Drying Characteristics of Maize in Convective Dryer

Syamchand uppalapati[1], Aditya. G*[2], Bibek Bahadur Shrestha[3] & Ayyanna D.S.

Student[1], Assistant Professor[2,3,4] Department of applied Engineering, Vignan Foundation for Science Technology and Research Vadlamudi-522 213, Guntur India

Gmail:[1] uppalapatisyamchand1999@gmail.com *[2] adityapfe@gmail.com

ABSTRACT

A grain drier with a convection system that simultaneously acts as storage is known as an in-store dryer. The purpose of this study was to see how drying and storage—In-Store Dryer—affected the physical and chemical qualities of maize. Drying takes place at an average drying temperature of 40-43°C, with an average RH of 76.8% in the environment and 52.2% in the dryer chamber. The maize can be dried for 4 – 5 days using pre-drying material with an initial moisture level of 30.14 percent to 10.56 percent, which is the right water content for storage. The nutritional components of maize after drying and storing for 4-5 days using the In-Store Dryer can be analyzed to maintain maize quality. At the same time, when temperatures rise, the water content of the crop decreases due to the convective process, reducing the crop's weight.

INTRODUCTION:

With its illustrious career spanning over 3.5 decades in Seed industry, Maize is an important cereal in India, accounting for roughly 4% of the country's net sown area. Since India's independence, there have been significant fluctuations in maize production. In 1950-51, it was just 1.7 million tons, but by 1960-61, it had risen to 4.1 million tons, and by 1970-71, it had risen to 7.5 million tons. Following that, production fluctuated until 1984-85, when it increased to 84.42 lakh tons. During the 1987-88 drought, production dropped to 57.21. It has been progressively increasing since then. The year 2003-04 was a record year for maize, with production, area, and yield all reaching new highs. India produced 14.7 million tons of maize in that year, up from 7.4 million tons the previous year. million hectares of land, with a yield of 1963 kg/hectare on average. In 2020-2021, overall maize output in India is expected to be around 24.51 MMT, based on our total annual consumption of 25.2 MMT, which includes exports. In 2020-2021, ending stocks are estimated to be 1.59 MMT.

Distribution:

Andhra Pradesh and Karnataka have become major maize producers in India. Maize yields in these two states are significantly higher than in typical producing states. Maize is irrigated properly in both of these states. The dry areas of Rajasthan are ideal for maize agriculture, and it is farmed in the districts of Udaipur, Bhilwara, Dungarpur, Chittorgarh, and Bashara.

Losses due to moisture:

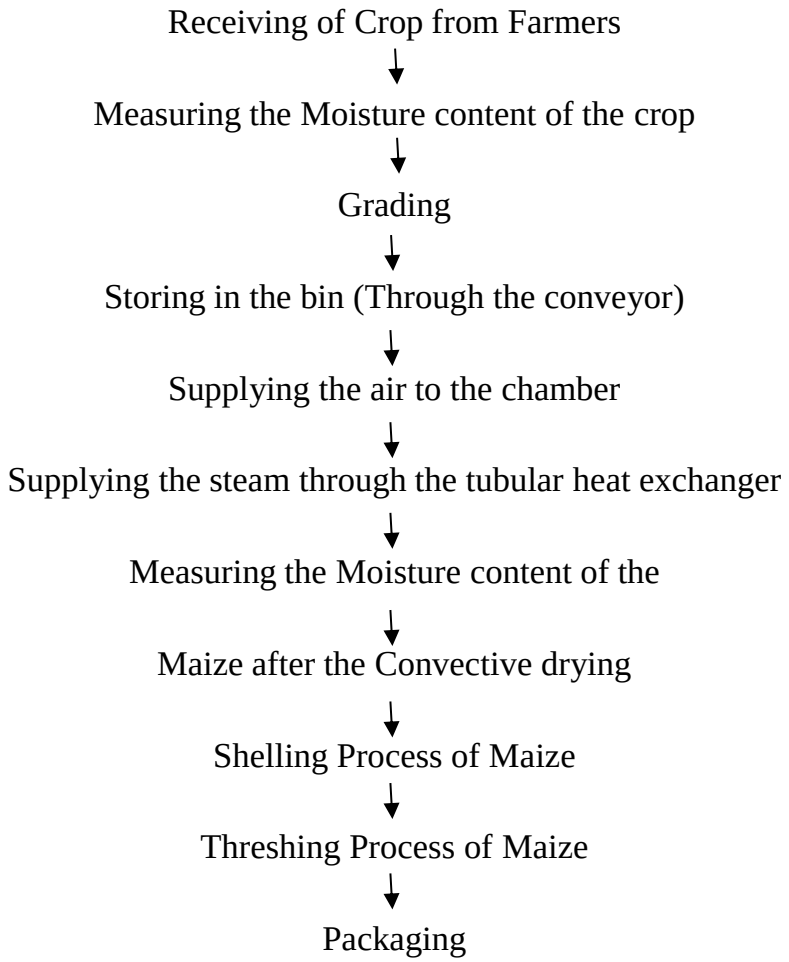
Despite its value, it is estimated that up to 30% of the maze is lost during post-harvest handling and processing by producers, manufacturers, and traders. Moisture is a contributing factor to the significant loss. External moisture, which could be induced by irregular weather during harvest as a result of climate change, can harm the mare, resulting in decreased quality and quantity. Sudden rainfall may cause the maize to re-wet. Developing climate-resilient post-harvest management methods is a vital first step in combating such crop loss causes. Flash floods have also been triggered by climate change, posing a threat to maize stocks.

