NEWSLETTER

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Editorial

Biotechnology is an innovative technology, which offers many possibilities for development and application. The advancement of biotechnology has the potential to enable better outcomes for our society specially health, the environment and for industrial, agricultural and energy production. Successful capture of these will provide significant opportunities for sustainable growth that meets the economic, environmental and societal needs of our countries. One of the highlights during the last World Summit at South Africa was the Science Forum Workshop on the role of Biotechnology and Biodiversity in Sustainable Development. It aimed towards partnerships for sustainable development between governmental, nongovernmental and public sectors. Biotechnology applied in industrial products and processes brings significant environmental as well as economic benefits towards sustainable development. It is also necessary to develop science and infrastructure that will help to determine the long-term contribution that biotechnology can make to sustainable growth and development in developing countries like India.

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Biodiversity and Biotechnology in India

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Introduction:

India is one of the world's most biologically and culturally diverse country. The status of India's biodiversity, discussing several key development priorities. It shows how these could be addressed through wider use and industrial applications of genetic resources specifically biotechnology and increased trade in products derived from them. The country's present scientific and technological capacities in the public and private sectors as well as the community level in this context agreed obligations to reduce the barriers. The Government is encouraging national firms to increase their participation in foreign trade including science based industries, such as pharmaceuticals and biotechnology. The aim is to ascertain the types of high value biodiversity based goods and services in which Indian companies enjoy competitive advantages in international markets or could with the right institutional structures in place. The food/agriculture and healthcare industries have more importance in markets in products from other industrial sectors. It also to be needed to assess the prevailing policy and legal frameworks that seek to increase India's bio-scientific technological and other capacities to exploit the commercial potential of its biodiversity while conserving its resource base.

The biodiversity status of India:

India is one of the world's 'mega diversity' country, coming 9th in the world in terms of higher plant species richness (Table-1). At the ecosystem level, India is also well endowed, with ten distinct biogeography zones. It also contains two of the world's 25 biodiversity hotspots, so called because of their extraordinary high levels of species–richness, endemicity and threatened status.

India is considered to be the center of origin for the following crop species; pigeon pea, egg plant, cucumber and possibly cotton and sesame. But for millennia, numerous other crop species have been introduced to India and adapted to localized conditions. As a consequence of both the diversity of these conditions and of the various ethnic populations living in India, the country has become an important center of diversity of a great many domesticated species, including various cereals, millets, legume, vegetables, temperate and tropical fruits, fiber crops, medicinal and aromatic plant.

But India's biodiversity is threatened by the destruction and degradation of ecosystems, and by overexploitation of species. More specifically the threats are due to large-scale development projects such as mining, dam and road construction. Conversion of biodiversity-rich ecosystems such as tropical forests to farmlands, industrial & residential sites is also main cause of biodiversity loss**.** Some other reasons are poaching of wildlife and over-harvesting forest products. Of particular seriousness is the loss of agro-biodiversity. Although the causes are various, this situation is due to primarily to the replacement of low-input polycultural agricultural systems with higher-input monoculture.

Biodiversity and India's Development priorities:

Biodiversity is important for all socioeconomic sectors of the population. Above all it offers great subsistence value to rural communities, which can benefit in many different ways from having a wide range of species to exploit. Many such communities play a major role in maintaining biodiversity and some may have increase diversity. They tend to be an integral part of the ecosystem, since they interact so closely with the local biota.

Science based industrial use of biodiversity creates employment, increasing the demand for scientifically–trained personal. Industrial use of biodiversity should also improve India's trade balance by increasing exports of high value products and technologies, by reducing imports of these, or both. However such commercialization of biogenic resources should not be at the expense of poor rural communities living in areas where the resources were found and who may have played a role in their discovery.

Food security:

India's nutrition problem is not so much one of lack of food grains at the national level, but as a lack of adequate access to food. India is self-sufficient in terms of the quantity of food produced. But food prices are

low enough for the urban poor to afford, while at the same time enabling farmers to secure sufficient incomes minimally to cover their costs. Achieving an optional balance so that both are achieved is highly difficult.

