

Physico-Chemical Properties Of Different Corn (*Zea Mays*) Verities

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ABSTRACT

Corn is one of the world's most popular cereals and a staple food source in many countries. Corn is the third most important food crop in India, after rice and wheat. Corn is also used as a food and a raw material in industry. It is highly cultivated multipurpose cereal, is grown in a variety of varieties around the world. The current study was designed to examine the physico-chemical properties of five different varieties of corn. The chemical properties of corn seeds were determined using five different corn varieties. The physico-chemical properties of corn are very important to determine the nutritional quality of grains. Moisture (%), Ash (%), Crude Fat (%), Crude Fibre, Crude Protein (%), Carbohydrate (%), and Starch (%) are the physico-chemical properties of corn. There was significant variation observed in physico-chemical properties 9.10-10.06%, 1.32-1.85%, 6.75-7.05%, 5.04-6.54%, 8.06-9.86%, 65.37-69.09%, and 63.68-67.95% respectively.

Keywords: Corn variety, Moisture, Starch, physico-chemical properties, carbohydrate, protein, fat.

INTRODUCTION

Mankind has always utilized crops for his development and survival, achieving: nutrition, medical, pharmaceutical, herbal, economic, industrial, including research values from crops. Wheat, Rice and Maize are the three most explored food crops by Mankind, owing to the high value derived from these crops (Brewbaker, 2003). Corn belongs to the grass family known as Poaceae. Corn is also called maize, with its botanical name as (*Zea mays* L.). It is one of the widely cultivated cereal crops in all ecological zones. Maize is one of the crops modified to adapt to areas of cultivation, resulting in its subspecies, which are identified and classified depending on the extent of starch each possess. After wheat and rice, maize is the third most cultivated crops globally (Piperno *et al.*, 2001).

Various other synonyms like zea, silk maize, makka, barajovar, etc. are used to recognize the plant. In India, the major corn growing states are Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh, Punjab, Haryana, Maharashtra, Andhra Pradesh, Himachal Pradesh, West Bengal, Karnataka, and Jammu and Kashmir, jointly accounting for over 95% of the national maize production (Tajamulet *al.*, 2016). Corn has recognized as one of the most important 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" (Abenezeret *al.*, 2020).

Corn is cultivated throughout the year in all states of the country for various purposes in addition to food for human being, it serves as a quality feed for animals, as an ingredient to thousands of industrial products that includes starch, oil, protein, alcoholic beverages, sweeteners, pharmaceutical, cosmetic, plastics, fabrics, gum, package and paper industries etc (Sangamithraet *al.*, 2016). Chemical characteristics of grains play a very important role in determining the quality of grains. This study was, therefore, aimed to determine the physico-chemical properties of local corn varieties.

Material and method

Sample Preparation

The harvested different varieties of corn seeds used in the present study were obtained from the local market at Nasik Maharashtra in India. The corn kernels were cleaned manually in order to remove the impurities such as dust, stone, and sticks, immature and damaged kernels.

Determination of chemical properties of corn seeds

To determine the chemical properties were studied for different five varieties of corn i.e. (Advanta 757-V₁, Nidhi 8080-V₂, Pioner 3302-V₃, MRM 38445S-V₄, Rashi 3499-V₅) were selected for the study. The research was conducted at the session of 2021-2022 (December 2021 to May 2022) at the Department of Processing and Food Engineering, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj.

Moisture content of the corn

The percentage moisture content was calculated as (AOAC, 2000).

$$\% \text{ moisture content} = \frac{(W_1 - W_2) \times 100}{W_1 - W} \dots \dots \dots (I)$$

Where,

W₁ = Weight in gms of the dish with the material before drying

W₂ = Weight in gms of the dish with the material after drying

W = Weight in gms of the empty dish

Ash content of the corn

The percentage ash content was calculated as (AOAC, 2000).

$$\% \text{ ash content} = \frac{(W_2 - W) \times 100}{W_1 - W} \dots \dots \dots (II)$$

Where,

W₂ = Weight in gm of the dish with the ash

W = Weight in gm of empty dish

W₁ = Weight in gm of the dish with the dried material taken for test

Crude Fat of the corn

Crude fat was estimated by standard method (AOAC, 2000) using soxhlet extraction apparatus.

$$\text{Fat \%} = \frac{(W_2 - W_1)}{W_3} \times 100 \dots \dots \dots \text{(III)}$$

Where,

W_1 = weight of the empty extraction flask

W_2 = weight of the flask and oil extracted

W_3 = weight of the sample

Crude Fibre of the corn

Crude fibre was estimated by the standard method of analysis (AOAC, 2005).

$$\text{Crude Fiber \%} = \frac{W_1 - W_2 \times 100}{W} \dots \dots \dots \text{(IV)}$$

Where,

W=Weight of sample

W1=Weight of the crucible + weight of treated sample after oven drying

W2= Weight of the crucible + weight of ash

Crude Protein of the corn

The protein content of the corn was determined by Micro Kjeldhal method described by (AOAC, 2000).