Preventing moisture damage:

Maize must be dried to prevent moisture damage and to keep the moisture content at a safe level for storage. This applies to all agricultural commodities, and the safe moisture content threshold for maize is around 13% to 14%. This guarantees that there is no excess moisture in the maize, which could contribute to mould formation. Moisture damage can also be avoided by storing the maize in regions with low relative humidity.

MATERIALS & METHODS-

Process flowchart for drying of Maize



STORAGE OF MAIZE:

The crop is received form farmer with the moisture content of 30-33%. It stored for 4-5 days until it gets down the moisture content to the 10-9% and it will send to the shelling process.

The purpose of any grain storage facility is to prevent grain loss from.

- Weather
- Moisture
- Rodents
- Birds
- Insects
- Microorganisms.

Conditions for storage

- Maize can be stored for a long period of time (a year of more) if the moisture content is below the safe moisture level (below 14% or 12% and less).
- The moisture level should not rise during the storage process by either re-wetting by rain or imbibing moisture from the surrounding air.
- The maize must be protected from insects, rodents and birds.
- The longer the grain needs to be stored, the lower the required moisture content will need to be.

DETERMINATION OF MOISTURE CONTENT:

The moisture meter is used to check the moisture percentage in the maize grains it is used to check the moisture content in the grains and the same time it shows the density of the grains.The thermo-gravimetric concept, commonly known as the 'Loss on Drying' (LOD) principle, governs how a moisture analyzer operates. A balancing device and a heating unit make up the moisture analyzer. The sample's starting weight is recorded in order to determine the moisture content. After that, the sample is heated and dried using a halogen light or other infrared radiator, while the integrated balance continuously records the sample weight. The equipment shuts off when the sample no longer loses weight, and the moisture content is determined. The moisture content is calculated based on the overall weight loss. Thermal drying techniques are commonly used to determine the moisture content prescribed in food standards.

CONVECTIVE DRYING:

The maize crop is used to store in the closed bin and then the artificial hot air supply to the bin through the Centrifugal blower it will remove the moisture content in the crop Convective dryer is used to dry the crop it will remove the water contain in the crop through the hot air is supply to the bin with the help of the blower the rpm of the blower 600rpm and relates to the 3ph induction motor the capacity of the motor was the 335 hp. It will rotate the 1100 rpm.

SHELLING: -

The shelling process after drying the crop from past 4 days the crop will reduce the normal moisture content and then it will move to the shelling process the sheller is used to separate the grains and shank and it will send two different path through at the down of the sheller the concave shape to pass grains from the concave the size of 1mm to 3.5mm and the remaining size will come from the sheller and it will go to the boiler section to feed the boiler through the belt Convery.

Operation: -A corn sheller works similarly to a threshing machine, but with certain changes to account for bigger grain sizes and other variations between maize and wheat and other crops. A manual crank, a tractor, a stationary engine, or an electric motor can all be used to power corn shellers. Corn cobs in their whole are put into the machine. They are normally dragged between two toothed metal wheels. Each wheel revolves in the opposite direction. The teeth rip the kernels from the cob until no more are left. The kernels fall through a screen into a receptacle beneath the machine (such as a bucket). Because the cob cannot travel through the screen, it is expelled.

THRESHER: -The little grain that was cultivated in the early days of agriculture was most likely shelled by hand, but as the amount rose, the grain was most likely bashed out with a stick, or the sheaf beaten on the ground. As the quantity of grain rose, the ancient Egyptians improved on this by spreading the loosened sheaves out on a circular enclosure of hard ground and driving oxen, lambs, or other animals round and round over it to stomp out the grain. This enclosure was built on an elevated section of ground so that when the straw was removed, the chaff was blown away and the corn was left.

To evaluate physical properties of maize: Hardness: For three hybrids, the impacts of maize grain hardness, morphological variables (grain size and shape), drying rate, and stress cracking development over time were explored (C-25, C-45 and C-17). The re-parametrized Morgan–Mercer–Flodin (MMF) model correctly predicted the rate () and maximum value () of percentage checked stress cracking (checking) in grains of diverse sizes, shapes, and hardnesses with time after drying. Grain length (r = 0.707), thickness (r = 0.620), roundness (r = 0.703), and the shortest diffusion pathway (r = 0.627) were all substantially linked with the greatest percentage checking (). The rate () of percentage checking with time after drying was substantially connected with grain bulk density (r = 0.564), hardness ratio (r = 0.611), and drying rate (r = 0.551), as well as grain size factors such as hundred-grain weight, to a lesser extent.

