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Concept Paper

Biotechnology and information technology in agriculture

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ABSTRACT

Science-based agricultural tools hold great promise for tackling the world's growing population and food demands. From improved seeds to modern crop protection solutions, to mobile technology for farmers in the fields, to make foods fresher, safer and healthier along the food chain the agricultural and food system of the future can be more productive, more sustainable, more efficient and more interconnected. Greater investment and broader adoption of science and technology can enable the world to meet the growing demand for food as the population increases by improving the livelihoods of farmers and their families by producing more and higher quality crops for a growing population, enhancing the nutritional value and safety of food to improve the health and wellbeing of people around the world and contributing to agricultural sustainability through reduced resource use.

Keywords: Technology; agbiotech; infotech; science; agriculture; food; sustainability

INTRODUCTION

The development and dissemination of new technology is an important factor determining the future of agriculture. Agriculture has always been in a transformation mode. For millennia human beings have been engaged in improving the crops and animals they raise. The painfully slow process accelerated in the last 150 years or so with scientists helping development and refinement of techniques of selection and breeding (Agarwal 2002).

Conventional selection and breeding are time consuming and bear technical limitations. Similarly agricultural marketing too has been evolving over the centuries. Markets have been expanding and would continue to do so with rising incomes and population growth. With advantages in communication and transportation, in storage and preservation farm produce marketing today is considerably more scientific than it used to be.

In recent years the growth rates of world agricultural production and crop yields have slowed raising fears that the world may not be able to grow enough food and other commodities to meet the needs

of the future population. There are still areas in the world with shortages of land or water or with particular problems of soil and climate. More often these are areas with a high concentration of poor people facing threat to food insecurity. Technology can play a critical role in addressing the issues relating to food production, processing and marketing while ensuring that the benefits are more equitably spread (Satyanarayana 2004).

Affordable technologies

A revolution in agriculture technology is the need of the times. Although productivity increase is vital, environmental protection is equally important. Technologies must be both affordable and geared up to the needs of the poor and undernourished people. In future farming as an activity largely for the developed world and livelihood for many in the developed regions will be at once more knowledge intensive and productive in more sustainable ways.

As a factor in farm and rural development infusion of two apparently disparate technologies viz agricultural biotechnology (agbiotech) and information technology (infotech) are expected to catalyse progressive changes. Agbiotech and infotech together are helping create new tools to attack the problems of rural poverty, generate employment and incomes by helping enhancement of farm productivity and production, improve quality and explore marketing and income generating opportunities in newer ways. Agbiotech offers considerable promise as a means of improving food security and reducing pressures on the environment (Chaturvedi 1999).

Genetically modified (GM) crops

GM crop varieties such as those resistant to drought, water logging, soil acidity, salinity and extreme temperatures could help to sustain farming in marginal areas and to restore degraded land to production. Pest resistant varieties can reduce the need for harmful pesticides that can pollute the environment. The technology is also capable of delivering health benefits to consumers by helping produce crops with superior quality characteristics and nutrition levels. However potential concerns and risks cannot be ignored. Issues of biosafety especially food safety and environmental impact of agbiotech have to be adequately addressed without which widespread use of this technology may not materialize (Bruhn 1992, Anon 1999).

The risk and benefits may vary from one product to another and these are often perceived differently in different countries. To reap the full potential of this technology, scientists argue that appropriate policies must be developed to ensure that the potential risks are accurately diagnosed and necessarily avoided (Anon 1993, Ghosh 1997).

The debate between sound science and precautionary principle should form the basis of adaptation of GM technology is far from over. Fortunately the spread of GM varieties in developed countries in recent years and absence of any notable and documented negative consequences have helped address some of the concerns. However improved testing and safety protocols have to be an ongoing process. It is worth recounting that subsidies and technologies together have revolutionized farming in developed economies over the last ten years or so.

Huge farm support agricultural subsidies of Organisation for Economic Cooperation and Development (OECD) countries are in excess of $300 billion a year and account for 1.3 per cent of OECD GDP that has meant a massive increase in production without of course any serious concerns for costs and consequences. However there is a limit to raise output and yields with more and more payment. Since the mid 1990s introduction of GM crops mainly in cotton, soyabean and corn has helped countries produce more and reduce crop losses arising out of biotic stresses (mainly pest attack). Is agbiotech scale neutral or location neutral? Doubt persists. Developed countries such as US have their rationale or compulsion to develop, adopt and promote GM technology (Doyle and Persley 1996).

Cutting down on losses

Large farms, low level of labour input, mechanization and intensive cultivation meant that incremental costs of raising yields would be greater than the value of incremental output. GM technology helps cut losses (for instance, BT cotton seed repels bollworm attack) and thus reduce costs. However conditions in developing countries are vastly different. Fragmental landholding, low level of input usage, antiquated agronomic practices, lack of irrigation all combine to make output unsteady, quality suspect and prices volatile (Visalakshi and Sandhya 2000).

