
- Fermentation method
- Mechanical method
- Juice and seed extraction

Manual method

- Scooping
- Maceration
- Crushing
- crapping

- Fermentation method

- Mechanical method

- Alkali Method

- Acid method

Seed Drying

Process of elimination of moisture from seed to a safe level through evaporation.

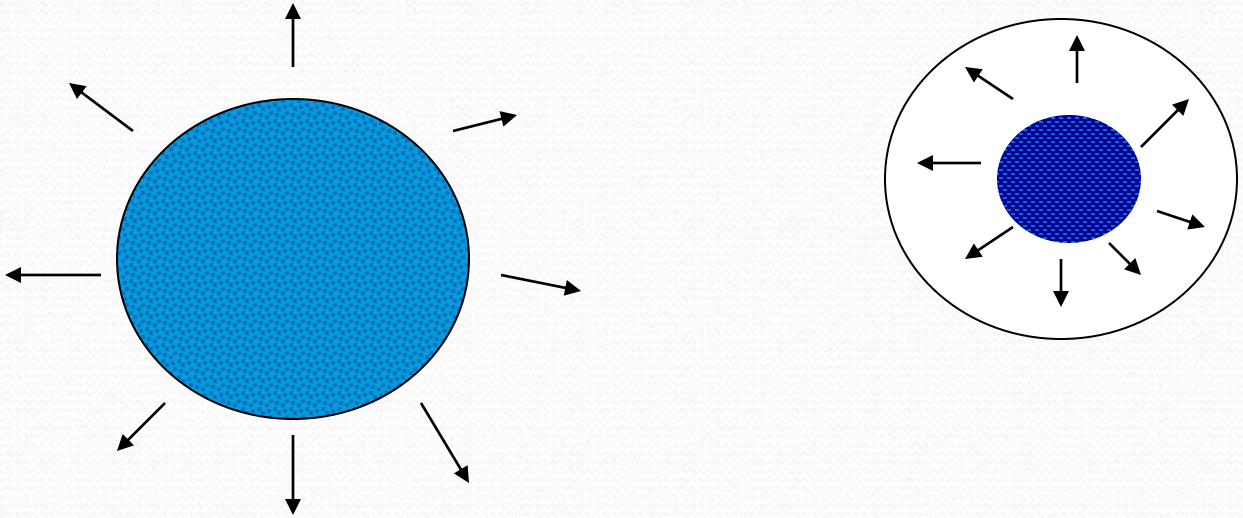
Stage of moisture elimination

- Surface moisture – removed initially by drying air.
- Imbalance in the moisture potential in the surface of seed and inner portion of seed – migration of moisture from inner organ to the surface.

Drying Process

Evaporation of moisture from seed surface.

Movement of moisture to surface from with in the seed.



Equilibrium moisture content

- Rate of moisture loss from the seed to the surrounding atmosphere is equal to the rate of moisture gained by the seed from the atmosphere.
- **Drying temperature**

  Greater the seed moisture content lesser should be the drying temperature and vice versa.

  10% MC and below 110 ° F (43.3° C)

  10-18 % MC 100 ° F (42.2 ° C)

  18-30 % MC 90 ° F (32.2 ° F)

The rate of drying depends on

- Initial seed moisture content
- Size of the bin and capacity
- Depth of spread of seed
- The rate of air blow
- Atmosphere air temperature and relative humidity
- Static pressure
- Drying temperature

Different methods of drying

- Physical drying (or) natural drying (or) sun drying
- Mechanical (or) artificial drying
  - a) Drying with forced natural air
  - b) Drying with forced artificially heated air
  - c) Drying with desiccants
  - d) Drying with infrared rays

Different types of dryers

- . Natural dryers
- 2. Artificial dryers

a) Batch bin dryers (or) Metal bin dryers

i) Rectangular metal bin dryer

ii) Circular metal bin dryer

b) Continuos flow dryer

i) Louisiana state university dryer

ii) Non mixing column dryer

Physical drying / Natural drying / Sun drying

- Conventional Method
- Radiant energy of sun
- Advantages
- 1. The method is easy and cheap
- 2. Does not require any expenditure or fuel.

Disadvantages

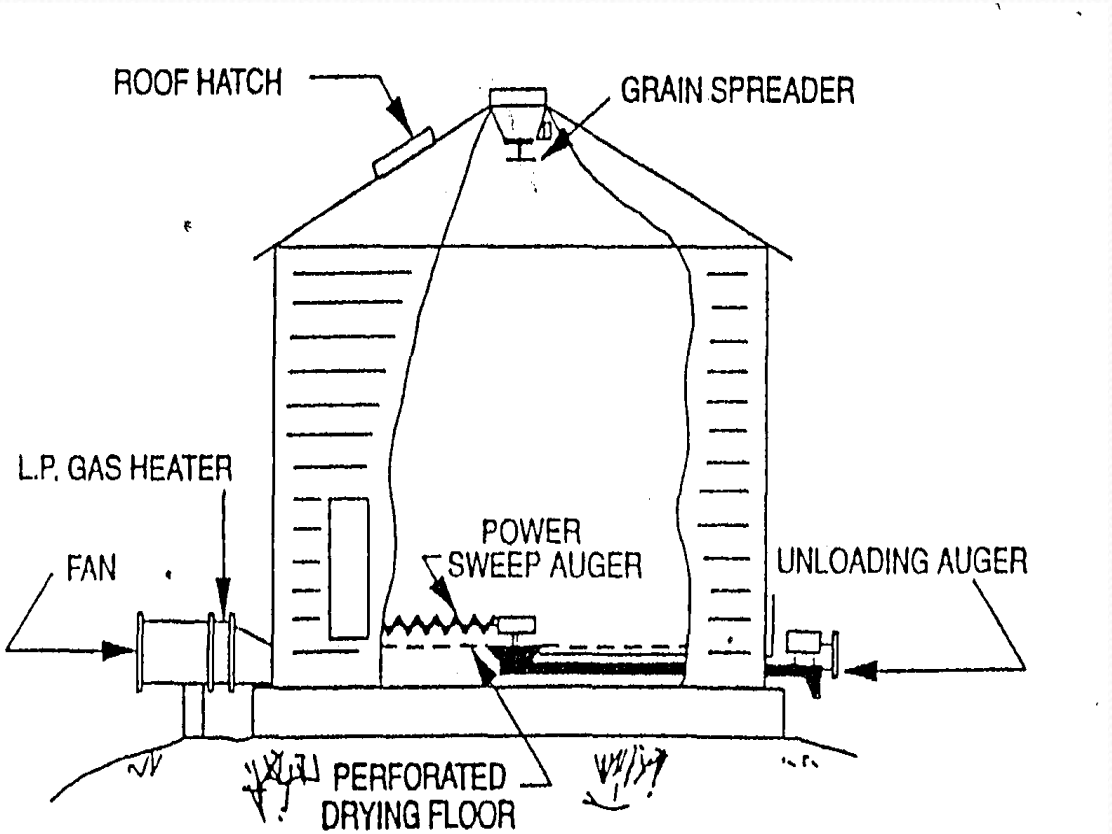
- 1. The rate of drying is slow
- 2. Loss due to attack by insects, birds and animals.
- 3. Large floor area is required
- 4. Involves extra labour for collecting and spreading of seeds during the day.
- 5. Sun drying cause checks or hot spots due to variation in temperature from time to time
- 6. This checks or spots induce high amount of breakage while processing.
- 7. Dust, dirt and other foreign materials get admixed
- 8. High weather risks and damage by heavy wind and rains.

