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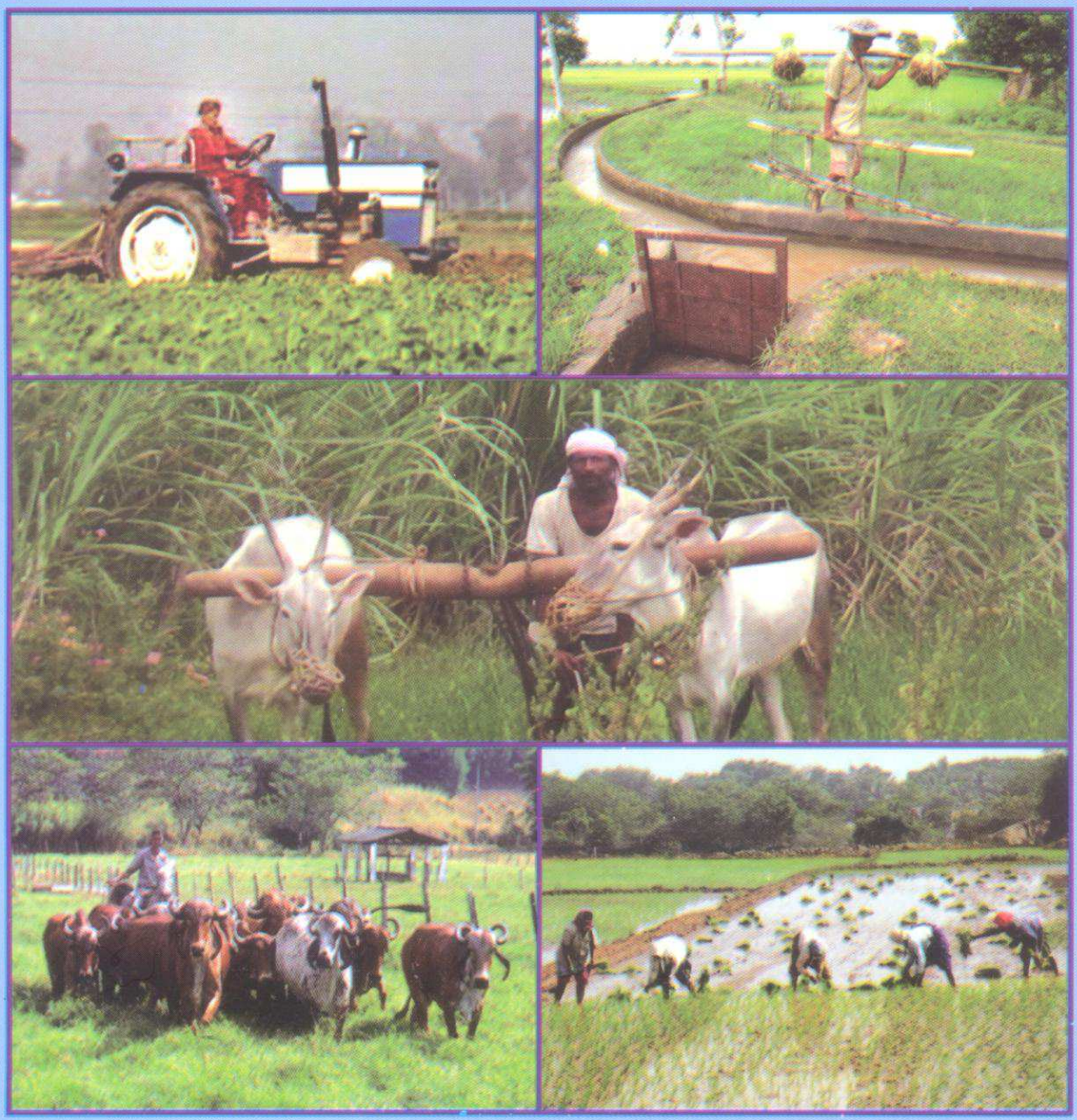

Arundhati Vashishtha Anusandhan Peeth, Allahabad

HISTORY AND DEVELOPMENT OF AGRICULTURE IN INDIA

- **Agriculture began some 10,000 years ago.**
- **Agriculture was very important profession during Vedic age.**
- **Buddhist period (600BC) marked the importance of trees.**
- **Irrigated agriculture with rice was started in south India during 300 A.D.**
- **Amarakosha written during the period of Chandra Gupta – II contained information on soil, irrigation, implements, manures and land use.**
- **History of agriculture from 9th to 11th century is evident from Krishi – Parashara written by "Parashara" (950-1100AD)**
- **Modern Agriculture was started during early 19th century but was confined to western countries.**
- **Most developments in India started after independence**
- **At the time of independence, cultivated area in India was 98.5 m. ha. And irrigated area was 19.4 m.ha (out of 329 m. ha of geographical area).**
- **Now the total cultivated area is 143 m. ha and the gross irrigated area increased to 82.6 m. ha (2005-06).**

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Contents

Editorial

Indian Agriculture: Today and Tomorrow

India has a long history of agriculture. Over centuries, farmers in this country devised practices to keep our farms sustainable. Practices like mixed cropping, crop rotation, using organic manure and pest management kept our agriculture sustainable. But things changed for the worse with the onslaught of a chemical intensive model of agriculture, imposed through the so called Green Revolution in 1965. The Green Revolution changed the 10,000-year evolutionary history of crops by changing the fundamental nature of seeds.'

