MEETING REPORT

New advances towards food security*

Increasing population worldwide has resulted in competitive survival of human beings on the earth. Except in a few developed nations, availability of food material has become a big challenge. In India wherein the development of food biotechnology is in its seedling stage, fast developments in the food sector are required. In view of reduction in agricultural land in the recent past, we have to increase the agricultural production manifold. Classical plant breeding, which is the soul of all breeding programmes deployed to increase agricultural production, has now come to a saturation point. Further improvement of food production is now at the door of Genetic Engineering and Molecular Breeding. Unfortunately, India is lagging behind in spreading the knowledge of current status of plant biotechnology to all corners of the country.

With a view to introducing the scientific community to biotechnology-based progress and achievements towards food security, Mahatma Gandhi Institute of Applied Sciences, Jaipur organized a two-day National Symposium.

C. K. Ojha delivered an informative lecture on the current situation of food grains in the world with special reference to India. He also focused on the present status of increasing population and demand for food grains. According to him, biotechnology can provide immediate solutions towards food security. An important trend threatening sustainable agricultural development and hence food security has to do with the widespread effects of human activities on the environment: on the global level, major key indicators show that the physical condition of earth is deteriorating, i.e. earth is getting warmer. The deforestation of the planet continues unabated, reducing the capacity of soils and vegetation to absorb and store water.

V. S. Vyas (Institute of Developmental Studies, Jaipur) dealt with the importance and relevance of the theme of the Symposium. He also emphasized the increased production of food grains in recent years. Vyas encouraged taking initiative for the Evergreen Revolution to solve the problem of food scarcity.

Amla Batra (University of Rajasthan, Jaipur) highlighted the importance of plant tissue culture technique. She urged scientists and researchers to emphasize more and more on use of this technique in assuring food security. Satish Kumar highlighted the theme of the symposium. He outlined the advantages that India has for progress in biotechnology.

In the first session, C. P. Malik (Formerly from Guru Jambheshwar University, Hisar) presented his talk on 'Biotechnology in 21st Century: Some milestones, some challenges, genes, dreams and realities'. He referred to the historical background of biotechnology in making wine and vinegar. He emphasized the use of genomics for advancement of biotechnological approaches with special reference to food security. According to Malik, by the end of the second decade of 21st century, molecular biologists hope to download the catalogue, the genomes of tens of thousands of living organisms, a vast library containing the evolutionary blueprints of many microorganisms, plants and animals.

In his special lecture O. P. Saxena (formerly from the Department of Botany, Gujarat University, Ahmedabad) highlighted on 'The challenges ahead in biotechnology for advances towards food security'. He spoke on the alarming situation of population increase and stated that to feed the global population in the next 50 years, the agricultural production has to be doubled. The genetic improvements in the crop plants are needed not only for more food but also for a great diversity, higher quality and nutritious diet.

Sunil Pabbi (National Centre for Conservation and Utilization of BlueGreen Algae, IARI, New Delhi) delivered a lecture on 'Microalgae: from biology to biotechnology in 21st century'. He highlighted on the role of nitrogen fixing cyanobacteria in maintenance of fertility of rice fields. He also enumerated the developments in the field of microalgal biotechnology that have yielded some excellent contributions dealing with different aspects of mass cultivation of microalgae and their possible use in mariculture, food, fertilizer, colourants, production of secondary metabolites, including vitamins, toxins, enzymes, pharmaceuticals, pollution abatements, etc.

Shubhra Chakraborti (National Centre for Plant Genome Research, New Delhi) enumerated many ways for 'Feeding the World in 21st century'. She presented a comprehensive report of the achievements of NCPGR. She encountered the novel finding of transfer of *Ama*1 gene of *Amaranthus* into potato. She elaborated on how nutritionally improved potato with a balanced amino acid composition using a heterologous protein from *Amaranthus* and development of molecular methods for heterosis breeding techniques were developed at NCPGR.

Suresh Chand (Devi Ahilaya University, Indore) discussed the role of plant tissue culture in developing high frequency regeneration protocols of some economically important plants. He also explained the effect of different minerals like copper and zinc on regeneration of plants. He referred to his contributions in improving cereals like barley, rice, etc.

