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IMPROVEMENT OF QUALITY TRAITS IN CEREALS USING VARIOUS BREEDING APPROACHES

Shaukeen Khan[1] , Amit Dadheech[2] and Rashid Khan[3]

[1&2]Department of Plant Breeding and Genetics, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan- 313001, INDIA

[3]Department of Horticulture, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan- 313001, INDIA

Email of corresponding author: Shaukeen4@gmail.com

This article is associated with timelines and breeding procedures of cereals crops in crop improvement. Recent integration of advances in biotechnology, genomic research and molecular marker applications with conventional plant breeding practices has created the foundation for molecular plant breeding, an interdisciplinary science that is revolutionizing 21st century crop improvement. Cereal is major source of carbohydrate (56–74%) followed by protein (8-11%), β-glucans (0.5–7%) vitamin B, B2, B6 (3.7-4.6 %), lipid (1.8-3.9%), mineral (1.2-1.9%). The relatively high content of B-vitamins is in particular of nutritional relevance. Cereals are having physical quality parameters (resistance to biotic stress like drought, salinity, alkinity) and biological quality parameters (resistance to biological stress like disease, pathogen, pest). Inter-varietal and inter-specific hybridizations, coupled with appropriate cytogenetic manipulations, proved useful in moving genes for resistance to diseases and insect pests from suitable alien donors into crop cultivars. The successful deployment of transgenic approaches to combat insect pests and diseases of important crops like rice (*Oryza sativa* L.), wheat (*Triticum aestivum* L.), maize (*Zea mays* L.), barley (*Hordeum vulgare* L.), and cotton (*Gossypium hirsutum* L.) is a remarkable accomplishment. Conventional plant breeding assisted by marker assisted selection and wide hybridization coupled with manipulation of chromosome pairing has clearly been instrumental in producing superior crop cultivars. Fermentation is carried out to enhance taste, aroma, shelf-life, texture, nutritional value and other favourable properties of foods. With the advent of molecular biology, it has become possible to develop DNA-based markers for traits of interest. These markers are now gaining the attention of the breeders, since PCR-based functional markers developed from gene sequences provide accurate and high throughput data for determination of allelic compositions in breeding materials (Goutam *et al,* 2013).

Today, the most challenging task for wheat breeders is not only to increase grain yield (Duveiller *et al.,* 2007) but also to improve the grain quality for end products to meet the requirement of ever increasing population. The QTL approach provides markers for areas of the genome involved in stress tolerance that can coincide with yield and quality QTLs or other important genomic regions (Foster *et al.*, 2000).

Targeted quality traits to be used for improvement of cereals:

The goal of breeding in cereals for quality improvement is to meet the demand of needy people and people under malnutrition. Here, there has been emphasized on productivity as well as quality traits. There are two methods (conventional & modern) used for improving quality traits. Here there is limitation in conventional (time consuming , less accuracy) which are compensated by modern breeding approach. Here developed countries are more advanced than developing countries in terms of latest technology to be used for improvement of cereals.

Quality includes biochemical, physical and biological traits. Nutritional traits are carbohydrate (56–74%), protein (8-11%), β-glucans (0.5–7%) vitamin B_1, B_2, B_6 (3.7-4.6 %), lipid (1.8-3.9%), mineral (1.2-1.9%), Sugar (3%), sodium, cholesterol, fiber, prolamin and globulin storage proteins, gluten proteins, prolamins (wheat), iron, zinc. Prolamins is largely responsible for the ability to process wheat to form bread, pasta and many other food products. In the present study, the term "safety" was referred mainly to the naturally gluten-free foods or foods specially processed to reduce gluten content which trigger celiac disease in susceptible individuals. Sorghum cultivars with high protein digestibility as well as high lysine content are being developed and offer prospects for combining high nutritional quality and grain yield. Wild Species as Sources of Genes for Crop Improvement. Special efforts have been made to improve protein quantity and quality in maize. Protein content of maize varies from <8% to as high as 27% (Dudley, 1974), but there is generally a negative correlation with yield. Recent reports showed that selected QPM-hybrids outperformed normal-endosperm maize by 14% in grain yield and 48% in grain tryptophan due to opaque2 gene. The most recent method (since 1964) is the replacement of the normal cereal grain with its high lysine mutant counterpart. The absence of gluten in natural and processed foods represents a key aspect of food safety of the gluten free diet. Gluten level does not exceed 20 mg/kg in total, based on the food as sold or distributed to the consumer. Physical traits include resistance to abiotic stress like drought, cold, Salinity, heat, water logging, low-temperature, mineral toxicity and deficiency. Biological traits include resistance to disease, pathogen and pest.

Breeding Approaches:

Participatory plant breeding (PPB) methods represent alternatives aimed to improve local adaptation breeding, to promote genetic diversity, to empower farmers and rural communities in Durum wheat. Participatory plant breeding programs originated in developing countries to meet the needs of low-input, small-scale farmers in marginal environments who were often overlooked by conventional crop breeders. The EPB method is an efficient breeding system uniquely suited to improving crop varieties for the low-input and organic farmer. Modern breeding approaches are molecular breeding, marker assisted breeding, biofortification, chromosome engineering methodologies, cytogenetic techniques, methods of circumventing the Ph1 system, Transgenic Approaches, genomics, proteomics, QTL mapping.

Biofortification tool to Combat Nutritional Deficiency in cereals:

Some 842 million people worldwide are malnourished. It is very difficult to improve nutritional deficiency, particularly for iron and vitamin A, using traditional crop breeding. Efforts are being made toward biofortification of crop plants using tools of biotechnology, and levels of essential nutrients have been increased.

Ongoing research for improvement of cereals:

Current study is going on gluten free flours & biofortification. The absence of gluten in natural and processed foods represents a key aspect of food safety of the gluten free diet. Food processing is in progress to remove gluten. In maize, work is running for improving quality traits like essential amino acids lysine and tryptophan.

References:

Goutam P. 2013. Biotechnological approaches for grain quality improvement in wheat: Present status and future possibilities. *Australian journal of crop science,* **7**(4):469-483.

Duveiller, E., Singh, R. P. and Nicol, J. M. 2007. The challenges of maintaining wheat productivity: pests, diseases, and potential epidemics. *Euphytica*. **157**:417–430

Forster, B. P., Ellis, R. P., Thomas, W. T. B., Waugh, R., Ivandic, V., Tuberosa, R., Talame, V. D., Teulat-Merah, B., El-enein, R. A., Bahri, H. and Ben Salem, M. 2000. Research developments in Genetics of drought tolerance in Barley. Proceedings of 8th Int. *Barley Genetic Symposium*, pp. 253-259.