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Studies on Physical Properties of Different Corn (*Zea mays* L.) Verities

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ABSTRACT

Background: Corn is one of the major popular cereals in the world and forms the staple food source in many countries. After rice and wheat, maize is the third-most significant food crop in India.Corn is also used as food and raw material for industrial use. Corn, various types of a highly cultivated multipurpose cereal are grown all over the world.

Methods: The present study was designed for to analyse physical properties of corn different five verities. Five corn varieties to determine the physical properties of corn grains by using different methods. Physical characteristics of grains play a crucial vital function in determining the quality of grains.

Results: The physical property of corn was carried out such as 1000 kernel weight (g), 1000 kernel volume (mm^3),True density(kg/m^3), Bulk density (kg/m^3), Porosity (%), Sphericity (%), Angle of repose° (%) respectively. The results demonstrate range of 283.491 to 301.028 (g), 292 to 308 (mm^3), 1197.043 to 1380.259 (kg/m^3), 726.949 to 766.062 (kg/m^3), 36.001 to 47.320 (%), 0.551 to 0.616 (%), 23.38 to 29.75 (°C), respectively.

Key words: Cereal, Corn variety, Physical properties.

INTRODUCTION

Zea mays L., even called as corn or maize, is a significant annual grain crop that is a member of the Poaceae family. Over 95% of the country's maize production is produced in the major corn-growing states of West Bengal, Bihar, A.P., Punjab, U.P., Rajasthan, M.P., Jammu and Kashmir, Haryana, Himachal Pradesh, Karnataka and Maharashtra, (Tajamul *et al*., 2016). Corn has recognized as one of the vitalcrucial crops for food, feed and industrial purpose in most parts of the world. With such a significant yield potential, it is known as the Queen of Cereals (Abenezer *et al*., 2020). When compared to rice and wheat, corn (Zea mays L.), which is a major cereal food crop, has the highest yield and productivity. It is the most adaptable crop and is grown in more than 166 nations worldwide, in temperate, subtropical and tropical areas (Kumar *et al*., 2012). Corn has wide ecological adaptability and is grown in almost all parts of the country. Industry and food sectors, corn is considered as an internationally important commodity driving world agriculture (Yadav *et al.,* 2016). In addition to being grown all year long for human consumption, corn is also used as high-quality animal feed and as an ingredient in thousands of other industrial products, such as those used in the starch, oil and protein industries, as well as the pharmaceutical, cosmetic, plastics, textiles, gum, packaging and paper industries(Sangamithra *et al*., 2016). The physical qualities of grains are crucial in determining their quality. To build machinery for grading, handling, processing and storage, among other tasks, information on the physical qualities of maize is required, just as it is for other agricultural materials. Physical characteristics of several crops, including wheat, barley grains, cucurbit seeds, pigeon peas, pearl and millet seeds have been researched recently (Ashwin *et al*., 2017). This study was, therefore, aimed at determining the physical properties of corn using local corn verities.

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MATERIALS AND METHODS

The research was conducted in the session of 2021-2022 (November 2021 to April 2022) at the Department of Processing and Food Engineering, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj. The physical properties were studied for different five varieties of corn *i.e*. (Advanta 757-V_1, Nidhi 8080-V_2, Pioner 3302-V_3, MRM 3845.S-V_4, Rashi 3499-V_5) were selected for the study. Different verities were grown at the Maharashtra during 2020-2021 growing season. In order to get rid of pollutants like dust, stone, twigs, immature and damaged kernels, the maize kernels were hand cleaned.

Corn's physical characteristics are determined

The physical properties like 1000 kernel weight, 1000 kernel volume, porosity, true density, sphericity, bulk density angle of repose.

1000 kernel weight of the corn

Determine the 1000 kernel weight was weighed by means of an electronic weighing balance (Sangamithra *et al*., 2016).

1000 kernel volume of the corn

The amount of dry seed in millilitres per thousand grammes was calculated (Sangamithra *et al*., 2016).

