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1. Seed Harvesting, Drying, Packaging, Pre-Treatment and Storage : - Processing & Quality Assurance

Seed Harvesting, Drying, Packaging, Pre-treatment and Storage : - Processing & Quality Assurance

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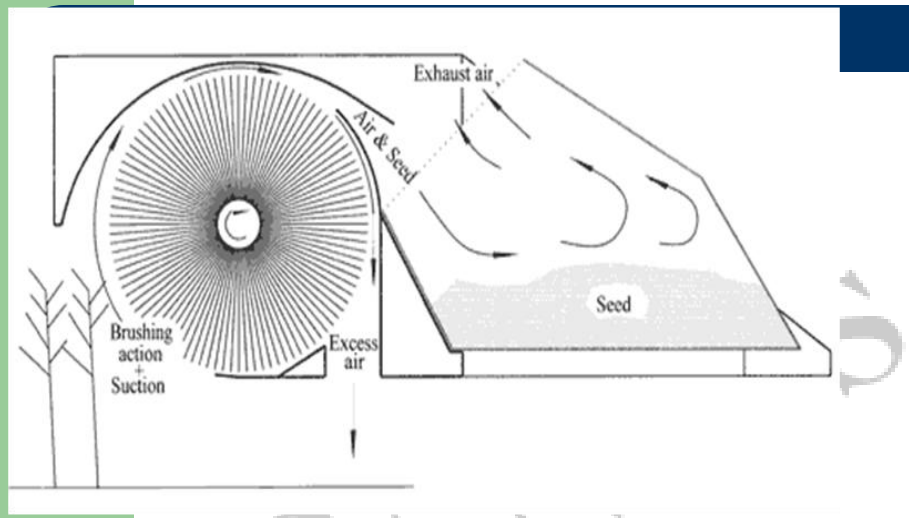
Seed Harvesting

There are a variety of reasons for harvesting seeds; some personal and others environmental.

Methods and techniques of seed harvesting includes;

- **Non-mechanical methods** – Manual Harvesting: Seed heads can be individually cut off or seed stripped from the inflorescence.
- **Conventional mechanical harvesting** - Windrowing followed by threshing the dry crop.
- **Trough, beater and brush harvesting** - In their simplest form, trough harvesters are simply a trough fixed on the front of the vehicle at an appropriate height. As the vehicle is driven through the crop ripe seeds fall into the trough while immature seeds remains on the plant to be harvested later.
- **Suction or vacuum harvesting**
- **Combine Harvester –** Combines numerous processes i.e. cutting, picking, threshing, cleaning, separation and temporary storage.

Trough, beater and brush and Combine Harvesters



Components of a seed processing plant

- Reception
- Seed laboratory
- Pre-drying
- Storage and Drying
- Processing
- Packaging
- Warehousing

Definitions:

- **Drying:** Removal of moisture to moisture content in equilibrium with normal atmospheric air or to such moisture content that decrease in quality from moulds, enzymes action or insect will be negligible. Normally to 12 to 14% m.c. for most materials/products.

- **Dehydration:** Removal of moisture to a very low moisture content, nearly bone-dry condition (all moisture removed).

- **Equilibrium Moisture Content (EMC):** Moisture content of the material after it has been exposed to a particular environment for an infinitely long period of time or the m.c. that exist when the material is at vapour pressure equilibrium with its surrounding. EMC depends on; humidity, temperature, species, variety, maturity of seeds etc.

Merits of seed drying

- Early harvest (at high m.c.) minimizes field damage and shatter losses and facilitates tillage operations for products.
- Long storage period is possible without product deterioration
- Viability of seeds is maintained over long periods
- Products with greater economic value are produced
- Waste products can be converted to useful products
- Production operations are facilitated for products.

