

Effect of Germination on Proximate Composition of Two Maize Cultivars

IMRAN

Department of Agronomy, The University of Agriculture Peshawar - Pakistan

*Correspondence author: imranagrarian@aup.edu.pk

ABSTRACT

Two varieties Azam and Jalal were analyzed for proximate composition before and after germination. The data showed that germination significantly effect proximate composition of maize. The data showed that moisture content was increased after germination from 7.35% to 40% for Azam and Jalal. Ash content was also found to be increased after germination. Proteins content increased from 12.25 to 14.88% in Azam and from 14.00 to 18.38% in Jalal. Fiber content was also found increased after germination. Germination also affected fat content of both varieties. It was also observed that fat content after germination increased from 4.5 to 6.5 % for Azam and Jalal. It was concluded from present study that Maize contains appreciable amount of various nutrients and germination significantly increased nutrient composition.

Keywords: Maize (*Zea mays L.*), seed priming, protein, fiber, nitrogen free extract (NFE).

INTRODUCTION

Maize (*Zea mays L.*) is the most important grain crop in Pakistan and the second most important cereal crop in the world. The corn leaf consists of blades, sheath and collar like ligule. It is normally monoecious with staminate and pistillate flowers Produce on tassel and ear. In Pakistan about 60% maize is grown in irrigated and 36% in rain fed areas. Basically it is a tropical Plant but at Present it is being cultivated extensively with equal success in temperate, tropical and sub-tropical regions of world. Corn is a dominant crop in the farming system because it is a staple food crop for much of rural Population. Corn grain is valuable source of Protein (10.4%), fat (4.5%), starch (71.8%), vitamins and minerals like calcium, Phosphorous and sulfur. It also Provides raw materials to starch industry and is used in the Preparation of many Products. Its grain is used for several industrial Purposes such as starch, alcohol, corn sugar, corn oil, acetones and lactic acid. Besides its multipurpose uses, corn is getting popularity for its non-cholesterol oil content in the Present day world (Martin *et al.*, 1975). Whole maize flour contains moisture 12%, 10% protein, 4.5% fat, 70% carbohydrates and 2% ash. . It also provides raw materials to starch industry and is used in the preparation of many products. It is grown throughout Khyber Pakhtunkhwa (Shah, 2007). Maize is an important starch crop forming the staple source of carbohydrate in the diet of hundreds of millions of people. It is also a big source of B group vitamins. However, dietary protein needs to come from elsewhere as maize protein lacks two amino acids essential for human and animals, lysine and tryptophan. Maize is also low in calcium as compared to other grains. People who rely too heavily on maize in their diets can suffer from the disease pellagra, which is due to poor bioavailability of the vitamin niacin. Some indigenous people learned to prepare maize flour with lime, which improves the availability of niacin. Maize is used as fodder crop for animals. Maize flour is used for making of bakery products, it is also used for biofuel production. Corn oil is also extracted from maize grain proved to be the best for heart diseases. Germination is the process in which a plant emerges from a seed or spore and begins growth. The maize grain when sown in moist soil, takes water, swells and slowly become active and germinates. The cells of the epithelial layer of seed produce digestive enzymes which digest the organic nutrients in the endosperms to obtain energy for germination. Keeping in view the importance of maize, this project is endeavoring to high light its nutritional importance by analyzing proximate composition before and after germination.

MATERIALS AND METHODS

The present research work was performed at the Department of Agricultural Chemistry Khyber Pakhtunkhwa Agricultural University, Peshawar. Two varieties of corn namely, Azam and Jalal were collected from Malakandher Research Farm, Agricultural University Peshawar. The samples were cleaned and to facilitate handling and for further storage, each sample was reduced to 1kg. All the samples were analyzed for proximate composition i.e moisture content, crude protein, crude fats, ash, crude fiber and nitrogen free extract (NFE). Samples of both varieties were then germinated on petridishes by incubating at 30⁰C for 48hrs. After the germination was completed, the sample was again analyzed for the aforementioned parameters. All the analysis was carried out in triplicate. The moisture content was calculated by the following formula:

