

Food Security - Agricultural Bio-Diversity **YAMINI KURANI, gms**

Agriculture and its allied sectors like fisheries are a tradition, which for centuries, has shaped the thought, culture and economic life of people around the world. It, therefore, continues to be central to all strategies for planned socio-economic development of many countries including India. Rapid growth of agriculture is essential not only to achieve self-reliance at national level but also for household food security and to bring about equity in distribution of income and wealth resulting in rapid reduction in poverty levels.

"Agriculture is the backbone of the Indian economy and the villages are the life lines of growth of India".

Agriculture has made lot of progress in terms of growth in output, yields and area under many crops. It has gone through a series of successful revolutions starting with the "Green revolution (food grains), a White revolution (Milk), a Yellow Revolution (Oilseeds) and a Blue revolution (Fishery)".

However the growth of agriculture has slackened during the Nineties. The world population has topped 6 billion people and is predicted to double in the next 50 years. Ensuring an adequate food supply for this booming population is going to be a major challenge in the years to come especially in developing countries where most of the population growth is concentrated. For instance, agriculture is a very important sector for the sustained growth of the Indian economy where 70% of the rural household and 8% of urban households are still principally dependent on agriculture.

Agriculture is at the heart of food security and hence when agriculture is challenged, so is food security.

Feeding Population Vs Growth in Output

The United Nation (UN), 2001 report indicates that the world population will grow from 7.2 billion (2015) to 9.3 billion (2050). This acceleration in demographic growth and the gradual saturation in per capita food consumption for parts of the world population are important factors that will contribute to the growth of food demand and, at the world level, also of production. The world food consumption grew by average 19 %. Of the seven countries with a population of over 100 million (China, Indonesia, Brazil, India, Pakistan, Nigeria and Bangladesh), besides Bangladesh the rest remains at very high levels of per capita food consumption. In India, the projections indicate that population will be 1.5 billion by 2050 which will only increase the demand for an already stressed food production. Rising population and per capita income push up the demand, which needs to be met through enhanced productivity.

Agricultural output has more than kept up with population growth. Better plant varieties, major increases in the use of fertilizers, a doubling of the irrigated area, more effective control of insects and pests, improved strains of livestock and poultry, and wider use of nutritionally balanced feeds have enabled food production to outpace population. However despite this increase, there are over 850 million undernourished people in the world today. Hence it is not a question of "feeding the world" but "keeping the world fed" wherein lies true "food security".

Worldwide, some 1 billion people in 70 of the lower income countries are hungry, and the situation could grow worse in the poorest countries. Ironically, most of these people live in rural areas where food is produced. But food availability does not guarantee food security, which depends also on the ability to buy food and to utilize it effectively. Individual health and education levels, as well as local conditions such as safety of the water supply, affect the ability to utilize food effectively.

The broader reasons for food insecurity are many: war, poverty, population growth, environmental degradation, limited agricultural technology, ineffective policies, and disease. Large-scale scarcity, however, is not on the list since the growth rate in world food production has at last surpassed population growth, meaning more food available per person. But this abundance is distributed unevenly. Many low-income countries have difficulty producing enough food and are thus food-insecure on a national level. More common is inequality of food consumption within countries-the result of uneven purchasing power. This problem exists in even in the highest income and food surplus countries like the United States.

Natural resources base like land, water, forest and the biodiversity being the foundations for both food security as well as environmental sustainability has been irreversibly damaged owing to the increasing food demand and consequently food insecurity. Agricultural production can only be sustained on a long term basis if the resource base like land, water and forest on which it is based are not degraded.

Land resource and its management

The constant increase in the demand of the burgeoning population for food, fodder, fuel and shelter puts a tremendous pressure on our land resources always resulting in a continuous decline of the cultivable land area at a very fast rate. Vegetation that is cleared for varied human activities results in accelerated run-off which in turn gives rise to soil erosion and landscape degradation. These are among glaring environmental problems badly affecting soil productivity and continuously turning productive lands into wastelands.

