AGRO-BIODIVERSITY STRATEGY

Tribhuwan Pant, Vandana Pandey and Subhash Chandra Das
Defence Agricultural Research Laboratory
Pithoragarh (Uttaranchal) - 262 501

ABSTRACT

India is one of the largest and oldest agricultural societies of the world and despite the modernization process of the decades, it still remained rural. Approximately 900 million of people are governed by the agricultural sector. The Indian region is one of the world's eight centers of crop plant origin and diversity. At least 166 food and crop species and 300 wild relatives of crops have originated here. Plant genetic resources of any crop constitute a spectrum of "gene and gene complexes", so essential for progressive improvement of crop plants. There is need on priority to develop the strategy as how to protect the extinction of this valuable gift of the nature that leads to the process of creating new life to meet the requirement of living being. Current Green Revolution methods and use of chemical based products by each and every human-being, the waste of which is going in water streams and polluting the available precious water, poses threat to the marine diversity, life of birds, wild animal, growth of vegetation and ecosystem. There is also need to develop the policies that only ecofriendly and biodegradable chemical products are launched for mass consumption through industrial processes so that the question of sustainability is taken care at global level.

BIODIVERSITY

The variety and variability among living organisms from all sources including interalia, terrestrial, marine and other aquatic systems and ecological complexes of which they are part, it include diversity within species between species and of ecosystem. (UNEP: 1992 conservation of biodiversity).

India is one of the largest and oldest agricultural societies of the world and despite the modernization process of the decades, it still remains rural. Approximately 900 million people are governed by the agricultural sector. Therefore, the stability as well as the sustainability of Indian agriculture is of great concern. There is need to develop the strategy as how the modernization process effected the biodiversity found in the nature and in cultivated area and how to protect the extinction of this valuable gift of nature that leads to the process of creating new life to meet the requirement of living beings. These questions have assumed special attention because of the reason that the increasing un-sustainability and ecological as well as social danger of the Current Green Revolution methods and use of chemical based products by each and every human-being, the waste of which is going in water stream and polluting the available precious water thus posing

threat to the marine diversity, life of birds, wild animals, growth of vegetation and ecosystem. Therefore, there is need to adopt the proper strategy so that the modernization process does not affect the biodiversity and ecosystem. There is also need to simultaneously develop the policies so that only eco-friendly products be launched through industrial process so that the question of sustainability is taken care of at global level. India is characterized by complex agroecosystem differentiated by their climate, soil, vegetation and other features. A recent clarification by National Bureau of Soil survey and Land use planning distinguished 20 broadbased agro-ecological zones, separated by natural features (Sahgal *et al*., 1992). The Indian region is one of the world's eight centers of crop plant origin and diversity, which was distinguished by Vavilov, a Russian Scientist. At least 166 food and crop species and 300 wild relatives of crops have originated here. Plant genetic resources of any crop constitute a spectrum of "gene and gene complexes", so essential for progressive improvement of crop plants. The strategical approach and available biodiversity are discussed in the present paper.

The loss of biological diversity and related traditions need urgent attention. The wild relatives of crops that have originated include rice, pigeon pea, ginger, turmeric, bitter gourd, brinjal, okra, pepper, banana, coconut, cardamom, jack fruit, sugarcane, bamboo, taro, indigo, sun hemp, amaranthus, mango and gooseberry. Species, which may have originated exclusively in India include mango, taro, cucumber, pigeon pea, pepper, egg plant and cardamom (Kothari, 1999). It is interesting to note as has been compiled by Sharma pers. Comm. 1992 and Sampemane 1993 that one species of rice (*Oryza sativa*) has been diversified into at least 50,000 distinct varieties. One species of mango (*Mangifera indica*) has yielded over 1,000 varieties having size from peanut to muskmelon (Negi, 1993). Other crops with rich diversity in India are wheat, sugarcane, legumes, egg plant, sesame, ginger, turmeric, okra, jack fruit, jamun, jute, pepper, cardamom, cinnamon, yam, velvet bean, kidney bean, sweet potato and coconut. The world's largest diversity of domestic animals is available in India which includes 26 breeds of Cattle, 40 of sheep, 20 of goats, 8 of camels and 18 of poultry, apart from the mithun, the yak and several species and breeds of birds including ducks, geese, doves and pigeons (CSIR 1970, Mohapatra and Pandey, 1981, Khanna, 1993, Sahai, 1993). There is need to undertake a survey to update the information.

The diversity of crops and livestock is neither only accidental nor purely natural, it is the outcome of thousand of years of deliberate selection and planned exposure to a range of natural conditions, field level cross breeding and other manipulation which farmers have tried out. The different crop varieties and livestock breeds adapted to diverse local conditions of growth and survival. In Garhwal hills of the Himalaya over 40 crop species and a number of varieties are grown, a diversity which maintained through diverse cropping pattern and which evolve in the contest of wide variations in edaphic, topographic and climatic conditions coupled with careful selection by farmers (Maikhuri *et al*., 1997).