Moisture content = $(W1 - W2 / Wt \text{ of sample}) \times 100$

W1 = Weight of Petri dish + sample before drying

W2 = Weight of Petri dish + sample after drying

Percent protein content of the sample was calculated by the formula.

$$\text{Crude Protein} = 6.25 * x \% N \quad (*\text{Factor for Cereals})$$

$$\% N = (S-B) \times N \times 0.014 \times D \times 100 / \text{Wt of sample} \times v$$

Percent of fat in the sample was calculated as under:

$$\% \text{ Crude fat} = \{(\text{Wt of beaker} + \text{Ether extract}) - (\text{Wt of beaker}) / \text{wt of sample}\} \times 100$$

The ash content was calculated on percent basis as under.

$$\% \text{ Ash} = \{\text{Weight of ash (W3-W1)} / \text{wt of sample} \times 100$$

$$\text{C F \% in samples} = (\text{Wt crucible} + \text{dried residue}) - (\text{Wt crucible} + \text{ashes}) / (\text{Wt crucible} + \text{sample}) - (\text{Wt of empty crucible}) \times 100$$

Nitrogen free extract (NFE), representing the total digestible carbohydrates was calculated by difference using the following formula.

+ Ash and Crude fiber)

$$\% \text{NFE} = 100 - \%(\text{Moisture} + \text{Crude Protein} + \text{Fats}$$

RESULTS AND DISCUSSION

Moisture Content

Figure 1 represents the moisture content of Azam and Jalal varieties before and after germination. It was observed that before germination the average moisture content was 7.35 % and 9.6 % for Azam and Jalal varieties, respectively. After germination the moisture content of both varieties increased significantly. The average values for moisture content after germination were found to be 37.3 % and 39.5 % for Azam and Jalal varieties, respectively. The results of our studies are fairly contributed with that of Bassir (1976), who reported that maize contain 11.12% moisture.

Protein Content

Figure 4 represents % protein content of Azam and Jalal varieites, before and after germination. It was examined that average protein content of Azam variety was 12.25% and that of Jalal was 14.00% before germination. After germination, the protein content of Azam variety was increased to 14.88%. Similar observations were recorded for Jalal variety where the protein content increased to 18.37%. The data was in close agreement with Adeyeye et al (1992) who found that the protein content of maize was increased from 9.6% to 14.0% after germination.

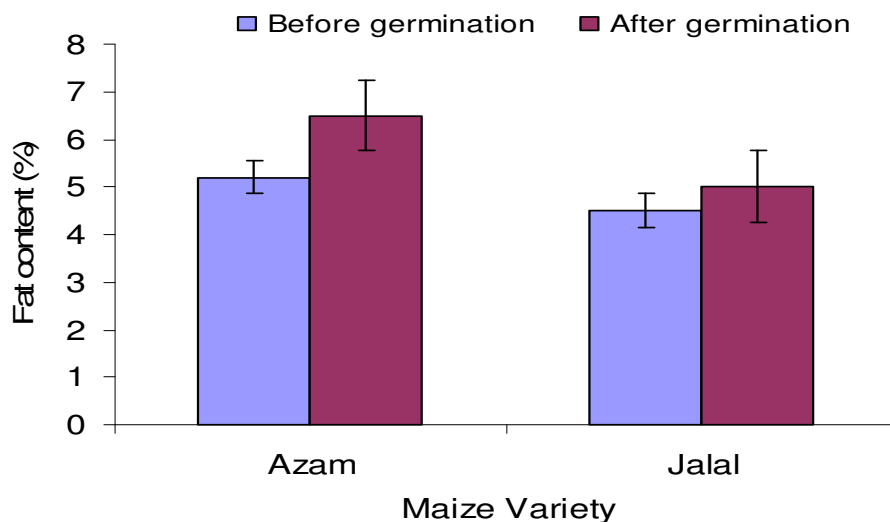


Figure 3: Fats content (%) of Azam and Jalal varieties of maize before and after germination. The bars represent the standard errors of means.

