EVALUATION OF IRON CONTENT IN THE GRAIN OF SOME WINTER WHEAT CULTIVARS

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ABSTRACT
The purpose of the research is to follow the influence of the biological factor on iron content of nine varieties of winter wheat: Alex, Potenzial, Soissons, Kalango, Apache, Kristina, Lovrin 34, Chevalier and Panonnikus. Two of these (Potenzial, Chevalier) are of German origin, three (Apache, Kalango, Soissons) of French origin, one (Kristina) of Yugoslavian origin, one of Austrian origin (Panonnikus) and two (Alex and Lovrin 34) were created at S.C.D.A Lovrin, Romania. The experimental field was placed on a cambic chernozem in Timisoara (west of Romania) in 2010, and the fertilization level was $N_{120}P_{60}K_{60}$. Quality parameters monitored were: moisture, protein content, hectolitre mass and iron content. Variation in the iron content of different winter wheat cultivars was found in this study. Soissons winter wheat cultivar registered the highest value of iron content (54.3 mg/kg dry matter) followed by Kristina (52.07 mg/kg dry matter) and Kalango (50.45 mg/kg dry matter) winter wheat cultivar. Potenzial and Apache winter wheat cultivars registered the lowest values of iron content: 21.29 (mg/kg dry matter) and 20.5 (mg/kg dry matter), respectively.

Keywords: winter wheat, cultivar, iron content, hectolitre mass, protein

INTRODUCTION

Due to the high consumption of wheat in a variety of food products all over the world, wheat is considered an important source of minerals. Flour is one of the main sources of iron in the diet, which is an important mineral, essential for healthy blood cells and good circulation. The major source of iron is from cereals including wheat flour and other cereal based products. Bread is an excellent source of iron. Nutritional value and bread-making quality in winter wheat depends on the content of starch, fats, mineral substances, vitamins and proteins, which varies between 8- 26% (TABARA ET AL., 2009).
Minerals are important components required by humans in their daily food. Minerals are divided into two groups: macro minerals, which are needed in large amounts, e.g., calcium (Ca), magnesium (Mg) and potassium (K), *etc.*, and micro minerals which are required in smaller quantities, e.g., copper (Cu), zinc (Zn), iron (Fe), boron (B), selenium (Se) (MARTINEZ ET AL., 2009).
The concentration of minerals in wheat flour is genetically determined by the choice of cultivar and environmentally, determined by soil, climate and management practices (DIKEMAN ET AL., 1982). Genetic difference for grain mineral concentration has also been reported from various varietal trials (PETERSON ET AL., 1986; GRAHAM ET AL., 1999; ZHAO ET AL., 2009).
Iron has been considered an essential mineral for human body for over a century. Iron functions primarily as a carrier of oxygen in the body as a part of hemoglobin in the blood and of myoglobin in the muscles. It also aids in immune function, cognitive development, temperature regulation, energy metabolism, and work performance.
The iron content of wheat is strongly influenced by locality and it is positively correlated with protein content (GREER ET AL., 2006).
Hectoliter mass is a winter wheat yield component and represents the weight of one hectoliter of wheat expressed in kilograms.

MATERIAL AND METHOD

Nine wheat varieties were used in this experience: two of these (Potenzial, Chevalier) being of German origin, three (Apache, Kalango, Soissons) of French origin, one (Kristina) of Yugoslavian origin, one of Austrian origin (Panonnikus) and two (Alex and Lovrin 34) created at S.C.D.A Lovrin, Romania.

The experimental field was placed on a cambic chernozem in Timisoara (west of Romania) and the fertilization level was $N_{120}P_{60}K_{60}$. Sampling was done from the mass of wheat grain after harvest. Wheat samples were cleaned of foreign matter and then were processed.

The heavy metal contents in edible parts of vegetables were carried out in HNO_3 solution resulted by plant ash digestion (LĂCĂTUSU ET AL., 2008; KHAN ET AL., 2008).

Each sample solution was prepared with dilute HNO_3 (0,5 N) to a final volume of 50 mL and analyzed by flame atomic absorption spectrometry. Necessary dilutions were made.

The concentrations of Fe in the filtrate was determined by using flame atomic absorption spectrophotometer with high resolution continuum source (Model ContrAA 300, Analytik Jena, Germany). The iron concentration (mean of measurements of three analytical samples) was expressed as mg/kg dry matter.

OmegAnalyzer G device was used for the determination of moisture, protein content and hectoliter mass. This is a German engineered whole grain and seed NIR analyser for rapid analysis, operating in the 730 nm to 1100 nm wavelength range.

RESULTS

The aim of this study was to measure the levels of iron found in nine winter wheat varieties, cultivated under pedoclimatic condition of Banat area, in the 2009/2010 agricultural year.

Humidity is the first quality indicator that was determined, and the winter wheat cultivars had the following values of this parameter: Alex (11.1%), Potenzial (10.7%), Soissons (11.6%), Kalango (11.3%), Apache (10.9%), Chevalier (10.9%), Kristina (11.4%), Lovrin 34 (12.5%) and Panonnikus (12.8%). For these cultivars, the iron content varies between 20.5 mg/kg (Apache) and 54.3 mg/kg (Soissons).

On the comparison of iron concentration (mg/kg dry matter) we observed that Soissons winter wheat variety registered the highest value (54.3 mg/kg) of this parameter, followed by Kristina (52.07 mg/kg) and Kalango (50.45 mg/kg). Potenzial and Apache registered the lowest values of iron content: 21.29 mg/kg and 20.5 mg/kg, respectively.

The hectoliter mass registered values were between 67.7 kg/hl (Soissons) and 76.9 kg/hl (Potenzial).

In *Figure 1* we can observe a negative correlation between hectoliter mass and iron content.

