HarvestPlus

ABSTRACT

Abstract no. 2

Are Synthetic Hexaploids a Means of Increasing Grain Element Concentrations in Wheat?

Daniel F. Calderini and Ivan Ortiz-Monasterio

In a world where there is arguably enough food produced and many gains have been made in increasing wheat production, Calderini and Ortiz-Monasterio have evaluated wheat varieties for their suitability for breeding to increase essential micronutrients. Specifically the research examines parameters such as grain yield, nutrient input use, and whether better distribution of nutrients in the edible portions of grains is possible.

Research findings

Synthetic hexaploid varieties of wheat serve as a genetic bridge between wild wheats and cultivated wheats. Once developed, they, and not their wild parent, can be crossed directly with improved wheat facilitating the transfer of useful traits from wild but alien species of wheat. Synthetic hexaploid lines have been identified as potential sources for increasing micronutrient content in grains. However the physiological mechanism responsible for greater micronutrient concentrations in these lines of wheat was unknown.

Calderini and Ortiz-Monasterio measured biomass, grain yield, micronutrient, and macronutrient content in hexaploids with two cultivars and one synthetic hexaploid on two field tests managed by the International Maize and Wheat Improvement Center (CIMMYT). The results of the Calderini and Ortiz-Monasterio's research point to some advantages for incorporating synthetic hexaploids into germplasm breeding programs. The synthetic hexaploids showed higher concentrations of selected micro- and macro-nutrients in grains – between 25 and 30 percent more for iron, magnesium, and zinc. These lines also showed higher nutrient uptake of potassium and phosphate, and better distribution of micronutrients to the edible grain portions of the wheat, all with yields similar to the non-synthetic hexaploid lines. From these findings, the researchers suggest that synthetic hexaploids would be a valuable source of germplasm for increasing micronutrients in wheat. If traits present in synthetic hexaploids can be incorporated into tomorrow's wheat fields, it could mean both hardier plants and food that is more nutritious.

The researchers suggest a mechanism to further increase synthetic hexaploid's utility in germplasm development. By breeding for shorter stem length, an achievement already reached in modern wheat breeding programs: research suggests that even greater gains can be made in increasing micronutrient concentrations in the edible portions of the wheat.

Implications

Increasing wheat yield potential has been and remains a central aim of breeding programs. Calderini and Ortiz-Monasterio work to find wheat that is both high yielding and highly nutritious is of central importance to achieving better health globally. In South and West Asia, where the populations do not regularly consume foods that contain enough micronutrients, many suffer the debilitating effects of micronutrient deficiency. If nutritionally enriched wheat were widely available, malnourished populations could automatically receive more iron, zinc, vitamin A, and other crucial micronutrients in the staple foods. Breeding better staple crops with higher nutrient concentrations has been proposed as a low cost strategy for reducing micronutrient deficiencies in humans. A group of international research organizations including CIMMYT and other HarvestPlus partners has engaged in research to study the feasibility of increasing micronutrient concentrations in wheat, rice, maize, sweet potato, and beans, among other crops. Calderini and Ortiz-Monasterio's research on synthetic hexaploid wheat, part of a larger, international effort to understand nutrient physiology in wheat and other staple crops, suggests ways to accomplish the twin goals of increasing yields to meet increased demand while also reducing micronutrient malnutrition through targeted breeding for increased nutrient potential.

HarvestPlus Abstracts

Abstract no. 1

Grain Position Affects Grain Macronutrient and Micronutrient Concentrations in Wheat

Calderini, Daniel F. and Ivan Ortiz-Monasterio, 2003. *Crop Science* 43:141-151

Abstract no. 3

Coliforms in the water and hemoglobin concentration are predictors of gastrointestinal morbidity of Bangladeshi children aged 1-10 years.

Bhargava, Alok, Bouis, Howard E., Hallman, Kelly and Hoque, Bilqis. Am J Human Biol 2003;**15** (2):209-19

SOURCE

Daniel F. Calderini and Ivan Ortiz-Monasterio. 2003. *Are synthetic hexaploids a means of increasing grain element concentrations in wheat?* Euphytica 134. Kluwer Academic Publishers: 169-178.

HarvestPlus www.harvestplus.org
c/o IFPRI 2033 K Street, NW
Washington, DC 20006 USA

HarvestPlus is an international, interdisciplinary, research program that seeks to reduce micronutrient malnutrition by harnessing the powers of agriculture and nutrition research to breed nutrient-dense, staple foods.