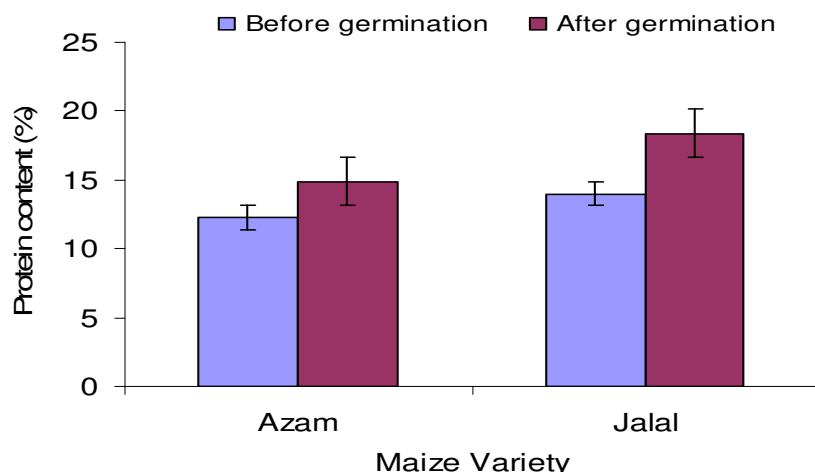


Figure 4: Protein content (%) of Azam and Jalal varieties of maize before and after germination. The bars represent the standard errors of means.

Fat Content

The average fat contents of Azam and Jalal varieties before and after germination are presented by figure 3. It was observed that before germination the fat contents of Azam and Jalal varieties were 5.2% and 4.5%, respectively. After germination the fat content of Azam variety significantly increased and was found to be 6.5%. Similar trend was observed for Jalal variety. The results of our study are in good comparison with Adeyeye et al (1992) who studied the effect of germination on potential nutrients (mineral matter, protein, lipids, fiber, carbohydrates and total energy) and an anti nutrient (phytate) of corn. Comparison of the coefficients of variability revealed striking differences in the contents of these nutrients as a result of germination. Total mineral matter increased from 1.15% to 1.40%, protein from 9.6% to 14.0%, lipids from 4.36% to 4.60% and fiber from 0.71% to 0.82% whereas phytate decreased from 200 to 105 mg/100 g and carbohydrates from 85.5% to 70.0%.

Ash Content

Fig-2 represents ash content of Azam and Jalal varieties before and after germination. It was observed that the ash content of Azam and Jalal varieties before germination were 1.5% and 0.5%, respectively and after germination were 1.5% and 1%, respectively. Germination had no significant effect on the ash content of Azam variety while it significantly increased the ash content of Jalal variety. The data was found parallel to Adeyeye *et al* (1992) who investigated the proximate composition, mineral and fatty acid contents of the major cereal grains (sorghum, millet, maize and rice). The water, oil, ash, protein and carbohydrate contents were in the ranges 9.4–11.0%, 0.3–4.9%, 0.8–2.6%, 6.5–10.9% and 70.7–82.4%, respectively.

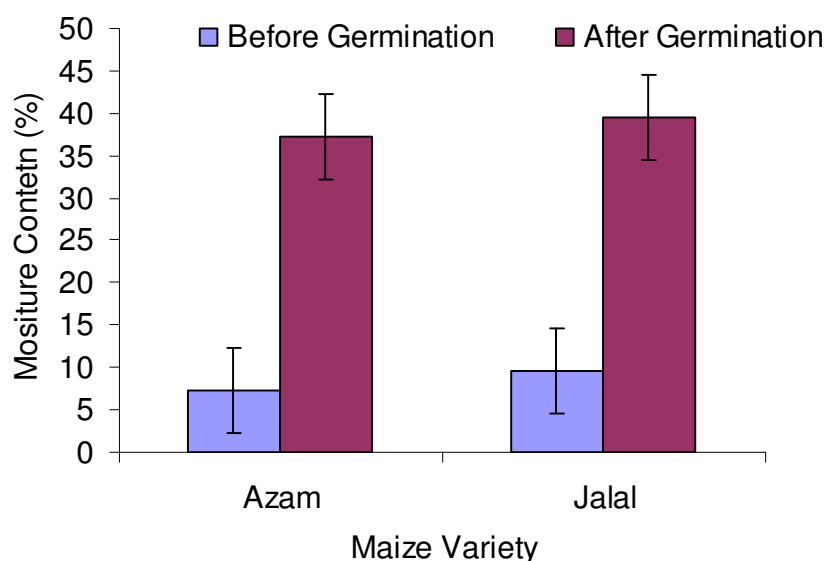


Figure 1: Moisture content (%) of Azam and Jalal varieties of maize before and after germination. The bars represent the standard errors of means.