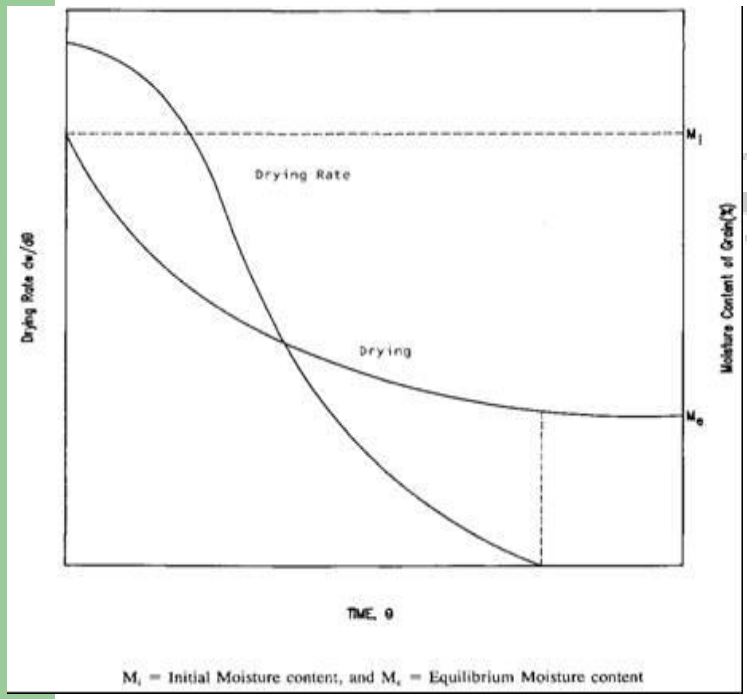
DRYING MECHANISMS

- In the process of drying heat is necessary to evaporate moisture from the grain and a flow of air is needed to carry away the evaporated moisture.

- There are two basic mechanisms involved in the drying process; the migration of moisture from the interior of an individual grain to the surface, and the evaporation of moisture from the surface to the surrounding air.

- The rate of drying is determined by the moisture content and the temperature of the seed and the temperature, the (relative) humidity and the velocity of the air in contact with the seed.

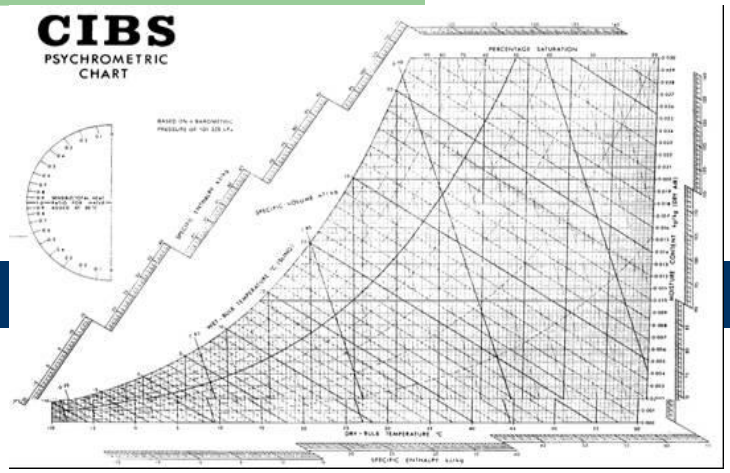
Drying and drying Rate curves and EMC for Various Seeds