Among the different processes responsible for land degradation, erosion of soil (through water and wind) is the most destructive. Efficient land resource management needs to be given adequate attention to increase the productive capacity of land and to prevent it from deterioration. Suitable location, specific soil conservation and land reclamation measures based on soil survey on watershed basis needs due priority.

Shifting cultivation which involves clearing a patch of forest land, cultivating it for two to three years and then abandoning it for 10-20 years to allow the natural forest to grow back and the soil to regain its fertility helps in retaining useful trees and plant varieties. The Jhum cycle as it is called practices conservation and taking care of the ecological balance.

However, with the population pressure, communities wanting to grow more food have cleared greater chunks of forest lands and returned to the fallow plots much sooner than 10-20 years. The length of the fallow phase between two successive cropping phases has come down to even two to three years in some places. This has resulted in soil degradation; fall in yield, lower returns, and reduction in green cover.

It is this change in traditional practice, arising out of changing conditions, that has given jhum agriculture a bad name. Separately, forests are being exploited for timber and hills are being flattened for soil and stones. Often, this denuding of the forest too is blamed upon jhum cultivation.

Agro Chemicals

Despite the fact that an extensive use of fertilizers and effective control of pests and insects through pesticides has been largely responsible for a quantum jump in the agricultural production, their injudicious use has given rise to a number of environmental issues.

There has been a phenomenal increase in the use of pesticides in the world over the last three decades to combat pest attack. The multifarious harmful consequences of its indiscriminate use have posed a serious threat to the ecosystem. And so has the per capita consumption of fertilizers which has been increasing. Although pesticides have always played an important role to prevent crop losses caused by crop pests, their indiscriminate use has given rise to grave consequences such as residual toxicity in food, feed, fodder, environmental pollution, development of resistance in pests to pesticides, destruction of predators and parasites and pest resurgence etc

Environmental pollution such as eutrophication and nitrate contamination of the surface and ground water resources are also caused by such agro-chemicals.

Moreover, pesticides and fertilizers can be expected to be over-used due to risk aversion among farmers. This means that farmers will prefer to over-use them rather than under use them, the latter option being associated with risks of unacceptable increases in the variance of the profit from crop yield. In view of the fact that increased use of pesticides has been seriously endangering the environmental sustainability, integrated approach to pest management needs adequate importance to make the agriculture eco-friendly.

With increasing awareness on the ill effects of pesticides however, and the increasing popularity of Genetically Modified food, a decreasing trend in the extent of pesticide use has been gradually observed.

Genetically Modified (GM Food)

Genetically Modified (GM) foods promise to meet the growing need of the population, this need in a number of ways, which may help in improving food availability, nutritional quality and shelf life of harvested produce and in developing plants resistant to insect pests, disease pathogens and herbicides.

However, as is true with all innovations and changes involving complex systems, there will always be trade-offs. Making the best choices will always be a matter of weighing the risks against the benefits, so as to avoid or mitigate the unwanted consequences, and intelligently deciding which to accept and which to

reject. Genetically modified crops (GMCs) have attracted many critics because of their potential impacts on biodiversity, toxicity to non-target organisms, cross-resistance in pests, the higher prices of seeds and foods, monopoly of companies, patent and regulatory approval, and safety to consumers. Some consider that GMCs are unwanted, unsafe and unnecessary, and can lead to an increasing depletion of bio-diversity in agriculture while others favour their introduction and use. The debate about its advantages and disadvantages continues among a wide spectrum of people from different walks of life.

Loss of Crop Diversity

Existence of the strains with vast genetic diversity within the same crop species provides basis for crop improvement. Apart from physical & biological adaptation, a host of economic, cultural, religious, and survival factors have played a role in diversification for instance several varieties of rice and other crops were grown in many parts of India just for their use during festivals, marriages, or other auspicious occasions; several others were grown for their taste, color or smell; yet others for their pesticide or soil fertilization characteristics.