Methods of drying

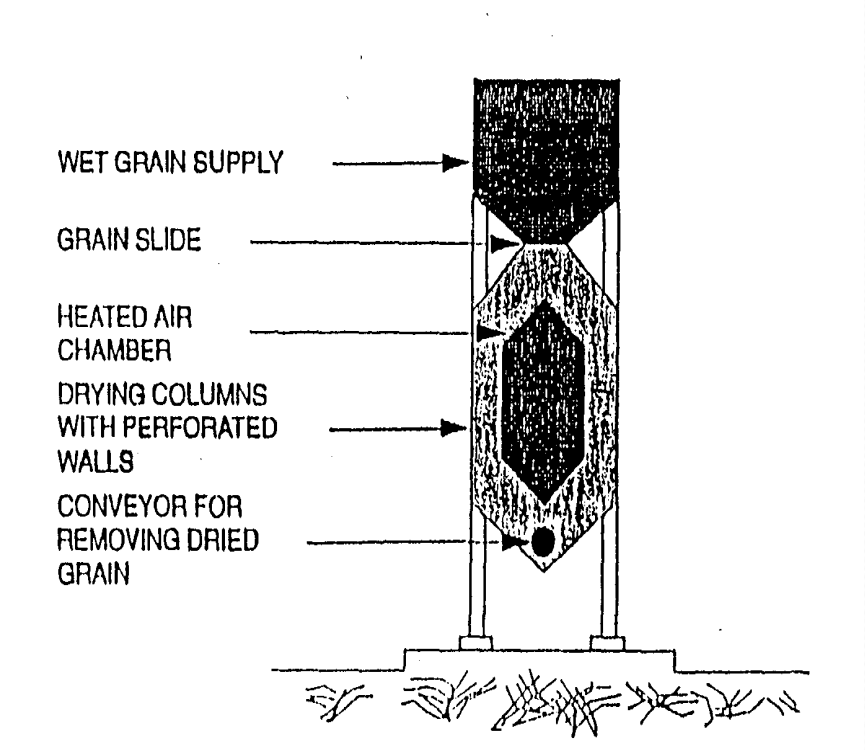
Mechanical (or) artificial drying

- Drying with forced natural air
- Drying with forced artificially heated air
- Drying with desiccants
- Drying with infrared rays

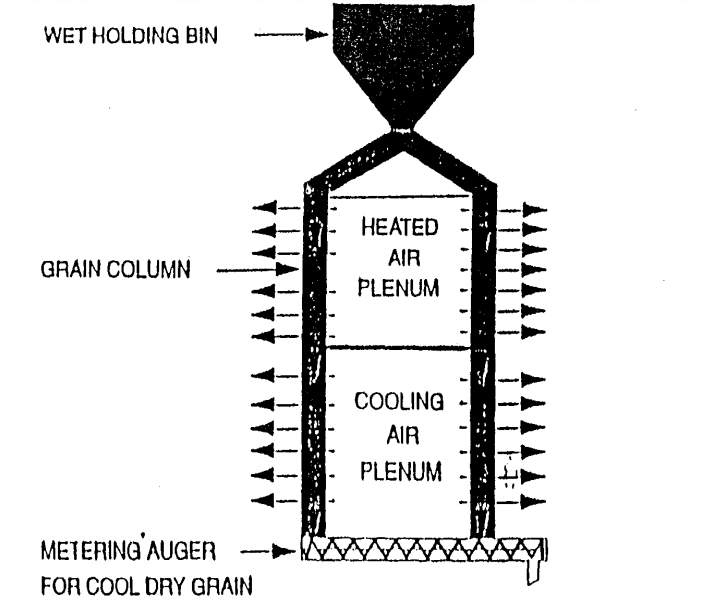
Batch Bin dryer



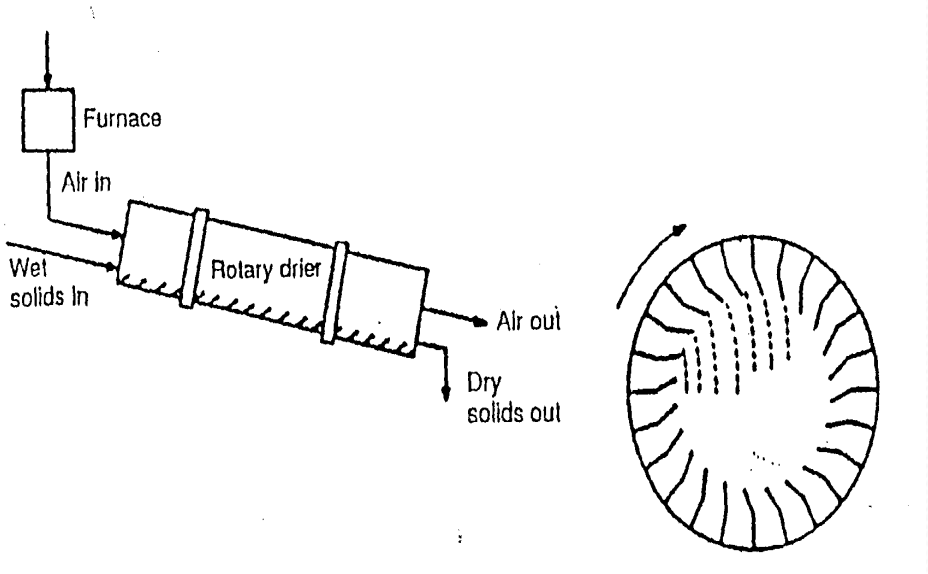
Column Batch-Dryer



Continuous flow dryer



Rotary dryer



Advantages of mechanical drying

- Quick method, timely and uniform drying is possible
- Makes early harvest possible
- It reduces the chances of losses due to over ripening and shattering of seed
- Losses due to rodents and birds are prevented.
- Less damage during processing operation.
- Permits long time storage by preventing sun checks and other damages.

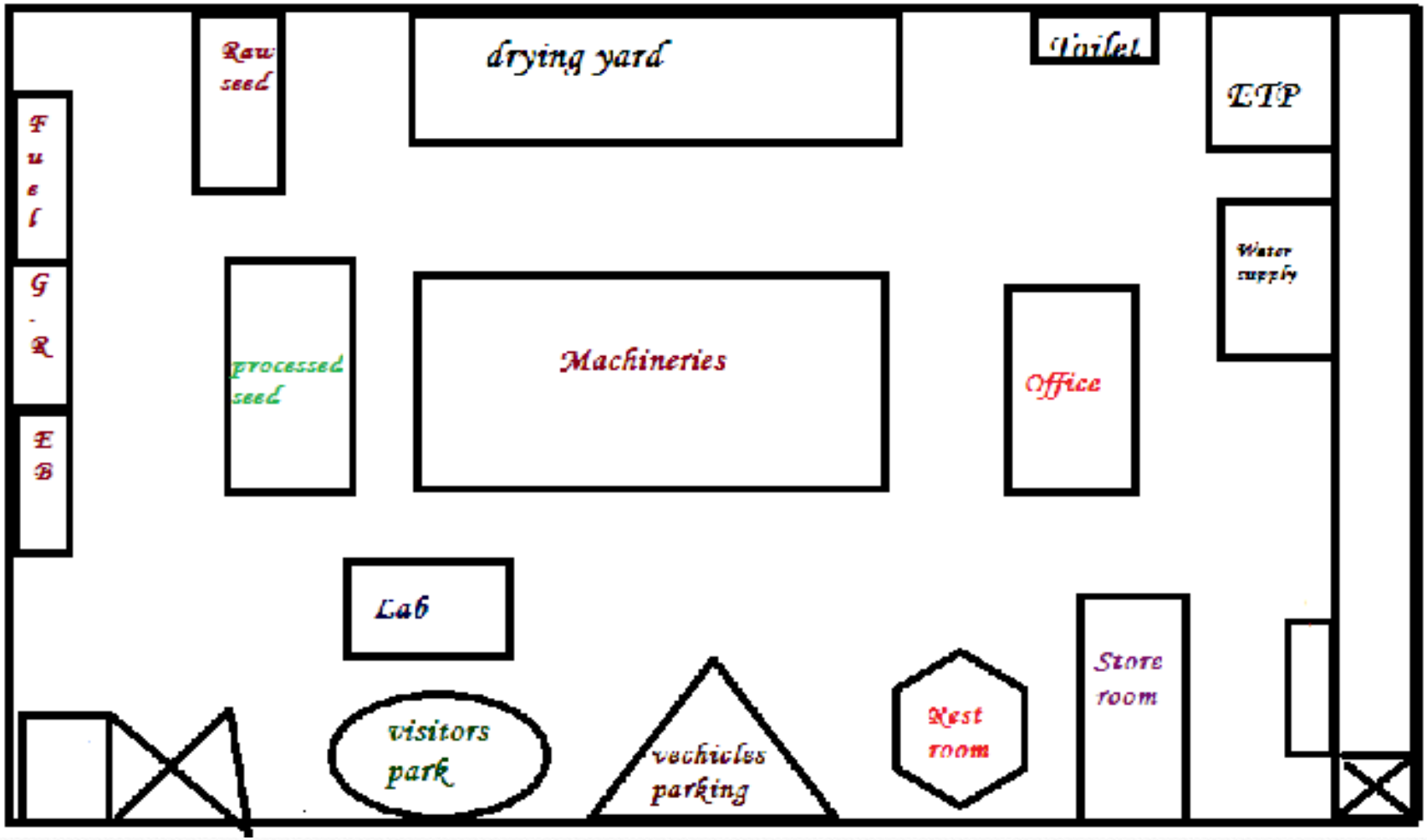
Disadvantages

- 1. Initial cost of drying equipment's is high
- 2. Fuel is expensive
- 3. It produces possible fire hazards
- 4. Considerable supervision is necessary

Tempering

- Seed is usually dried in stages with heated air each stage consisting of a pass through the drier. Between passes the seed is stored in bins for an equilibrium period known as tempering period. This period of tempering shortens the total in drying time. During drying surface moisture is removed and internal moisture moves towards the surface is slower than evaporation, and a moisture gradient develops in the kernel. The outside becomes drier than the inside and evaporation rate decreased. During tempering moisture concentration equalizes in the kernel and then evaporation of surface moisture is nearly as rapid as at the start of drying.

