A New User-Friendly Approach for Iron Biofortification in Wheat

Iron is an important micronutrient, the trace amount of which plays an important role in storage, transport and utilization of oxygen. Apart from this, iron is a major component of several enzymes, haemoglobin and cytochromes. Nutritional surveys conducted by various notable agencies have identified children, adolescents and women suffering from common micronutrient malnutrition which is also called hidden hunger. A large percentage of population having anaemia has been identified due to inadequate intake of dietary iron constituents, a public health condition of epidemic proportion especially in developing countries including India. The iron intake in the range of 10-18 mg per day is recommended to subdue the health hazards resulting from the dietary iron deficiency.

Various strategies have been utilized to combat the global challenge of iron-deficiency anemia to ensure the nutritional quality of food with minimum health risk to the consumers. This has employed the strategies that can improve the micronutrient intake in human diet with dietary diversification, mineral supplementation and post-harvest food fortification. Fortification in the above context is the practice of manual increase of the available amount of an essential micronutrient during processing of the crop by adding water soluble and insoluble inorganic minerals. Consequently, these water soluble inorganic minerals cannot be used beyond a particular limit because it can only be added in certain amounts, and if added in higher amounts than recommended, the sedimentation of these inorganic minerals may occur due to higher specific gravity. Another drawback of adding the inorganic minerals is that they can destroy the stability of the food product. Moreover, iron fortification in such a way promotes the generation of destructive free radicals, the intake of which is harmful for the consumers.

Wheat (*Triticum aestivum*) is a major staple crop. To address the challenge of iron malnutrition, it is deemed essential to develop a cost-effective and user-friendly integrated technology of biofortification that can enhance the grain iron content in wheat to meet the goal for eradication of iron-deficiency anemia in developing countries. Biofortification of wheat require developing new wheat varieties with increased grain iron content. In order to completely eradicate the iron-deficiency anemia and iron malnutrition, an integrated approach of nanotechnology and biofortification appears viable. The nano-biofortification of wheat is an innovative approach which has the potential to be transformed into a cost-effective technology to enhance the grain iron content to eradicate the iron-deficiency anemia among the consumers in the developing countries including India.

Advantages:

1. The described approach is user-friendly and cost-effective, thus can be recommended to the farmers.
2. The approach is scalable, hence can be commercialized easily.
3. The wheat grains obtained upon harvesting have much higher grain iron content; makes it an innovative eco-friendly approach for crop biofortification.
4. The wheat varieties harvested have significantly higher grain iron content but more importantly, they are non-GMO, hence would have wider acceptability among consumers as well as regulatory agencies.
5. The harvested wheat grains having higher grain iron are totally safe to consume.
6. The nanoparticle solution of the optimum recommended concentration for higher grain iron biofortification can be provided to the farmers on commercial basis.
7. This solution can be manufactured at small scale industry level due to less expenditure.