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Biotechnology in Agriculture: Risks and Opportunities for the Rural Poor in Semi-Arid-Tropics

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ABSTRACT In spite of the fact that neediness and nourishment frailty give off an impression of being developed in urban areas as urbanization continues a pace in a large portion of the developing nations, almost seventy percent of meager and sustenance uncertain individuals still dwell in remote areas. Profitability increases are key not only for monetary development, however, also to maintain satisfactory sustenance supplies for the developing world populace. Subsequently, associate quickened open venture is obliged to encourage agronomic development through great yielding resistant accessions to both biotic and abiotic stress by setting agreeable biotechnology innovation, which will benefit the environment as a whole.

INTRODUCTION

The United Nations projected that by 2025 the populace would surpass eight billion (Godfray et al. 2010; Gupta 2011). In a normal year, 73 million individuals will be included every year (Roetter and Van Keulen 2007) and the projection for worldwide sustenance request in the creating nations will be multiplied in the following 50 years. About 1.2 billion individuals live in a condition of supreme neediness (Olinto et al. 2013). Around 800 million individuals are starved and 160 million pre-school adolescents experience the ill effects of malnourishment (Pinstrup-Andersen and Cohen 2000; Townsend 2014).

A large range of individuals conjointly lack iron and vitamin A in their diet resulting in malnutrition (Hurrell and Egli 2010). Nourishment unreliability and lack of healthy sustenance prompts genuine general wellbeing issues and loss of human potential in emerging nations. The fundamental issues since a long time ago confronted by the rustic poor grasp low efficiency, sustenance frailty and poor nourishment. Eventually, the cropland availability is diminishing inside the emerging nations than the advanced nations. For instance, in the year 1990, there is low availability of cropland of about 0.25 in nations like Mexico, Ecuador, Nigeria and Ethiopia than in Egypt, Kenya, Bangladesh, Vietnam and China with 0.10 ha. Sharma (2008) reported that in the year 2025 the land accessibility to cropping in South American nations might fall beneath the usual one, resulting in notable adverse effect on the food security as a whole. Hence, there is a need to implement biotechnological strategy to enhance productivity rate. This paper highlights the use of biotechnology for the improvement of crop yield in eradicating poor productivity, which can result in starvation and poverty, having an adverse effect on the growth of the populace as a whole as well as the various shortcomings.

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Objectives

The main objective of this paper is to provide some highlights on the deployment of biotechnology in combating crop diseases to improve the quality as well as the yield for economic growth of the nations.

OBSERVATIONS AND DISCUSSION

Crop Loss Due to Insect Pests

Most of the low productivity in agriculture is as a result of insect pests, diseases and weeds

(Oerke 2006). Out of the aggregate available yield of 568.7 billion around the world, they produced about an expected loss of US $243.4 billion in 8 noteworthy fixed crops (42%). These insect pest resulted in greatest loss reducing the total yield output of the objective crop (Sharma et al. 2002a). Insect's pests and diseases can possibly bring about 52-85 percent damage to cereal, legumes and cotton (Sharma et al. 2001). Oerke (2006), reported accounted damage by the biotic and abiotic stress components of approximately $15.74 billion in the five mandate crops of the International Crops Research Institute for the Semi-Arid Tropics. In all $3.17, 4.12 and 1.14 billion damages were accountable to insects, diseases and weeds one-to-one (Oliveira et al. 2014). Losses of $2.19, 0.51, 1.15, 1.53 and 3.10 billion of sorghum, pearl millet, pigeon pea, chick pea and groundnut were attributed to biotic pressure respectively (Sharma et al. 2001). In sorghum and pigeon pea, the major loss is as a result of abiotic stress components like dampness stress whereas insects along with weeds remain less prominent than diseases in terms of harms done to pearl millet, groundnut and chickpea (Pinstrup-Andersen and Cohen 2000; Sharma et al. 2002a).