True density of the corn

This was determined by the toluene (C7H8) displacement method was calculated by (Tiwari *et al*., 2017) using the equation (I).

$$\text{True density (pt)} = \frac{\text{Mass of sample (kg)}}{\text{Volume of displacementtoluence (m}^3\text{)}} \qquad \text{Eq.....I}$$

Bulk density of the corn

The bulk density was determined mathematically by dividing the bulk mass by the bulk volume. Bulk density was determined by using equation (II) a container of known volume(Babatunde *et al*., 2018).

$$\text{Bulk density, Kg/M}^3 = \frac{\text{Weight of bulk mass (kg)}}{\text{Bulk volume (m}^3\text{)}} \qquad \text{Eq.....II}$$

Porosity of the corn

The porosity was calculated from the equation (III)by(Babatunde *et al*., 2018).

$$\text{Porosity} = 100 \times \left(1 - \frac{\text{Bulk dendity}}{\text{True density}}\right) \qquad \text{Eq.....III}$$

Sphericity of the corn

It was determined using Equation (IV) as described by(Babatunde *et al*., 2018).

$$\text{Spericity} = \frac{(L \times W \times T)1/3}{L} \qquad \text{Eq.....IV}$$

Where, sphericityis the; *L* is the length, cm; *W* is the width cm; *T* is the thickness, cm.

Angle of reposeof the corn

By measuring the height of the heap and the diameter of the heap created by the seeds, the angle of repose can be calculated. Corn seed's angle of repose° () was calculated using (Brar *et al*., 2017) using the equation (V).

$$\text{Angle of repose} = \tan\text{-}1\left(\frac{2H}{D}\right) \qquad \text{Eq.....V}$$

RESULTS AND DISCUSSION

1000 kernel weight

It is common to be aware of the weight of 1000 kernels when handling and processing grains. The grain size can vary depending on growing conditions and maturity, even for the same variety of a given crop and the 1000 kernel weight is a good measure of this. compared to crops with the same moisture content. In most cases, this is calculated immediately by weighing 1000 grain kernels. As the moisture content increased, the weight of 1000 maize kernels grew linearly from 288.152 to 301.028 g. With an rise in moisture %, the trend for 1000 kernel weight increased, as was seen in (Fig 1). Similar results have been obtained by (Bhise *et al*., 2014) for maize kernel and (Tarigh *et al*., 2011) for corn seed.

1000 kernel volume

With an increase in moisture content in the maize seed, it was discovered that the volume of 1000 kernels increased linearly from 292 mm^3 to 308 mm^3 (Fig 2). A similar trend in thousand kernel volume has been reported by Sangamithra *et al*., (2016) and Dawange *et al*., (2019).

True density

The true density varied from 1197.04^3 Kg/m^3 to 1380.259 Kg/m^3 in the (Fig 3). The substantially lower true volume compared to the comparable mass of the seed achieved through water adsorption may be the reason why the rise in true density varies with increase in moisture content. The outcomes matched those that were reported by Zahedi *et al*., (2010) and Ashwin *et al*., (2017) for maize grain.

Bulk density

The bulk density decreased from 766.062 kg/m^3 to726.949 kg/m^3 in (Fig 4). The difference between the concomitant volumetric expansion of the bulk and the increase in mass caused by the sample's moisture gain can be seen in the decrease in bulk density with increasing moisture content. This happened because the sample's mass gain from moisture was less than the volumetric expansion of the bulk that was also present. Similar results were reported by Brar *et al*., (2017) and Ashwin *et al*., (2017).

Sphericity

With [Eq-IV], the values of sphericity were determined individually using the information on axial dimensions length, width, thickness of the grain and the results shown in the in [Fig 5]. The sphericity of the different corn variety grain increased from 0.551 to 0.616%. The results were in agreement with the earlier findings for Zea mays L. Yenge *et al*., (2018) and Sangamithra *et al*., (2016).

