Agricultural Biotechnology Services Section Front Page

?Over the centuries, agricultural technology developed a broad spectrum of options for food, feed, and fiber production. In many ways, technology reduces the amount of time we dedicate to basic activities like food production.Agricultural biotechnology, also known as agritech, is an area of agricultural science involving the use of scientific tools and techniques, including genetic engineering, molecular markers, molecular diagnostics, vaccines, and tissue culture, to modify living organisms: plants, animals, and microorganisms.

Application:

Crop plants provide essential food nutrients to humans and livestock, including carbohydrates, lipids, proteins, minerals and vitamins, directly or indirectly. The level and composition of food nutrients vary significantly in different food crops.The development and application of biotechnology offers opportunities and novel possibilities to enhance the nutritional quality of crops, particularly when the necessary genetic variability is not available. agricultural biotechnology has been placed on input traits of crops such as herbicide tolerance, insect resistance and virus resistance, increasing effort and promising proof-of-concept products have been made in output traits including enhancing the nutritional quality of crops since 1990s. Advancements in plant transformation and transgene expression also allow the use of plants as bioreactors to produce a variety of bio-products at large scale and low cost. Many proof-of-concept plant-derived healthcare products have been generated and several commercialized.Embryo rescue: Often when distantly related plant species are hybridized are crossed, the embryos formed following fertilization will be aborted. The development of embryo rescue technology permitted crop breeders to make crosses among distantly related varieties, and then to save the resulting embryos and then grow them into whole plants through tissue culture.Protoplasts are cells that have lost their cell walls. The cell wall can be removed either by mechanical means, or by the action of enzymes. They are left with only a cell membrane surrounding the cell. Protoplasts can be manipulated in many ways that can be used in plant breeding. This includes producing hybrid cells (by means of cell fusion) and using protoplasts to introduce new genes into plant cells, which can then be grown using tissue culture techniques. Building on the above discoveries into the 1980s, advances in the field of molecular biology provided scientists with the potential to purposefully transfer DNA between organisms, whether closely or distantly related. This set the stage for potentially extremely beneficial advancement in crop breeding, but has also been very controversial.Building on the above discoveries into the 1980s, advances in the field of molecular biology provided scientists with the potential to purposefully transfer DNA between organisms, whether closely or distantly related. This set the stage for potentially extremely beneficial advancement in crop breeding, but has also been very controversial. In agricultural biotechnology, changes are made directly to the plant's genome. Once the gene that determines a desirable trait is identified, it can be selected, extracted, and transferred directly into another plant genome. The aim of modern breeders is the same as that of early farmers - to produce superior crops or animals. Conventional breeding, relying on the application of classic genetic principles based on the phenotype or physical characteristics of the organism concerned, has been very successful in introducing desirable traits into crop cultivars or livestock breeds from domesticated or wild relatives or mutants.

Challenges:

Over the past decades, vast tracts of uncultivated land have been converted into production; even so, less than 11% of the world's surface is well suited to agriculture. As the population increases, there will not be enough land available to meet food requirements - finding ways to enable plants to grow on compromised soils is the most effective means available for meeting these growing demands.All organisms have tremendous genetic diversity within their populations; humans learned long ago to use selective breeding to capture this diversity and to enhance desirable traits. These changes were slow initially, but with the advent of modern genetics 100 years ago, their pace accelerated. Considered merely an extension of "conventional" breeding, crops were altered by making random mutations, creating hybrids, culturing tissues and fusing embryos. In the past decade, a new technology - molecular biology - has been applied, sparking concerns where few had been previously raised. As with any technology, there are inherent risks to developing GM food. Genes that are helpful or harmful could be added, and tests need to be in place to determine the consequences. climate change will impose additional stresses to many delicately balanced agro-ecosystems, especially in tropical areas, where significant intensification of biotic and abiotic stresses is expected in the next decades. It threatens to reverse the gains made in the past and to impose severe limitations on future gains the research community could achieve, using conventional methods and tools. Therefore, it is not reasonable to expect that technological progress based on conventional innovation strategies will allow the world to take important leaps toward increasingly safer and sustainable agricultural production systems in a short period of time.

Future: An agricultural robot or agribot is a robot deployed for agricultural purposes. The main area of application of robots in agriculture is at the harvesting stage. Robots like these have many benefits for the agricultural industry, including a higher quality of fresh produce, lower production costs, and a smaller need for manual labor.The farm of the future will involve multiple lightweight, small, autonomous, energy-efficient machines (AgBots) operating collectively to weed, fertilize and control pest and diseases, while collecting vasts amount of data to enable better management decision making.Today, genetic engineering provides a set of new tools for agriculture. In addition to continuing research and development on basic crops, there are also hundreds of potential novel uses for biotechnology being researched across the entire agricultural spectrum—from trees to grass and flowers, mammals, fish, and even insects. Significant research on plant and animal genomics will likely lead to new applications, while marker-assisted breeding may accelerate conventional, non-transgenic animal and plant breeding. Future directions for agricultural biotechnology- Nutritionally enhanced crops and Plant production systems –“Phactories”.

Market Demand:

The increase in demand for good quality food is propelling the demand for transgenic crops. As a response to this, the global market for agricultural biotechnology is experiencing a boost in the market growth. The growing demand for bio-fuels owing to the depletion of traditional resources is also adding to the rise in the global agricultural biotechnology market. On the basis of applications, the global agricultural biotechnology market has been segmented into synthetic biology-enabled products and transgenic crops. In 2012, the transgenic crops segment was identified as the biggest market segment of the global agricultural biotechnology industry. The rise in the demand for food production together with the lack of fertile land is expected to drive the market for transgenic crops.The market for transgenic crops occupies major share in the overall agricultural biotechnology industry as they are largely accepted in developed as well as emerging economies. Corn and soybean are the most common genetically modified crops consumed globally. The rise in demand for animal feed owing to the increased consumption of meat is likely to drive the global industry for agricultural biotechnology for these crops. Soybean is expected to be the fastest growing crop in the coming years. Apart from its consumption as grain, corn is utilized in several industrial applications such as the production of bio-plastics and bio-fuels. Cotton is generally utilized in Asia owing to the high demand from the textile sector.

Synonyms: Agritech