SEED DRYING

J.P.Lakhani
R. Shiv Ramakrishnan

Jawaharlal Nehru Krishi Vishwa Vidyalaya
Jabalpur

- The process of elimination of moisture from the seed is called drying.
- Seed drying should reduce the seed moisture content to safe moisture limits to maintain its viability and vigour during storage, which may otherwise deteriorate quickly owing to mold growth, heating and enhanced microbial activity.

- Seed drying also permits early harvesting, long term storage of seeds, more efficient use of land and manpower, the use of plant stalks as green fodder and production of high quality seed.
- Depending upon the climate and method of harvesting adopted the threshed seed may or may not be dry enough for safe storage.
- Under less favorable conditions, threshed seed needs further drying

Importance of seed drying

Due to improper drying and storage conditions, seeds suffer from major retarding effects.

1. Loss of viability
2. Discoloration
3. Toxin production
4. Growth of fungus

- Seed conservation through efficient processing and storage becomes factor of prime importance

Stage of moisture elimination

The moisture from the seed is eliminated in 2 stages

- Surface moisture of the seed that initially removed by the drying air.
- The removal of the moisture in the surface cause an imbalance in the moisture potential in the surface of the seed and the inner portion of the seed which leads to the migration of moisture from the inner organ to the surface.

- Elimination of moisture from the seed depends upon the relative humidity and temperature of the environment surrounding the seed. When RH of the atmosphere is less than the seed, moisture is eliminated from the seed.
- While drying, care should be taken to minimize /prevent oxidation and decomposition and volatilization.
- In this process there will be loss of dry weight of seed which is widened when the processes take place at high temperature.
- High moisture seeds should be dried at low temperature