While several intellectual and activists have condemned biotechnology and argued that the results of scientific plant breeding in India have more often jeopardized food security than improved it, science based research can contribute to food security by increasing yields, reducing water usage, extensive and possibly dangerous chemical input requirements, and lengthening the self life of perishable foods so that they reach distant markets without rotting. A frequently raised development concern is that when agriculture becomes oriented more towards international markets, non-food cash crops are emphasized at the expense of subsistence food crops for local and domestic consumption.

Public health care provision:

Biodiversity is extremely relevant to health. The vast majority of Indians depend for their health care needs upon folk and classical Indian remedies based largely on plants, other biological material and minerals. Only about 30 percent of Indians have access to pharmaceuticals. Of the 25,000 plant species that exist in the Indian Subcontinent, as many as 8,000 are used as medicinally. In addition, using natural products in traditional health systems, compounds with undiscovered therapeutic applications are bound to exist, given the huge diversities of plants and micro-organisms.

Environmental sustainability:

India, having second largest population, will need to meet the needs of this enormous population without severely polluting the environment or depleting scarce natural resources. Greater industrial utilization of the country's biodiversity with the help of biotechnology may become a force for environmental sustainability. The biogenetic resources have potential economic value that cannot be realized as long as the reckless destruction of biodiversity goes on.

The national system of conservation:

Biodiversity management consists of three types of activity: surveying and characterizing biodiversity, regulating its protection and ensuring its sustainable utilization. National system of conservation consists of ex-situ conservation bodies, R & D organizations, human resource institutions, in-situ situation as well as norms, regulation and laws which determine their roles and seek to ensure they operate effectively. With respect to in-situ conservations. India has a large protected area comprising 4.2 percent of natural territory. The country also has a well developed network of gene banks, as well as botanical and zoological gardens for ex situ conservation. To fill the policy and regulatory gaps, the MoEF developed National Biodiversity Strategy and Action Plan (NBSAP) and drafted a legislation that was passed in 2002 as Biodiversity Act. This act constitutes a National Biodiversity Authority (NBA). The NBA is empowered to grant or refuse to access biological resources for research purpose or commercial use.

India's Bio-scientific and Technological capacities:

India is one of the most advanced countries in terms of scientific capabilities, including the life sciences and also in terms of scientific and technological development. Regarding biotechnology, India has research capabilities in a broad range of biotechnologies and biotechnological applications including industrial biotechnology, medicinal biotechnology, microbial biotechnology, plant molecular biology and agricultural biotechnology, biological pest control, aquaculture and marine biotechnology, animal biotechnology etc. In consequence of India's high standing compared to most other developing countries and the achievements made so far, there is optimisms within and outside the government that India is fully capable of harnessing its biodiversity to alleviate poverty, to create prosperity by expanding trade in high value products, and to improve the health of its population.

The application of biotechnology on a sustainable basis to utilize India's natural resources can convert the biodiversity into economic wealth for the country. Also it is argued that India's strength in second generation biotechnologies like fermentation and tissue culture provides a firm foundation for better exploitation of India's biological wealth.

Some of the biotechnology products and processes that had been commercialized by 1992 shown in Table-2. It also clearly illustrates the major role of public sector institutions such as the National Chemical

laboratory and National Institute of Immunology in their development. Since 1992 more biotech products have gone on the market in India, including two bio-pesticides manufactured by processes patented by Anna University in Madras.

Food and agricultural sciences:

In India, high proportion of the population depends on agricultural systems oriented towards staple foods. However during the first half of the 1990's, a shift occurred towards cultivation of non-staple crops. The wider applications of agro biotechnology satisfy the needs of general farmers, commercial farmers producing food for domestic consumers and export-oriented cultivars. India's agro biotechnology capabilities are quite substantial as compared to most other developing countries indicated by some experts. India has lots of experiences in research dating back to colonial era, maximum carried by public sector, mainly on hybrids.

Agro technology is applied not only to R & D but is also utilized in the production of explorable products. There are growing number of tissue culture companies producing ornamental plants and flowers having set up of biotechnology departments where tissue culture technologies are being applied to a large number of indoor and commercial plants. Life science industry focus on very extensive research aimed at integrating different types of product into new packages (such as herbicide resistant GM seeds with associated herbicides) required them to sell worldwide to cover their substantial R&D expenditures.

However private sectors should focus much of its R&D resources on applications that benefit small farmers. Technologies are not only tools but also instruments of power and control. The new biotechnologies are like one of that. Sometimes the companies develop products suitable for better off commercial farmers and disregard the needs of poorer farmers and also may benefit farmers in the short term and increase dependency and make their livelihoods less secure.

