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Comparative analysis of physical and chemical characteristics of organic and inorganic wheat

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Abstract

The present study was conducted to evaluate the nutritional quality of organic and inorganic wheat. Organic wheat and inorganic wheat samples were procured from the university farms and samples were analyzed for their physical and chemical constituents. Physical parameters analyzed were color, size, seed weight and density and proximate composition. Samples were anlysed using standard method for estimating moisture, ash, crude protein, crude fat, crude fiber content, total carbohydrates, non protein nitrogen and true protein content. calorific value The results of the present study showed the organic wheat had better physical characteristics i.e. color (light yellow), density (1.28 g/ml), length (6.83 mm), width (1.20 mm) as compared to inorganic wheat. Significantly ($p \leq 0.05$) higher amounts of moisture (12.91%), ash (2.06%), crude protein (14.82%), crude ether extract (1.97%) and fibre (1.71%). Calorific value (361.4Kcal) , carbohydrates (66.69%),Non protein nitrogen(0.14%) and true protein (14.02%). Was found in organically grown wheat as compared to inorganically grown wheat. Organically grown wheat was better in nutritional composition as compared to inorganically grown wheat.

Key words: Organic wheat, inorganic wheat, density, weight, moisture, protein, calorific value.

Wheat (*Triticum aestivum*) has been the staff of life for countless numbers of human beings right from the dawn of the history. It is the second most important crop grown in the world and is accorded a premier place among cereals because of the vast acreage devoted to its cultivation and high nutritive value, providing about 77.4 per cent of carbohydrates and 12.8 per cent of proteins and good amount of minerals (Gopalan *et al.* 2006). India is the second largest producer of wheat after China in the world with 95.91 million tons production (Anonymous 2014).

In India after independent the food security was one of the main items of free India agenda. Therefore, to meet the food demand of the growing population, the Green Revolution came into existence which extended over the period of 1967-68 to 1977-78. Due to green revolution, crop production and high yielding verities of different crops were developed for obtaining higher production which resulted in the increased use of pesticides and insecticides, which has resulted into adverse impacts on the environment.

Due to the health conscious population all over the world, people look for the safe foods and organic foods can be one of the solutions for the same. The term organically grown food denotes products that have been produced in accordance with the principles and practices of organic agriculture. Organic foods are those which are grown by using natural manures like Farm Yield Manure (FYM), oil cake etc. Organic farming is a holistic production management system which promotes and enhances health of agro-ecosystem related to biodiversity, nutrient biocycle and microbial activities (Purohit and Gehlot 2006). Many people believe that organic foods are healthier than inorganically produced foods, since these are produces in a more environmentally compatible manner. Much work has not been done on the comparative nutrition analysis and also on the nutritional quality of organic and inorganic wheat. Therefore, the study was planned with the objective to assess the physical and nutritional analysis of organically and inorganically grown wheat.

Materials and Methods

Procurement of sample

Organically and inorganically grown wheat varieties HPW155 used in this study was procured from the two different farms of CSKHPKV Palampur *i.e.* Model Organic Farm, Department of Organic Agriculture and Department of Plant Breeding and Genetics, College of Agriculture, CSKHPKV, Palampur. Organic wheat was grown in the university organic farm under controlled conditions using only organic inputs like Farm Yield Manure (FYM), biodynamic compost, green manures and no chemicals were used.

Preparation of sample

Grains were cleaned manually to get rid of dust and other foreign material. The samples were stored in air tight plastic containers for further nutritional analysis.

Physical Characteristics

Physical characteristics observed were color, size, weight and density. The color and shape of the seeds were observed from their physical appearance through visual perception. One hundred seeds in triplicate from each variety were randomly selected and weighed on an electrical weighing balance. Twenty seeds in triplicate from each variety were taken and length and width was measured with the help of vernier caliper.

Density

One thousand seeds in triplicate from each variety were weighed and put in graduated cylinder containing known quantity of water and rise in water level was noted. Density was calculated by the following formula: Density (g/ml) =W (g)/V (ml)
Where, W = Weight of 100 seeds and V= Rise in water level after adding seeds

Proximate analyses and nutritional analysis

The proximate analyses of sample for moisture, crude fat, crude fibre and total ash were carried out in triplicate according to the standard methods of Association of Official Analytical Chemists (AOAC 2010). Nitrogen was determined by the micro-Kjeldahl method multiplied by the factor of 5.7 for converting it in to crude protein (AOAC 2010). The total carbohydrate content was determined by formula.

