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EDITED AND REVIEWED BY
Autar Krishen Mattoo,
Agricultural Research Service (USDA),
United States

*CORRESPONDENCE
Maryke Labuschagne
✉ labuscm@ufs.ac.za

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Editorial: Crop biofortification for food security in developing countries – volume II

Maryke Labuschagne[1]* and Abdul Wakeel[2]

[1]Department of Plant Sciences, University of the Free State, Bloemfontein, South Africa, [2]Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad, Pakistan

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Editorial on the Research Topic
Crop biofortification for food security in developing countries – volume II

Crop biofortification is a promising strategy for addressing the issue of food security, especially in developing countries. It involves enhancing the nutritional content of crops by breeding or biotechnological methods to increase the levels of essential vitamins and minerals in the edible parts of the plant. Moreover, the interventions in agronomic practices can also contribute to combating malnutrition and related health issues in populations that rely heavily on staple crops with limited nutritional value. Malnutrition is a significant problem in many developing countries, where people often rely on a limited range of staple crops, such as rice, wheat, maize, and cassava. These crops are calorie-rich but often lack essential micronutrients like iron, zinc, vitamin A, and folic acid. Crop biofortification focuses on increasing the levels of specific nutrients in these staple crops. For example, biofortified rice can be developed with higher levels of vitamin A, while biofortified beans can be bred to be richer in iron and zinc. These biofortified crops offer a cost-effective and sustainable solution to nutrient deficiencies. Biofortified crops can contribute to sustainable agriculture by reducing the need for costly and environmentally damaging nutrient supplementation and fortification programs. Promoting biofortified crops often requires addressing cultural and social factors, therefore a continuous effort is needed to educate the people about the benefits of these crops and encouraged to accept them as part of their regular diet. Addressing food security through crop biofortification requires collaboration between governments, agricultural institutions, non-governmental organizations, and the private sector. Investment in research, development, and scaling up production is essential.

Therefore, two volumes of the Research Topic "*Insights in Crop Biofortification for Food Security in Developing Countries*" collated recent information from various sectors to develop coherent pool of information for policy makers as well as scientists. The second volume of this very important Research Topic highlighted the latest advancements in crop biofortification and how it can influence food security in developing countries.

Five papers were published in this Research Topic. In the first paper "*The resurrection of sweet corn inbred SC11-2 using marker aided breeding for β-carotene*" by Saha et al., the favorable allele of *crtRB1* (responsible for high β-carotene) from a donor was introgressed into a recurrent sweet corn inbred to develop β-carotene-rich sweet corn by marker-assisted breeding. The β-carotene content was increased to 9.878–10.645 μg/g in the introgressed lines compared to the recurrent parent (0.989 μg/g), while the high sugar content was maintained.

The second paper "*Agronomic iron-biofortification by activated hydrochars of spent coffee grounds*" by Lara-Ramos et al. investigated the effect of activated spent coffee grounds and its hydrochars at three temperatures as bio-chelates to increase iron content in lettuce. All bio-chelates increased iron, varying between 41 and 150% compared to the control. They concluded that activated, compared to non-activated spent coffee ground hydrochars at small, sub-toxic doses can lead to successful agronomic iron biofortification.

The third paper "*Combining ability estimates for quality and non-quality protein maize inbred lines for grain yield, agronomic and quality traits*" by Amegbor et al. aimed to better understand the genetic mechanisms conditioning the inheritance of grain yield and other agronomic and quality traits from crosses of a set of quality protein maize (QPM) and normal maize lines with the same two QPM and non-QPM testers. Significant specific combining ability effects showed that hybrid breeding for increased yield in a QPM background is possible. Some of the quality traits were highly heritable, showing potential response to selection.

In the fourth paper "*Exploring the linkage between root system architecture and grain iron content in wheat (Triticum aestivum L.)*" by Sultana et al., a hundred wheat genotypes were analyzed for root architectural characteristics in relation to grain iron concentration. They reported large genetic diversity for both grain iron concentration and root structure architecture. A vigorous root system not only increased shoot iron concentration but also grain iron content and improved yield, as 90% varieties with extensive root systems had higher yield. Three genotypes with high iron content and yield were identified for possible production.

The fifth paper was by Dhaliwal et al. on "*Biofortification of wheat (Triticum aestivum L.) genotypes with zinc and manganese lead to improve the grain yield and quality in a sandy loam soil of Punjab-India*." They investigated nutrient use efficiency for zinc and manganese in wheat genotypes. They categorized genotypes based on efficiency and responsiveness under different zinc and manganese applications against a control. Zinc and manganese efficient genotypes with acceptable yield were identified which can potentially be used for production, and which can contribute to alleviation of deficiency of these minerals in consumers.

This Research Topic added new information on both genetic and agronomic biofortification of essential minerals, amino acids (in QPM) and provitamin A in important food crops. Root morphology as a means to increase iron content was also investigated. This Research Topic contributed to current knowledge on biofortification and indicates the direction into which this field is moving.

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