Considering the case of India, like many large tropical countries, it is characterized by a complex mosaic of distinct agro- ecosystem differentiated by their climate, soil, geological, vegetation, crop- growing and other features. According to agricultural scientists at least 166-food crop have originated in India, including rice, pigeon pea, turmeric, ginger, pepper etc. However Enormous exploitation of the forest resources for human activity has given rise to loss of valuable gene pools of different crop species including their wild relatives.

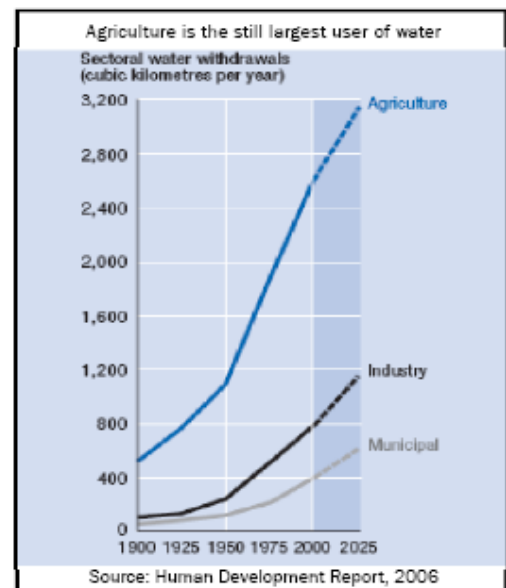
And with present intensive agriculture, continuous cultivation of a limited number of high yielding and economically profitable cultivars of choice, often the end result is the narrowing of genetic biodiversity. It in turn not only aggravates the infestation of insect pests and diseases but also raises concern about the stability of production. Depletion of genetic diversity, an unfettered outcome of the current trend of cultivation, seriously threatens the future progress of the genetic improvement of crop.

This erosion of agricultural bio- diversity threatens the long term stability & sustainability of agriculture itself in many ways. Firstly, it erodes the genetic base on which scientists depends for continuous improvement of crops. Secondly, by opting for high yield varieties (HYV's), farmers becomes increasingly dependent on the industry dominated market and the Government.

Water resources and its management

Agriculture singularly remains the dominant user of water resources and the gap between population growth and demand for water has also tremendously increased: as the world becomes richer and more industrialized, each person in it has been using more water. In developing countries agriculture still accounts for more than 80% of water consumption. The agricultural sector faces the real challenge. People have a minimum basic water requirement of 20-50 liters each day. Compare this with the 3,500 liters to produce enough food for a daily minimum of 3,000 calories. In other words, it takes roughly 70 times more water to produce food than people use for domestic purposes. Growing a single kilo of rice takes 2,000-5,000 liters of water. But some foods are thirstier than others. It takes eight times more water to grow a tonne of sugar than a tonne of wheat.

It is estimated that 40% of all crops grown in the world today are grown using irrigation. The practice of irrigation can increase the productivity of crops on what would otherwise be rain-fed agriculture. It can also expand agriculture into areas where it would not otherwise be practiced due to aridity. Such uses lead to vast quantities of water exploitation and also cause extensive pollution, primarily by introducing non point source contaminants. Runoff from agricultural fields often contains fertilizers, animal manure, or pesticides that together form a major source of water pollution.



The national Policy on Water, 2002 (India) declares water as scarce and precious natural resource to be planned, developed and conserved as such and in an integrated and environmentally sound basis. Water resources in India will decline in future due to increased urbanization and industrialization.

A World Bank Survey reveals that most of the India's irrigation projects suffer from deficiencies of design, construction and maintenance which are causing poor drainage resulting in water logging, loss of large volume of water, low water use efficiency, loss of large amount of fertilizers etc.

The measures that can be adopted for recommended production technology and crop planning is to increase water use efficiency, crop diversification, Integrated watershed development to use rainwater, ground water, soil water and runoff water efficiently, artificial recharge of ground water through series of check dams in natural streams, percolation tanks and recharge wells etc.