With recent change in climatic pattern, the growth and yield are getting affected. The pollution of water with non-biodegradable products such as detergents and pesticides are mainly responsible for affecting the nature's process and ultimately the climatic pattern, i.e., time of precipitation, duration of precipitation, sunshine and temperature conditions are getting affected. It has been observed that since last 3 - 4 years due to development of adverse conditions, the crop growth is affected adversely both in Kharif and Rabi season. In case timely precautionary measures are not taken and water pollution is not attended by adopting suitable remedial measures, it will ultimately lead to extinction of most of the vegetation and biodiversity.

Higher detergent use is a cause for concern. People pay more at the cost of health and environment. The consumption of detergent is estimated as under. More consumption will bear high environment cost.

Country	**Population (millions)**	**Per capita detergent consumption (Kg.)**	**Total consumption (million tons/year)**
EU	459	9.16	4.20
India	1082	3.00	3.25
U.S.A.	296	10.00	2.96

Detergent laden effluent harms closed water bodies, and the persistent toxins may inhibit microbial activity thereby causing even biodegradable chemicals like surfactants to bio accumulate (Suresh, 2005).

The stability of biodiverse agriculture is perhaps its most important characteristic as recorded from many part of the world (Salick and Merrick, 1990; Altieri, 1999). This practice has been nicely illustrated by the common practice that was being followed in Garhwal region of Uttaranchal called the **baranaja,** literally meaning 12 grains. This practice involves sowing of mixture of crops into a single plot of land, urad (black gram, *Vigna mungo*), mung (green gram, *Vigna radiata*), rajma (bean, *Phaseolus vulgaris*), gahat also known as kulth (horse gram, *Macrotyloma uniflorum*), ramdana (*Amaranthus frumentaceous*), jhungora (barnyard millet, *Echinocloa frumentacea*), Madua (finger millet, *Eleusine coracana*), Bhat (Soybean, *Glysine soja*), Lobia (*Vigna catiane*) and other crops are grown in jumble profusion but was carefully considered the way of obtaining optimal and sustainable yield. Since the maturity period of different crops varied, different crops are harvested at different times, helping to retain soil moisture and providing a constant supply of food (Jhardhari and Kothari, 1996)

Since traditional agriculture system were finely interwoven with the social and cultural fabric of villages and also with the forests and other ecological features within which villages use to be existed in a sustainable manner, they could not withstand with changing policies. These changes severely disrupted traditional agriculture (Dharmpal, 1983) and other ecosystems.

A considerable amount of genetic material which has been grown or bred by farmers may no longer be available in field, as has been collected and stored in gene banks and breeding stations. Such collections also suffer from severe limitations. They are very expensive also.

Diversity of wild relatives of cultivated plants and naturally occurring food plants provides enormous economic potential. These plants not only sustain the present day plant crop improvement programme but it will also be utilized by future generations for new sources of genes against virulence of pathogen, pest, drought, frost and may other unforeseen circumstances. Thus eco-system balance also can be maintained by avoiding the application of huge amount of insecticides, fungicides and other harmful chemicals and thus also saving money. But due to environmental pressures there are many plant species, which are endangered, and there is growing concern about their conservation. Efforts are continued to identify threatened plants and collect diversity in wild plants, a few of which are listed as follows.

WILD RELATIVES OF CROP PLANTS

Solanum sp. (Wild egg plant): *S. sisvmbrifolium, S. hispidum, S. indicum, S. torvum, S. verbescifolium, S. jasminoides, S. seaforthianum (Wild relatives of potato).*

Abelmoschus sp. (Wild okra) : *A. manihot* sp. *Tetraphyllus var. pungens, A. moschatus, A. ficuineus.*

Brassica sp. (Wild crucifers) : *Erysimum hiercifolium, Cardimirie scutata, Crambe cordifolia, Megacarpaea polandra, Nastrurtium palustre, Lepidium sativum, Rorripa nasturtium aqaticum.*

Vigna sp. : *V. sublobata, V. vexillata.*

Cicer sp. (Wild gram) : *Cicer microphyllum*

Allium sp. : *A. auriculatum, A. carolinianum, A. humile, A. wallichii, A. ampeloprasum, A. cernuum, A. griffithianum, A. consenguineum.*

Rosa sp. : *R. macrophylla, R. brunonii, R. sericea, R. webbiana, R. microphylla.*

Cucumis sp. (Wild cucumber) : *C. sativus, var. hardwickii, Tricosanthus cucumerina, Diplocyclos palmata.*

Leafy vegetables : *Phytolacca acinosa, Rumes* sp., *Lepidium sativum, Polygonum alpinum, Oxvria digyna.*

Oil yielding plants : *Aesandra butyracea, (Indian butter tree) Perilla fruitescence, Pricipia utilis.*

There is need to encourage the natural conservation process of biodiversity by providing them incentives. It has been noticed and reflected by Gadgil (1996), Bhatia & Kothari (1996) that local communities have for centuries been using and conserving the biodiversity found around them. In the process they have developed knowledge, skill and techniques related to these biological resources.

