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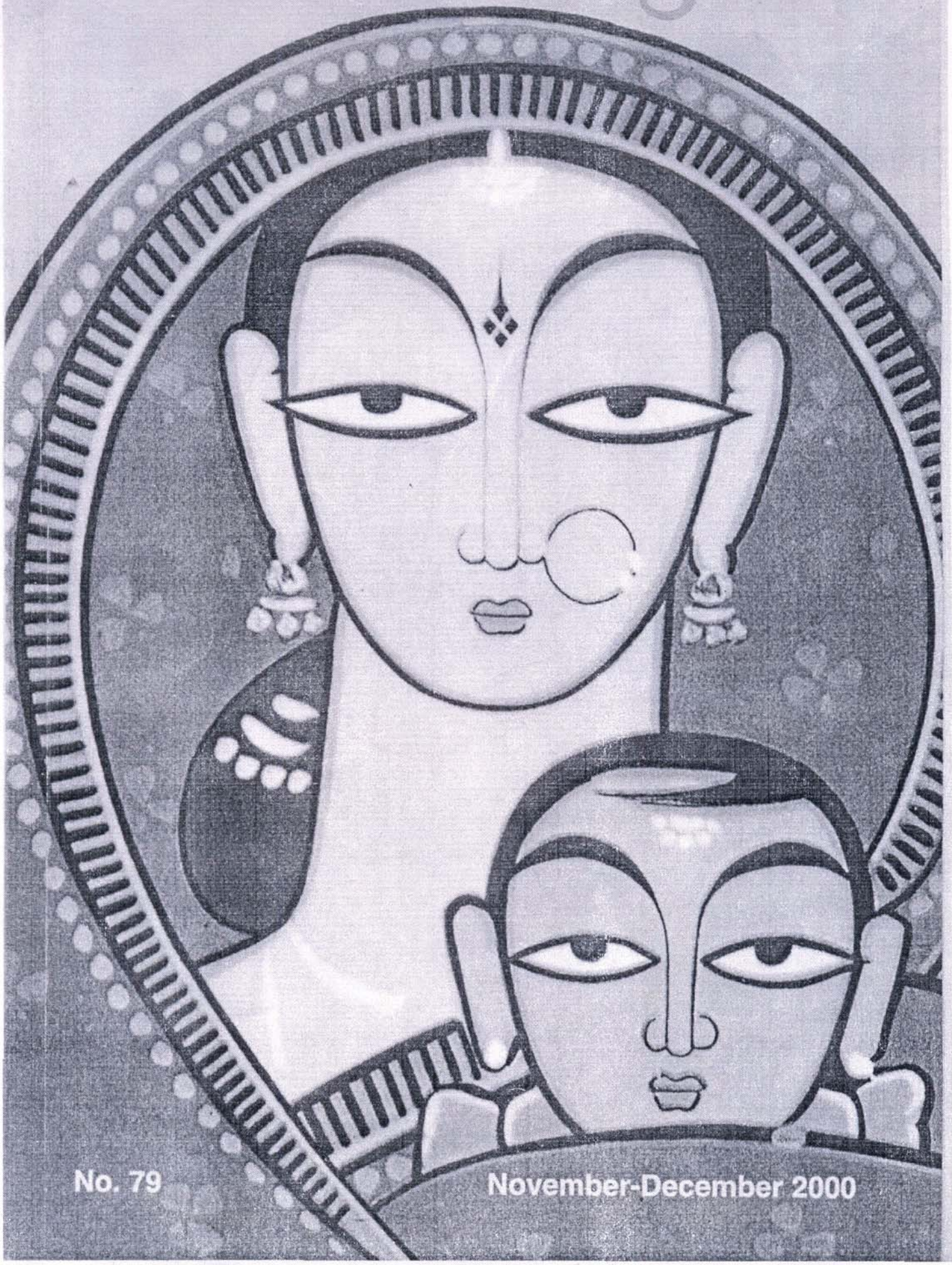

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Genetically Modified Crops and India

by

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Genetically modified foods have the potential to help overcome the growing problem of food shortages and malnutrition in developing countries.

However, it is essential that their safety to health and the environment is assured.

Dr. P. K. Ghosh argues that India should keep these issues in mind while taking advantage of biotechnology with the help of international organisations and agreements.

All crop plants are complex life forms, each containing thousands of genes. Our knowledge base on this subject is growing, starting from the sequencing of genes in a genome to finding the functional relationships among them. Such knowledge is not expected to be profound for another two or three decades.

Presently, genetically modified (GM) plants used in commercial agriculture are linked with traits of one or two transgenes. The advantages or defects of such single controlled genes are understood remarkably well and fast. These crops include one or more properties such as herbicide, insect and microbial disease tolerance or nutritional quality improvement. The development of plants resistant to salinity, alkalinity or drought is still in the research stage.

GM plants so far released have been able to reduce the cost of production of crops as also simplified agricultural practices. In the USA, the use of Bt plants has, for example, considerably reduced the consumption of chemical pesticides and our limited experience in India bears this out.