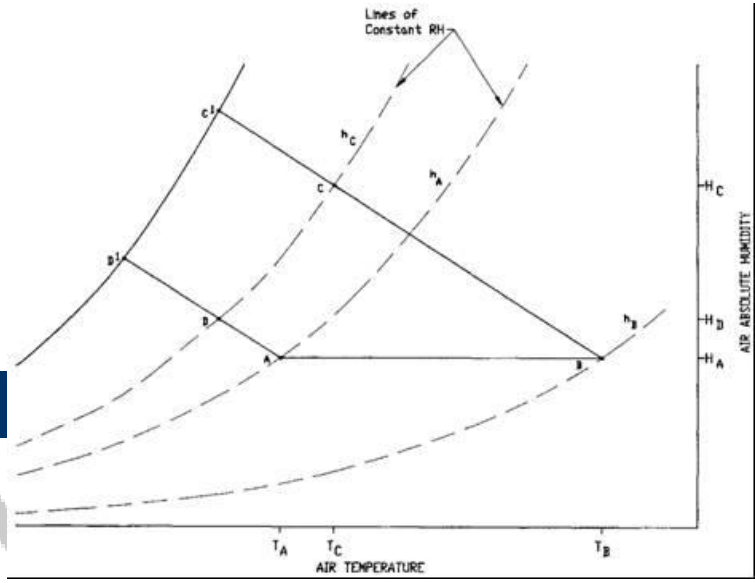


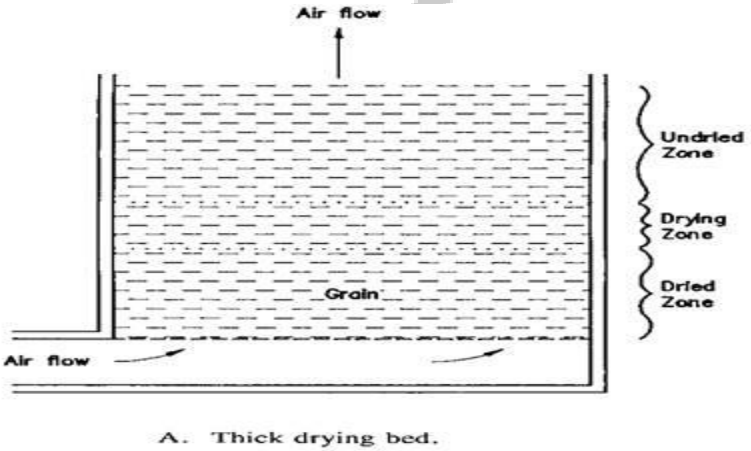
M_i = Initial Moisture content, and M_e = Equilibrium Moisture content

Grain	Relative Humidity (%)							
	30	40	50	60	70	80	90	100
	Equilibrium Moisture Content (%wb*) at 25°C							
Barley	8.5	9.7	10.8	12.1	13.5	15.8	19.5	26.8
Shelled Maize	8.3	9.8	11.2	12.9	14.0	15.6	19.6	23.8
Paddy	7.9	9.4	10.8	12.2	13.4	14.8	16.7	-
Milled Rice	9.0	10.3	11.5	12.6	12.8	15.4	18.1	23.6
Sorghum	8.6	9.8	11.0	12.0	13.8	15.8	18.8	21.9
Wheat	8.6	9.7	10.9	11.9	13.6	15.7	19.7	25.6

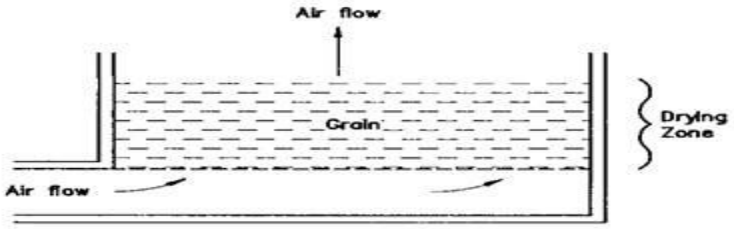
Psychrometric Chart and Drying







A. Thick drying bed.



Conversions Between MC dry and wet basis

$$MC_{db} = \frac{100MC_{wb}}{100 - MC_{wb}}$$

Table 2. Conversion of Moisture Contents.