% Nitrogen in the sample = $100 \{ [(A \times B) / (C)] \times 0.014 \}$

Crude protein (%) = nitrogen in sample $\times 6.25$

Where: A = volume of hydrochloric acid used in titration (mL)

B = normality of standard acid

C = weight of sample (g)

Carbohydrate of the corn

This was determined by subtracting the values of the aforementioned parameters from 100 (i.e. by difference method) (AOAC, 2000).

% Carbohydrate = $100 - (\% \text{moisture} + \% \text{ash} + \% \text{crude fat} + \% \text{crude fibre} + \% \text{crude protein})$

Starch percentage of the corn

The starch percentage of the corn was determined by Indian Standard: 4706 (Part 11) – 2005.

Statistical Analysis

All values presented in this paper are mean of three replicates. Analysis of variance (ANOVA) was done using one-wayanova.

Result and discussion

Chemical properties of corn grain with respect to moisture content, ash, crude fiber, crude protein, crude fat, total carbohydrate, starch percentage.

Moisture content

Moisture content of five corn varieties was found in the range of $9.10 \pm 0.03\%$ to $10.06 \pm 0.05\%$ is shown in Fig. 1. It is evident that V_2 had lowest moisture content as and highest for V_4 . Same parameters were observed by *Aliet al. (2011)*. The value of moisture content in different varieties of corn seeds in the range which is in good agreement with reported result with small variation in different maize variety with reported by *Ndukwee et al.(2015)*; *Qamar et al.(2016)* for maize varieties.

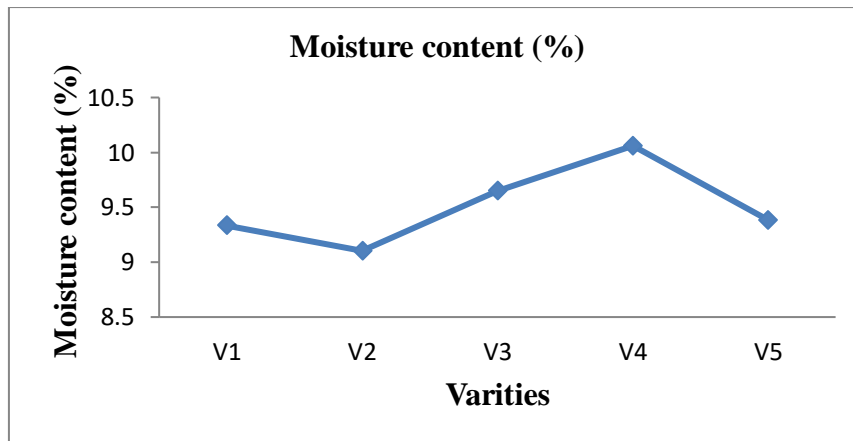


Fig.1. Graphical representation of moisture content of different corn varieties

Ash content

Ash content of different corn varieties is shown in Fig. 2. V_1 was found to have the maximum ash content i.e., $1.85 \pm 0.02\%$ and the minimum ash content for sample V_4 i.e., $1.32 \pm 0.03\%$ ash content. The grain with high ash content a greater proportion of non-endosperm material. ash values are determined in order to indicate the level to which non-endosperm components are present. Ash contents indicate the level of minerals present in samples *Ape et al.(2016)* for maize. Total minerals in a food material by similar results in different maize hybrids were reported by *Marta et al. (2016)*.