The safety or otherwise of a GM plant to human health and the environment can be determined by a case-by-case analysis. This will include a study of the implications of pollen escape, an assessment of aggressiveness properties and weediness traits, and effects of the trans-genes on non-target organisms. Food safety issues similarly require much analysis from different points of view.

Since 1996, countries have been working to develop a biosafety protocol for the transboundary movement of genetically modified organisms (GMOs). The Cartagena Protocol on Biosafety, which was adopted in Montreal on 29 January, 2000, is applicable to all kinds of GMOs, which have been described as Living Modified Organisms (LMOs) in the Protocol.

The objectives of the Protocol are "to contribute to ensuring an adequate level of protection in the field of the safe transfer,

handling and use of living modified organisms resulting from modern biotechnology that may have adverse effects on the conservation and sustainable use of biological diversity, taking into account risks to human health, and specifically focussing on transboundary movements."

Although the Protocol is applicable to all kinds of GMOs including those used in the drugs and pharmaceuticals industry, environment management projects etc., it is currently sharply focussed on the use of GMOs for agriculture and for the food industry. This is because the world population is increasing very fast and the food security situation in developing countries is far from satisfactory.

Genetically modified crops can contribute significantly to increase productivity and enhance the nutritional quality of crops

Moreover, everyone has to have food every day. Food comes from agriculture. Food served must be safe. Safe food must be available at low prices in a sustainable manner. Whether GM food from agriculture can fulfill these objectives are the questions the world community is looking answers for.

Approximately 800 million people all over the world are presently suffering from mal-nutrition. The population of India alone crossed the one billion mark in May, 2000, and is expected to touch 1162 million in 2010 and 1600 million in 2050.

A large proportion of the present population is under-nourished, and the poor among them do not get adequate nutrients and vitamins in their diet. Of the various factors that can improve the present status of the people of India and in developing countries, the adoption of GM crops in Indian agriculture, for increasing crop productivity and enhancing nutritional quality, is expected to contribute significantly.

Indian agriculture is one of the largest in the world, but its productivity is one of the lowest. Rice and groundnut yields in India are less than half the yields obtained in China. Even in wheat and cotton, which are major crops, Indian yields are only

two-thirds of the average of China for wheat and one third for cotton.

In molecular medicine where global progress has been very high, India has made only a beginning by producing viral hepatitis B vaccine, while all other bioactive molecules (presently 11 in number such as insulin) are imported. Consequently these are very expensive and not within the reach of the common man. Indian capabilities for developing GMOs for different uses and for improving the polluted environment are yet inadequate.

Countries like India would have to invest heavily in research to attain this capability and if it did not sign the protocol that eases the free flow of GMO technologies across the globe, the impediments would be further compounded. The importing member countries could also have further information on products of GMOs through the biosafety clearing house mechanism. Further, exporting parties would have to conduct an elaborate risk assessment and members of the protocol would be entitled to have access to this information.

If importing countries are not satisfied with the risk assessment information so provided they could invoke *the precautionary principle,* and conduct further trials locally. This does not come in conflict with the provisions of the WTO and be seen as trade barriers.

This is because according to the Vienna Convention, the Protocol of Biosafety takes precedence over the provisions of WTO which was enacted earlier. As such, the importing country can conduct scientific evaluation of risks on its territory, and can stop the entry of these GMOs into its territory until it is satisfied about their safety. The protocol also provides for capacity-building for countries in terms of infrastructure, training and exposure to various facets of this new technology.

Though Indian domestic regulation adequately safeguards

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India and Genetically Modified Crops

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the risks from the use of GMOs and products thereof, domestic research is yet to catch up with international advancements. This protocol provides a better opportunity to have access to GMOs through a rationally developed international agreement, to which every country will have to show equal respect.

Issues on food security, livelihood security and access to molecular medicine for better health that are linked with the use of GMO technologies can be addressed more rationally by countries that are parties to protocol through information sharing.

India has great potential to use this technology to address the issues of food security and health. It has a rich store of genetic biodiversity as also skilled technological manpower. Consequently, in order to harness the benefits from GMO technologies it would be advantageous to sign the protocol, which has been signed - till 26 May, 2000 - by sixty-eight countries.

The implementation of the Protocol is contingent on the establishment of four structures in every Member Country, namely, a legal provision that deals with GMOs; a Biosafety Clearing House Authority; a federal structure within countries with a focal point for handling the issues related to GMOs; and technical competence for carrying out environmental safety and human food safety evaluation of GMOs.

India already has a sound legal structure in place as also a federal structure that inter-connects the Central and the State Governments reasonably well. It needs to create its Biosafety Clearing House Authority for which also a structure and competence are in place.

The capability of assessment of environmental safety issues is however low in India. But this can be enhanced by identifying specific institutes for this purpose and by strengthening them in infrastructure and skills. Further, although capabilities exist for the assessment of human health safety, the structure needs to be offi-

cially identified and activated.

The present structure is a make-shift arrangement of getting specific evaluations carried out piecemeal. At least one Central Institute with core competence needs to be created that can address most of the food/feed safety questions of GMOs.