Lay out of the plant



Objective :

To minimise the heterogeneity in a seed lot – for uniformity

Principle :

physical differences in a seed lot.

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.)

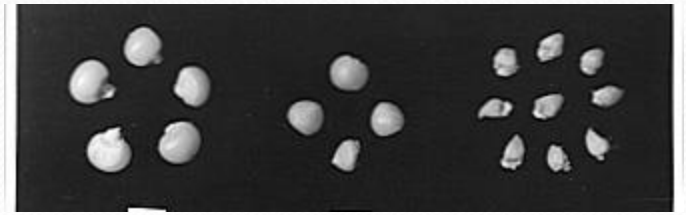
Variability in ability of the seedling for utilizing the inputs

Variability in pest and disease infestation

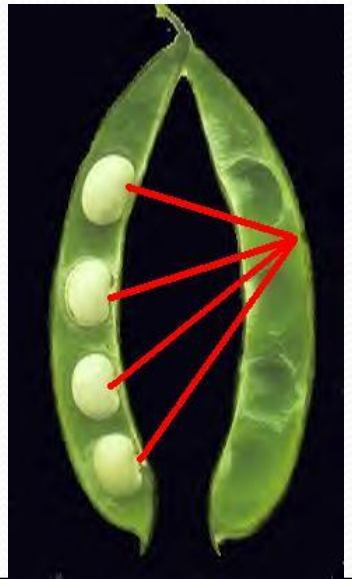
Position of pod or fruit in a plant or the position of seed in a pod.

Physical differences found in seed are

Seed size **varied from small to bold**



Filling **ill filled, immature to mature**



Density — **light weight to dense seed**

Shape — **round to oval & different shapes**

surface texture — **smooth to wrinkled and rough**

Colour

light color to dark colors

Conductivity of seed

low to high

Suitable machineries

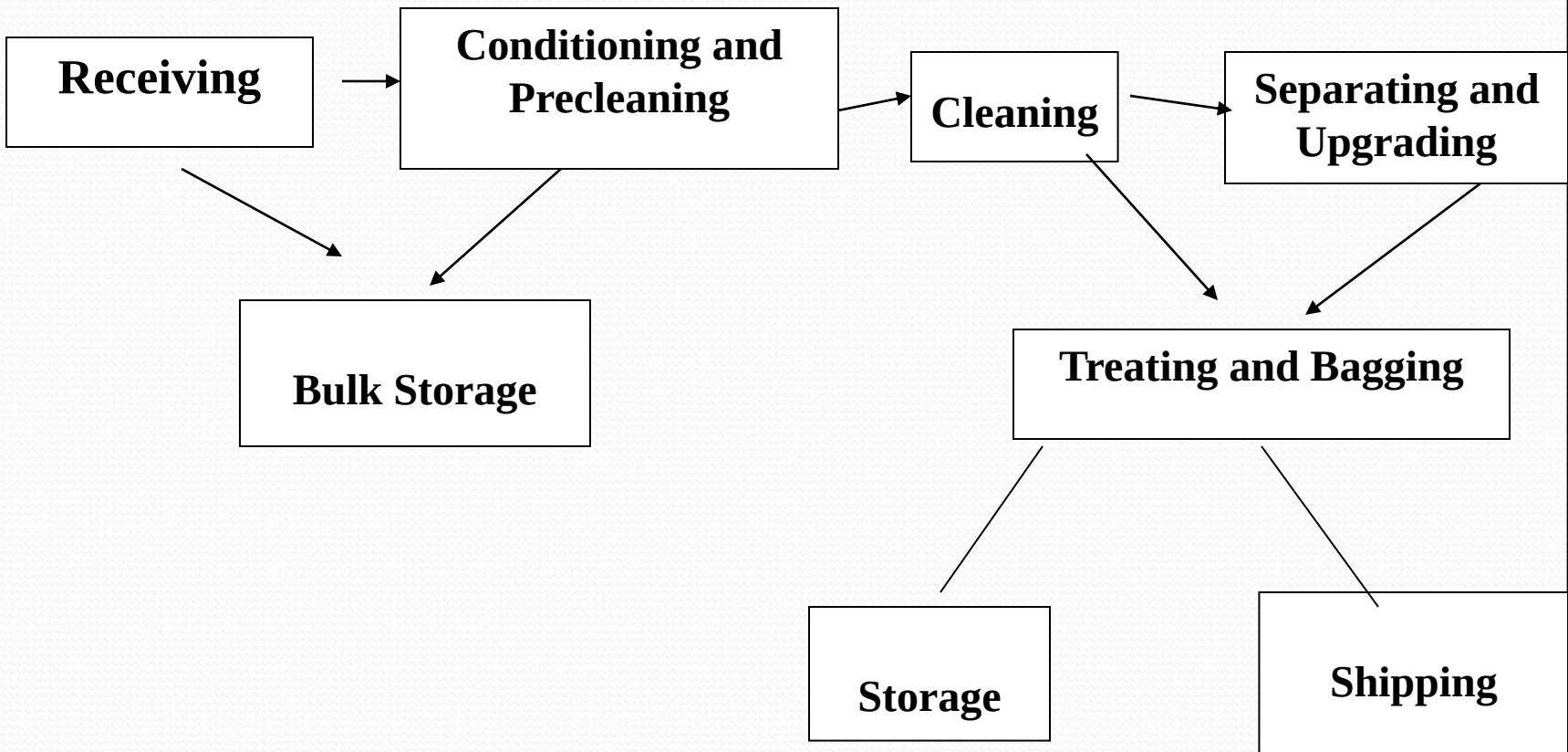
1. Seed size -Air screen cleaner cum grader
2. Density -Specific gravity separator
3. Shape -Spiral separator
4. Surface texture -Roll mill / dodder mill
5. Colour of the seed - Electronic color shorter
6. Conductivity of seed -Electronic separator

While processing ensure

Complete separation of all contaminants
Minimum seed loss
Upgrading
High efficiency
Minimum labour / time requirement.

