Chapter 15
Bioinformatics Resources for Sustainable Agriculture

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ABSTRACT

Plant breeding and genetic engineering have made significant contributions in improving crops and thus addressing the problem of food security over the last few decades. However, due to continuously growing population, increasing urbanization, environmental pollution, land degradation, and global climate change, food security is still a major concern worldwide. More attention needs to be paid to sustainable crop production for ensuring enough food for current and future generations. Emergences of genomic technologies holds promise for improving crop productivity and provide solutions to the food shortage. Recent advances in high throughput technologies have led to generation of a tremendous amount of genomics data from plants that can be put to a variety of uses. Computational tools are essential to analyze this complex data generated from sequencing of genomes, determine complete set of genes, analyze transcripts and proteins encoded by an organism, and understand their interactions that bring out changes in phenotypes.

INTRODUCTION

Bioinformatics is an interdisciplinary field involving Microarray, Genomics, Proteomics, Protein modeling Bio Grid computing, Molecular biology, system biology, protein ligand docking and structure prediction of macromolecule (Fig-1). Bioinformatics overlaps other areas of research that are designated informatics and computational biology. Informatics has traditionally been a discipline in which mathematicians, computer scientists, statisticians, and engineers develop technologies for supporting information management in fields like health care. Bioinformatics is now involved in these activities by organizing biological data related to genomes with a view to applying this information in agriculture, pharmacology, and other commercial applications.

Figure 1. Role of bioinformatics in various field

In recent years sustainable agriculture has assumed a great significance in face of ever-increasing human population, global climate change and environmental problems (Brown and Funk 2008, Turner *et al.* 2009), newly emerging insect pests, abiotic stress resulting in poor yields etc. It aims at meeting the needs of present generation without eroding the natural resource base of the future generations. Modern agriculture is based on use of synthetic fertilizer and chemical pesticides and has caused enormous damage to land and water bodies. In addition effluents of industries constantly degrade arable land and pollute water bodies. There is loss of biological diversity and erosion of germplasm resources due to monoculture. Genetically modified crops too promote large scale monoculture at expense of diversity. The conventional plant breeding practices may not able to ensure the sustainable production of crop

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