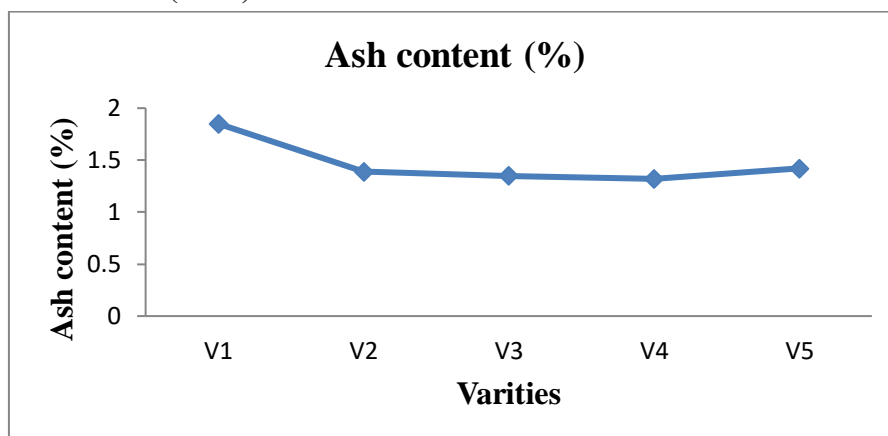


Fig. 2 Graphical representation of ash content of different corn varieties

Protein content

The results protein content of different five varieties is shown in Fig.3. In the range of 8.06 ± 0.003 to 9.86 ± 0.002 V₃ had the lowest protein content and V₁ had the highest protein content. The findings of the studies are in agreement with the results reported by Ape *et al.*, (2016). Similar observations for protein were recorded by Kataria *et al.* (2014); Suryadi *et al.* (2017) for maize and rice.

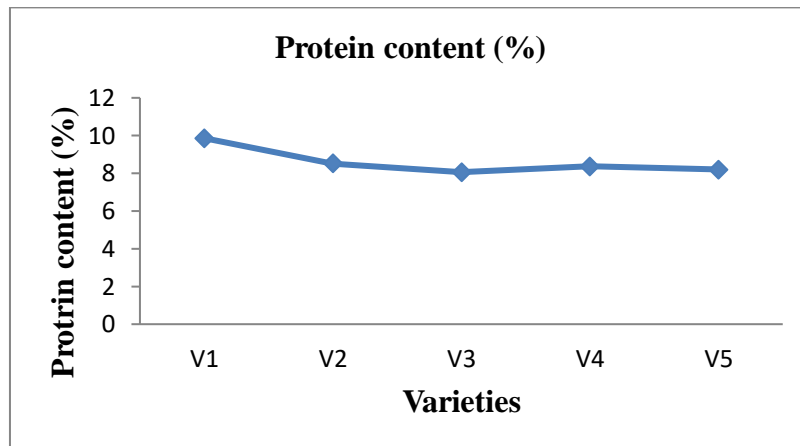


Fig. 3 Graphical representation of protein content of different corn varieties

Fat content

Fat in the form of oil is the 3rd largest nutritional component of the kernel. Fat content can be increased by germ size noted by Nusset *et al.* (2010). The results showed that the fat content was ranged from the 6.75 % to 7.05 %. The maximum fat content percentage 7.05 % were found in the Variety V₁ and minimum fat percentage 6.75 % were found to the Variety V₂ presented in Fig. 4. The result shows similarly with the results of Ullah *et al.* (2010); Langyanet *et al.* (2022).

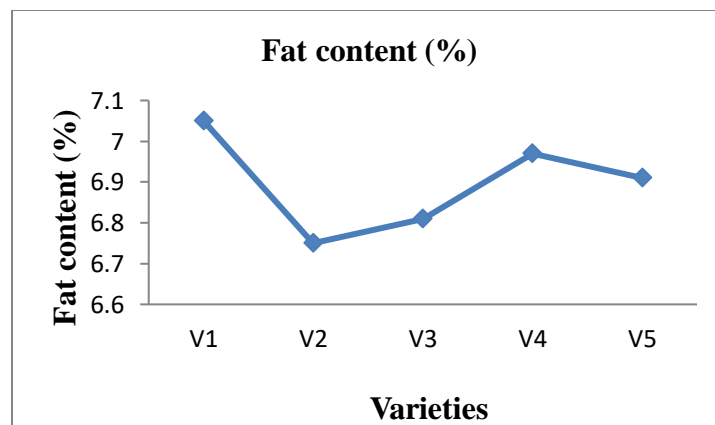


Fig. 4 Graphical representation of fat content of different corn varieties

Fibre content

Fibre content of different corn varieties was calculated and shown in Fig.5. The average fibre content found all varieties was range of 5.04 ± 0.08 - 6.54 ± 0.011 %. It is evident that V₅ had least fibre content as 5.04 ± 0.08 % and highest for V₁ as 6.54 ± 0.011 %. Crude fibre is highly characteristic of the kernel seed coat, but is also found in smaller amounts in the endosperm

and germ walls reported by Nusset *et al.* (2010). The result is an agreement as reported by Chaudhary *et al.* (2014) for nutritional value of maize, Mohammed *et al.* (2021) in nutritional quality of maize (*Zea mays* .L).