Porosity

The porosity of corn seeds increased from 36.001% to 47.32% (Fig 6). This might be explained by the seeds' swelling and expansion, which may have increased the volume of the bulk by creating more spaces between the seeds. This is further demonstrated by the fact that bulk density decreases as moisture content increases. The same porosity trend was reported by Ashwin *et al*., (2017) and Javad *et al*., (2011) for maize seed, it was said that the porosity value grew as the moisture content did.

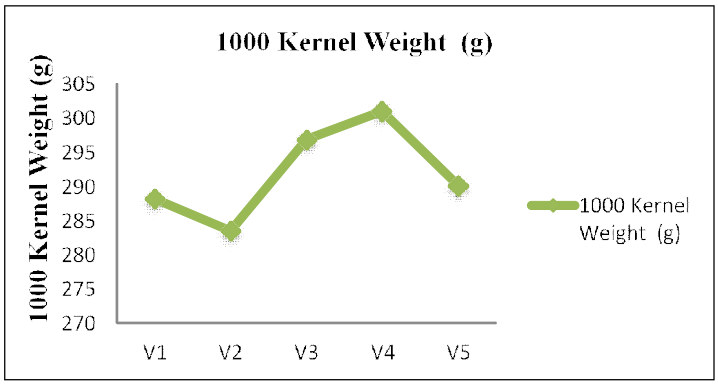

Fig 1: Physical properties thousand kernel weight of different corn varieties.

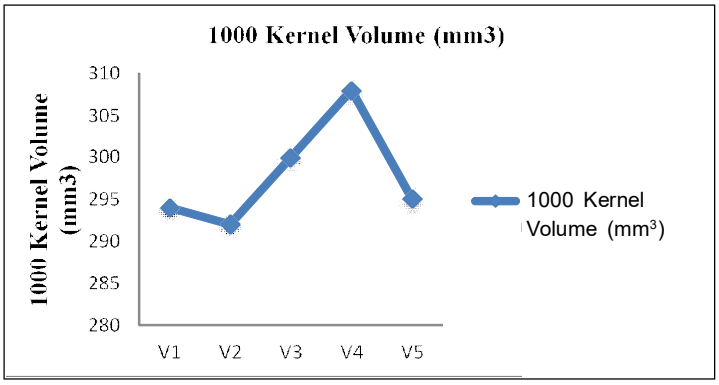

Fig 2: Physical properties thousand kernel volume of different corn varieties.

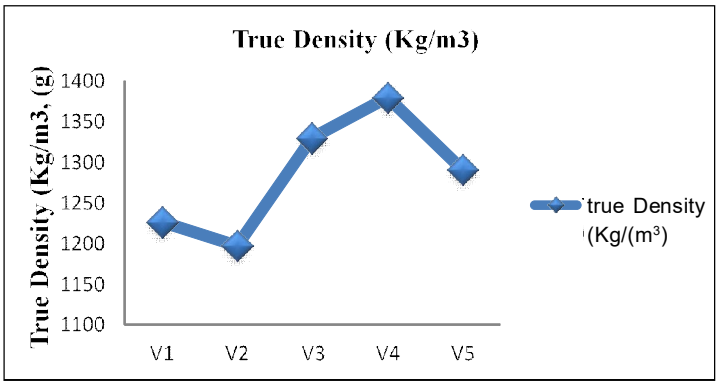

Fig 3: Physical properties true density of different corn varieties.

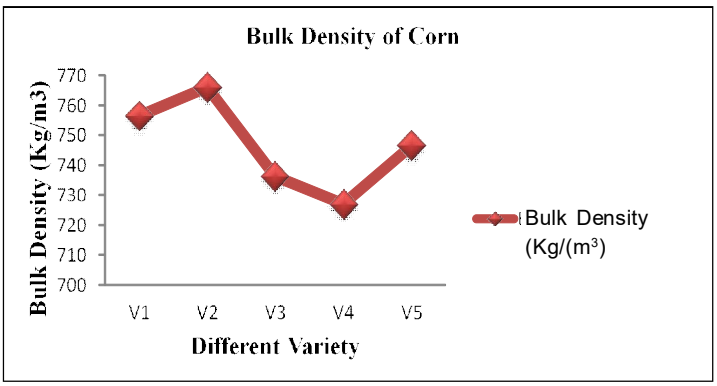

Fig 4: physical properties bulk density of different corn varieties.

