Proc Indian Natn Sci Acad **80** No. 1 March 2014 pp. 17-19

10.16943/ptinsa/2014/v80i1/55082

Meeting Report

Innovative Approaches to Crop Improvement**

P V SANE[1*] and U C LAVANIA[2]
[1]*C-739/B, Sector-C Mahanagar Extension, Lucknow 226 006, (UP), India*
[2]*Division of Genetics & Plant Breeding, Central Institute of Medicinal & Aromatic Plants, Lucknow 226 015, (UP), India*

(Received 31 January 2014; Accepted 03 February 2014)

The Mini Symposium on "Innovative Approaches to Crop Improvement" was held on 27th December 2013 in the pre-lunch session. The symposium was preceded by a Silver Jubilee Commemoration Medal Lecture 2000 that was delivered by Professor R S Paroda, Former DG, ICAR on "Immerging Challenges Before Indian Agriculture" Prof. Paroda narrated the major achievements of the National Agricultural Research System in increasing crop production in the past 50 years through science-led Green Revolution and its adoption by the farmers of India. He dwelt upon the future requirements of food grain for the increased population with less land, increased inputs and decreased natural resources. Prof. Paroda was optimistic about meeting the needs provided a major reorientation in agricultural research is adopted together with a paradigm shift towards sustainable agricultural systems and most importantly a political will to support agricultural science. This informative and thought provoking lecture set the tone for the following mini symposium.

P V Sane, Chairman of the symposium briefly remarked that while India ranks very high in terms of total production of many crops, its rank in terms of production per unit area is poor. He mentioned that while Indian Plant Breeders have done an excellent job in improvement of varieties of many crops, plenty remains to be done. Newer techniques of molecular genetics provide opportunities for innovative approaches for further improvement and the speakers of this Mini Symposium will bring out some of these.

The first speaker Prof. Deepak Pental of Department of Genetics, University of Delhi, South Campus delivered his talk on Technology Mapping In Crops for more Productive Agriculture. He emphasized that while breeding objectives for varietal improvements of our crop plants are very clear, the strategies to achieve those objectives have not been well spelled out. He made a strong case for generating Technology Mapping for each of the crops and strengthened his argument by providing an example of his group's in-depth studies on mustard. He showed how success was achieved by using the available germplasm and using marker assisted breeding approach. Similar strategies could be used for improvement of other crops. While improvements are possible in some cases through conventional breeding or through the use of marker assisted breeding, Pental asserted that some of the improvements could only be tackled through the transgenic technology. He argued for ending the current imbroglio on transgenic crops and predicted that agricultural productivity of our country could be enhanced by 6-7% as against 3-3.5% if we follow proper planning and execution. The presentation generated a major discussion that centered around the controversy related to transgenics.

**Aughor for Correspondence: e-mails: rajsane@hotmail.com; Former Director, National Botanical Research Institute, Lucknow*
***Symposium organized during the INSA Anniversary Meeting held at Lucknow on 27 December 20013*

Dr. Narendra Tuteja working in the Plant Molecular Biology Group at the International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi, was the second speaker. Following his earlier work on helicases at ICGEB (Italy), he has examined roles of plant helicases and G proteins in abiotic stress tolerance. Helicases, shown by his group to participate in several basic cellular processes, have emerged as potential tools for developing abiotic tolerant crops without decrease in yields. His work essentially involves gene transfer, over expression of helicase from pea and study of the transgenic lines for several attributes. Demonstrating success using the example of transgenic rice and groundnut, he stressed that the resultant transgenic plants were salt tolerant without any detrimental effect on yield. He presented data to show that in case of ground nut the yield in fact had increased significantly. The transgenics showed improved antioxidant defense system to overcome oxidative damages due to salinity. The transgenics expressing pea helicase did not alter the microbial communities of the rhizosphere. This talk generated interesting discussion on the possible mechanism/s through which an over expressed helicase confers improved tolerance to the crop plants. It was clear that the mechanism is not yet known and needs further studies.

The third speaker of the symposium, was Dr. Ramesh Sonti from the Centre for Cellular and Molecular Biology, Hyderabad on Marker Assisted Breeding (MAB) for Disease/Pest resistance. He emphasized that the Marker Assisted Breeding, one of the two tools of biotechnology, the other being the more commonly talked about transgenic technology, can be used to develop pest and disease resistant crop varieties through proper planning of the crosses based on suitable genetic markers followed by selection. He provided evidence from his work on rice that has resulted in developing a bacterial blight resistant variety and has become now popular with the farmers. The marker assisted breeding approach can be used only when the gene sequences of interest to confer resistance are present in the gene pool of the crop and can be identified through the known sequences that flank the gene interest. He provided thought provoking strategies in which the MAB can be used along with the use of induced variations in DNA sequences through other approaches of Plant Breeding. It was evident that MAB is a powerful tool, as was also brought out by Prof Pental, provided the trait is present in the gene pool of the same species or any other that can be crossed with the crop of interest. There was intense discussion on how the possibility of selecting unwanted changes in the non-targeted traits alongwith the desirable change in the targeted trait could be achieved.

The fourth speaker of the symposium was Dr. Umesh C Lavania of the Central Institute of Medicinal and Aromatic Plants (CSIR), Lucknow, who was also the convener of this symposium. He brought out the difficulties in working with the non-traditional crops like Medicinal and Aromatic Plants (MAPs) that produce secondary metabolites of interest for pharmaceutical or perfumery industry, through conventional methods of crop improvement since majority of MAPs are deficient for sexual reproduction and produce/store the economic product in vegetative tissues and organs. He then made a case that this group of plants offers unique breeding opportunities by virtue of being inherently heterozygous/homoploid besides their obligatory and efficient system of vegetative propagation/asexual reproduction. Since heterozygous clones continue to throw selectable variations in seed progenies, their repeated clonal selections over generations, termed as 'clo-line breeding', and homoploid hybrids, (monoploid hybrids that have combination of two or more than two different genomes, and are generally sexually sterile) have led to the development of several value added clones in aromatic grasses, including *Cymbopogon* spp. and Vetiver. Using suitable examples of *Menta arvensis*, Citronella grass, he emphasized that this group of plants also offers opportunities for 'bud sport mining' and 'propagule mining' to tap *de novo* somatic variations. He suggested that genomic agitation caused by application of high polyploidy pressure leads to enhanced occurrence of bud sports and somatic propagule variation. These can be scored to realize genetic enhancement even in the absence of sexual reproductive system. Further, highlighting the significance of diploid like behaviour of

autotetraploids that promise reduced segregation in autotetraploids on account of tetrasomic mode of inheritance, he provided an account of 'polyploid model for fixation of heterozygosity' citing practical examples from Palmarosa grass, *Cymbopogon martinii*. Based on his studies on eight diverse paired sets of diploid vs autotetraploid clones in *Cymopogon* spp. differing for native secondary metabolites, he resolved the myth that polyploidy brings about 'gigas' characteristics, pinpointing that both increase and decrease in body size may occur on account of polyploidy across the plant kingdom. The actual outcome depends upon the composition of native metabolites since longer the metabolic pathway, larger would be the negative impact of polyploidy on plant biomass. This is an important guiding principle for polyploidy breeders.