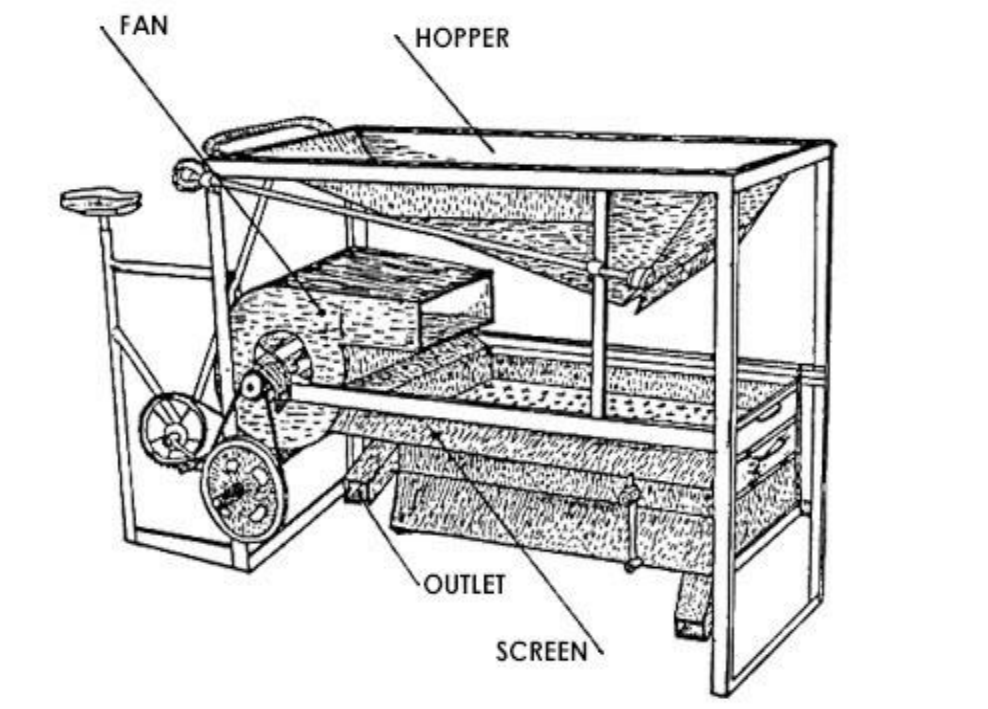
Seed Processing

Basic flow diagram showing essential steps in seed processing

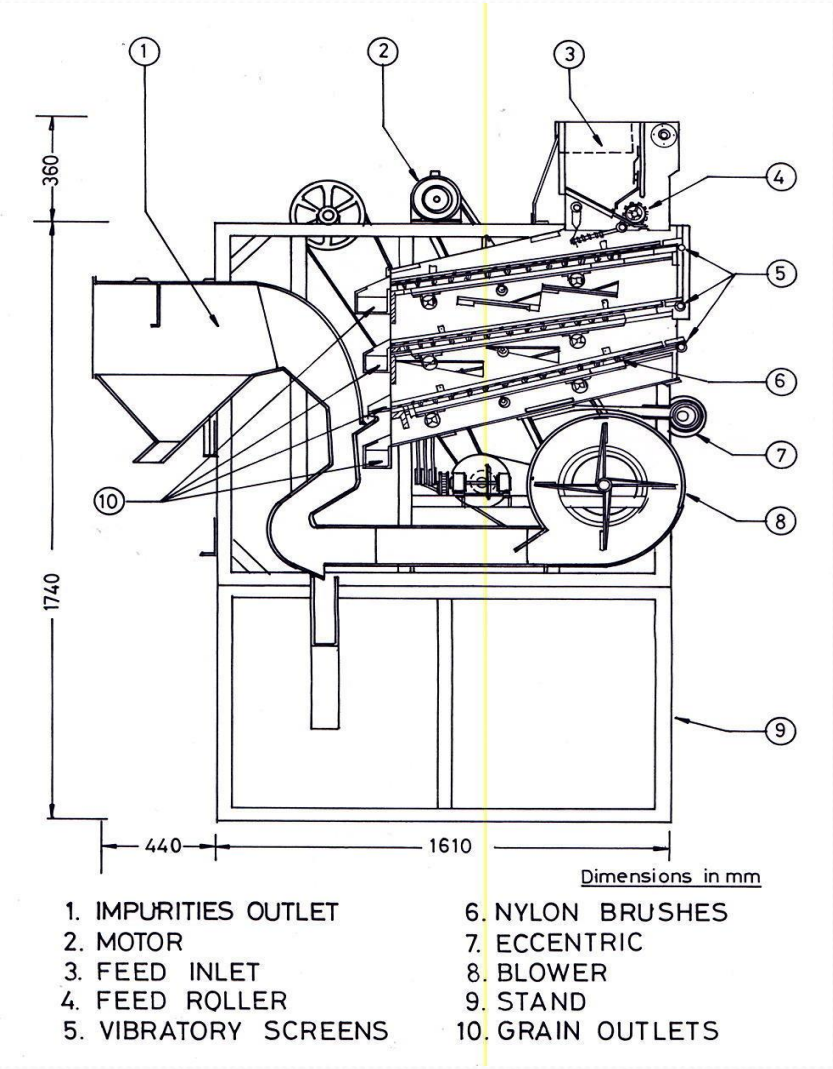


Copeland and McDonald (1995)

Step –2. Basic cleaning



Seed cleaner cum grader



Operation:

- Material is fed into a feed hopper where they are evenly distributed by a feed roller and drop through a controlled gate on the top sieve.
- Before falling on Top Screen, grains are subjected to primary aspiration which drains off chaff, straw, dust, deceased grains etc.
- Material is then passed through two sieve layer for separation according to width and thickness.
- Sieve perforations are kept cleaned by specially designed Nylon brushes.

- After passing through screens, cleaned material once again passes through air shifter and aspiration where remaining light particles are sucked off by a strong upward draught of air.
- Final product and impurities are collected separately through discharge chutes.
- Dust loaded air from Air chamber is cleaned in dust collector to prevent it from spreading in environment/ surroundings.

Types of seed cleaner cum grader

- **Crippen model cleaner cum grader**
- **Clipper model cleaner cum grader**
- **Petkas cleaner cum grader**

Upgrading

Further cleaning treatment to remove adulterants that are similar to pure seed in size and shape, to be separated by air screen cleaner.

Removal of seeds larger or smaller than required size (sizing) and removal of cracked, damaged or otherwise defective seeds (grading)

Upgrading machines

Specific gravity separator
Indent cylinder
Disc separator
Roll mill
Magnetic separator
Inclined dropper
Electronic colour sorter
Electrostatic separator
Spiral separator
Polishers
Picker belts (groundnut, corn)
Vibrator separator

VARIOUS GRADING TECHNIQUES IN SEED PROCESSING

GRADING OF SEEDS

- Grading is one of the post harvest handling techniques
- major operation under seed processing is the seed grading.
- Alf Hannaford, the father of the seed grading industry in Australia.

Why grade your seed?

As you might expect, a good heavyweight will beat a good lightweight any day.

So the aim of seed grading is **to maintain this quality from one season to the next by removing all these destructive elements:**

Other crop seeds

Weed seeds (especially herbicide resistant weeds)

Straw, soil dust and other inert material

Immature, shrivelled, damaged, cracked, undersized or oversized seed.

SEED GRADING:

It is done after threshing and before seed treatment in any seed production cycle.

Grading reduces the heterogeneity of seed lot and improves the seed quality - storability, planting value and marketability.

The morphological characters used for grading are size, weight, colour, shape and surface texture.

- **Seed lot can be graded adopting any one of this characters.**

1. SIZE GRADING:

- **Mostly the seeds are initially graded based on size to bring uniformity (homogeneity) in seed lot.**
- **It is also termed as basic grading.**

For size grading different sieves of uniform hole size are used.

S.NO	CROP	SEIVE SIZE (Perforated round metal sieve)
1	Maize	18/64
2	Paddy	1/14x3/4
3	Pear millet	4164 (5 / 64 for WCC5)
4	Sorghum	10/64
5	Bengalgram	10/64
6	Cowpea	10/64
7	Blackgram	10/64
8	Greengram	17/64
9	Red gram	10/64
10	Gingelly	4/64
11	Sunflower	9/64
12	Soybean	12/64
13	Cotton fuzzy	12/64 .
1.4	Aciddelinted	10/64
15	Tomato	5/64
1.6	Brinjal	5/64
1.7	Bhendi	10/64
18	Gourds	16/64
19	Onion	5/64
20	Groundnut	18/64

Example:

Crop	Method
Paddy	Salt floatation using egg
Sunflower	Use of specific gravity separator
Cotton, bhendi	Water flotation technique

Grading based on colour:

- Seed are having their original seed colour which is genotypic.
- Any deviation from the colour is known as colour variation and is termed as off coloured seed which may either dull or dark from original colour.
- Off colour seed occur in seed lot due to rain at harvest or due to harvesting of immature seed or due to over maturing of seed in plant or due to aging of seed in storage.
- Off coloured seed are poorer in quality in terms of germination, vigour and storability.
- Removal of off coloured seed is known as colour grading.
- It can be done either manually or mechanically.
- The machine used for colour grading is electronic colour sorter.

Grading based on shape

- Seed vary in shape as oblong, rectangular, round, triangular, square, hexagon within a seed lot and sorting of this shape to single is known as shape grading.

- It is not a usual practice in commercial crop as this shape variation occur only with wild and ecotypes that are prevalent mostly in perennial tree species [eg] Tamarind, Pungam, and Neem [round and oblong].

- In processing cylinder separator or inclined separator is used for homogenising based on shape

Seed Treatment - Chemical

Ideal seed treatment chemical

- Highly effective against organisms
- Relatively non-toxic to seed / plant
- Harmless to human and animals
- Stable for relatively long time
- Easy to use / easily available
- Economically competitive
- Environmentally safe

Eco-friendly

- Neem (*Azadirachta indica)*
- Notchi (*Vitex* sp.)
- Vasambu (*Acorous calamus*)

Special treatments

- Coating and pelleting
- Invigoration treatments
- Irradiation
- Radio frequency treatment
- Electro magnetic seed treatment

Hydration -de hydration treatments

Mid storage treatments

- Seeds in storage - accumulate damage to cell membranes during senescence
- Mid storage treatment
- Reduce age induced damages
- Restore seed vigour to certain extent
- Improve seed viability and productivity

Hydration – Dehydration (H-D)

- low and medium vigour seeds in water with or without added chemicals usually for short durations.
- seed moisture content to 25 – 30% and drying back the seeds to safe limits for dry storage

Types of H-D treatments

- Soaking-drying
- Dipping-drying
- Spraying-drying
- Stepwise hydration-drying
- Moisture equilibration-drying
- Moisture equilibration soaking-drying
- Moist and conditioning-drying, etc.

The choice of the treatment depends upon the characteristics of seed and initial vigour status of the seeds.