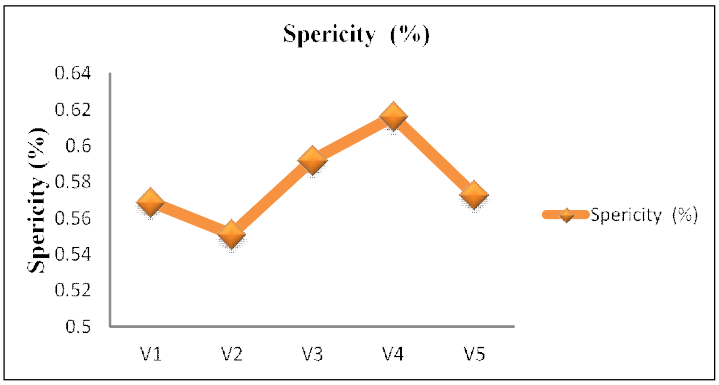

Fig 5: Sphericity of different corn varieties.

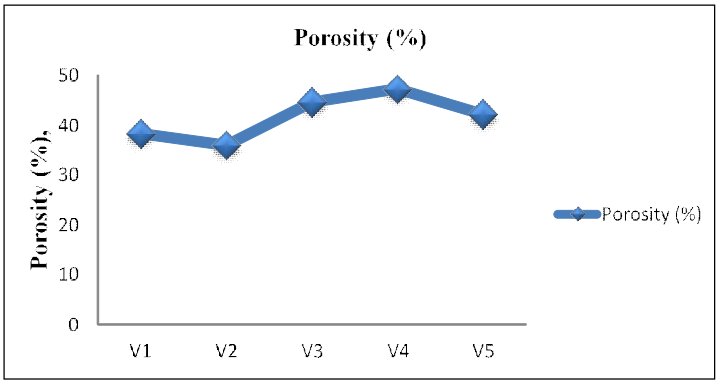

Fig 6: Porosity of the different corn varieties.

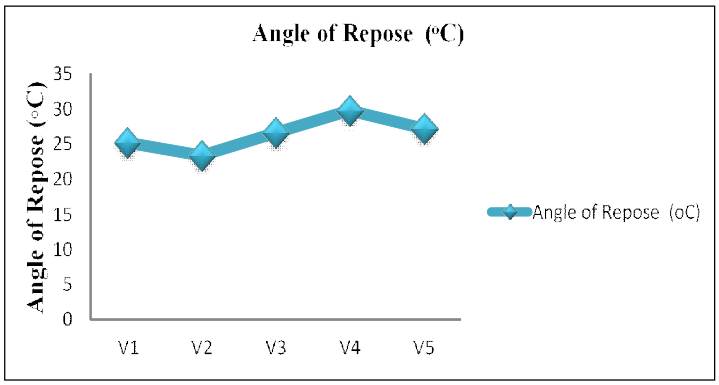

Fig 7: Physical properties angle of repose of different corn varieties.

Angle of repose

It was discovered that the readings rose from 23.38° to 29.75° as in Fig 7. Due to the rear layer of moisture nearby the fleck, which acts as a bonding agent due to surface tension, there is an increasing among the moisture % and angle of repose. For maize, rising moisture content has been linked to rising trends in angle of repose. The values given by the actual values for the physical attributes documented in the current study were in good agreement with Sangamithra *et al*., (2016) for maize kernel and Brar *et al*., (2017).

CONCLUSION

The following conclusion from the above investigation on selected physical properties of corn varieties like as 1000 kernel weight, 1000 kernel volume, bulk and true density, porosity, sphericity, angle of repose was determined. For the design and improvement of process machinery as well as the creation of goods with improved nutritional quality, physical qualities are crucial. This research might serve as a springboard for further research on the physical characterisation of corn.

Conflict of interest: None.

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