The values of the protein content registered by cultivars are between 10.8% (Apache) and 14.4% (Soissons).

In *Figure 2* the correlation between iron and protein contents in winter wheat cultivars is presented.

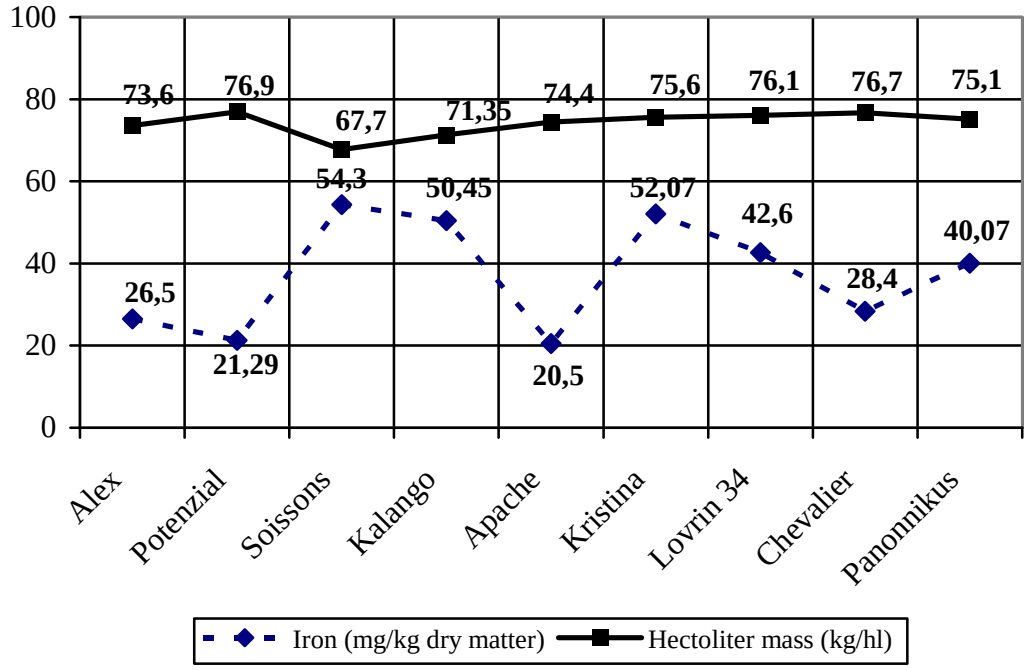

Figure 1. Graphical representation of mean concentration of iron (mg/kg dry matter) and hectoliter mass of winter wheat cultivars

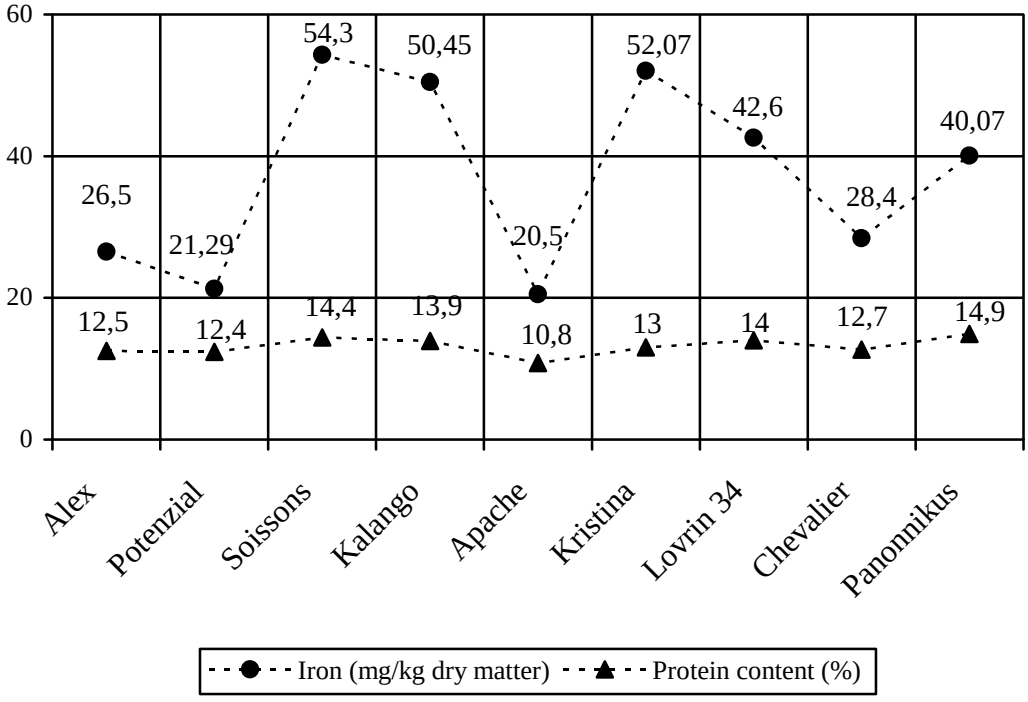

Figure 2. Graphical representation of mean concentration of iron (mg/kg dry matter) and protein content of winter wheat cultivars

CONCLUSIONS

Variation in mineral composition of different winter wheat cultivars found in this study can be used in further breeding to improve the nutritional quality of wheat grain.
In winter wheat, iron content is positively correlated with protein content and negatively correlated with hectoliter mass.
Soissons winter wheat cultivar registered the highest value of iron content (54.3 mg/kg dry matter) followed by Kristina (52.07 mg/kg dry matter) and Kalango (50.45 mg/kg dry matter) winter wheat cultivar.
Potenzial and Apache winter wheat varieties registered the lowest value of iron content: 21.29 (mg/kg dry matter) and 20.5 (mg/kg dry matter), respectively.

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