Wet Basis %	Dry Basis %
10.0	11.0
11.0	12.3
12.0	13.6
13.0	15.0
14.0	16.3
15.0	17.6
16.0	19.0
17.0	20.5
18.0	21.9
19.0	23.5
20.0	25.0

Initial Moisture Content %(wb)	Final Moisture Content %(wb) 19	18	17	16	15	14	13	12	11
	Moisture Loss (kg/tonne)								
30	136	146	157	167	176	186	195	205	213
29	125	134	145	155	165	174	184	193	202
28	111	122	133	143	153	163	172	182	191
27	99	110	120	131	141	151	161	170	180
26	86	98	108	119	129	140	149	159	169
25	74	85	96	107	118	128	138	148	157
24	62	73	84	95	106	116	126	136	146
23	49	61	72	83	94	105	115	125	135
22	37	49	60	71	82	93	103	114	124
21	25	37	48	60	71	81	92	102	112
20	12	24	36	48	59	70	80	91	101
19		12	24	36	47	58	69	80	90
18			12	24	35	47	57	68	79
17				12	24	35	46	57	67
16					12	23	35	45	56
15						12	23	34	45

Effect of Drying on Seed Quality

The drying operation must not be considered as merely the removal of moisture since there are many quality factors that can be adversely affected by incorrect selection of drying conditions and equipment.

The desirable properties of high-quality seeds include:

- low and uniform moisture content;
- minimal proportion of broken and damaged grains;
- low susceptibility to subsequent breakage;
- high viability;
- low mould counts among others

Seed Drying Methods and Equipment

- **Sun Drying**
  - The traditional practice of grain drying is to spread crop on the ground, thus exposing it to the effects of sun, wind and rain.
  - The logic of this is inescapable; the sun supplies an appreciable and inexhaustible source of heat to evaporate moisture from the grain, and the velocity of the wind to remove the evaporated moisture is, in many locations, at least the equivalent of the airflow produced in a mechanical dryer
  - Although not requiring labour or other inputs field drying may render the grain subject to insect infestation and mould growth, prevent the land being prepared for the next crop and is vulnerable to theft and damage from animals.
- **Crib Dryers**
  - The maize crib in its many forms acts as both a dryer and a storage structure.
  - The rate and uniformity of drying are controlled by the relative humidity of the air and the ease with which air can pass through the bed of cobs.
  - The degree of movement of air through the loaded crib is largely attributable to the width of the crib

Equipment Cont.

Solar Dryers

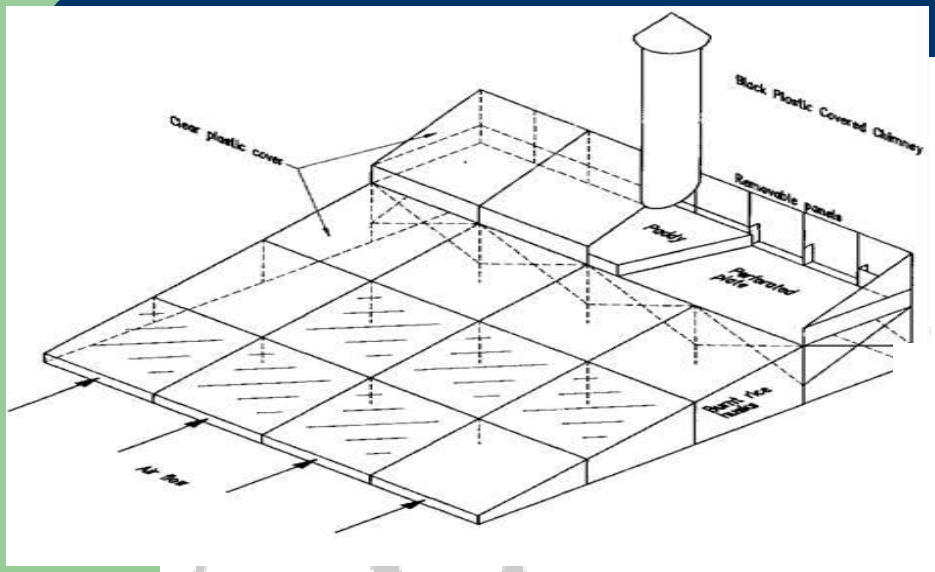
- Natural Convection dryers
- Forced Convection Dryers