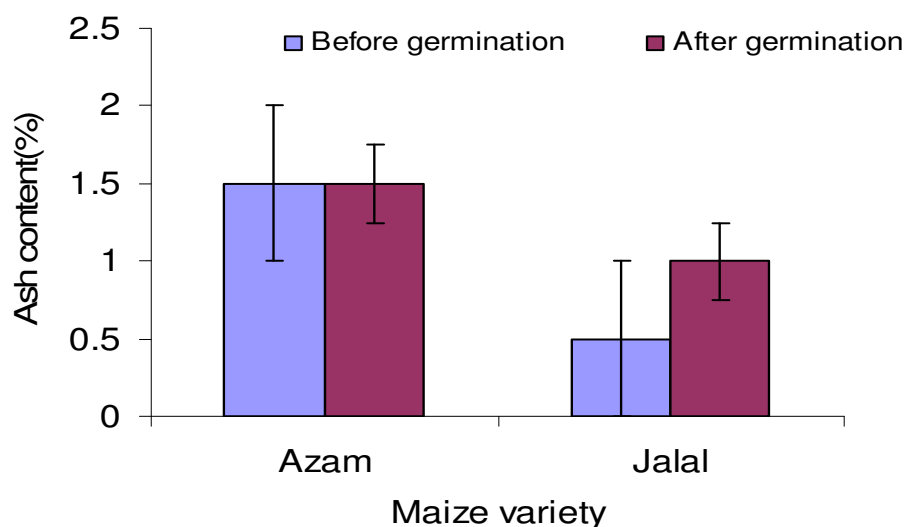


Figure 2: Ash content (%) of Azam and Jalal varieties of maize before and after germination. The bars represent the standard errors of means

Fiber Content

Fig-5 represents fiber content of the selected maize varieties. The crude fiber content was found to be 2 and 1.5% for Azam and Jalal varieties, respectively before germination. After germination the fiber content of both varieties increased significantly. The data was in good comparison with Hussain *et al* (1985).

Nitrogen Free Extract

The data regarding Nitrogen Free Extract (NFE), which represents the total digestible carbohydrates, are presented by figure 6. It was noted that before germination the NFE of Azam variety was 71.7 % which significantly decreased to 37.32% with germination. Similarly the NFE content of Jalal variety was found to be 69.9% which decreased to 34.13% after germination.

The results of our study are closely in agreement with adeyeye *et al.* (1992) who reported 70.2 to

82.4% carbohydrates in maize grain.

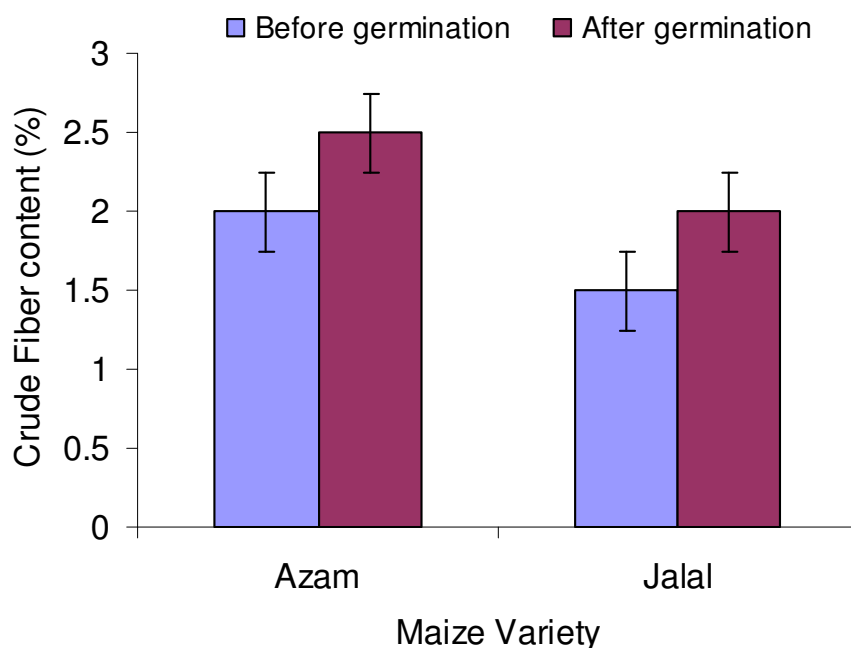


Figure-5: Crude Fiber Content (%) of Azam and Jalal varieties of maize before and after germination. The bars represent the standard errors of means.