Unsustainable Way "Back to Traditional Farming"

With increasing requirement and demand for resources across the verticals of land, water and the environment in terms of agriculture, one of the few sustainable ways of restoring the balance would be to revert "back to traditional farming".

Traditional farming systems have emerged over centuries of cultural and biological evolution and represent accumulated experiences of indigenous farmers interacting with the environment without access to external inputs, capital, or modern scientific knowledge. Using inventive self-reliance, experiential knowledge, and locally available resources, traditional farmers have often developed farming systems with sustained yields.

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Organic Farming - A Way towards Sustainable Agriculture

"The commercial industrial technologies that are used in agriculture today to feed the world... are not inherently sustainable," A survey of recent studies comparing the productivity of organic practices to conventional agriculture provides an excellent example of the wide range of benefits which can expect from a conversion to sustainable agricultural methods.

"To the consumers, Organic Agriculture offers safe food and to the farmers better profit margins. It is therefore, a win-win option offering business opportunities without compromising ecological balance and soil equity".

Organic agriculture is a holistic approach based on principles and practices defined as Standards, which restores ecological balance by re-establishing natural cycles thus resulting in improved soil health, gradually increasing land productivity, safe food, social justice and value added employment opportunities at farm level.

It hardly needs to be emphasized that in a country where land is a limited resource, and soil fertility a limiting factor, the only way of increasing the resource base is through increased productivity and for this purpose use of external inputs. For this reason, optimum use of inorganic fertilizers supplemented with farm - green manures, crop residue, industrial wastes and biological nitrogen fixation techniques is

indispensable. This is more important in view of the fact that soils of India having low organic matter content are generally poor in fertility. Due to soil depletion inadequate use of fertilizers Indian agriculture is operating at a net negative balance of plant nutrients. India would need about 25 millions of NPK in addition to 10 million tonnes of organic and bio-fertilizer sources to produce about 246 million tonnes of food grain required by 2010.

Conclusion

For every human being, today is a reality and tomorrow is a possibility meaning the hungry need food today and not just promises for tomorrow. India produces so much food today that it can ensure food for everybody but as the population is growing and the per capita land and water availability is decreasing, producing sufficient food for everyone could be difficult. To overcome this problem we have to produce more crops but produce it differently

-in a manner that high yields can be obtained in perpetuity without associated ecological or social form. Farming systems' intensification, diversification and value addition are extremely important to generate the needed on farm and non farm employment. An awareness for food security has to be spread and there is a need for greater research in the field of breeding crop varieties, having the quality characteristics needed for food processing and exports.

There is no time to relax, both on the production and consumption fronts. The stock of 65 million tonnes should not lull us into complacency. Concurrent attention to production and consumption is important. Enhancing production through an ever green revolution is a priority task. However, eliminating widespread endemic hunger is both a national responsibility and an ethical obligation.

The biggest question remains to be answered - Can we feed a growing population with biologically diverse agriculture? And can farmers achieve livelihood security through diversity? It is evident that there is great potential to increase and sustain food production through a mix of strategies to revive diversity.

M.S Swaminathan's epilogue to his book "From Rio de Janeiro to Johannesburg" ends with the concluding lines of W.H.Auden's poem September 1, 1939, in a hope that this decade would see the emergence of global crops of hunger fighters which would ensure that every child, woman, and man, would have an opportunity of healthy and productive life.