Mode of Action

- **The main purpose of hydration is to raise the seed moisture content to 25 – 30% (wet weight basis) before drying back to safe limits for dry storage.**
- **The hydration - dehydration treatment may improve the vigour by controlling free radical reactions and consequent peroxidative damage to lipoprotein cell membranes**

Colouring of seeds

- Improved lusture / appearance
- Prevents inadvertent use of treated seeds
- Trade mark identity

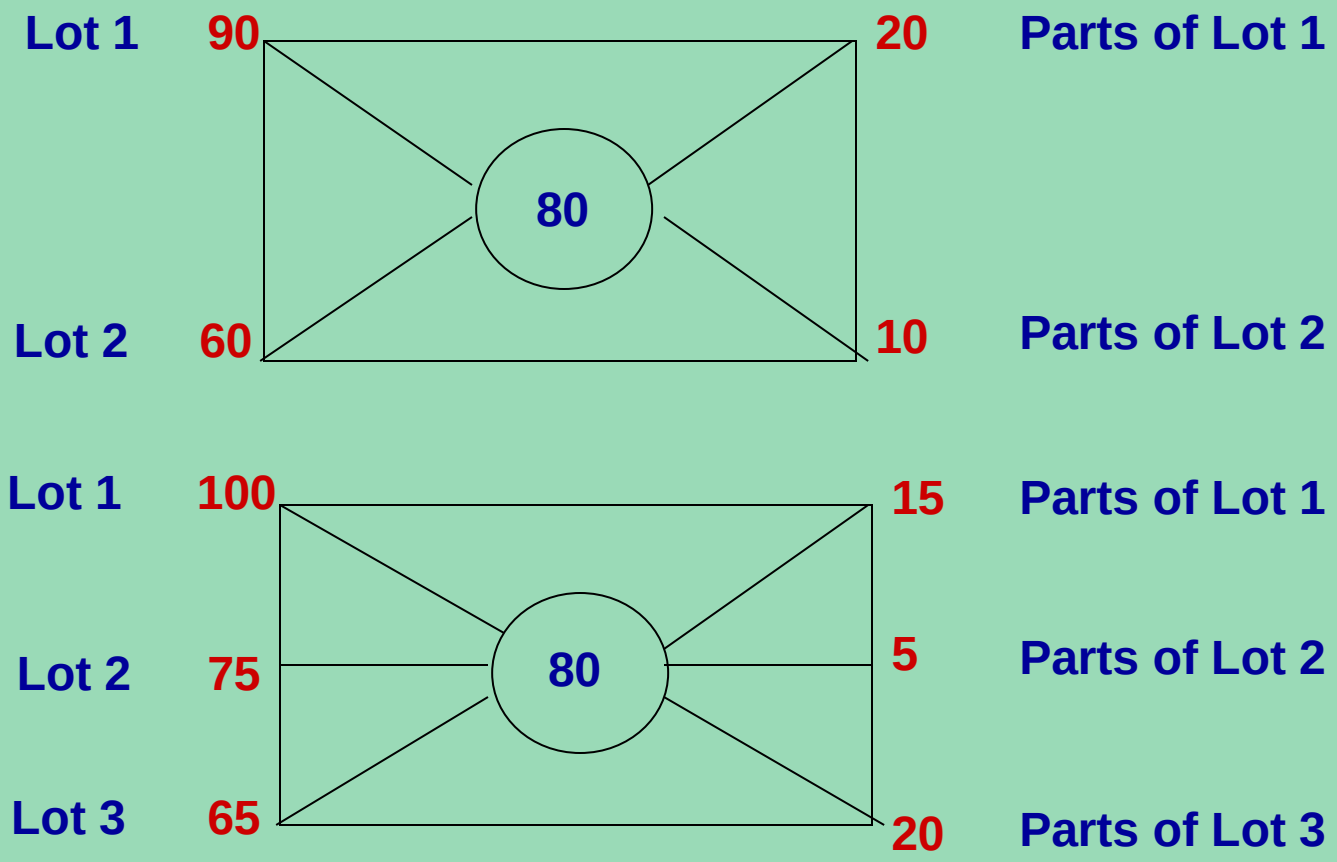
Synthetic dyes

Plant based dyes

Plant powders

Blending

Pearson's Square law method



THE LIFE SPAN SEED

- Long-live seed
- Short –live seed

NATURAL LONGEVITY OF SEEDS

- Microbiotic: seed life span not exceeding 3 years
- Mesobiotic: seed life span from 3 to 15 years
- Macrobiotic: seed life span from 15 to over 100 years.

TWO MAJOR CLASSES OF SEEDS

- Orthodox. Low MC of around 5% (wet basis) and successfully stored at low or sub-freezing temperatures for long periods.

- Recalcitrant. Relatively high moisture content (often in the range 20–50% wet basis) and which cannot be successfully stored for long periods.

FACTORS AFFECTING LONGEVITY IN STORAGE

- Seed maturity
- Parental and annual effects
- Freedom from mechanical damage.
- Freedom from physiological deterioration
- Freedom from fungi and insects
- Initial viability

Factors Affecting Seed "Storability"

SEED AGEING

- Enzyme activity is reduced
- Cell membranes become leaky
- Genetic damage occurs

→ increased likelihood of mutants and abnormal seedlings;

- vigour is lost

→Declining ability to germinate under sub-optimal conditions; declining rate of germination; uneven establishment; lower seed yield

- Death occurs

HOW DO YOU MEASURE SEED LONGEVITY?

- Controlled ageing experiments
- Rate of ageing accelerated by raising temperature and moisture content
- Seeds sampled at intervals and tested for viability
- Germination plotted against storage period

MOISTURE CONTENT

- Over most of the moisture range, the rate of deterioration increases as the moisture content increases.

Seed moisture content %	
(wet weight)	
Above 45 – 60 %	Germination begins
Above 18 – 20 %	The seed may heat (due to a rapid rate of respiration and energy release)
Above 12 – 14 %	Fungus growth can occur
Below 8 – 9 %	Insect activity much reduced
4 – 8 %	Sealed storage is safe.

RELATIVE HUMIDITY AND TEMPERATURE DURING STORAGE

Equilibrium moisture content

- The moisture content at which a seed is in equilibrium with the relative humidity of the surrounding air.

TEMPERATURE

- Within the normal range of biological activity of seeds, insects and moulds increase as temperature increases
- The higher the moisture content of the seeds, the more they are adversely affected by temperature
- Decreasing temperature and seed moisture, therefore, is an effective means of maintaining seed quality in storage

Role of moisture and temperature on seed viability and storability

Seed moisture %	Effect on seed
35-80	Moisture content of developing seed. Seed not mature enough to harvest
18-40	Physiologically mature seed, High respiratory rate, susceptible to field deterioration, heating occurs if seed is bulked without proper ventilation.
13-18	Respiratory rate still high, mold and insects can be damaging and seed resistant to mechanical damage
10-13	Seed store well for 6-8 months in open storage in temperate climates
8-10	seed sufficiently dry for 1-3 years open storage in temperate climates. Very little insect activity.
4-8	Safe moisture for sealed storage
0-4	Extreme desiccation. Can be damaging to seed.
22-60	Seed germinates when they imbibe water to

Role of moisture and temperature on seed viability and storability

- Temperature plays important role in the life of seed, though not as important as moisture;
- Temp below 50F is effective in maintaining seed quality, even though RH may be relatively high;
- Where as both seed moisture & temp are important factors in seed storage, moisture

Harrington's rule:

- A one per cent decrease in moisture content nearly doubles storage potential of seed.
- A 10° F decrease in temperature nearly doubles storage potential of seed.
- Good seed storage is achieved when the percentage of relative humidity in storage environment and the storage temperature in degrees Fahrenheit add up to one hundred

MANAGEMENT FOR SUCCESSFUL STORAGE:

- Control of temperature
- Control of seed moisture

Control of temperature

- Ventilation
- Insulation
- Refrigeration

CONTROL OF SEED MOISTURE

- Ventilation
- Moisture-proofing
- Dehumidification
- Sealed containers
- Desiccants

- silica gel
- The usual cobalt chloride treated silica gel turns from blue to pink at about 45% relative humidity
- Thus a quantity of silica gel (1 kg per 10 kg of seeds and packets) is dried and enclosed with the seeds in metal box when the indicator granules turn pink, the silica gel is removed, reactivated by drying in an oven at 175°C,
- cooled in a sealed container and returned to the metal box

ORTHODOX SEEDS (tolerate extreme drying)

- Tolerate drying to low
- moisture levels (2-5% of wet weight)
- Longevity increases as
- moisture level decreases
- Tolerate low temperatures,
- can be frozen
- Longevity increases as
- temperature decreases
- Often long

INTERMEDIATE SEEDS (tolerate some drying)

- Tolerate drying, but only down to a critical moisture level
- Tolerate some low temperatures, but not freezing
- Short to medium term storage is practical-lived

RECALCITRANT SEEDS (do not tolerate drying)

- Intolerant of drying
- Seeds die if moisture level is reduced to less than 12-31% of wet weight
- Intolerant of low
- Temperatures
- Lose viability rapidly after ripening