Bulk Density: Maize density is a measure of its hardness and maturity. There are two ways to quantify it: bulk density and actual density of individual grains. The bulk density of maize is a factor in US grain standards, and it is significant for storing and shipping maize since it dictates the size of container needed for a specific amount of corn. Bulk density is also employed in the maize processing industry as a key indication of processing yield and end product quality. However, no consistent association has been shown between bulk density value and good end-use attributes. Density as a quality indicator may only be determined within

the confines of the same hybrid and hybrids with inherently lower average bulk densities are not necessarily of poor quality.

Germination of maize: After administering the appropriate pre-treatment, 100 seeds are put on wet blotting paper or cotton wool in a Petridis; in the event of very small seeds, one-gram seed is taken. The Petri dishes must be maintained wet and kept in a warm (not hot) environment.

Every day, the number of seeds that germinate is tallied, and LGC is computed as: It is represented as the number of seeds germinates per kilogramme after 4 weeks or longer.

$$\text{LGC}(\%) = \frac{\text{No. of Seeds germinated}}{\text{No. of Seeds sown in petridish}} \times 100$$

PACKING: The grains are stored from silos or grains bin and then we will be pack the grains from the grains hopper after the shelling process and the storing the grains in the hopper**.** The grains will be received from the elevator and it will store in the silo or hopper and then it will be pack the HDPE bags the weight of the bag was filled up to 70kg per each bag and each bag will done the weighment of the each bag and it will close the bag with the help of the semi-automatic bag closing machine with nylon thread and lateral they will pack with the 25 kgs bags and then they will be pack with HDPE bags it will be five bags in the hdpe.

RESULTS AND DESCUSSION:

A comparison of the drying rate curve indicates that differences in vigor between the air-dried seeds and the room temperature, convective dried seeds existed only when the drying rates obtained by the latter method were faster than those obtained by the former. These data suggest also that seeds with initial moisture content of 30 per cent or greater may be damaged by drying at a rate as rapid as that attained with the 40-43° C convective method.

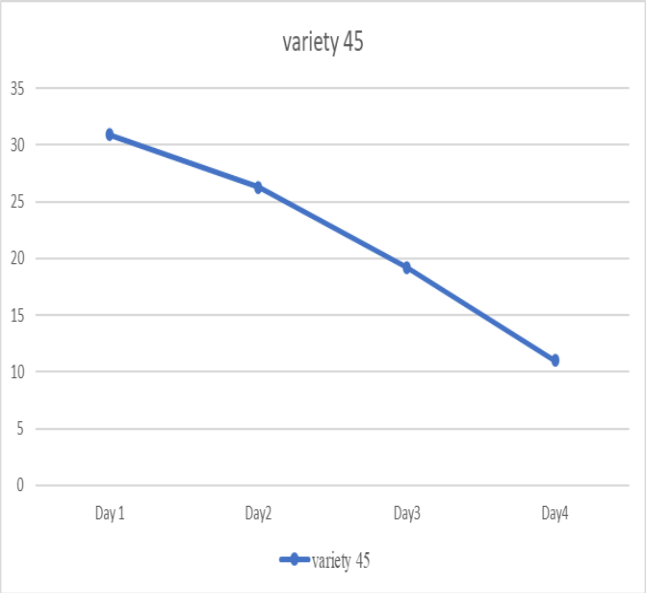
DRYER CHARACTERISTICS OF MAIZE:

Sl. No.	No Of Days	MC % of the maize bottom of the bin	MC % of the maize top of the bin	MC % of the maize verage of the bin
1	Day 1	30	30.4	30
2	Day 2	23.5	27	26.1
3	Day3	15	24	19
4	Day4	9.9	11.5	10.7

Table1:Dryeing characteristics of maize

Graphs: drying time vs moisture content

Fig 1: drying time vs moisture content



Germination of maize:

After the drying process was completed, seed samples from each batch moisture level and treatment were gives the laboratory germination test. The percentage germination of these samples is shown in table 2. It was observed that greater difference in vigor existed between this samples than were brought out by this test; hence a second lot of seed samples was taken from each batch Additional differences in vigor were determined by the use of this test.

SL.NO	MAIZE VARIETY	GERMINATION%
1	C-45	91
2	C-17	89
3	C-25	86

Table: 2 germination percentage for different Variety

Calculation:

- Weight of the crop received from the farmerW_1 = 9040 wt of the crop
- Weight of the raw seed after dryed crop W_2 = 4256 wt of the rawseed
  9040-4256=4784 W3
- The recover % of the crop is = 47% at 9.1% moisture content, the variety name C-25 bin no:A-12
- The recover % of the crop is 39% at 8.8 % moisture content, the variety name C-17 bin no: A-2

CONCLUSION:

- The moisture content of the maize is reduced to 10.7% by using convective dryer
- 42-43˚C temperature was maintained inside the dryer so that slow drying will takes place which do not effect on the viability of the maize.
- The germination % of the maize were 91, 89 and 86% for the varieties C45, C17 and C25 respectively.
- It was observed that at higher temperatures the viability of the seeds was affected, it shows that drying temperature directly proportional to the viability.

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