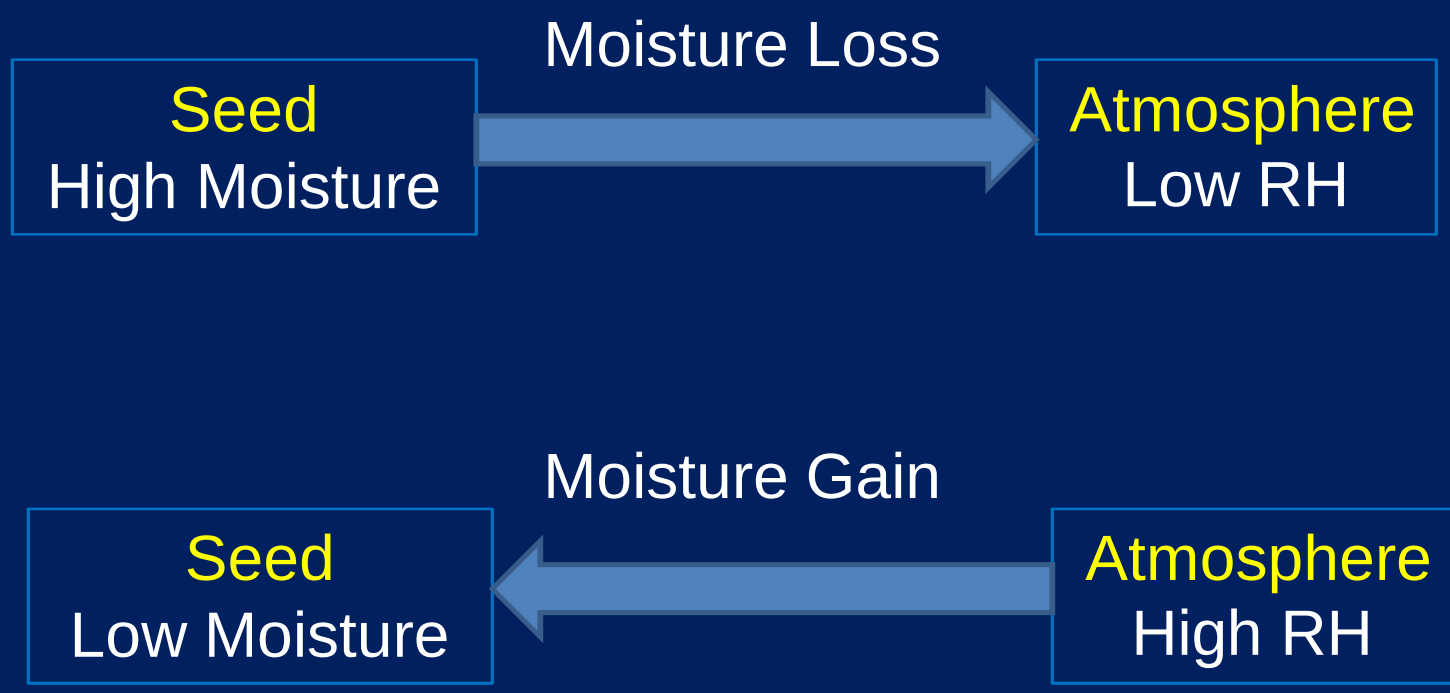
Drying temperature

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

Moisture Content (%)	Temperature	
	^{0}F	^{0}C
10 >	110	43.3
10-18	100	42.2
18-30	90	32.2

Equilibrium moisture content

A seed is in equilibrium with the environment when the 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.



The rate of drying depends on

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

Methods of drying

I. Physical drying (or) natural drying (or) traditional sun drying

II. Mechanical (or) artificial drying

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

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I. Physical drying / Natural drying / Traditional Sun drying

- To achieve uniform drying, the seed should be spread in thin layer.
- High moisture content seed with a moisture content of more than 17% should be dried first under shade / light to reduce the moisture content less than 17% and then dried under heavy sun i.e. noon drying.
- 2-4 days are needed to reduce the moisture content to 10-12%.
- Direct sunlight also can adversely affect seed germinability owing to high temperature and ultraviolet radiation, especially if the moisture content of the seed is high.

Advantages

- Easy and cheap
- Does not require any expenditure or fuel.

Disadvantages

- The rate of drying is slow
- Loss due to attack by insects, birds and animals
- Large floor area is required
- Involves extra labour for collecting and exposing during the day
- Sun drying cause sun checks or hot spots due to variation in temperature from time to time. This checks or spots induce high amount of breakage while processing
- Mechanical admixtures are possible
- Dust, dirt and other foreign materials get admixed
- High weather risks and damage by heavy wind and rains

II. Mechanical drying or artificial drying

Forced air drying

- In forced air drying, natural air or air supplemented with heat is blown through a layer of seed until drying is completed.
- Ordinary seed godowns are provided with two types of ventilators for free movement of air circulation.
  - Modern godowns, provisions are to be made for forcible circulation of air with the help of an electronic blower.
  - Outside air which is comparatively dry is circulated in the godown and thereby the seed get dried up in this process. This is possible only in dry months.

Two types of driers are used: batch and continuous flow driers.

1. Batch dryers

- Relatively dry air is blown through a layer of seed until the seed is dried completely, after which it is removed and replaced by another batch of seed.
- The method is simple and well suited to small quantities of seed, allows easy cleaning and is recommended for farm drying.

Advantages over bin dryers

- Short drying period
- Less damages or spoilage during wet weather
- Drying is more uniform.

2. Continuous flow dryers

- In this type of drier, the seed moves horizontally or vertically through a stream of hot air and then into a cooling chamber.
- These driers are however difficult to clean when there is a change of cultivar.
- These driers can use air temperature higher than those of batch dries, because the seed is heated for a much shorter time.

There are further two type of continuous flow dryers

1. L.S.U. dryer [Louisiana State University dryer]
2. Non mixing column 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

- Initial cost of drying the equipment is high
- Fuel is expensive
- It produces possible fire hazards
- Considerable supervision is necessary

Storage structures for Seed drying

- Small grain seeds in bulk exert large pressures against the sidewalls. The side pressures are converted to a vertical load on the foundation, which should be strong enough to hold the seed lots.
- The roof and walls of bins must be airtight for drying to proceed satisfactorily.
- The openings for filling and removal of seed should be large and convenient to use. A full size entrance door is desirable.
- A hand space about 1 m should be provided for easy inspection of seed. Cleaning and spraying operations should be convenient. For fumigation, the structures should be airtight, with a provision for temporary sealing of all openings.