As opposed to agribusiness in developed economies for farmers in developing countries agriculture is a livelihood issue. This is not to argue that GM technology is inappropriate for developing countries far from it. The technology has delivered. It has to be adopted and disseminated in a way that resource poor farmers in agrarian economies benefit from it. It is necessary that institutional reforms precede a strict regulatory regime that seeks to protect the interest in all stakeholders even while ensuring food and environmental safety is called for (Sadananda 2002).

It is important to recognize that GM technology is not a magic bullet. It cannot solve all the problems confronting agriculture. Other necessary conditions have to be in place and fulfilled to obtain best

results from adoption of this technology. Meanwhile other promising technologies have emerged. These combine increased production with improved environmental protection. No-till or conservation agriculture, the lower input approaches of integrated pest management or nutrient management and organic agriculture are some of them. Complex scientists assert that no till or conservation agriculture can raise crop yields by 20 to 50 per cent. While yields are more stable resilient against drought improves and labour and fuel costs are lower. However management is more complex (Qaim 2009).

If agbiotech can help address production related issues, infotech is capable of allowing farmers and other stakeholders to take informed decisions about what and how to grow as also when and how to market. It could be effectively used to find end to end solutions to the problems of agricultural sector beginning from land records and input supplies. Infotech can help deliver sensitive price and market information to growers and others in addition to delivering marketing, financial and technical advice. It can enable more scientific supply chain management. Thus e-agriculture is emerging as a promising 'change agent' that encompasses the agricultural value chain through the application of the internet and related technologies. It helps policymakers and others to be more responsive to the specific needs of the rural communities in general and farmers in particular. No wonder several cooperates have established backward linkages and are utilizing information and communication technologies to network with farmers and other stakeholders.

Limitations in IT

It must however be emphasized that IT is but a tool and as such helps stakeholders take informed decisions. It cannot become a stand-alone tool to enhance production, raise yields and improve quality. Its utility increases when deployed with other necessary conditions that foster agriculture. Initiatives of the government and the private sector in the country are beginning to make a difference in Indian agriculture.

One key initiative of the government is to use IT to link over 7000 Mandis or marketing yards spread across the country. India is in the forefront of IT while steady advances are visible in agbiotech area. Leveraging the country's inherent strengths in these two frontier technologies may well be the key to sustained growth in agriculture and rural prosperity.

CONCLUSION

As with any crisis of our time, hunger and malnutrition will require the efforts of all stakeholders. Through increased collaboration and partnerships

we can leverage the resources, expertise and tools of the collective whole. The Green Revolution demonstrated the potential for science to bring countries from famine to a surplus of food. We must again embrace collective innovation to achieve food and nutrition security (Aslam 1993). We will need to support the full array of innovative solutions that are available to farmers to meet global food demand.

REFERENCES

Agarwal S 2002., Technology development and transfer at grassroots level. Kurukshetra **50(5):** 8-9.

Anonymous 1993. Genetically engineered foods, fears and facts: FDA. Consumer **27(1):** 11-14.

Anonymous 1999. Applications of biotechnology to crops: benefits and risks. Issue Paper # 12, Council for Agricultural Science and Technology, India.

Aslam M 1993. Integrated rural development in Asia: concept, practice and perspective. Manohar Publishers and Distributors, New Delhi, India.

Bruhn CM 1992. Consumer concerns and educational strategies: focus on biotechnology. Food Technology **46(3):** 80-102.

Chaturvedi S 1999. The Asian biotechnology market: emerging investment trends. AgBiotechNet **1:** 1-4.

Doyle JJ and Persley GJ 1996. Enabling the safe use of biotechnology: principles and practice. Environmentally Sustainable Development Studies and Monograph Series 10, World Bank Washington, DC, pp 29-42.

Ghosh PK 1997. Genetically engineered plants in Indian agriculture. Journal of National Botanical Society **51:** 11-32.

Qaim M 2009. The economics of genetically modified crops. Annual Review of Resource Economics **1:** 665-693.

Sadananda AR 2002. Agricultural biotechnology – an industry perspective. Paper presented, International Conference on Biotechnology and Development: Challenges and Opportunities for the Asian Region, RIS, New Delhi, India.

Satyanarayana J 2004. E-Government: the science of the possible. Prentice-Hall of India Pvt Ltd, New Delhi, India.

Visalakshi S and Sandhya GD 2000. R & D in pharma industry in context of biotech commercialization. Economic and Political Weekly **35(48):** 4223-4233.

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