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Comparative study of micronutrients present in barley seeds

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Abstract
A systematic study was carried out to evaluate the concentration of micronutrients accumulation in barley from soil. The sample collected from different varieties of barley and soil samples of cultivated farm land. The great range of some elements was observed. The calcium, iron and magnesium were determined in barley with respect to the concentration of the soil of the specific agriculture land where all collected varieties of barley was cultivated. The objective of the study was to investigate the different uptake of mineral contents of collected barley varieties under different environmental conditions.

Keywords: barley seeds, micronutrients.

1. Introduction
Barley is the cereal grain rich of all important nutrients [1]. The minor concentration of some elements is useful to the health of the growing plant. It has been also observed that there are great quantitative and qualitative differences in requirement of minerals among the plant kingdom [2]. The calcium, Iron and magnesium are strongly depending on environmental specification and concentration of soil. It has been observed that iron is cycled through different natural pathways and processes. Comparing with other micronutrients, iron is more strongly absorbed on the surface as iron oxy hydroxide.

2. Methodology
Experimental working conditions: The soil samples (30 cm. depth) collected from the agriculture field where the barley grows in different environment of Rajasthan and Haryana. Barley grain was also collected from the selected different places of Rajasthan and Haryana in the month of December-January and April-May 2010-2011 respectively.

3. Method
The collected samples of barley grain and soil were dried at 105 ºC in oven for 12 hours. Each samples, 20.0 g of dried soil collected from Jaipur, Sikar and Mahendragarh (Haryana) and 20.0 g of barley samples were weighed into 100 ml clean and dried conical flasks. The content of the flask treated with 5 ml of concentrated nitric acid (conc.HNO_3) and simultaneously 5.0 ml of concentrated nitric acid also added to a clean and dried empty conical flask, which will serving as a blank sample. The sample flasks with content were covered with a clean and dried watch glass.
The contents of the flask were reflux gently on an electric water bath for one hour. After refluxing for an hour, the contents of flasks were extracted with excess of concentrated nitric acid (conc.HNO_3), 2 ml of 35% Hydrogen peroxide (H_2O_2).The content of the reaction flask was further genteelly refluxed for another one hour until the volumes of the content present in the flask was reduced to 2-3 ml. The contents of reaction flask were cooled, diluted with high purity water. Now the content of the reaction mixture was filtered through Whatman filter paper number 42 in to 25 ml volumetric flask. The contents of the volumetric flasks were brought to volume with high purity water and examined by Atomic absorption spectrometry hydride-generation (AAS-HG) for their magnesium, calcium and Iron (Fe) levels. The analyses were performed according to the Association of official analytical Chemist [3] (Standard Official Methods of (FL/SOP/C-14/ (P-10 and 7) AAS) for soil samples and barley samples were analyses by ICP-MS technique using ELAN DRC-e, MS PERKIN ELMER SCIEX-9000 instrument.