New Innovative Pest Control Techniques

Chemical utilization immensely lessens damage levels accountable to pest, consequently posing an unfriendly impact on the biological creatures, leaving toxic chemical substance in the food and winding up as an ecological contamination. These pesticides are not highly selective, 50 percent of these often reached the non-target crops that are useful to the ecosystem, causing waste of the resources used in acquiring them. Apart from this, an enormous number of insects possessed the resistance ability towards the insecticides employed to eradicate them (Gill and Garg 2014). Maximum numbers of insects/mites showing resistance to pesticides have been recorded in vegetables, followed by those infesting fruit crops, cotton, cereals and ornamentals (Simon 2015). *Helicoverpa armigera* has shown resistance to several groups of insecticides in cotton, tomato, chilies, sunflower, groundnut, pigeon pea and chickpea (Singh et al. 2014). This has brought about across the board disappointment of insect control, prompting amazing obligations and notwithstanding constraining agriculturists to confer suicide (Ambethgar 2009). The cotton whitefly (*Bemisia tabaci*) has indicated imperviousness to pesticide in cotton, brinjal and lady's finger, whereas tobacco caterpillar (*Spodoptera litura*) has been observed to be immune to insecticides on cotton, cauliflower, groundnut and tobacco. Green peach/potato aphid (*Myzus persicae*), cotton aphid (*Aphis gossypii*), mustard aphid (*Lipaphis erysmi*) and diamondback moths (*Plutella xylostella*) have additionally been found to display resistance to insecticides in many plants (Sharma et al. 2001). Advancement of resistance to insecticides sprays has required the utilization of upper measurements of an identical compound or scope of substance applications. It is amid this connection that biotechnological techniques intending to regulate the insect damage each within the advanced and evolving countries is of decent significance (Sharma et al. 2002a).

Genetic Innovation of Resistance Crops

Genetic innovation brought about likelihood of growing totally novel natural pesticides having the upsides of traditional organic control with practically zero impediments (Sharma et al. 2000; Uneke 2007). Furthermore to augmenting the pool of supportive genes, gene-splicing allows the usage of numerous attractive genes in an exceedingly single occasion and decreases the opportunity to introgress novel genes into elite foundation (Eakin et al. 2014; Mugo et al. 2013). Biotechnology has given numerous open doors which include: access to novel molecules, capability to change the measure of quality of gene expression, ability to shift the expression pattern of genes and create transgenic with totally distinctive insecticidal gene qualities (Sharma et al. 2000). In the some crop plants like maize, cotton, potato, tobacco, rice, broccoli, lettuce, walnuts, apples, alfalfa and soybean genes resistance to insect have been incorporated to enhance high yield in these crops (James 2003). In the year 1999, the transgenic crops increased immeasurably to 39.5 million ha from 1.7 million ha of the year 1996 in their growing areas (Eakin et al. 2014; Mugo et al. 2013). In 1997, transgenic products were completely developed in twelve nations and the greater part of the area planted with genetically improve crops were in only five advanced nations namely: Australia, Canada,

Argentina, China and United States which have up to 80 percent crops nationwide (James 2003). A portion of the emerging nations are experiencing the exploration on transgenic edits adroitly.

The preparation of transgenic plants with resistant genes qualities for insect management can prompt a lessening in insect powder sprays, enhanced action of normal adversaries and integrated pest management of minor pest. At the International Crops Analysis Institute for the Semi-Arid-Tropics numerous harvests were assessed based on their natural effectiveness against the sorghum shoot fly (*Atherigona soccata*), saw stem borer (*Chilo partellus*), tobacco caterpillar (*Spodoptera litura*) and tomato fruitworm or legume pod borer (*Helicoverpa armigera*) which are real yield pests in the semiarid tropics (Sharma et al. 2000). New innovation can be employed changing the genetic constitution of plants to resist the antagonist (insect and diseases), enhance adjustment of totally diverse abiotic pressure and biological production process (Mugo et al. 2013). Such an attempt can play a serious part in reducing the insect related damages and expansion crop generation and accordingly enhancing the standard of life for the provincial poor (Sharma et al. 2000).

Transgenic Crops and the Environment

In the construction and disposition of transgenic crops for insect control, various natural and financial issues should be tended to. The most critical belief is that of the prompt decrease within the quantity of chemical used for pest management. The quantity of synthetic chemical applications on a harvest, differs with large splashes of the potion falling on main pest, for example, *Helicoverpa armigera* on cotton plant. On the off chance that the transgenic products are presented, the amount of pesticide utilized apparently to be diminished by two third to half of the ordinary amount utilized for non-transgenic crop (Gouse et al. 2008). Since the introduction of the transgenic crops, many issues have to be considered. The improvement of resistance ability of the crop to target pest that would probably result in new biotypes. The expression of resistant genes as well as the overcoming of their restriction, in order not to affect non target organisms that may be beneficiary to the environment. Also, the sensitivity of the target insect of the transgenic crops and the prevention of the gene from being wiped out to the environment with time. This is paramount to the development and introduction of the transgenic crops for better control of pest affecting major crops for better yield and productivity which in turn can resolve starvation in the populace.