Recalcitrant" Seeds Do Not Tolerate Dry Storage

- **"Recalcitrant" seeds do not have longer storage lives as temperature and MC decrease, and generally do not tolerate desiccation:**
  - Coffee (*Coffea liberica*)
  - Cocoa (*Theobroma cacao*)
  - Rubber tree (*Hevea brasiliensis*)
  - Oil Palm (*Elaeis guineensis*)
  - Mango (*Mangifera indica*)
  - Rambutan (*Nephelium lappaceum*)
  - Jackfruit (*Artocarpus heterophyllus*)
  - Durian (*Durio zibethinus*)
- **It is difficult to store seeds of these species, and most are maintained as living plant collections**

- **Various conventional SEED STORAGE STRUCTURES**

Storage methods

Indoor storage
Bamboo containers, bamboo bag, wooden box, mud structures, earthen containers

Materials used
Bamboo, paddy/wheat straw, wood, mud, cow dung

Out door storage
Bamboo structures, paddy/wheat straw structures, brick structures, wooden structure

Materials used
Bamboo, wood, mud, bricks, cement, cow dung, paddy/wheat straw

Miscellaneous
temporary storage, under ground storage

Materials used
Cotton sticks, mud, straw ropes

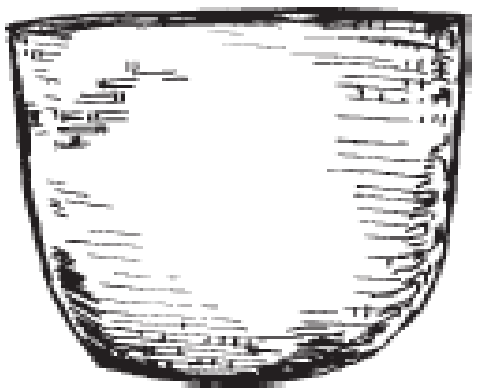
Indoor storage structure

Mer

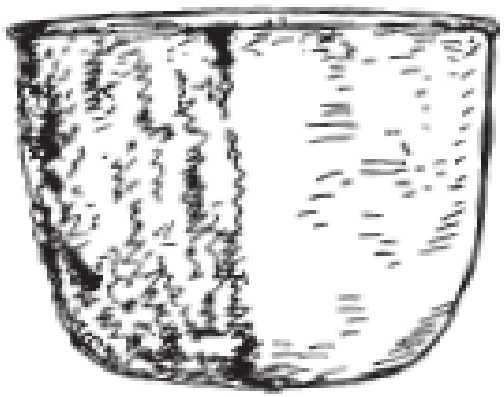
Bamboo containers

Gade - Andra Pradesh
Mer - Assam
Duli - Assam
Hak - Assam
Kanaja - karnataka
Kangi - Maharastra

Duli



Duli



Improved *duli*
(with tar coating)

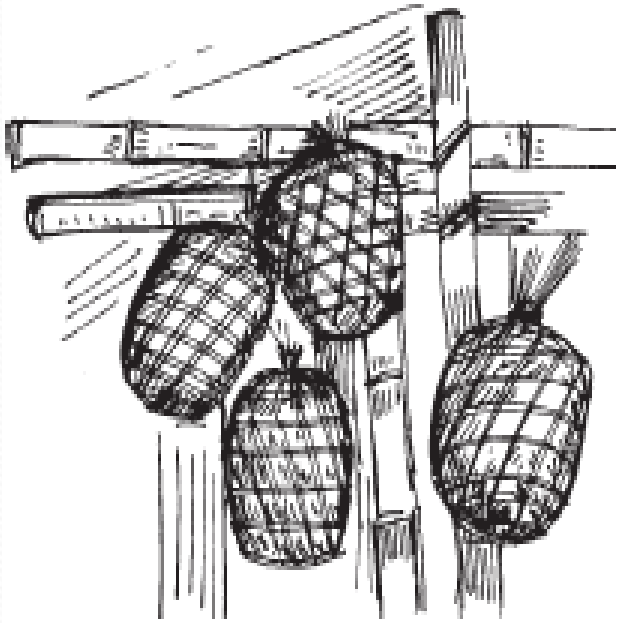
- Basket woven with bamboo strips
- Round in shape ,inner side plastered with mud
- Storage of paddy for small quantity

Peru

- Traditional bamboo basket
- Dumma community in himachalapradesh
- Special variety of bamboo- magar (*dendrocalamus hamiltonii*).
- ¾ inch width used for woven

Bamboo bag

Tome



Tome

- Small capacity bamboo bag
- Stored in paddy seeds in Assam
- Immature and tender bamboo stripes are woven to make bag

Advantages

- Suitable for storing small quantity of seed
- Light in weight and portable
- Construction cost is nominal
- Materials are abundantly available

Dis advantages

- Containers are not air tight – spoilage due to high moisture
- Some containers do not have lid –rodents and insects
- Bamboo- susceptable to woodborers

Wooden boxes

- Peti and tunn in HimachalaPradesh
- Sanduka in Karnataka and Andra Pradesh
- Sandak in Karnataka
- Pathayam in Tamil Nadu

Peti

- Hilly areas of Himachala Pradesh
- Storage capacity – 0.3t to 1.2 t
- Made by red cedar(*toona regia)*, walnut (*juglans regia)*
- Partition is also made inside the box-two to three types of seed storage
- Pegs of 12 " are fixed at the bottom of the box-avoid direct contact

Pathayam (Wooden bin), 1.5 m height, 1.5 width, 2 m length, capacity > 500 Kg.

Door of *Pathayam (Wooden bin).*

Pathayam

- wooden planks joined together by carpentry work
- No gap between planks.
- Top open is big (30 x 30 cm) and small out let in bottom

Advantages

- Moisture contamination is less
- Seed/ grain protected – rodents and insects
- Structures -seeds, pulses, and small quantity of grains.

Dis advantages

- Inferior quality of wood - wood borer-life of the box reduced
- Carpentry skill is required
- Cost of wood and labor increases the cost of making wooden boxes

Mud structures

- Mud is mixed with paddy or wheat straw and cow dung –mud structures
- Kachha kothi or kothi in Punjab, Rajesthan, Haryana, Uttranjal
- Seed/grain stored for 6 to 10 months
- Storage capacity various from 1.5 to 2 t
- Kuthla in Himachala Pradesh and Haryana
- Storage capacity is 15 to 50 kg

Mud storage structures for cumbu storage

Advantages

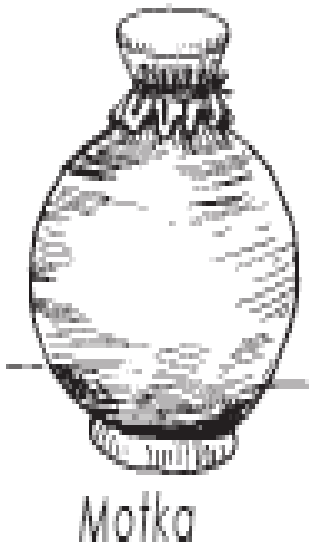
- Temperature is constant
- Possible for fumigation
- Rat cannot enter the structure
- The structure is long lasting

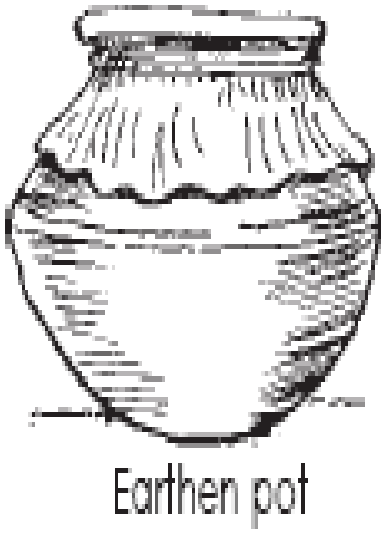
Dis advantages

- Time consuming
- Skill is required for constructing

Earthen structures

- Storing small quantity of seeds
- Made by burned clay –different sizes and shapes
- Mukta in Punjan and Haryana
- Ghara in Himachala Pradesh and Uttaranchal
- Utrand in Maharastra
- Adukupannai –Tamil Nadu


Matka


Earthen pot

Outdoor structures

- Gummi in AndraPradesh
- Bamboo strips or locally available reed
- Circular or hexagonal shape and plastered from outside with mud
- Base-reed
- Roof-palm leaf or loose straw
- Capacity is 2 to 25 t
- Cost around Rs 250