The agro-biodiversity can be saved if the country's path of development undergoes fundamental development and implements the programme by deeply studying the process and its impact which were being followed in past that led to conservation of biodiversity and sustainable evolution process. The hurried development process and implementation of process and techniques at bigger level based on short span study will certainly be misleading process of development and will ultimately affect the ecosystem that will put challenge for the survival of the living beings. The result of such processes is visible now in all spheres. Simultaneously there is also need to develop the policies that may be helpful in planning the proper population size from time to come, to reduce the unwanted load on nature. The studies on nature's process and its capacity for sustenance of various living beings and their associations for sustainable development could be helpful in better understanding and suggesting future path of developmental process, without affecting the available valuable biodiversity in nature to build a global consciousness for healthy development and checking threatened extinction of biodiversity.

BIODIVERSITY IN INDIA

- Situational advantage of India to have vast biodiversity.
- Possesses 8% of global biodiversity.
- Eastern Himalayas and Western Ghats are among 25 hot spots of biodiversity in world.
- Important centre of origin of agro biodiversity.

Diversity of Indigenous Species

Taxa flora	Species
Plant	15,000
Algae	5,000
Lichens	1,600
Fungi	20,000
Bryophytes	2,700
Pteridophytes	600

Vegetable in India with Maximum Diversity

Okra	Pepper
Egg plant	Sweet potato
Ginger	Colocassia
Turmeric	Yams

Indigenous genetic diversity of main cultivated crops

Potato	16
Sorghum	5,160
Aroids	350
Arecanut	45
Ginger	124

Sugarcane	48
Rice	500-600

Human welfare and biodiversity

Food	:	Organic farming, variety, nutrition.
Shelter	:	Bioclimatic, architecture, bio-paint.
Clothing	:	Bio-fiber
Fuel	:	Bio-fuel and bio- energy.
Health	:	Herbal medicine
Eco-environ	:	Biosphere.

Animal genetic diversity of main domestic animals

Animal	**Breeds**	**Animal**	**Breeds**
Sheep	40	Ducks	04
Goat	20	Yak	01
Cattle	26	Horse/ Pony	06
Camel	04	Pig	02
Donkey	02	Buffalo	08

Fish genetic resources

Description	**No. of Species**	**Percentage**
Upland coldwater	73	3.32
Warm water plains	544	24.73
Brackish water	143	6.50
Marine environment	1440	65.44

Loss of biodiversity causes

Global climatic changes

Technological development

Industrialization

Deforestation

Shifting cultivation

Soil erosion

Mass unawareness

Biodiversity conservation

Genotypes

Species

Ecosystems

Methods of conservation of biodiversity

Survey and inventory of genetic resources

In situ conservation

Ex situ conservation

Encapsulation, dehydration, cryo-preservation

Gene bank seed and tissues

Sustainability and biodiversity

Sustainability ⇔ Biodiversity

SYNERGY

Food demand and production (million tons)

Commandant	**94-95**	**2006-2007**
Food grain	191.1	243.2
Milk	119.5	
Oil seeds	21.4	33.8
Vegetables	80.8	110.7
Fruits	47.0	70.5
Meat, fish & eggs	15.8	

Biodiversity

Variety	**No. released**

Paddy	474
Wheat & barley	217
Sugarcane	111
Maize	107
Pearl millet	71
Other cereals & small millets	93
Pulses	373
Oil seeds	275
Vegetables	341
Forage	89
Fiber crops	179

BIODIVERSITY AND PLANT PROTECTION

- Biocontrol of pests – Microbial pesticides, insect baculoviruses, engineered microbes.
- Resistant varieties – transgenic, synthetic & composites, hybrids.
- Inter cropping – trap crop, medicinal plants.

STRATEGY FOR FOOD DENSITY & BIODIVERSITY

- Broaden the production area of wheat and rice
- Introduction in hybrid rice
- Increase production of coarse grain in Central India
- Central India be made productive centre of vegetable & fruits
- Improvement in rain fed agriculture
- More emphasis in tuberous crops
- Increased production of pulses
- Vegetable and fruit production in all possible area
- Increased production of animal products
- Modern methods of irrigation

- Proper land use planning including water
- Promotion of bio-fertilizers

"Nature provides for everybody's need but not for everybody's greed" - Mahatma Gandhi

Biodiversity conservation and utilization contribute immensely towards sustainable agriculture.

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