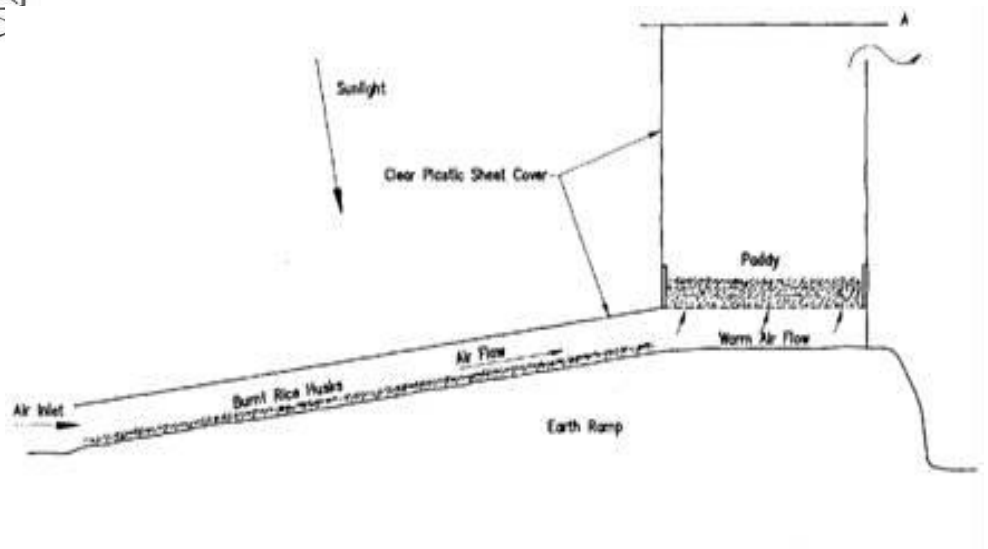
Mechanical Dryers

- Flat Bed dryers
- Re-circulating Dryers
- Continuous Flow Dryers (Cross-Flow, Counter flow and Concurrent-Flow)