Strategies for Deployment of Transgenic Plants

The integrated pest management philosophy is being employed in the deployment of transgenic plants instead of using only one gene construct (Sharma et al. 2001). For more efficient management strategies, alternative mortality variables, diminishment of selection pressure and monitor populaces are put into consideration (Uneke 2007). Keeping in mind the end goal to expand the adequacy and convenience of transgenic plants, it is of great paramount to build up a procedure for reduction of the ability to resist pest population to objective genes through resistance management, gene deployment and gene pyramiding, regulation of gene expression, development of synthetics, devastation of persist populace and substitute hosts, assuming of integrated pest management strategies from the earliest starting point (Pinstrup-Andersen and Cohen 2000; Sharma and Ortiz 2000; Sharma et al. 2001).

Opportunities Offered By Biotechnology

It gives rise to numerous prospective advantages to the less privileged people of emerging growing nations. New innovation could assist to accomplish the profitability increases expected to nourish developing populace, impact ability of resisting insect pests and any other factor causing great damage to crop planted, enhance healthful esteem and also to improve items amid reaping toughness/dispatching (Sharma et al. 2001). New plant hybrids and biocontrol agents may diminish reliance on pesticides in this manner diminishing agriculturists' yield insurance costs and benefitting both the environment and general wellbeing (Phillips 2012). Exploration on genomic change give rise to proper weed management, expanding ranch earnings alongside with efficient time management, giving room to the female agriculturists having enough time for taking good care of their children rather than weeding (Sharma et al. 2001). Biotechnology would in likewise manner offer fiscally financial-

ly savvy answers for lack of healthy sustenance. Remarkable exploration of new innovation technology enhances efficient farm input resulting in prompt improved harvests. This innovation has helped in the production of improved cereal (Nitrogen Efficient Cereal) possessing the ability to trap atmospheric nitrogen for plant nourishment, assisting the meagre farmers who lack technical know of integrating novel gene in local varieties (Sharma et al. 2001). The confirmation on these issues is still uncertain and warrants cautious checking before the transgenic products are sent on a huge scale by the subsistence agriculturists (Phillips 2012). The danger of cutting edge biotechnology for creating nations is that innovative improvement may sidestep poor agriculturists due to absence of edified appropriation. It is not that biotechnology is unessential, it rather examines necessities to focus on the issues of little agriculturists in creating nations (Sharma et al. 2001). Private sector research is unlikely to take on such a focus, given the lack of future profits. Without a stronger public sector role, a form of scientific apartheid may develop in which cutting edge science becomes oriented exclusively towards industrial countries and large scale farming (Pinstrup-Andersen and Cohen 2000).

Risk in the Deployment of Transgenic Plants

The guarantee of biotechnology for expanding the efficiency of harvests has been darkened by the inborn security of the transgenic life forms and advancement of resistance strains of insects (Anderson and Cuthbertson 2014). In the advanced nations, biotechnology is seen to be of vital significance for expanding the offer of the world business sector (Kumar and Siddharthan 2013). However, there is a serious concern about the presentation of this innovation in a few nations (Ghasemi et al. 2013). Genetically adjusted living beings have a superior consistency of quality gene expression than the ordinary breeding strategies and transgenic are not reasonably unique in relation to the utilization of natural gene qualities or creatures altered by routine advances (Shelton and Zhao 2002).

Hence, the focus on biosafety regulations needs to be on safety, quality and efficiency (Sharma et al. 2002b). The need and degree of wellbeing assessment might be found on the examination of the new nourishment and undifferentiated from sustenance, assuming any. In connection to nature, one needs to take a gander at the cooperation of the transgene with the environment. The capability of recombinant innovations permits a more noteworthy alteration that is conceivable with the traditional advancements (Sharma et al. 2002a).

In most of the emerging nations, there is no framework set up to manage the generation and utilization of genetically modified creatures (Jaffe 2004). The administration, elucidation and usage of data will be a critical segment of danger appraisal and decide the adequacy of unwavering quality of their innovation. For evaluating the danger of genetically modified crops, there is a requirement for general data on association and individuals included, DNA donor and the accepting species, states of discharge, control, checking and waste treatment, interactions between transgenic plants and the environment, control, monitoring and waste treatment (Sharma et al. 2002b; Shelton and Zhao 2002).

CONCLUSION

There are lots of risks in the employment of biotechnology for alleviation of poverty in the semi-arid region. Irrespective of these shortcomings biotechnology still stand out in resolving the world problem of malnutrition with the use of different biotechnological strategy. The production of resistant crop to major insect pest can be a threat to agricultural productivity, thereby improving yield and quality of the produce.

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