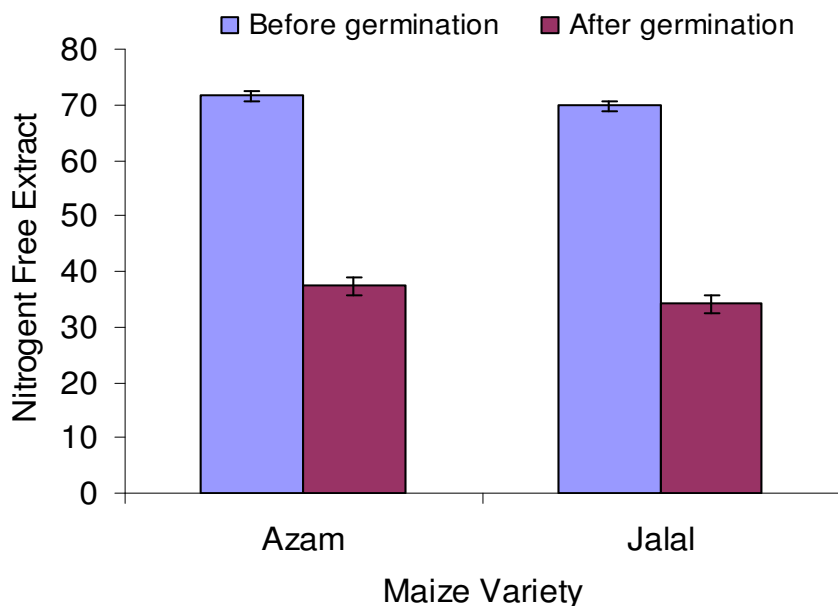


Figure-6: Nitrogen Free Extract of Azam and Jalal varieties of maize before and after germination. The bars represent the standard errors of means.

CONCLUSSION AND RECOMMENDATIONS

From the present study it was concluded that maize contain various nutrient in abundant quantity. Azam variety of maize was found better for ash, fats, crude fiber and NFE contents as compared to Jalal. Nitrogen free extract was the major nutrient which was affected by germination. On the basis of above conclusions following recommendation were made. Azam variety is recommended to be included in daily diet because of its higher nutrients density. Since Azam variety was more efficient in germination, this variety may proved to be best as

compared to Jalal in water deficit areas.

REFERENCES

- Adeyeye, K. and Ajewole. 1992. Chemical composition and fatty acid profiles of cereals in Nigeria. *J. Food Chem.* pp 41-44
- Bassir, A.1976. Nutritive value of maize. *J. Trop. Med. Hyg.* 70: 279-280.
- Hussain, T. 1985. Food Composition table for Pakistan. Department of Agriculture Chemistry and Human Nutrition. NWFPAgriculture University Peshawar, Pakistan. pp: 10-11.
- Martin, H.J., W.H. Leonard and D. L. Stamp. 1975. Principles of Field Crop Production. 3rd Ed. Mac. Publishing CO., Inc., New York.
- Shah, S.R. 2007. Effect of seed priming on yield and yield components of maize. M.Sc. (Hons.) Thesis Deptt. of Agron. KP Agric. Univ., Peshawar, Pakistan. P. 1-73.

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:

<http://www.iiste.org>

CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

Prospective authors of journals can find the submission instruction on the following page: <http://www.iiste.org/journals/> All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

MORE RESOURCES

Book publication information: <http://www.iiste.org/book/>

Academic conference: <http://www.iiste.org/conference/upcoming-conferences-call-for-paper/>

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digital Library, NewJour, Google Scholar