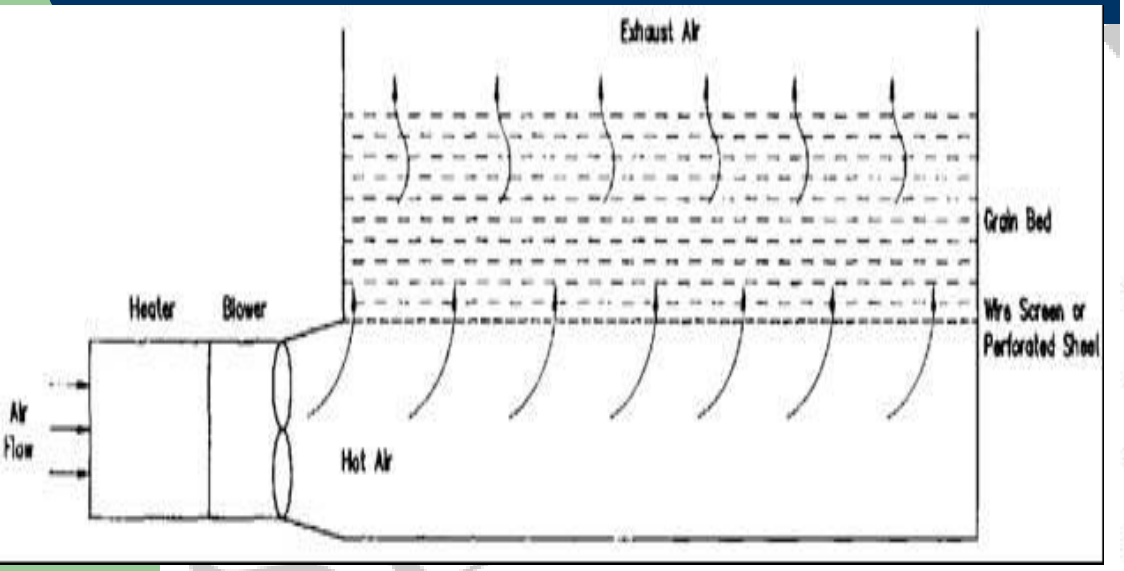
Drying Process and Equipment

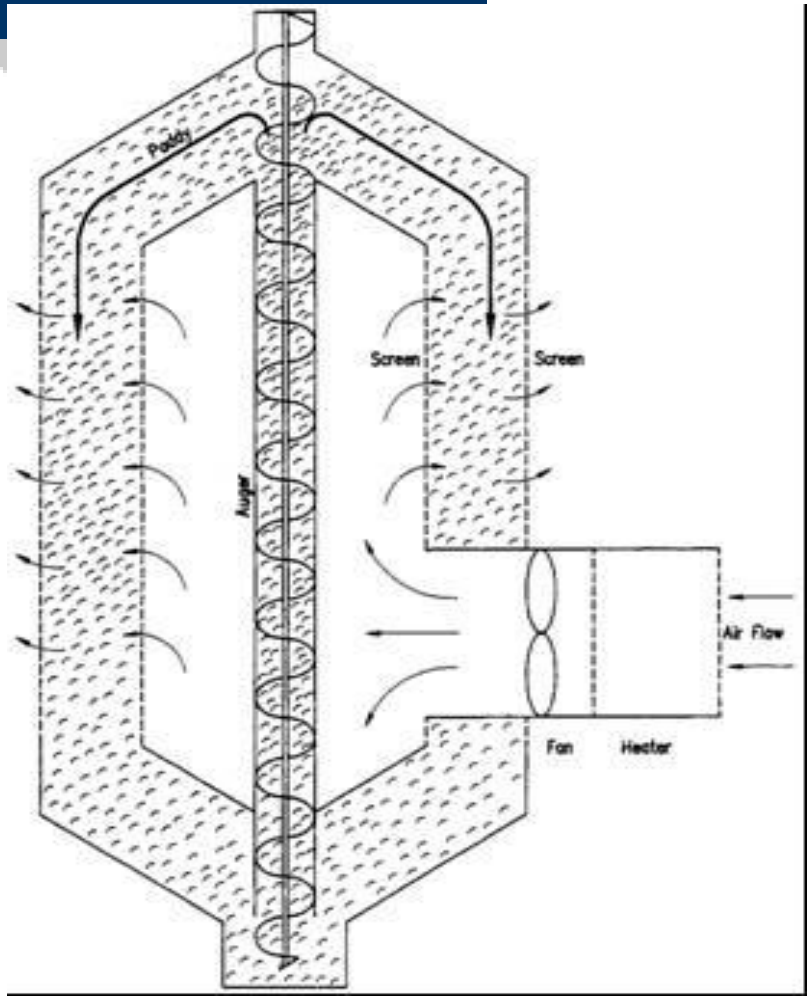
Natural Convection and Small Scale Solar dryers