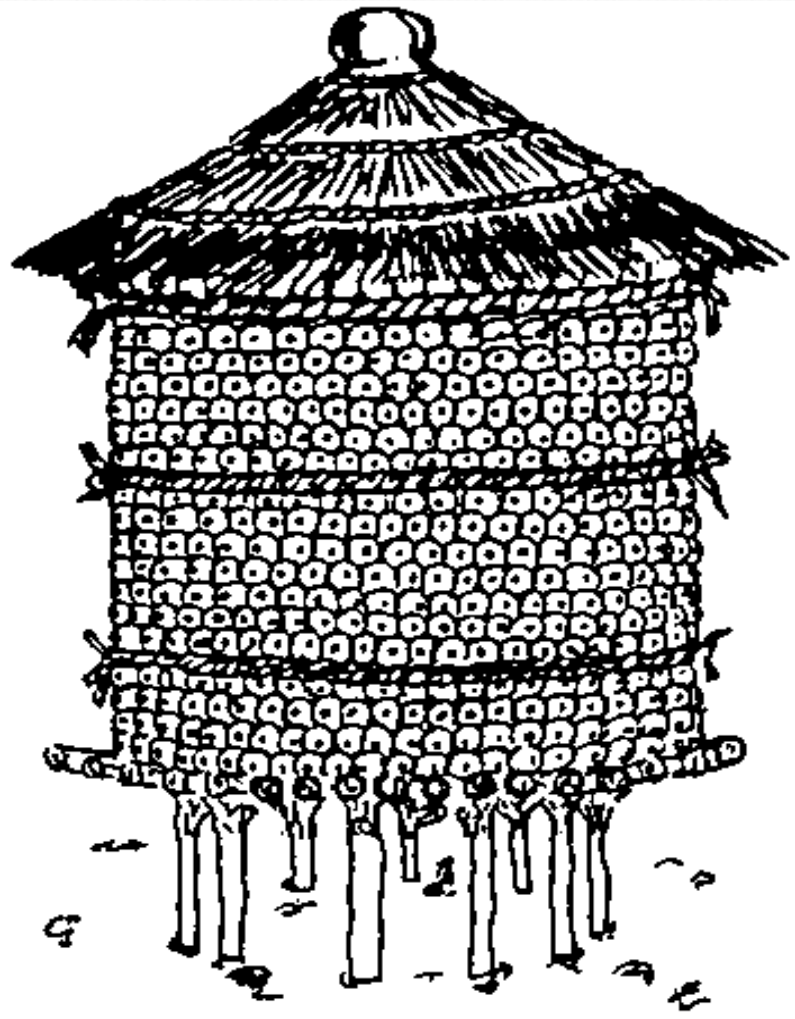
Advantages

- Structure constructed in raised platform-protected from moisture and rodent
- Un plastered spilt bamboo facilitates aeration
- The covered structure prevents bird attack

Dis advantage

- The structures require constant maintenance and mud plastering

Out door structures



Temporary storage

- ✓Moosal –dom shaped used in Punjab, Haryana and rajesthan
- ✓Thin sticks or branches of cotton or pigeonpea used
- ✓Sticks are tied in bundles –outer peripery
- ✓Inside filled with hay and then seed/grain bags
- ✓Outer part is covered with wheat straw
- ✓Fragile structure-protected from strong wind

Disadvantages

- ✓Grain storage in moosal is a temporary structure
- ✓Structure is demolished
- ✓Construction requires time and skill

Underground structure

- ✓Pathara
- ✓Used in AP
- ✓Simple dug out pit lined with straw ropes – prevent moisture
- ✓Stones as an indoor structure
- ✓Finally sealed with mud plaster

Advantages

- Fumigation is not required for disinfecting grain in pathara
- The grain/ seed can be stored for a longer period without damage by insects or mold
- The structures saves storage space

Seed Packaging

- Moisture pervious – Short term storage
- Moisture resistant – Medium term storage
- Moisture vapour proof – Long term storage

Commonly used seed packaging containers

- Burlap or gunny bag (MP)
- Cotton or cloth bag (MP)
- Paper bag (MP)
- Elastic multiwall paper bags (MP)
- Cellophane / polyethylene laminated bag (MR)
- Polyvinyl bag (MR)
- Aluminium foil bag (MR)
- Cardboard, metal or glass containers (MVP)
- Polyethylene bag with >700 gauge (MVP)

CRYOPRESERVATION TECHNIQUES FOR CONSERVATION OF PLANT GENETIC RESOURCES

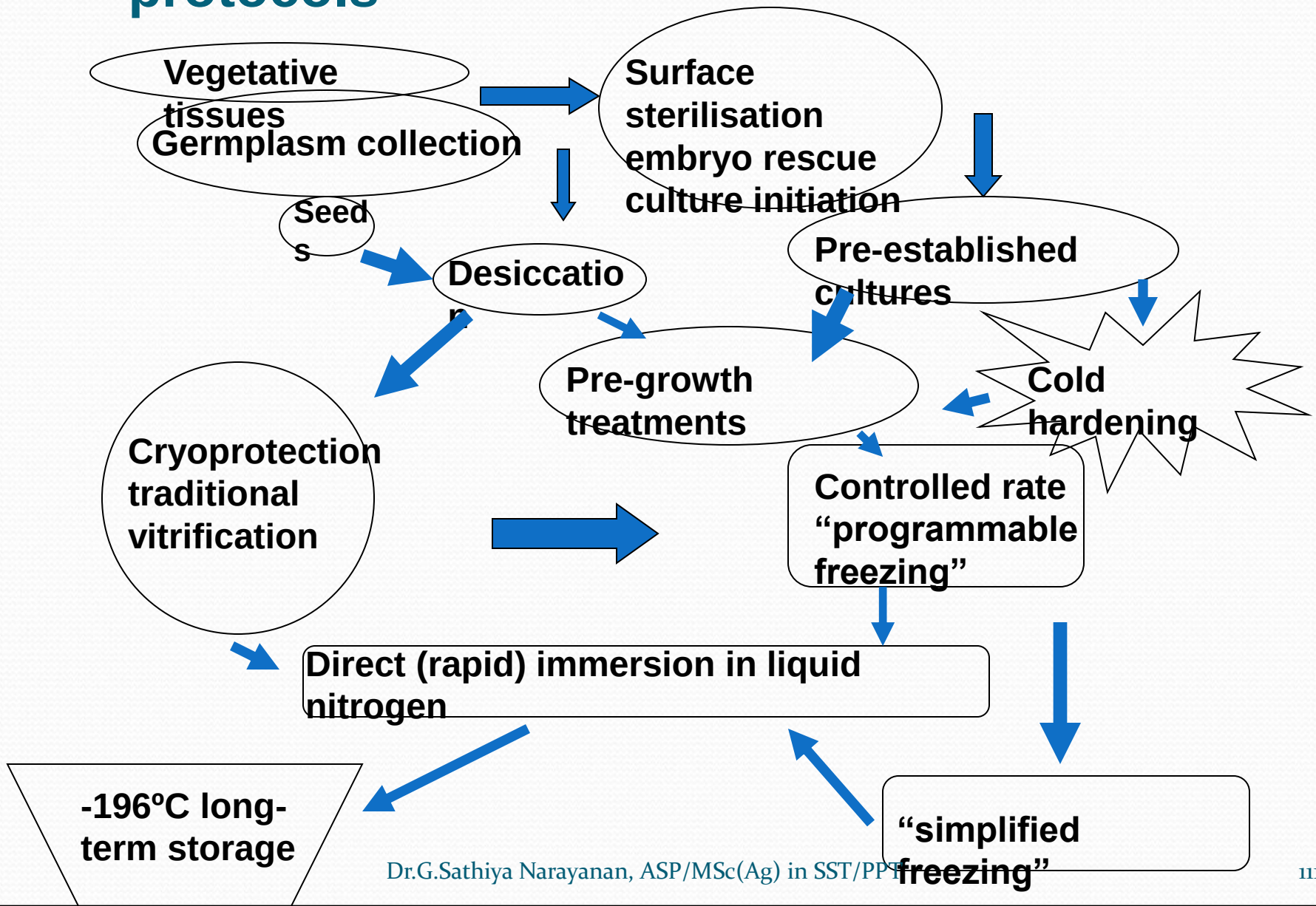
What is cryopreservation?

- Storage below –130^{o}C
- A state of suspended animation
  - Ultra low temperatures
  - Stops cell division & metabolic processes
  - Very long-term (indefinite?) storage
- Viability decreases over time

Need for cryopreservation

- Maintain reserves without constant care
  - Replacement of contaminated cultures
- Reduce alterations or loss of culture characteristics
  - Genotypic drift due to genetic instability
  - Senescence
  - Transformation
  - Phenotypic instability due to selection and dedifferentiation
- Need for distribution to other users

Component steps of cryopreservation protocols



Role of Cryoprotectants

Cryoprotectants protect lowly frozen cells by one or more of the following mechanisms:

- ❑ Suppressing high salt concentrations
- ❑ Reducing cell shrinkage at a given temperature
- ❑ Reducing the fraction of the solution frozen at a given temperature
- ❑ Minimizing intracellular ice formation

Equipment for cryopreservation

- **Liquid nitrogen**
  - ✓ **Liquid phase (-196^{o}C) or vapor phase (-156^{o}C)**
- **Fancy freezing chambers to regulate the freezing rate**
  - ✓ **Controlled rate freezing unit**
  - ✓ **Styrofoam containers**
- **Water bath for resuscitation**

Why liquid nitrogen is used?