Storage structures for Seed drying

- The structure should be able to dry and store more than one kind of seed.
- The drying air should be uniformly distributed through all portions of the seed lot for efficient drying.
- The flow of air leaving the seed should proceed rapidly so that back pressures do not hinder the flow of drying into the seed.

Air-Distribution Systems

- Agrawal described three types of air-distribution systems used for seed drying.

1. Main and lateral duct system
2. Single central perforated duct
3. Perforated false floor system.

- Multiple bin storage structures for drying can be built so that they are arranged to enable the drying of several seed lots simultaneously using the same drying fans.
- Different seed lots can be dried successively with sliding air gates controlling the flow of air to the respective bins.
- A multiple bin arrangement is particularly useful to dry more than one kind of seed simultaneously.

Heated air drying system

Heated air driers consist of

1. A heater unit where fuel is burned
2. A fan to force the heated air through a canvas connecting duct into the air distribution system of the drying bin.

- Safety features such as automatic thermostatic high limit temperature control, which cuts off the burner flame if the air temperature exceeds a certain safe maximum and flame failure control, which automatically cuts off fuel flow to the burner if the flame goes out are provided.
- A thermostat can also automatically maintain the air temperature at a desired setting.
- In many driers, such thermostats are provided as a standard feature.

Types of Driers:

Two main types of driers are available, which differ in the manner heat is supplied to the air, through

1. Direct fired :

- Fuel is burned and the hot combustion gases are thrown directly into the air distribution system.
- Although the heat is used very efficiently, there is possibility of blowing soot, unburned fuel and objectionable fumes into the seed.
- The burner needs to be adjusted properly to burn the fuel completely with certain fuels, there is also a danger of blowing small sparks into the seed.

2. Indirect fired:

- Hot combustion gases pass into a chamber. The drying air circulates around this chamber and picks up heat as in a hot air furnace.
- The drying air thus does not include combustion gases, sparks, soot or fumes.
- These driers are less efficient in the use of heat, but are safer than direct fired types.

Fuels used in driers

- The driers are designed to burn various types of fuels (eg. liquid propane or butane, natural gas, fuel oil and coal.
- Both liquid propane and natural gas burn readily with minimum soot and are the best fuels for direct driers
- Kerosene oil is better for indirect fired driers.

Drying System

- Large differences in the degree of drying between the top and bottom layers of seed have been noticed during drying by heated air.
- Advisable to dry seed at shallow depths to minimize these differences and avoid overheating of the bottom layer.
- Heated air drying requires higher rates of airflow, because water is evaporated faster and more air is needed to carry it away.
- Higher air flow rate also ensures more uniform drying of the top and bottom layers of the seed, completing the drying much faster at the recommended temperatures.
- Agrawal recommended maximum seed depths and temperatures for batch drying of seeds of different crop species in bins (Table)

Table:

Crop seed	Maximum depth (cm)	Recommended maximum temperature (^{0}C)
Shelled corn	50.8 (20 in)	43.3 (110 º F)
Wheat	50.8 (20 in)	43.3 (110 º F)
Barely	50.8 (20 in)	40.4 (105 º F)
Oats	91.4 (36 in)	43.3 (110 º F)
Rice	45.7 (18 in)	43.3 (110 º F)
Soyabean	50.8 (20 in)	43.3 (110 º F)
Peanuts	152.4 (60 in)	32.2 (90 º F)
Grain Sorghum	50.8 (20 in)	43.3 (110 º F)

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 drying time.

Vegetable Seed Drying Machine

Capacity	50-60 kg/hrs
Blower:	1HP AC Motor

Seed Drying & Storage dehumidifier