Total carbohydrates=100-(Moisture content+ Crude protein + crude fiber+ crude ether extract+ crude ash).

Energy content was estimated by the method of O'shea and Maguire (1962). Non- Protein Nitrogen was determined by the method of Pellet and Young (1980). True protein was calculated by subtracting the values of Non- protein nitrogen from crude protein nitrogen and multiplying by factor 5.7 to get true proteins

The experiments were carried out in triplicate and the data so obtained data were subjected to Analysis of Variance (ANOVA) using statistical method of Sendccor and Cochran (1994).

Results and Discussion

Physical parameters of organic and inorganic wheat

Physical parameters of organic and inorganic wheat such as color, length, width weight and density were investigated and the results are tabulated in Table 1.

From the table it is clear that organic wheat was light golden in color where as inorganic wheat was light yellow in color. The difference in color might be due to different agriculture practices used during cultivation of organic and inorganic wheat *i.e.* inorganic wheat was grown by using chemical fertilizers, insecticides and pesticides whereas organic wheat was grown by using organic inputs like Farm Yield Manure (FYM), biodynamic compost, green manures. Nitika *et al.* (2008) reported that color of organic wheat was light golden yellow while inorganic wheat was bright golden yellow in color. The results of the study are at par with these results. Slight variation in the results might have been due to the agro-climatic conditions and the varietal difference of wheat cultivar taken for study. Length and width of organic wheat was significantly ($p \leq 0.05$) higher (6.83 mm and 1.20mm) than that of inorganic wheat (6.33 mm and 1.00mm). The difference of length and width in organic and inorganic wheat might have been due to the reason that organic wheat had higher nutrient composition as compared to inorganic wheat due to use of organic inputs. A non significant ($p \leq 0.05$) difference was observed in the weight and density of organic wheat (5.71g and 1.28 g/ml respectively) when compared with weight of inorganic wheat (5.12g and 1.24g/ml). The slight difference of weight might have been due to the reason that organic wheat had higher nutrient composition and higher moisture content. Coskuntuna *et al.* (2008) reported that weight of 1000 grain of different varieties of wheat ranged between 40.24g to 35.50g. The results of the study are at par with these results. The variation in the result of present study might have been due to the agro-climatic conditions and the varietal difference of wheat cultivar taken for study. The difference in density might have been due to reason that weight of organic wheat was higher as compared to inorganic wheat and density is the

Table 1. Physical characteristics of Organic and Inorganic wheat

Parameter	Organic wheat	Inorganic wheat	CD (P≤0.05)
Color	Light golden	Light yellow	-
Length (mm)	6.83	6.33	0.321
Width (mm)	1.20	1.00	0.060
Weight (g)	5.71	5.12	NS
Density (g/ml)	1.28	1.24	NS

Table 2. Proximate composition of Organic and Inorganic wheat

Parameter	Organic wheat	Inorganic wheat	CD (P≤0.05)
Moisture (%)	12.91	11.87	NS
Ash (%)	2.06	1.76	0.082
Crude protein (%)	14.82	12.77	1.005
Crude fat (%)	1.97	1.59	0.045
Crude fibre (%)	1.71	1.67	NS
Carbohydrate (%)	66.69	70.33	0.104
Energy (kcal)	361.4	330.2	3.277
NPN (%)	0.14	0.12	0.008
True protein (%)	14.02	12.09	0.714

weight volume ratio, so higher the weight more will be the volume. Suhasini and Malleshi (1995) found that the density of native wheat and malted wheat was 1.44 and 1.33g/ml, respectively.

Proximate composition: Proximate composition of organic and inorganic wheat is given in Table 2. It could be seen that moisture content was slightly but non-significantly higher in organic wheat (12.91%) as compared to inorganic wheat (11.87%). The higher moisture content in the organic wheat might have been due to the reason that for growing organic wheat organic material was used which retains more moisture as compare to chemical fertilizers. This might have been resulted in an increase in moisture as compared to chemical fertilizers. Similar reasons have been reported by Supekar (2005) that the moisture content in different wheat varieties ranged between 11.3 to 13.8%.