Health:

The area in which life science and biotechnology are making significant and rapid contributions to sustainable growth in the health-care sector. A better understanding of biology of disease is providing researchers and health professionals more effective interventions based on biotechnological products and processes that promise a better match between the supply of effective health interventions and increasing societal expectations for good health and better quality of life.

In India apart from the traditional medicine, health-related S&T capabilities lie mainly in diagnostics, vaccines and fermentation processes, rather than in pharmaceutical products. India has some outstanding research institutions and a number of health products developed by the public sector have been commercialized. The private sector consists of 20,000 registered pharmaceutical firms, of which 7000-8000 are actively manufacturing drugs and drug formulations. Investment in R&D is gradually increasing in India, especially among larger firms.

Conclusion:

The most biodiversity-rich countries like India are self sufficient in biogenetic resources for food and agriculture. Indian's agriculture system is based on crops that either originated in India or has been cultivated there for centuries and which have diversified genetically since their introduction. India's tremendous range of agro-climatic zones means the country has a large diversity of biogenic resources and the potential to transform its food and agricultural industries through wider use of its own resources and associated knowledge.

Biotechnology has the potential to benefit poor farmers if it can help reduce their dependence on external inputs. Tissue culture greatly increases opportunities to consume and store germplasm, accelerate plant breeding and replace diseased or low-yielding plant material with disease free or high yielding varieties. As for agro-biotechnology, while life forms other than microorganisms will not be patentable, the range of patentable biotech related products and processes will of course increase. Thus it is very important since it has the potential to enhance the quality range and price competitiveness of both processes and unprocessed agricultural products.

Indian farms might seek to develop and commercialize biotechnological processes like those for producing new bio-pesticides and bio-fertilizers and research tools such as biosensors that may be based on enzymes or bacteria found in India. Biotechnological applications, including tissue culture and genetic modification techniques have the potential both to improve the quality, quantity and price competitiveness of

existing food and agricultural products. To sum up the easier availability of patents on biotechnological process is unlikely to harm India's efforts to add value to biodiversity and may be highly beneficial.

Table:1 Documentation of biological diversity in India

TAXA	Number of species		
	India [Endemics]	World	Percentage of India to the world
Bacteria	850	4,000	21.25
Viruses	Unknown	4,000	-
Algae	6,500	40,000	16.25
Fungi	14,500	72,000	20.14
Lichens	2,000	17,000	11.80
Bryophyte	2,850	16,000	17.80
Pteridophyta	1,100 *[200]*	13,000	8.46
Gymnosperms	64	750	8.53
Angiosperms	17,500 *[4,950]*	250,000	7.00
Protists	2,577 *[640]*	31,290	8.24
Mollusca	5,050 *[967]*	70,000	7.21
Anthropoda	60,383	1,065,000	5.67
Other invertebrates	8,329	87,121	9.56
Protochordata	116	2,173	5.34
Pisces	2,546 *[78]*	21,723	11.72
Amphibia	206 *[123]*	5,145	4.00
Reptilia	485 *[182]*	5,680	8.54
Aves	1,228 *[60]*	9,672	12.69
Mamalia	372 *[44]*	4,629	8.03
TOTAL	**126,656**	**1,719,183**	**7.36**

Source: MoEF (1998, pp27-28). using information from the Ministry, the Botanical and Zoological Surveys of India, and Heywood (1995).

Table-2 Selected biotech products and processes in India

Product	Institute/company	Industry
Fermentation technology		
Immobilized yeast	National Chemical Laboratory	VDSI, Dhanpur Sugar Mills
Microbial enzymes for alcohol	IMTECH	Vittal Mallaya Science Research Foundation, Union Biotech
Tissue culture		
Mungbean, black gram, pigeon pea, oil seeds, rice, groundnut	Bhaba Atomic Research Centre	State Seed Corporation
Wheat, soybean, grapes	MACS	State Seed Corporation
Cardamom, sugarcane, rubber	National Chemical Laboratory	AV Thomas, EID Parry
Banana, cardamom, papaya, sugarcane	Lupn	Lupin Labs Ltd.
Tomato	Madurai Kumaraj University	-
Diagnostic kits		
Filariasis detection kit	Mahatma Gandhi Institute of Medical Sciences	Cadila Labs Ltd
Pregnancy slide tests	National Institute of Immunology (NII)	Ranbaxy Labs ltd.

