Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

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http://ansinet.com

Plant Breeding Is Being Transformed by Advances in Genomics and Computing

The arrival of affordable, high throughput DNA sequencing, coupled with improved bioinformatics and statistical analyses is bringing about major advances in the field of molecular plant breeding. Multidisciplinary breeding programs on the world's major crop plants are able to investigate genome-wide variations in DNA sequences and link them to the inheritance of highly complex traits controlled by many genes, such as hybrid vigor.

Furthermore, there has been a step-change in speed and cost-effectiveness. What previously took six generations to achieve can now be done in two, delivering massive time and resource savings. This has made molecular plant breeding feasible on marginal crops including medicinal plants and crops of the developing world.

Agriculture faces demands to sustainably produce enough food for an expanding world population and to improve the nutritional quality of food crops, as well as to provide non-food crops, e.g. for the biofuels industry. The progress in molecular plant breeding can help meet these demands by;

* shortening the time it takes to domesticate new crops from semi-wild plants,
* tailoring existing crops to meet new requirements, such as nutritional enhancement or climate change,
* rapidly incorporating valuable traits from wild relatives into established crops,
* allowing plant breeders to work with highly complex traits, such as hybrid vigour and flowering,
* making it feasible to work on research-neglected "orphan" crops.

These issues were discussed during the session "Plant breeding today: genomics and computing advances bring speed and precision," at the Annual Meeting of the AAAS, Washington, D.C. on February 19, 2011.