Higher ash content was there in organic wheat (2.06%) and lower in inorganic wheat (1.76%). The difference in ash content might have been due to the soil under which wheat in grown and also due to organic inputs (Biodynamic and Nadep compost includes chalk powder, rock phosphate, lime stone, animal dung and dry leaves etc.) used for cultivation of organic wheat and nutritional composition of crop is affected by the soil health . Nitika *et al.* (2008) that ash content of different wheat varieties grown under organic and inorganic conditions ranged from 1.82 to 2.14%. The results of present study are at par with these results. The slight difference in ash content might be due to varietal changes and due to agro climatic conditions in which wheat was grown.

Crude ether extracts of organic and inorganic wheat were 1.97 % and 1.59 % respectively. Crude fat content was higher in organic wheat. The variations in results might be due to the reason of different agricultural practices used for growing the organic and inorganic wheat crops i.e. inorganic wheat was grown by using chemical fertilizers, insecticides and pesticides whereas organic wheat was grown by using organic inputs like FYM, biodynamic compost, green manures etc. Suhasini and Malleshi (1995) had observed 1.86% fat content in wheat grains.

Organic wheat had higher crude protein content

(14.82%) as compared to inorganic wheat (12.77%). The variation in results might be due to the use of different agricultural practices for growing the organic and inorganic wheat. For growing organic wheat soil was nourished with fermented butter-milk, cow urine and water in the ratio 1:1:10 and also FYM was used during cultivation of crop. This might have resulted in as increase in protein content of organic wheat. Krejcirova *et al.* (2006) found lower protein content in organic wheat (8.58) as compared to inorganic wheat (12.24%) in winter wheat from organic and inorganic farming. Nitika *et al.* (2008) has reported higher crude protein content in the inorganic wheat variety (14.82%) and lower in the organic wheat variety (12.77%). The Variation in the present results might be due to varietal difference and agro-climatic condition under which crop was grown and varietal differences. Organic wheat contained 1.71 % and inorganic wheat contained 1.67 % crude fibre. The variation might be due to the reason that organic wheat contained higher amounts of bran portion which also resulted in higher ash content as compared to inorganic wheat. Supekar (2005) reported fiber content ranged between 0.95 to 2.9% in different wheat variety.

As it is evident from the Table 2, total carbohydrate content of inorganic wheat was higher (70.33%) and it was lower in organic wheat (66.99%). The variation in results might be due to higher amount of moisture and other nutrients in organic wheat as compared to inorganic wheat which resulted in lower carbohydrate content in the organic wheat. Ranhotra *et al.* (1996) observed the carbohydrate content in different wheat cultivar ranged between 52.9 to 62.6 %. The results of present study are at par with these results. The variation in the results might be due to the agro climatic and the varietal changes of the wheat cultivars taken for study. Energy content of organic wheat was higher (361.4 Kcal) as compared to inorganic wheat (330. 9 Kcal). This difference of energy content might have been due to high proximate composition in organic wheat and comparatively less proximate composition in the inorganic wheat. Ranhotra *et al.* (1996) had reported the energy content of different varieties ranged between 319 to 325 kcal/100g. Non-protein nitrogen in plant might be due to the presence of nitrates and nitrites. Organic wheat contained higher amount (0.14%) of NPN as compared to inorganic wheat (0.12%). The variation in results might be due to the use of different agricultural practices for growing the organic and inorganic wheat. The organic wheat contained higher amount of true protein (14.09%) as compared to inorganic wheat (12.09%). The variation in results might be due to the reason that for growing wheat soil was nourished with butter milk, cow urine and also FYM (cow dung) was used during cultivation of crop. The higher true protein content of organic wheat also due to the reason that organic material added to soil might be higher in nitrogenous compounds which affected the protein content of the organic wheat.

Conclusion

This study has characterized the physical and proximate composition of organic and inorganic wheat. The results obtained from the study have shown that organic wheat had better physical and nutritional profile than the inorganic wheat.

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