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Editorial

Essential Mineral Element Status in Wheat and Maize Grains

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Wheat and maize account for a significant proportion of the food consumed by humans on different continents. As a consequence, knowing the amount of minerals taken up through these staple crops consumed together with other nutrients is an important aspect in human nutrition. In the past two centuries factors influencing mineral content of cops has changed, which includes crop varieties, production technology and to an increasing extent weather conditions (climate change). In addition to macro elements (N, P, K, Ca, Mg, S) essential micro elements (Mn, Fe, Zn, Cu, Se) also play an important role in nutritional quality. Researches into this field are relevant because wheat- and corn based food consumption increases in certain regions of the world. The tendency is also indicated by the fact that wheat consumption increases in countries of the Far East where traditionally rice constitutes a staple food and in Southern American countries where maize is the main crop in human consumption. A similar trend can be observed in the United States.

This issue has been addressed by researchers in a number of articles and studies published about the mineral composition of these two crops which might also challenge policy makers in terms of decision making. While searching for opportunities one has to answer the question of how to supplement or increase the amount of three significant micro elements - Zinc, Iron and Selenium - in a way to reduce micronutrient deficiency and the resulting malnutrition in certain countries and regions. Factors affecting plant quality, as summarized in table 1, indicate the complex system of the interactions researcher interested in this field have to face [1].

Genetic properties of the plant		Crop management practice
Biological resources	Environmental resources	Technical resources
Varieties	Climate	Plant Sequence
Hybrids	Soil	Soil Cultivation
	Water	Sowing Time
		Amelioration
		Plant Population
		Plant Protection
		Plant Growth Regulators
		Fertilization
		Irrigation
		Drying At Harvest
		Transportation
		Storage

Table 1: *Main Factors Determining Plant Quality.*

Describing this complex system of interrelations is challenging for researchers because individual varieties on the given production site produce different mineral and nutrient content year by year. For this reason a high number of experiments and chemical research data are needed in order for researchers to make general conclusions [2].

Among the detailed results, the study showing the mineral content of winter wheat and maize in geographical regions of the world has to be highlighted [3]. The concentration of elements was also determined and some varieties contained twice as much Iron as others and a difference of 3 to 4 times found among varieties in case of Zinc [4,5]. The results of analyzing archived samples dating back to decades are also known. These data prove that the Iron and Zinc content of winter wheat declined from the middle of the 19th century [6,7]. There have been extensive studies carried out to demonstrate to what extent these essential mineral elements – including Zinc and Selenium – can be increased through the soil in winter wheat [8,9]. Along with this process there were attempts to improve vegetables by biofortification without exploiting the environment.

A large number of researches attempted to determine how climate change especially the increasing carbo-dioxide content of the atmosphere affect populations consuming different plant food [10]. It was found that the Zinc and Iron content of C_3 plants and pulses can decrease significantly, which would affect billions of people, by increasing malnutrition in terms of these two elements.

The methods aimed at increasing the mineral content of staple crops and foods are the following:

- Supplementation by pills made of different compounds [11].
- Plant breeding strategy - developing a special variety mixture based on a more detailed examination of varieties [12,13]
- Producing identical varieties in different microecological conditions and creating a bulk based on element content [3]
- Agronomic biofortification: nutrient element uptake through the soil by the plant. An example was provided in Finland for Selenium raising environmental questions such as dose versus compound [14,15].
- Consumption of whole meal bread products [16-18].
- Consumption combined with plant products rich in these elements [19].

Another task is the application of new measurement technologies as a result of analytical developments that produce new data about hybrids and varieties [20,21].

In case of maize the situation has been unique, which is caused by the development of analytical measurement methods over the past 50 years. The decrease of Calcium from 300 mg/kg to 50 - 70 mg/kg was not caused by changes in variety or production technology but it was a result of a measurement technology that became increasingly selective. Calcium content was determined with flame photometry in the 50's and 60's, while application of atomic absorption spectrometry began in the 70's and inductively coupled plasma emission spectroscopy has become the main procedure from the 80's onwards [22]. The sensitivity and selectivity of determination methods have changed significantly. Due to this tendency, the recommendation of USDA for Calcium content is 70 mg/kg [23]. The methodological change is also indicated by the re-measurement results of the samples taken from different locations as they produced approximately identical results with the same certified samples.

In conclusion, biofortification of food with essential micro elements to improve nutritional quality is possible by different means and the option that best suits local conditions can be adopted out of them. Environmental aspects have to be considered as well including the application of fertilizers to soils and plant leaves.

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