*"Hunger allows no choice
To the citizen or the police;
We must love one another or die.
Defenseless under the night
Our world in stupor lies;
Yet, dotted everywhere,
Ironic points of light
Flash out wherever the Just
Exchange their messages:
May I, composed like them
Of Eros and of dust,
Beleaguered by the same
Negation and despair,
Show an affirming flame."*

Organic Food Security through Naturenomics™ Way

Globally Managed Services (gms) is also working at the grass root level under its trust Balipara Foundation (BF) to bring about the Green Revolution in the North East through its subsidiary companies. These involve work across the value chain - from growing organic produce to aggregation and retail sales of fresh produce from all over the North East. The company believes that it's only through empowerment at the grass root levels that the overarching aim be achieved. Towards this end, it has tied up with not-for-profit organic foundations in India and has set up a Joint Venture Company to focus on converting a large proportion of land in Assam as certified organic land. The company, through its out reach program has already enrolled over 1,500 farmers and the target is to convert over 5,000 farmers by the year end. In aggregate these would represent over 15,000 ha of land coverage.

The Balipara Foundation (BF) focuses on Organic farming practices and revival of Endemic trees and Plants with commercial values-empowering local communities to "feed themselves", therefore providing for food security, whilst ensuring that the fragile ecological equilibrium does not degenerate in areas of:

- Traditional Agriculture
- Floriculture
- Indigenous Medicinal and Aromatic Plants
- Indigenous and Endemic Tree Plantations
- Wild Crops

NaturalGist

- Agriculture is the back bone for all economy, especially for developing countries like India. The very reason for it is that the world population will go beyond 6 billion by 2015 which means extended pressure on all the agriculture economies will enhance the productivity.
- Using latest technology like R&D in crops, etc even barren land around the world is able to produce. Even then over 850 million people are undernourished. So the aim of agriculture is not just to make the land productive but to map the world feed that will have food security for all.
- The main reason for food insecurity is uneven purchasing power of people in developing countries, war ridden pockets of Africa, etc. which are unable to access even basic food commodities required for sustains.
- In the name of agriculture development across the world, natural resources like land, water, forest and biodiversity have been encroached upon and damaged beyond repair but in the long term sustainability will depend on this resource and unless a major step is taken to check the parasitic growth at the cost of our resources, it will be very difficult to achieve food security.
- Therefore the possible solution would be Genetically Modified food (GM) and Organic Farming.
- GM Food: This is a promising way to sustain the needs of our population but it comes at the cost of permanently changing our biodiversity, increasing toxicity in non tang at organism's resistance in pest and overall a very expensive method.
- The option of going "Back to Traditional Farming" has always maintained balance between the environments but then again achieving the high productivity that is needed is again questionable.
- The final option would be "Organic Farming" which helps to maintain a balance with the resources.
- The biggest question is - Can we feed a growing population with biologically diverse agriculture and can farmers achieve livelihood security through diversity?

NaturalGist

- *Feeding Population: The gradual saturation in per capita food consumption for parts of the world population will contribute to slow the growth of food demand and, at the world level, also of production. Despite the drastic fall in the growth rates of both population and aggregate demand and production, the absolute annual increments continue to be large.*
- *Land resource and its management: The constant increase in the demand of the burgeoning population puts a tremendous pressure on our land resources. With the population pressure, communities wanting to grow more food have cleared greater chunks of forest lands leading to depletion in forest cover and increasing wastelands.*
- *Water resources and its management: Agriculture singularly remains the dominant user of water resources. As the world becomes richer and more industrialized, each person in it has been using more water. The agricultural sector faces the real challenge with increasing water loss.*
- *Organic Farming - A Way towards Sustainable Agriculture: The holistic approach based on principles and practices defined as Standards, which restores ecological balance, increases land productivity, safe food, social justice and value added employment opportunities at the farming level. Sustainable agricultural practices can both feed people and protect oceans, forests and other ecosystems that harbor biological diversity.*
- *Achieving Sustainable Agriculture development through Naturenomics: Globally Managed Services (gms) works at the grass root level under its trust Balipara Foundation (BF) to bring about the Green Revolution in the North East through its subsidiary companies. These involve work across the value chain - from growing organic produce to aggregation and retail sales of fresh produce from all over the North East. The company believes that only through empowerment at the grass root levels will the overarching aim be achieved.*