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Genetic improvement for protein content and quality in coarse cereals

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The coarse cereals are a group of highly variable members of Poaceae grown all over the world for food feed and forage as industrial raw material. Coarse cereals have been traditionally the main component of food basket of the poor and predominantly grown in the resource fragile agro-climatic regions. Eight cereal grains viz., wheat, maize, rice, barley, *Sorghum*, oats, rye and millets provide 56% of the food energy and 50% of the protein consumed on earth. The proteins present in these grains may belong to one or more classes of proteins viz., albumins, globulins, prolamins or glutelins and the major seed storage proteins of coarse cereals are prolamins. The seed protein content appears to be determined by a combination of genetic and environmental factors. The protein content in general varies from 6-15% in cereal grains. Environmental factors including agronomic practices affect grain protein and its amino acid composition. The cereal proteins are generally deficient in essential amino acids like lysine and tryptophan. One of the strategies to increase the quality and quantity of protein available in coarse cereals is through genetic modification. However, low genetic variability for protein content, negative correlation between protein content and grain yield resulting into lower yield are the bottlenecks in development and adoption of such varieties. The work on genetic improvement of protein content and quality has mostly been attempted with considerable success in maize, *Sorghum* and barley which focused mainly on enhancement of lysine content using high lysine mutants. The methods attempted to enhance protein content and quality varied from traditional plant breeding to rDNA technology. The approaches used were increasing the protein content, enhancing the protein quality, increasing the levels of free amino acids and create a completely artificial protein containing the maximum number of the essential amino acids. Some of the examples of successful genotypes developed are Quality Protein Maize (QPM) varieties, Hiproly in barley, high lysine mutants 'IS 11167' and 'IS 11758' in *Sorghum* and Bichpuri local in pearl millet. However, the improvement in nutritional content of crops has been a challenge due to low genetic variability and the lack of clear understanding of plant metabolism and challenge of resolving intersecting networks of several metabolic pathways. The success in achieving the goal of enhanced grain quality in food crops will depend on active collaborative efforts of the institutions with expertise in breeding, molecular biology, biotechnology, food technology and the industry. Nevertheless, achievements so far made for the improvement of protein content and quality indicate the potential for fighting the menace of malnutrition through genetic improvement.

Biography

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