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Breeding techniques for bio fortification in maize crop

Gaurav Mahajan* and Shikha Sharma

Introduction:

Biofortification is a process that aims at enhancing the nutritional quality of crops through traditional breeding techniques, genetic engineering, or agronomic practices. The primary goal of biofortification is to develop crops that are naturally rich in essential vitamins and minerals, providing a sustainable and cost-effective approach to addressing malnutrition and improving public health, particularly in tribal regions of country where people rely on staple crops for their diet. Biofortification is often aimed at increasing the content of specific nutrients in crops, such as iron, zinc, vitamin A, vitamin C, and folate. These nutrients are critical for human health and can help combat micronutrient deficiencies.

Traditional breeding techniques, such as selective breeding and crossbreeding, are commonly used to develop biofortified crop varieties. This involves selecting and crossing plants with higher nutrient content.

Breeding methods in maize (corn) crop involve a range of techniques aimed at developing maize varieties with desirable traits, such as yield, disease resistance, tolerance to environmental stresses, and nutritional quality. These methods can be broadly categorized into conventional breeding and advanced biotechnological approaches. Breeding methods for biofortification in maize involve the development of maize varieties with enhanced nutritional content through traditional breeding techniques. The goal is to create maize varieties that are naturally rich in essential nutrients, such as vitamins and minerals, to combat malnutrition and improve public health. By using mass selection technique under conventional breeding a way out can be provided for biofortification. In mass selection, maize plants with desirable traits, such as higher nutrient content, are identified and saved as seed sources. Over successive generations, the nutrient content can be improved. However, in order to have higher levels of specific nutrients, inbred line of maize are created through self-pollination and selection. Further, these lines can be used in hybridization programme. The objective is to develop hybrid maize varieties with enhanced nutrient content is a key strategy.

Gaurav Mahajan* and Shikha Sharma

AICRP on Maize, Zonal Agricultural Research Station, J.N.K.V.V, Chhindwara, M.P. 480001, India

By crossing inbred lines with high nutrient content, breeders can develop hybrids with better nutritional qualities. Whereas, to transfer specific genes or traits associated with enhanced nutrient content into existing maize varieties backcrossing technique can be used. Marker-Assisted Selection (MAS) is another tool with higher precision that can be employed in biofortified production of crops. MAS is a biotechnology-assisted breeding method that allows breeders to select maize plants with specific genes or markers associated with higher nutrient content. This method can help identify and advance maize lines with enhanced nutritional traits more efficiently. Doubled Haploid (DH) Lines can be used to accelerate the development of maize varieties with improved nutrient content. DH lines are created by doubling the chromosome number of plants, resulting in genetically uniform, homozygous lines. To make any breeding programme a success participatory plant breeding is the need of the hour. Involving farmers in the breeding process, particularly those who will be consuming the biofortified maize, can help ensure that the nutritional traits align with local preferences and dietary needs. Thus, the maize varieties developed for biofortification need to be tested in various environments to ensure their adaptability and stability of nutrient traits across different growing conditions. The final package and practice of a variety is worked out through integration of agronomic practices. Agronomic practices, such as fertilization, can be combined with breeding to enhance the nutrient content of maize. For example, nutrient-enriched fertilizers can be used to enhance the nutrient uptake by maize plants.

Breeding methods for biofortification in maize are often tailored to target specific nutrient deficiencies prevalent in different regions. These methods are typically combined with efforts to raise awareness among farmers and consumers about the importance of consuming nutrient-rich maize varieties. Additionally, it is essential to conduct trials and research to assess the nutritional impact of these biofortified maize varieties on human health.