

Review Form 1.6

Journal Name:	International Journal of Environment and Climate Change
Manuscript Number:	Ms_IJECC_89104
Title of the Manuscript:	Applied genetics and plant breeding in 21st century for crop improvement – status and prospects
Type of the Article	Review Article

General guideline for Peer Review process:

This journal's peer review policy states that **NO** manuscript should be rejected only on the basis of '**lack of Novelty**', provided the manuscript is scientifically robust and technically sound. To know the complete guideline for Peer Review process, reviewers are requested to visit this link:

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PART 1: Review Comments

	Reviewer's comment	Author's comment (if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should w his/her feedback here)
Compulsory REVISION comments	<p>-The foundation for molecular plant breeding is an interdisciplinary science that has revolutionized the 21st century with incorporation of genomic research, biotechnology and molecular marker applications with conventional plant breeding practices for crop improvement.</p> <p>-To meet the food demand of the ever-increasing population of the 21st century, conventional breeding methods like ideotype breeding, participatory plant breeding with combination of recent breeding approaches like Genetically Modified crops, Marker Assisted Selection, Next Generation Sequencing and precise genotyping tools with sufficient bioinformatics knowledge play a demanding role.</p> <p>-Co-operation among farmers, plant breeders, researchers and other plant scientists should exist to develop quality crops with increased nutritional value. The challenge to feed the ever-increasing population can be met by integrating different research disciplines and activities that form the core of molecular plant breeding.</p> <p>-Success of genomics depends on the ability to improve crop phenotypes and reduce the phenotype gap which will be a major concern of the 21st century.</p>	
Minor REVISION comments	<p>2. CONVENTIONAL BREEDING APPROACHES: One of the main drawbacks of conventional breeding is lack of effective selection scheme during early segregating generations, highly heritable characters unlike yield only effective for selection, tedious phenotype assessment in some traits</p> <p>3. IDEOTYPE MANIPULATION: The goal for organic breeding should include both grain yield and environmentally safe production while maintaining production cost and quality. Ideotype suitable for organic wheat-cropping systems should have fast early growth, lodging resistance, resistance to pests and diseases and adaptation to local environmental conditions [12].</p> <p>4. GM CROPS: The genes of concern can be incorporated into the target crops in a single occurrence while it takes five to six years to generate cultivars with stable gene expression (Fig.1) [4]. It provides a chance for crop enhancements in the 21st century through the following landmark achievements.</p> <p>5. MARKER ASSISTED SELECTION (MAS) SCHEMES IN PLANT BREEDING: Molecular markers are time saving, stable and reliable with high performance enabling precise selection of complex traits [19]. An ideal molecular marker should be highly polymorphic, co dominant, highly reproducible, abundant, easily available, and should be selectively neutral with easy and fast assay and exchange of data between laboratories [20].</p> <p>6. MARKER ASSISTED GENE PYRAMIDING: Gene pyramiding can be done by conventional methods or by molecular technique using marker assisted selection or transgenic method. Marker assisted backcross based gene pyramiding can be performed in three ways.</p> <p>7. RECENT TREND IN MARKER ASSISTED BREEDING: Genomic estimated breeding values (GEBVs) is the key parameter to Genome-wide selection approaches having higher gains of selection through the use of high-density genome wide data instead of being limited to a few known loci [54]. The use of elite genotypes or natural populations in association mapping can be improved for higher resolution to identify genes responsible for difference in a quantitative trait [58] [59].</p> <p>8. RECENT ADVANCES IN GENOTYPING: SNPs have appeared as potent tools for several genetic applications including linkage mapping, quality control (QC) analysis, germplasm characterization, allele mining, linkage-based and linkage disequilibrium based quantitative trait loci (QTL) mapping, marker-assisted backcrossing (MABC), marker- assisted recurrent selection (MARS) and genomic selection (GS).</p> <p>9. BREEDING FOR ORGANIC SITUATION: Organic agriculture differs from conventional farming in the techniques and approaches used by the growers. Organic farming maintains biological diversity and increase the population of natural enemies by exclusion of broad-spectrum pesticides [71].</p>	
Optional/General comments	<p>-Integration of conventional breeding with genetic engineering and marker assisted molecular breeding with precise genotyping platform will help in improving the nutritional status of food.</p> <p>-Multiple resistance genes can be transferred from wild varieties to extant varieties through gene pyramiding and gene staking to minimise the cost of production and improvement of elite varieties.</p> <p>-Standardization of molecular techniques with proper phenotyping and high throughput genotyping and sequencing may fulfill the food demand of the 21st century to some extent.</p> <p>-With the increased awareness and focus on health, people prefer organic products and so there is need to focus on this area to develop organically enriched crop varieties.</p>	

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PART 2:

	Reviewer's comment	Author's comment <i>(if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)</i>
Are there ethical issues in this manuscript?	<i>(If yes, Kindly please write down the ethical issues here in details)</i>	

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