Genetic Dissection of Phosphorus Utilization Efficiency in Bread Wheat Synthetic Derivatives Using Genome Wide Association Mapping Studies (GWAS)

Nazia salim

Department of Plant Sciences, Quaid-i-Azam University, 45320 Islamabad,

ABSTRACT

Phosphorus reserves are predicted to be depleted in next 50 years, while in Pakistan 90% of the soil is already phosphorus deficient. In recent years, plant breeders applied a different amount of mineral fertilizers for optimum yield. The increasing price of Phosphorus fertilizers improves the concept of phosphorus efficient varieties. The input use efficiency of phosphorus (PUE) is most important in breeding to attain the optimum crop production to fulfill our food requirement. A pot experiment was conducted to observe the response of 150 genotypes of synthetically derived wheat to different phosphorus availabilities in 2015-2016 at Quaid-i-Azam University Islamabad. The PUE genotypes were characterized from whole gene pool of bread wheat on the base of root profiling and yield related traits. The statistical analysis showed that morphological traits like plant height, tiller number, grain per spike, and thousand kernel weight were significantly showed difference in treatments as compared to control. The network length of roots increased due to phosphorus deficiency. GWAS was conducted to identify genomic regions associated with phosphorus use efficient traits. In total, 222 MTAs with –log p>4 were identified for yield-related traits and root architecture. Loci associated with PUE were mapped on chromosomes. Three genotypes of synthetic derivatives of wheat were characterized as phosphorus efficient lines i.e. SD-210, SD-177 and SD-225. These lines had higher yield at low phosphorus dose as compared to control. Markers and genotypes identified in this experiment can be and will be used in future breeding programs.