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MOLECULAR PH(F)ARMING: PRODUCTION OF PHARMACEUTICAL COMPOUNDS IN PLANTS

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Plants are the source of food for human life, as they provide energy and nutrition essential for growth and sustainability of the individual. The plants can also act as source of pharmaceutics which helps to overcome deficiency or disorders, when administered because of presence of active ingredients with medicinal value. Apart from natural occurrence of pharmaceutically important compounds in plants, the enhanced production can also be engineered for native or artificially designed compounds. The consumer can intake food material with enhanced quantity of pharma compound or the plant material can be processed to extract these compounds commercially, ultimately turning 'plants as factories' of producing pharmaceutical compounds. 'Molecular ph(f)arming' envisages production of proteins or other metabolites or compounds which are of value to medicine and industry in sufficient quantity through plants generally used in agricultural systems. The production can be through transformation of desired gene into the plants and assessing its expression and production of compounds. Many novel technologies are also available as and when candidate genes in plants were identified which are responsible for production of these compounds which can be altered through Genome Editing technologies like CRISPR-Cas9 (Clustered Regularly Interspaced Short Palindromic Repeats-CRISPR associated protein 9) or Base edition. This will help in enhanced production of desired compounds in plants with desired quantities. The engineered plants can be grown under controlled conditions such as glass house or vertical farming to obtain desired compounds in required quantities. This will also help in obtaining pharmaceutical and industrial compounds organically, which minimises harmful effects of factories under environmentally sustainable conditions. The plant based vaccines are being tested in potatoes, sweet potatoes, tomatoes, bananas and carrots. The plants can also produce large quantities of amylase or other enzymes to meet industrial requirement. The associated risks are also there as purity of the compound and processing technologies to isolate the compounds and quality testing, since these are being administered as medicine/ supplements to humans. The research work is on the way for identification of rice genotypes having high Fe and Zn content which is important from human nutrition, low glycemic index genotypes with slow starch hydrolysis which is relevant for diabetic patients along with GABA (Gamma Amino Butyric Acid) in germinated brown rice, which is important for enhancing immune system in humans. These are helpful in obtaining value added products useful to human health.

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