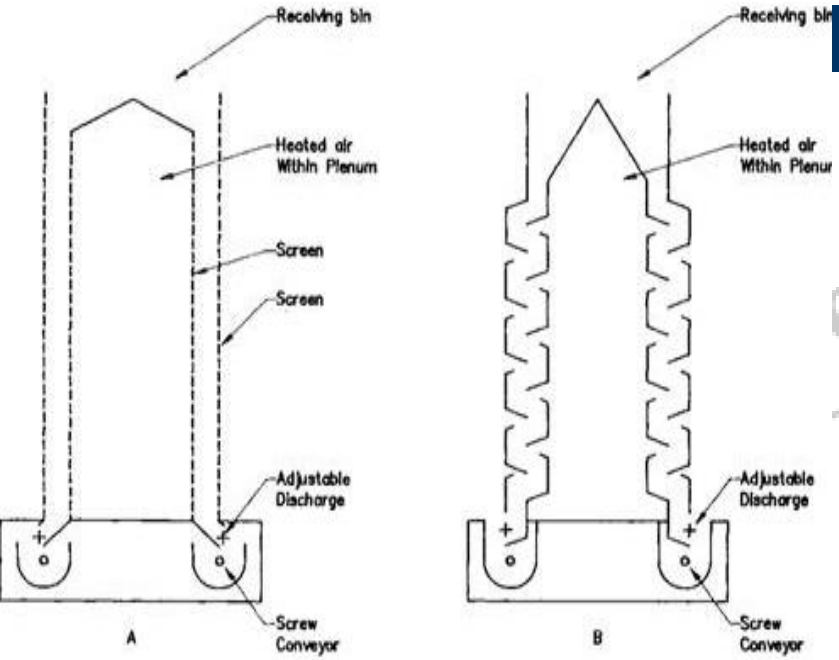


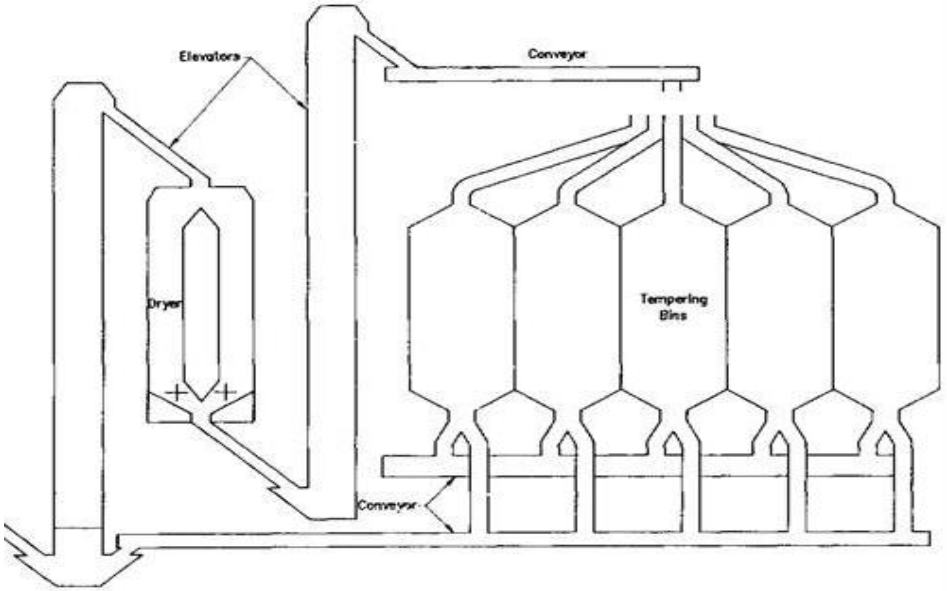
Flat Bed and Re-circulating Batch Dryers





Continuous Flow Dryer





Drying Cont.

- **Drying of Seed Grain**
- If grain is destined for use as seed then it must be dried in a manner that preserves the viability of the seed. Seed embryos are killed by temperatures greater than 40-42°C and therefore low temperature drying regimes must be used.
- It is essential that batches of grain of different varieties are not mixed in any way and therefore the dryers and associated equipment used must be designed for easy cleaning (removal of weed seed, damaged seed, chaff and stones).
- In this respect simple flat-bed dryers are more suitable than continuous-flow dryers.
- Cross-mixing between batches of different varieties can be avoided by drying in sacks in a flat-bed dryer although care must be taken in packing the loaded sacks in the dryer to ensure reasonably even distribution of airflow.

Seed Treatment and Packaging

Seed Treatment

- Involves hoppers, Bucket lifts and drivers, Treatment in drums: Dressing, coating, pelleting and drying

Cont.