Dot ELISA pregnancy test	NII	Ranbaxy Labs Ltd.
Typhoid fever detection kit	NII	All India Institute of Medical Sciences
Amoebic liver abscess detection	NII	Cadila Labs Ltd. Ranbaxy Labs Ltd.
Blood grouping	NII	Cadila Labs Ltd.
Detection of hepatitis – B	NII	Lupin Labs Ltd.
Leprosy immunomodulator	NII	Cadila Labs Ltd.

Source: TIFAC (1992), in Menon (1997)

References:

1. Graham Dutfield, Intellectual Property, Biological resources, Traditional Knowledge, Earth scan, UK, 2004.
2. Manju Sharma, Agriculture Biotechnology: Country case Studies. (eds. G. J.Parseley and L. R. Macyntyre), 2002.
3. S. C. Santra, Environmental Science, New Central Book Agency, Kolkata, 2001.

News and Views

Genetic improvement of crops

Through the ages, genetic improvement of crops has always preceded agricultural growth in developed and developing countries alike. Norman Borlaug relied on insect-resistant, high-yield wheat to successfully launch what has now been termed the first Green Revolution. This helped India embark on the road to achieving self-sustenance. Initiated in 1978, the first Green Revolution depended on increased use of irrigation, pesticides and fertilizers to drive agricultural growth. Prime Minister Manmohan Singh believes that the technologies and strategies counted on by the first Green Revolution seem to have run their course. The advent of genetic engineering promises to propel us towards a more eco-friendly, sustainable agricultural system, which India direly needs. Today, India must make another leap — from subsistence-farming to sustainable development. The impetus given to agricultural growth in India by the first Green Revolution has slowed down. There is an urgent need for renewed thrust on research to increase agricultural incomes and productivity. The key lies in achieving a harmonious blend of indigenous knowledge with advanced science and proper application of biotechnology to the improvement of seeds.

(By Kannan K. Unni, Hindustan Times: 03/14/2006)

Conference on "Biotechnology for Sustainable Agriculture and Agro- Industry" at Hyderabad

Union Urban Development Minister S. Jaipal Reddy has called upon agricultural scientists to focus on higher productivity to meet the needs of the growing population, while ensuring that there was no conflict between development and environment. Addressing the valedictory session of Agri Biotech-2006, first international conference on "Biotechnology for Sustainable Agriculture and Agro Industry" here on Saturday, he told scientists to be conscious of the conflict between development and environment. Underlining the need for a second green revolution in the country, he said a lot more was needed to be done by the governments in biotechnology research. The three-day conference, attended by more than 600 delegates from 15 countries, adopted "Hyderabad Agribiotechnology Declaration" affirming that that sustainable increase in food production, food security, stable income generation for poor farmers and landless agricultural labour was the highest priority. It said enhanced publicly-funded programmes will accelerate knowledge about the genomes of crop plants and lead to a fair access to crop gene resources to the needy. The declaration called for a multi-disciplinary approach to achieve increased food production by technologies that are sustainable and environmentally sound. It stressed the need for support to coordinated research, reviewing the regulatory processes keeping in view everyone's right to benefit from scientific advancement while applying rules in public interest. It wanted a thorough examination of the purview and purpose of intellectual property rights policies.

(The Hindu, Sunday, Mar 12, 2006)

Agricultural biotechnology critical for biodiversity protection

Agricultural biotechnology is necessary for the conservation and enhancement of biodiversity. As officials from 132 nations meet in Brazil this week for a UN meeting under the Biosafety Protocol, the plant science industry reminds governments of the vital role biotech innovations play in achieving sustainable agriculture and development. Biotech crops are essential to conservation and sustainable use of biodiversity – the overall objective of the Biosafety Protocol. They enable more efficient use of water in agriculture, reduce soil erosion, prevent loss of biodiversity, and increase air quality. By making farming more efficient on limited land area, they are critical for preventing habitat destruction – the biggest single threat to biodiversity. Biotechnology is an established technology, having been used in research for more than 30 years, and with biotech crops commercially available for more than 10 years. In this time, there has been no proven harm to humans or the environment.