4. Results and discussion

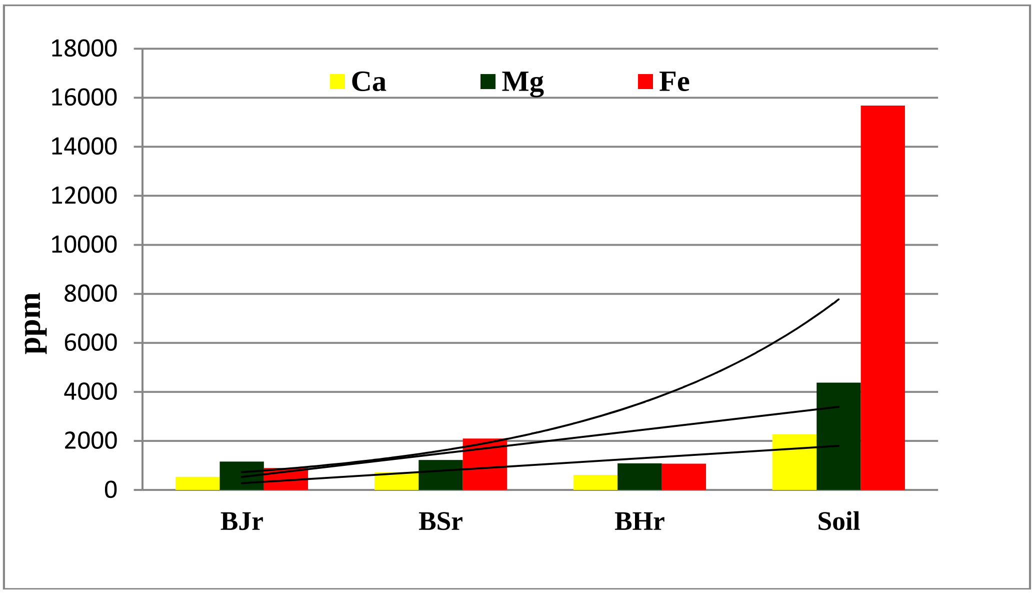
The consequences of agriculture soil and barley grain analysis have been summarized in the following table.

Table 1: Concentration consequences by (ICP-MS)

Instrumental conditions for the ICP-MS measurement of Na, K, Ca, Mg, and Fe elements	Mass	Conc. Means	Conc. SD	Conc. RSD	Net Intensity mean	Sample unit
Mg	24	54.365	0.12	0.2	133984.905	ppb
Fe	56	53.612	16.19	30.2	399915.601	ppb
Ca	43*	3068.259	65.31	2.1	22649.647	ppb
Na	23	19.171	0.07	0.3	80920.213	ppb
K	39	238.630	2.20	0.9	1261563.616	ppb

Above table, shows the comparative statement of concentration of elements present in barley grain. In terms of net intensity of the elements, potassium has greater value as compared to other elements. Therefore, consumption of barley helps in controlling the blood pressure due to the high concentration of potassium. Above experimental data also reveals an interesting fact that iron is present in sufficient amount, 30.2 RSD, which is remarkable. Presence of calcium is valuable for nutrition industry involving in making the food for the children and adults.

Plants mainly obtain elemental iron from the rhizosphere. Although iron is one of the most abundant metals in the earth's crust, but its availability to plant roots is very low. The iron availability for the roots is supported by the soil redox potential and pH. If the soil is rich of higher pH, iron is readily oxidized, in the form of insoluble ferric oxides. But at lower pH, the ferric iron is freed from the oxide, and hence becomes more available for uptake by the cereal roots.



Regardless of the fact that iron is the second most plentiful metal in the earth's crust. Iron deficiency is the world's most familiar cause of anemia. When it comes to life, iron is more precious than gold. The bar graph confirms that iron is in common, abundant in the soil, but a variety of soil conditions, Haryana and Rajasthan, can limit how well a plant can absorb the iron from the soil. Intake of iron from soil normally caused or affected by any one of the following four causes.

1. Soil pH is too high
2. Soil has too much clay
3. Compacted or overly wet soil
4. Too much phosphorus in the soil

If the soil is too wet, the roots do not have enough air to properly absorb enough iron for the plant from the soil. If so, the cultivators need to improve the drainage system of the soil. Sometime too much presence of phosphorus in the soil can also diminish the absorption of iron.

Absorption of elements by plant is normally via divalent ion channels after reduction in the plasma membrane. The transport of elements into seeds is dominated by the phloem sap system. The soil of the area investigation was moderately calcareous and loamy in nature [4, 5]. The concentration difference of iron present in barley grain may be also due to presence of xylem in root, which help in transportation of iron from xylem to phloem through transfer cells [6, 7], although these process are not yet well understood in the case of barley. This transportation mechanism observed at high pH of the soil (alkaline) range from 7.9 to 8.2. Increase in pH and clay content in soil decreased the movement of elements while a reverse trend is observed with increase in level of water application rate.

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