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Phenomics and its Application in Agriculture

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INTRODUCTION

Phenomics is a relatively new discipline with a plethora of applications and advantages to offer in different areas of science. The term was coined by Gerlai (2002) for the study involving the collection of huge amounts of data on behavioural and other phenotypic effects of gene mutations. Plant phenomics generally involves the evaluation of all or some selected traits (physical and biochemical) of relatively large populations of the plants that are grown in multiple environments to characterize the plasticity of the plant phenome. Based on the approach, phenomics can be classified as (i) Forward phenomics, in this high- throughput methods of data acquisition and analysis are used to screen germplasm collections for valuable traits. (ii) Reverse phenomics, in this approach a detailed analysis of a trait is carried out to decipher the various biochemical, physiological and biophysical processes and the genes involved in control of the trait. Further phenomics includes both extensive as well as intensive phenotyping (Singh and Singh, 2015)

Phenomics Approaches and Tools

High throughput phenomics employs imaging systems, high- tech sensors, robotics and image analysis softwares. High throughput approaches are generally nondestructive as opposed to traditional approaches of phenotyping. Commonly used tools and techniques in phenomics include imaging technology, infrared imaging, reflectance imaging, fluorescence imaging, multi-sensor monitoring approaches magnetic resonance imaging and field based phenomics. Image analysis is a crucial approach in phenomics. There are some paid software's available for that but presently various free and open- source image analysis software's viz. Rosette tracker, ImageJ, HTPheno etc. are also available for this purpose. Drones fitted with multispectral camera are also being used these days for the purpose of monitoring the growth of the crops.

Need for Phenomics

Plant Phenomics helps the researchers to collect high quality accurate phenotypic data. This phenotypic data is extremely crucial for meaningful genetic analysis and for genomics assisted breeding applications including candidate- gene based mapping association mapping, QTL interval mapping, QTL cloning, Genome wide association studies, Marker associated selection, Marker assisted recurrent selection, genome selection and TILLING (Targeting induced local lesions in genomes) (Welcker et. al., 2011; Tuberosa, 2012; Cobb et al., 2013).

Application of Phenomics in Agriculture

Plant phenomics has revolutionary applications to offer in the field of agriculture. Some of its applications among many are listed below:

- ✓ Phenomics approaches can replace the traditional methods of phenotyping which are slow and time-consuming making plant phenotyping more efficient, accurate and less time consuming.
- ✓ Integration of phenomics with genomics will lead to a better understanding of the effects of different environments on the genotype of a plant.
- ✓ Phenomics approaches can be utilised to screen for mutant genotypes.
- ✓ These approaches can be used to identify various biotic and abiotic stresses in a plant population and for the identification of stress tolerant genotypes.
- ✓ Phenomics approaches can be used to augment the evaluation of the pleiotropic effects of various genes.
- ✓ It will facilitate and accelerate the screening of a large number accession and germplasm collection for desirable traits or the genes of interest.
- ✓ It will permit us to reliably relate genomic information to high quality phenotypic data

CONCLUSION

Phenomics is a newly emerging trans-disciplinary field of science which has recently started making strides in the field of agriculture whereas much advancement has been made in the field of genomics and a lot of genomic information has been generated. But to exploit this wealth of genomic information for the advancement of crop programmes it is imperative to link and integrate this information with the phenotype in a real-world environment (Furbank and Tester, 2011). Presently we are still lagging in our capacity to collect reliable phenotypic data, so there is a need to develop and advance sophisticated plant phenomics facilities which will help to narrow down the genotype and phenotype gap (GP- gap).

REFERENCES

Cobb J.N., DeClerck G., Greenberg A., Clark R., and McCouch S., 2013. Next generation phenotyping: requirements and strategies for enhancing our understanding of genotypephenotype relationships and its relevance to crop improvement, Theoretical and Applied Genetics., DOI 10.1007/s00122-013-2066-0

Furbank, R.T. and Tester, M. 2011. Phenomicstechnologies to relieve the phenotyping bottleneck. Trends Plant Science. 16: 635- 644.

Gerlai, R. 2002. Phenomics: fiction or the future? Trends in Neurosciences. 25: 506- 509.

Singh, B.D. and Singh, A.K. 2015. Marker assisted plant breeding: Principles and Practices, DOI 10.1007/978-81-322-2316-0_15.

Singh, B.D. and Singh, A.K. 2015. Marker assisted plant breeding: Principles and Practices, DOI 10.1007/978-81-322-2316-0_15.

Welcker C., Sadok W., Dignat, G., Renault M., Salvi S., Charcosset A. and Tardieu F. 2011. A comman genetic determinism for sensitivities to soil water deficit and evaporative demand: meta-analysis of quantitative trait loci and introgression lines of maize. Plant Physiology. 157: 718- 729.