- **Seed Packaging**

  Introduction: After processing and treating are completed, seeds are packaged into containers of specified net weight. Packaging or bagging is essentially the last operation in which seeds are handled in bulk flow.

The packaging consists of the following operations:

- ✓ Filling of seed bags to an exact weight.
- ✓ Placing leaflets in the seed bags regarding improved cultivation practices.
- ✓ Attaching labels, certification tags on the seed bags, and sewing of the bags.
- ✓ Storage/Shipment of seed bags.

Packaging Cont.

What is meant by seed packaging?

- This is the placing of a counted or weighed sample of seeds into a container which is then hermetically (airtight) sealed ready for storage.

Why are seeds packaged?

- Seeds are packaged to prevent absorption of water from the atmosphere after drying, to keep each separate and prevent contamination of the seeds from insects and diseases.
- Other Reasons: Contain products, defining the amount the consumer will purchase; Protects products from contamination, from environmental damage and from theft; Facilitate transportation and storing of products; Carry information and colorful designs that make attractive displays.

When should seeds be packaged?

- The best time to package seeds is directly after the moisture content has been determined and found to be within the required limits for safe storage. Seeds will always show equilibrium between their moisture content and the relative humidity of the environment and therefore, if possible, seeds should be packaged into containers and hermetically sealed in the drying room or without delay on being removed from it.

Types of Packaging

- Packaging materials are classified as rigid, semi-rigid and flexible, according to their consistency.
- Those that present some specific characteristic due to the type of product it contains or on its applications, are considered special packs.
- **Rigid packs** are produced in metal (steel and aluminum), glass, cardboard (flat and corrugated), wood, rigid plastics or ceramics, with the addition in some cases, of materials such as tinfoil, resinous or synthetic oils, paints and glues.
- **Semi-rigid packs** are plastic bottles and containers and mixed laminated materials.

Seed Storage

According to Harrington's rule of thumb for storage,

- For every one percent increase in moisture content, the seed life is halved for seeds of moisture content of 5 - 14%.
- For temperature, every 5º C rise in temperature, between 0 - 50º C, the seed life is halved.
- Moisture content of seeds is the most important determinant of the life span of seeds. In addition, low moisture content will not favour the growth of fungi nor insect pests.
- Hence it is of vital importance to dry seeds to low moisture level of 6 - 8% and to store them at low temperature ie. at 20º C for short term storage and 5º C or -20º C far very long term storage.

Types of Storage for Seed

1. ***Ordinary storage for short periods***

- For short term storage in crops for the next season, an air-conditioned room at 20º C will be sufficient provided the seeds are properly dried and packed in bags preferably moisture proof containers.
- During storage, if the moisture content is too high, the problem of fungal growth is inevitable and also there will be insects which can breed at a faster rate in moist seeds.
- Pests will eat up the seeds or bore invisible holes which affect the vigor and quality of seeds. Too high moisture in stored seeds will lead to heating of the seeds and high rate of respiration leading to loss of viability.

Cont.

2. Cold Storage for Breeder Seed

- In case of breeders seed or seeds for genetic conservation then a higher standard is required. Seeds have to be dried to 6 - 8% moisture content sealed in airtight moisture proof containers and stored in cold rooms of 5º C to -18º C and 50% relative humidity. This is the case in a seed or gene bank, where genetic materials in small samples are stored in cans or aluminum foil packets.
- The temperature is often sub-zero at -10º to -20º C. The latest form of storage is cryogenic storage mainly for genetic resources as smaller samples are involved and stored in liquid nitrogen tanks at temperature of -196º C. Cryogenic storage has certain advantages in that no electricity is required. There is no mechanical breakdown and maintenance cost is low.

3. Storage with Drying Component

- In some cases, the storage facility may double up as the drying facility. In this case the silo takes the form of the deep layer dryer as elaborated earlier.

Thank you
for
your Attention