Swarnajayati Fellow from NIPGR to unravel mechanisms to improve phosphate use efficiency in plants

Dr. Jitender Giri, Scientist with National Institute of Plant Genome Research (NIPGR), Delhi, is one of the fourteen recipients of this year's Swarnajayanti Fellowship instituted by Government of India to commemorate India's fiftieth year of Independence. The prestigious fellowship is funded by Department of Science & Technology, Government of India.

With support from the fellowship, Dr. Giri plans to unravel the novel mechanisms to improve phosphate use efficiency using gene editing. The use of improved plants can cut down the dependence on phosphate fertilizers for crop production. To achieve this, a unique rice gene PHO1 which plays roles both in phosphate transport and cellular signaling, would be manipulated and the mechanism by which a domain of PHO1 gene suppresses cellular signaling would be uncovered.

Plants accumulate an insane amount of phosphorus probably because of the central role of phosphorus in plant life as it is a part of DNA, RNA, and plasma membrane-- the very basis of life. Even a slight dip in the plant phosphorus levels activates several responses that consume plant's energy leading to poor growth and yield. Intriguingly, many of these responses are not related to phosphorus metabolism.

Dr. Giri's research would explore the mechanism by which plant phosphorus sensitivity can be manipulated and this could minimise panic responses and optimise low phosphorus adaptations by modulating cellular signaling in rice.

Using gene editing in a way that does not leave any foreign gene in the final edited plants, we would be telling plants, "don't worry," you have sufficient phosphate. He expects to produce

gene-edited rice plants with improved phosphate use efficiency. These new plants would be free of any foreign gene and can be called non-GM rice. The use of such plants with improved phosphorus use efficiency can cut down the use of phosphate fertilizers.

Dr. Giri's research interests include understanding molecular regulation of low phosphate adaptations with focus on finding novel genes and understanding their functions in cellular signaling and his proposed work includes generating new rice varieties with improved phosphate use efficiency & low water requirements.

He is working on the development of phosphate-efficient varieties for sustainable agriculture to address the country's dependence on import for phosphate fertilizers which are provided to farmers at a heavily subsidized cost to feed the commonly cultivated rice varieties which are fertilizers intensive.

Such varieties could reduce the application of fertilizers thereby reducing cultivation costs as well as associated environmental problems. Such improved plants can also help sustainable crop production in the field for poor farmers who can not afford expensive chemicals.

The green revolution, which helped India achieve food security, made use of high yielding rice varieties in well-fertilized farmers' fields. However, these varieties showed a poor root system implying yield reduction in the soils with deficient minerals and water availability. Roots are now emerging as the new target for generating climate-resilient varieties of crops for sustainable agriculture.

Dr. Giri's research has strengthened the view that varieties with improved roots can help achieve successful crop production in the marginal soils with fewer inputs. With a slight alteration in root architecture, he has improved phosphorus uptake of plants from the soil. Such efforts would ultimately help reduce the use of chemical fertilizers in crop production which implies low input cost leading to more savings and income for farmers.