(*Checkbiotech.org (press release), Switzerland Wednesday, March 15, 2006)*

Organic farming is a way towards sustainable development

The concept of organic farming basically emerged from the biological processes available in nature and with the human efforts these are being utilized at large scale. For example decomposition of organic matter is a natural process but with human methodology it is efficiently utilizing in making compost, vermicompost, micro-organism like Trichoderma is being utilized for pest management. So there is no dearth of nature's biotechnology, the only requirement is to develop methodology for harnessing this several methods that have been developed for utilizing the natural biotechnologies like production and use of bio-fertilizers, vermicomposting, production of predator and parasites in artificial environment and this can help a lot for successful organic farming and ultimately the sustainability. The only need is promotion and demonstration of such technology so that farmer realize it a sustainable solution and come out form the illusion of deliberated biotechnology.

(By Muneer Ahmad Sofi, GreaterKashmir.com (press release), India - 10 Mar 2006)

West Bengal Biodiversity Board

(http://www.wbpcb.gov.in/biodiversity/wbbdb_info_act.shtml)

The West Bengal Biodiversity Board has been formed under the notification of the Department of Environment, Government of West Bengal on September 16, 2004.The West Bengal Biodiversity Board is the statutory agency for ensuring proper implementation of the Biological Diversity Act, 2002 to conserve the biological diversity, encourage sustainable use of resources and ensure fair and equitable sharing of benefits arising from use of genetic resources. It also can regulate by granting of approvals or otherwise requests for commercial utilization or bio-survey and bio-utilization of any biological resource by Indians.

Recent initiatives by the WBBB:

- Formation of BMC's in every phytoecological zone of West Bengal.
- Conducting workshops for PBR's under these BMC's.
- Conducting biodiversity related workshops for different target groups viz. Bureaucrats, School & College teachers, Universities, College & School students and NGOs.
- Building awareness regarding biodiversity conservation for the community.
- Identification of 'Heritage Sites' & 'Sacred Groves'.

Recommended Committees:

- Biodiversity Inventory Committee
- Agricultural Biodiversity Committee
- Wetland Biodiversity Committee
- Heritage & Sacred Grove Committee
- Awareness Committee

SDNP-ENVIS Programme on Sustainable Development

Ministry of Environment and Forest (MoEF) has selected 20 ENVIS Centres in India having different thematic area to work as partners under Sustainable Development Network Programme (SDNP) in collaboration with Indo-Canadian Environment Fund (ICEF). Under this SDNP-ENVIS Programme, ENVIS Centres envisage to collect, collate and disseminate the national level information on sustainable development. These ENVIS Centres have been assigned an additional responsibility to work on their specific thematic area to strengthen the ENVIS Network and to enhance the availability of information resources on sustainable development.

FORTHCOMING EVENTS

Events	Date	Place & Correspondence
Bangalore Bio 2006	June 7, 2006	Bangalore, India www.bangalorebio.in/conference.htm
National Conference on "Hazardous Waste Management & Environment Protection for Sustainable Development"	June 8th-10th, 2006	Taj Lands End, Mumbai, Organised by: Vidarbha Productivity Council, 35, MIDC Area, Nagpur-440028 E.mail: twmneeri_ngp@sancharnet.in
8th World Congress on Environment Management	9-11 June, 2006	Palampur, Himachal Pradesh (India)
Energy, Environment, Ecosystems, Sustainable Development (EEESD6)	July 11, 2006	Vouliagmene, Athens, Greece www.worldses.org/conference/2006/greece/energy E.mail: info@wseas.org
International conference on bio-fuels vision 2015	August 14, 2006	Bikaner, India Email: satish@ecb.ac.in , www.ecb.ac.in/biofuel
International conference On infrastructure development and the environment (ICIDEN-ABUJA 2006)	September 10-15, 2006	Ladi Kwali Way, Maitama, Abuja, Nigeria,
International Conference on Green Competitiveness for Sustainable Development (ICGC 2006)	27-28 October, 2006	Institute of Management Technology, Gaziabad, India Website: www.imt.edu
NanoBiotech World Congress	November 16, 2006	Boston, USA www.selectbiosciences.com/conferences/nanobiotech 2006
Global Sustainable 2nd Biotech Congress (2006)	December 18, 2006	Nagpur, India

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