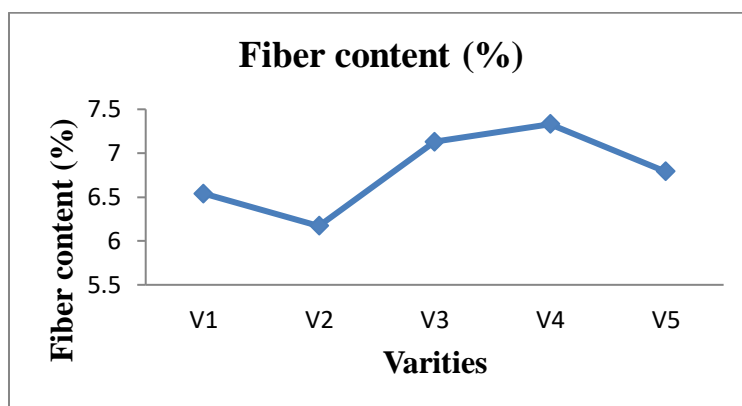


Fig.5. Graphical representation of fibre content of different corn varieties

Carbohydrate content

Corn is generally known to be high in carbohydrate and as such a good source of calories. Corn is generally known to be high in carbohydrate. Carbohydrate content of different corn varieties was calculated and shown in Fig.6. The average carbohydrate content found all varieties was range of 65.37-69.09 % and showed significant differences ($p < 0.05$). It is evident that V₂ had lowest content as 65.37 % and highest for V₄ as 69.09%. Ape *et al.* (2016). Ullah *et al.* (2010) reported percent carbohydrate was found in close agreement with the present study. These results are comparable to those reported by Adeniyi *et al.* (2019) with significant differences occurring between all the varieties. They are also similar to those of Ndukwee *et al.* (2015).

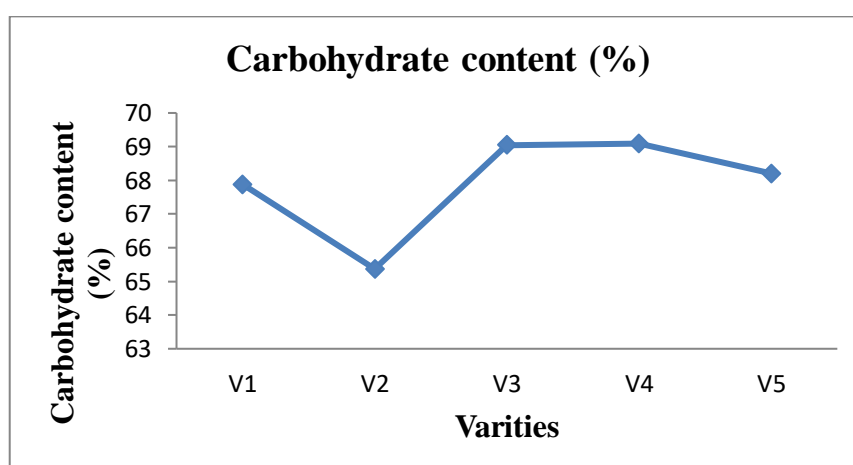


Fig. 6 Graphical representation of carbohydrate content of different corn varieties

Starch content

The results showed that the starch content was ranged from 63.68 to 68.05% (Fig.7). The maximum starch percentage (68.05 %) was found in the variety V₄ and minimum

carbohydrate percentage (63.68 %) was found in the variety V₂. The starch content in the corn seed was reported as the major component in our results as it was reported by **Orhunet al. (2013)**; **Sofi et al. (2009)**; **Ilyas et al. (2014)**. They reported the starch amount in the ranged of 60.38 to 66.31 %. There is little bit difference in the amount of starch in our results and in **Orhunet al. (2013)**. That difference in the amount of starch contents was due to nitrogen application. The variation in percent chemical composition might be due to variation in different varieties. Statistically results were found to be significant at $CD \leq 0.05$.

CONCLUSION

The chemical properties of different corn varieties chemical analysis showed that following conclusion from the above investigation on selected chemical properties of corn varieties such as Moisture, Ash, fat, protein, Fibre, Carbohydrate, and Starch Content were determined. The results demonstrate range of 9.10 to 10.06 (%), 1.32 to 1.85 (%), 6.75 to 7.05(%), 8.06 to 9.86 (%), 5.04 to 6.54(%), 65.37 to 69.09 (%), 63.68 to 68.05 (%), respectively. Determination of the chemical composition of different corn varieties is important so as to detect the varieties that are good sources of basic nutrients required for proper growth and development of either man or animals.

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