S. L. Kothari (Department of Botany, University of Rajasthan, Jaipur) dealt with 'Genetic transformation: the technology to feed a world population of 10 billion people'. He highlighted the role of genetic transformation technology in improving agricultural productions qualitatively as well as quantitatively. He dealt with the transgenic crops currently in the market: soybean, corn, tobacco, cotton, canola, etc. According to him, India needs much technological advancement for the practice of large-scale cultivation of transgenic food crops.

Vinay Sharma (Department of Bioscience and Biotechnology, Banasthali Vidyapeeth, Banasthali) explained the role of recently developed chloroplast transformation technology in developing GM crops. The GM crops through chloroplast transgenics offer many advantages, namely, high level of gene expression, multigene engineering in a single transformation event, use of natural selectable markers, elimination of position effects and gene silencing, minimized adverse effect of toxic proteins and no codon optimization for prokaryotic genes.

Pushpa Srivastava (formerly from Department of Botany, University of Raja-

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sthan, Jaipur) elaborated on '*Spirulina*: Super food for mankind'. *Spirulina* has an average protein content 65% higher than any other natural food. Still greater value is added to it due to its contents of vitamins, minerals and other useful nutrients. Due to its unmatched composition, it was declared as 'Best food for tomorrow' by the United Nations. *Spirulina* provides 20 times more proteins than soybean, 40 times more than corn and 400 times than beef. *Spirulina* can florish well in ponds of brackish water built on unfertile land.

Paresh V. Purohit (Regional Research Laboratory, Jammu) mentioned that food production remains independent India's most spectacular success from being a famine endemic nation under British rule. Today India is not only food self-sufficient but also has large reserves with which to feed its population of over a billion, though many still cannot afford to buy adequate nutritious food. He further highlighted that India is on the verge of a second green revolution with pockets of hunger threatening to erode its much-admired success on the farm. India is centreing its hopes on biotechnology to usher in a green revolution similar to the one that put India on the path to self-sufficiency in the seventies.

K. K. Sharma (Department of Zoology, Maharshi Dayanand Saraswati University, Ajmer) mentioned that functional food is currently defined as food of normal daily intake enriched with substances or organisms, which have health supporting activities. It should have good nutritional value to help the body to keep alive and activity on the physiological system to strengthen and modulate the physiological system. He further enumerated the importance of probiotic bacteria, the friendly bacteria that are the natural inhabitants of the digestive tract that balance the intestinal pH by producing lactic acid, and synthesize Vit. B2, Vit. B6, Vit. B12, Vit. K, etc.

B. D. Kaushik (Department of Microbiology, IARI, New Delhi) delivered a talk on 'Biofertilizers and sustainable developments using inoculants of Azotobacter and Rhizobacter'. He enumerated currently developed biofertilizers and their role in food security. He emphasized on increase in crop productivity by using biofertilizers without any adverse effect on food quality. He elaborated on the role of *Rhizobium*, *Azotobacter*, *Azospirillum*, BGA, PSM and VAM as biofertilizers. He also dealt with the techniques of biofertilizer production developed at IARI.

A. L. Bhatia (Department of Zoology, University of Rajasthan, Jaipur) gave a talk on 'Food security through biotechnology: hype/hope'. He introduced to the audience the genetically modified foods currently available in the market. He also reviewed the history of genetically engineered food from 'Flavr-Savr' tomato to present-day crops. He further recollected the golden rice technology and its benefits towards food security.

P. L. Swarnkar (Department of Botany, University of Rajasthan, Jaipur) discussed 'Bioengineered food' and the technological developments for the production of transgenic crops. He recollected the role of mutagenesis and gene silencing in production of transgenic plants and showed a wide list of transgenic crops with important traits. He summarized the various steps involved in the production of genetically modified plants via different techniques. *Agrobacterium*-mediated gene transfer and particle gene-mediated transformation techniques were also deliberated upon.

A poster session was organized on the second day of the symposium. More than forty posters were displayed on various research activities going on in the field of transgenic technology. Shazia Zahoor of Punjabi University, Patiala was awarded for the best poster presentation. Her poster illustrated the 'Molecular detection of enterotoxins and methicillin resistance genes in *Staphylococcus aureus* isolates from dairy products'. Prizes were also awarded to a few other posters having themes related to food security.

Meenakshi Hooja (Department of Food and Civil Supply, Government of Rajasthan, Jaipur) emphasized on equal and timely distribution of available food material. According to her, it will serve as a great solution towards food security.

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