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Environmental Biotechnology Under A Changing Climate

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Environmental biotechnology is when biotechnology is applied to and used to study the natural environment, and could also imply that, one try to harness biological process for commercial uses and exploitation. Environmental biotechnology can simply be described as “the optimal use of nature, in the form of plants, animals, bacteria, fungi and algae, to produce renewable energy, food and nutrients in a synergistic integrated cycle of profit making processes, where the waste of each process becomes the feedstock for another process”.

Biotechnology applications in food security, agriculture and climate change, regarding climate change, the Intergovernmental Panel on Climate Change (IPCC) asserts that on an average, global temperatures will increase worldwide by 0.2 degrees per decade. There will be changes in rainfall regimes representing both an increase and decrease in precipitation, and an increased frequency of droughts and floods will result. Climate change will also have an impact on production losses, which could worsen hunger in developing countries, beyond the current one billion that are going hungry. Many of agricultural resources will become more threatened over time, as global climate change will erode genetic diversity and destabilize food ecosystems, significantly. Under these circumstances, there is a need to improve crops by means of genetic modification, for food safety and to sustain agriculture.

Biotechnological contributions, to crop adaptation to climate change do not only, or even mainly, concern the placement into the crop of one or more genes, from an organism with which the crop could not normally breed (i.e. genetically modified crops). Biotechnological tools focus on providing the ability to directly detect and transfer genes of interest from other plant lines or organisms into the crop of interest, without the continuing need to use the appearance or stress response of the plant (its phenotype), as a proxy for the presence of that gene.

Genes that confer a measure of abiotic stress tolerance can be obtained from germbank collections, wild relatives of the crop, or from other organisms known to perform well under water deficit/excess or high salinity or temperatures. Careful use of the molecular breeding tools have enabled a three to five-fold increase in rice yields and a fivefold increase in the yields of the best maize lines. These materials are being actively disseminated into breeding lines across Asia and Africa now, and just as importantly, they have been passed to commercial seed companies, for the production of superior hybrid lines.

Biotechnology approaches have the potential to enhance crop production under different stress conditions. On the one hand, abiotic stresses are complex in nature; on the other hand, there are several challenges that have restricted the realization of the full potential of using biotechnology approaches in crop breeding, nevertheless, with current and fast emerging technologies such as RNA. Eventually, the adoption of biotech crops to mitigate abiotic stresses, that are expected to increase in frequency and intensity in coming years, will depend on public perceptions and public acceptance, as well as on cultural and institutional processes in developing countries.