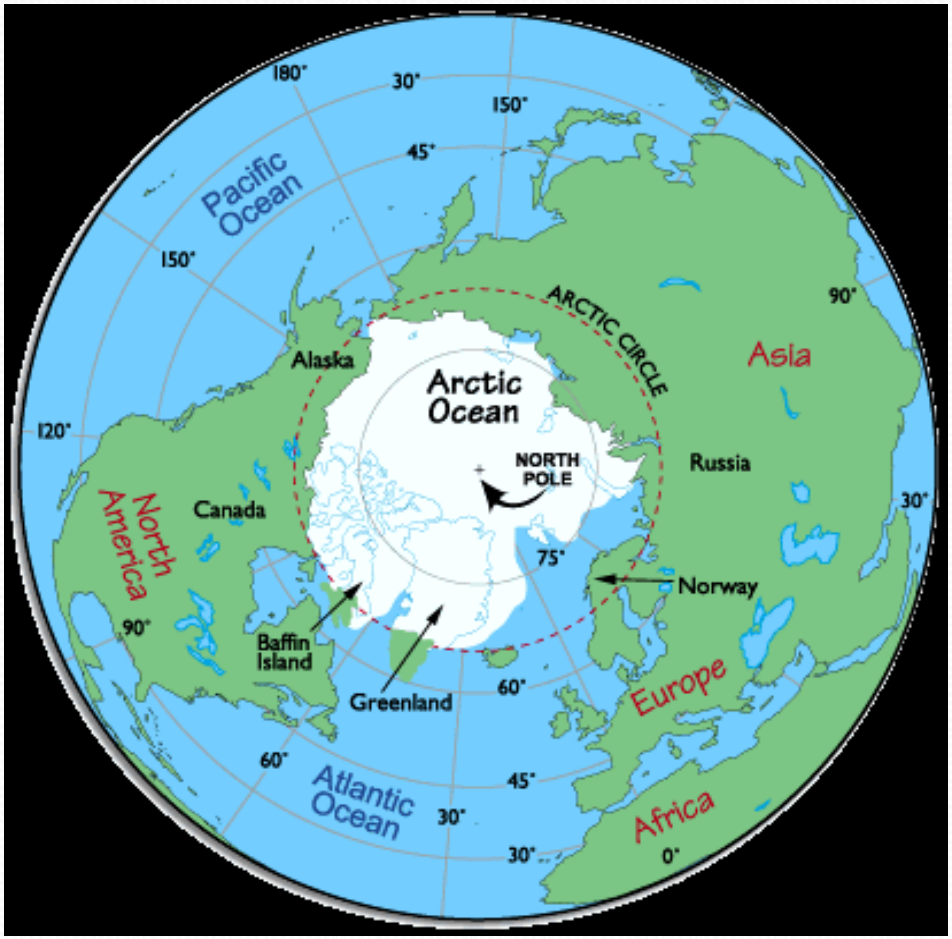
- ❖Chemically inert
- ❖Relatively low cost
- ❖ Non-toxic
- ❖ Non-flammable
- ❖ Readily available

Steps in cryopreservation

Selection of plant parts

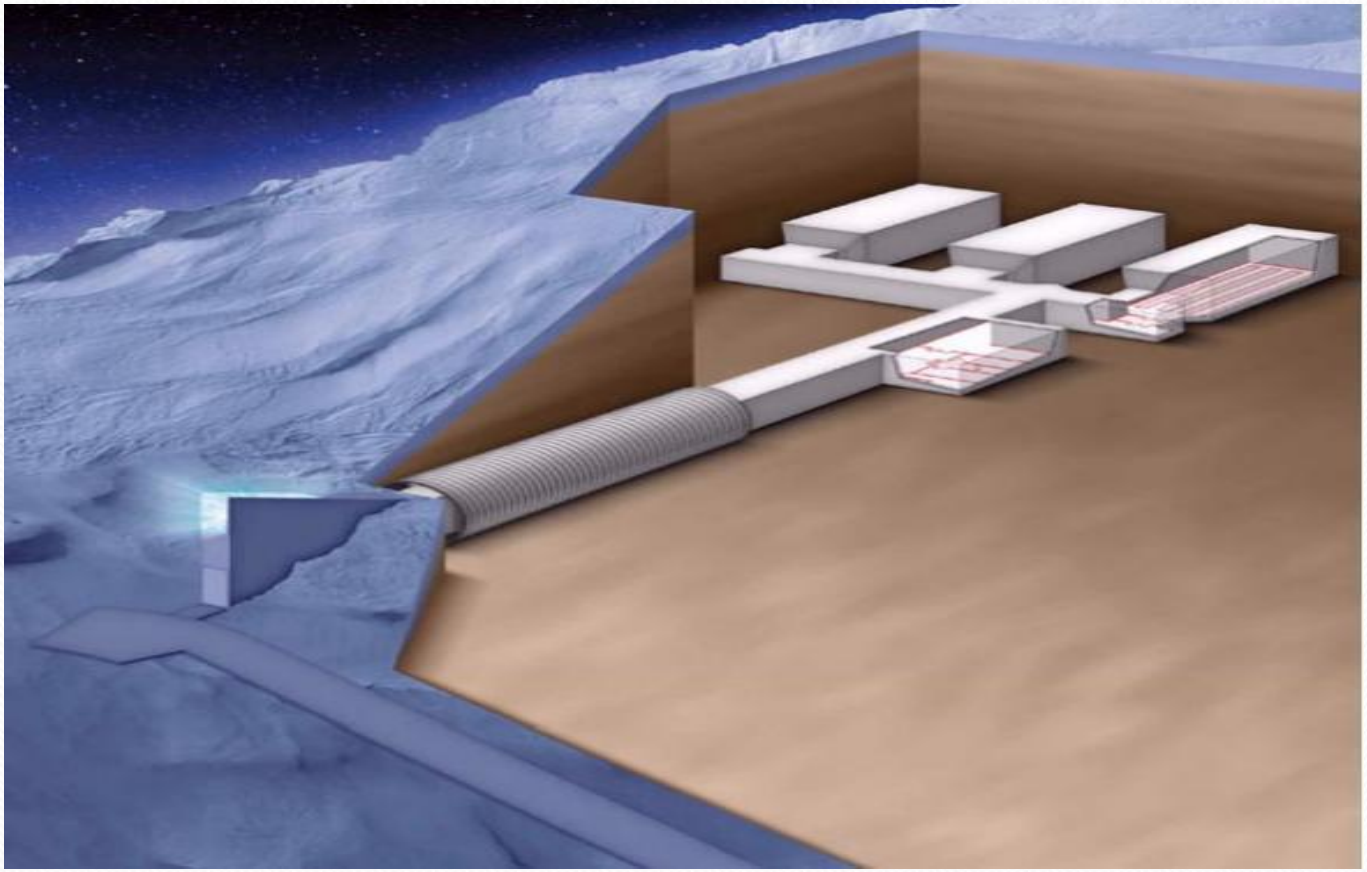
1. **Cryoprotection treatment**
2. **Freezing techniques used classical/new**
4. **Storage at -196^{o}C**
5. **Viability tests**
6. **Regrowth**
7. **Field establishment**

- **What is a seed vault?**
  Svalbard Global Seed Vault is not a gene bank, but a safety-storage for preservation of duplicate collections of seeds on behalf of genebanks. The Seeds in the Seed Vault shall only be accessed when the original seed collections have been lost for any reason.
- The depositors will retain their rights over the seeds. There will be no way that Svalbard Global Seed Vault, or Norway can give access to the seeds without consent from the depositors. The seeds will be returned to the depositors on request.


180°
30°
150°
45°
Pacific Ocean
150°
ARCTIC CIRCLE
90°
Asia
Alaska
Arctic Ocean
120°
NORTH POLE
Russia
Canada
North America
30°
75°
Norway
90°
Baffin Island
Greenland
60°
Europe
60°
45°
Atlantic Ocean
30°
Africa
30°
0°

- **How many seeds will be stored in Svalbard Global Seed Vault?**
  The Seed Vault has the capacity to store 4,5 million different seed samples. Each sample will contain on average 500 seeds, so a maximum of 2,25 billion seeds may be stored in the Seed Vault.

- **Management and operations**
- **Free of cost**
- **Packaging and shipment**
- **International regulations**
- **Replacement policy**
- **Black boxes**




Thank you