By attentive and intelligent restructuring of the existing facilities and set-ups India could be in an advantageous position compared to many other countries to obtain benefits from this Protocol.

Research in developing countries enables them to acquire competence in transforming plants into transgenic ones, as most of the transgenic traits presently being used commercially are the property of a handful of multinational companies. For example, the Bt-gene inserted into cotton plants, has what is known as a promoter sequence, known as 35S promoter, and a gene sequence [known as Cry 1 A(c)] which are the patented properties of MONSANTO and the patent is valid upto 2009 AD.

In India these are not patented, as our law does not permit this. Indian exports for commodities produced by any organisation (other than MONSANTO or its consented party) by using say 35S promoter, can be forbidden in USA by MONSANTO. Interestingly, 35S promoter is widely used by Indian researchers for developing new plant cultivars, but all of them could be debarred from commercial use for exports to countries where 35S promoter is protected.

In many situations genetic constructs are available to public sector outfit for research purposes only. This helps to find if the transformed plant that is native to a country, can become more useful by virtue of the incorporation of the transgenes. But in fact, it does not help the public sector research in its efforts towards commercialisation, as authorisation for this is required from the owner of the genetic construct.

Efforts therefore should be made to enable the use of genetic constructs freely or with terms that benefit all partners. This can be achieved at the time when material transfer agreements are signed by the recipient public sector undertakings with the provider of the genetic constructs. The existing seeds and propagating materials of the country used in agriculture are the genetic resources that belong to India and laws commensurate with such rights are being enacted under the provisions of the Convention on Biological Diversity by the Ministry of

Environment and Forests.

Invented genetic constructs that are protected need to be inserted into the seeds and propagating materials to derive benefits of the constructs as they themselves do not have any value in isolation. It should be possible to negotiate obtaining free use of such genetic constructs by utilising the advantages of sovereign rights of the large store of genetic resources (seeds and propagating materials) that belong to India and will be protected under laws under enactment.

There is also a need to intensify research in the public sector for crops that are used as staples and hence required by most Indians so that they can be grown more efficiently by the use of genetic engineering technology. This would dispel the fear from the minds of the public that this powerful technology is going to be controlled substantially by the multi-national companies (MNCs).

With its rich store of genetic bio-diversity and skilled manpower, India has great potential to use this technology to address issues of food security and health.

Public sector research in rice, wheat, potato, peas, pulses, maize as well as mustard and cotton has been intensified in India, but more needs to be done and more funds need to be diverted towards genetic engineering research. Interestingly, since most of the staple crops such as rice, wheat, soybean, and pulses are self-pollinated crops, stable varieties developed can be used by farmers for several years in cultivation by saving seeds from their own cultivation. In these areas, MNCs have less interest, as the probability of repeat selling of seeds is lower.

In this context, the research efforts of international organisations like the International Rice Research Institute, the Rockefeller Foundation, the International Crops Research Institute for the Semi-Arid Tropics etc. should be utilised by developing countries, including India, to catch up with the research efforts of powerful MNCs. The research results of many of these organisations are available at very reasonable terms for exploitation. However, there is no short cut to capacity building, as without core competence in place, such technologies cannot be gainfully exploited.

Public awareness of environmental and food safety of GM crops is also extremely important as, without public confidence, these products are not going to be accepted. This includes conscious opinion-makers, politicians, bureaucrats, vocal NGOs as well as passive citizens that would be using them. Dissemination of correct information to the public is a very important issue for the acceptance of the GM technology by society.

There has not yet been any new invention that is without any risk. The technologically powerful world of today is far better than what it used to be. On GM plants, the world is passing through the problems of pioneers.

From our limited field experience the world would do well if it would venture to examine and assess the technology, and move forward on the precautionary principle. This technology will do good to everyone but is more appropriate to the needs of developing countries, including India, to provide more food and to clothe more bodies in an emerging natural environment that is expected to be not only sustainable, but also cleaner.

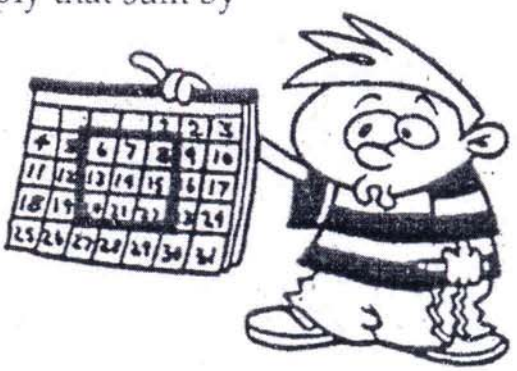
(Dr. P. K. Ghosh has been, since 1996, the Government of India's representative on the UNEP working group for framing the Cartagena Protocol on Global Biosafety. His research work on nanoparticle technology has earned him a U.S. patent. He is a fellow of the Royal Society of Chemistry, U. K.)

• MATH-A-RAMA

COOL CALENDAR TRICK!

Draw a box around a block of nine dates on a calendar. Add eight to the smallest number in the box and then multiply that sum by nine. What do you get?

Now try adding up all the numbers in the box. The answers should be the same!



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