In the past decades, India has made significant progress on providing food security for her people. The average rate of output growth since 1950s has been more than 2.5 percent per year; whereas it was greater than 3 percent during the 1980s, and less than 1 percent per annum during the period from 1900 to 1950. Most of the growth in aggregate crops output in India was the result of an increase in yields, rather than an increase in the area under crops (50.82 m/t from 97.32 m/ha during 1950 to 218.11 m/t from 121.33 m/ha during 2009-10). However, the yield performance of crops has varied widely. The gains in productivity remain confined to select areas. Between FY 1960 and FY 1980, yields increased by 125.6 percent in North India (Punjab, Haryana, and western Uttar Pradesh). The increase in other regions was much less: central India, 36 percent; eastern, 22.7 percent; southern, 58.3 percent; and western India, 31.6 percent. The national average was nearly 40.9 percent. Part of this disparity can be explained by the fact that during this period Punjab and Haryana were way ahead of other states in terms of irrigated area, intensity of irrigation, and intensity of cropping. Availability of irrigation is one of the crucial factors governing regional variations.

However, the growth rate of agriculture has decreased from 3.2 per cent during 1985-90 (seventh plan) to 2.1 per cent during 1997-2002 (Ninth plan). There has also been a decline in the growth rate of food grain production from 3.22 (1960) to 1.23 (1997). Food grain production is becoming a matter of concern again. The country is facing the challenge of achieving a higher rate of food production over the next 2–3 decades. Baseline projection for total cereal demand in 2020 is 246 million tons for direct human consumption. The relevant question that arises is whether India would be able to increase the food grain production in the coming years with the net-cropped area remaining the same? Much of the additional food demand in future will have to be met through productivity enhancement. What factors have contributed most to the productivity growth in the past? Reaching towards the goal of sustainable agriculture with high yield requires a crucial role of irrigation and other factors.

Use of chemical fertilizers, pesticides, mechanisation and petroleum, intensive and accurate irrigation, mostly made possible by building of dams are components of the Green Revolution. As a result of these components of the Green Revolution a lot of negative effects

occurred. Land degradation caused by water logging, salinization of the soil, desertification and water scarcity, depleting water resources, destruction of soil fertility, micronutrient deficiency, soil toxicity by high use of pesticides and chemical fertilizers, biomass reduction et al are but a few examples.

The challenge for Indian agriculture, simply put, is to increase production, while minimizing environmental impact. This includes conserving and protecting the quality of the resources that determine the performance of agriculture like land, water and air. Reductions in yield, although determined by many factors, may be partially a consequence of land and water exploitation.

Land degradation is one major constraint for Indian agriculture. By the early 1980s approximately 53 percent (173.6 million hectares) of India's geographical area had been considered degraded according to the Ministry of Agriculture (GoI, 2001a): Water logging affected about 6 percent of the cultivated area, while alkali and acidic soils both affected about 3 percent. The major process of land degradation is soil erosion (due to water and wind erosion) contributing to over 71 percent of the land degradation (GoI 2001a). Data compiled by the National Remote Sensing Agency (NRSA) indicated that 15 percent of India's total geographical area was comprised of degraded cultivatable wasteland (NRSA 2000). One third of this land was degraded by human activities, while nearly one half was degraded by a combination of human and natural causes (NRSA 2000). Too much use of fertilizers such as nitrogen has had adverse environmental effects. It has been shown that some of the nitrogen leaves fields with runoffs, damaging rivers, wetlands, estuaries and seas through the depletion of oxygen. Biodiversity has also been adversely affected including the disappearance of some types of fishery resources. The use of herbicides has also had adverse effects.

Water is another major constraint for Indian agriculture. Agriculture, through irrigation, accounted for 83 percent of the total water use in the country during 1990 (Vyas 2003). During the Green Revolution period water consumption in agriculture rose sharply as the net irrigated area increased from 31.1 to 54.68 million hectares between 1970-71 and 2000-01, while the area irrigated more than once per year increased from 7.09 million to 20.46 million hectares during the same period. Groundwater, one of the India's major sources for irrigation, is being rapidly depleted. The number of dark blocks (taluk or mandals), where groundwater extraction is more than 85 percent of the availability, increased from 253 to 428 out of over 5700 blocks between 1984-85 and 1998-99 (GoI 2002). The problem of groundwater depletion has been reported from rainfed states like Andhra Pradesh, Karnataka, Rajastan, Madhya Pradesh, Chattisgarh and Gujarat. Too much irrigation water has also been reported as environmentally harmful. Over-watering has had negative impact on soil composition with an increase in salinity and a reduction in soil productivity.

Besides, the increasing human as well as cattle population is imposing intense pressure on available natural resources; necessitating a new vision, holistic approaches for ecosystem management and renewed partnership between science and society.

According to the 11th Five Year Plan (2007-2012) documents, lower growth in productivity increase and profitability in agriculture is due to (i) Inadequate investment in rural infrastructure (ii) Illiteracy, socio-economic backwardness, slow progress in implementing land reforms and inadequate marketing and storage facilities (iii) Smaller size of land-holdings and fragmentation (iv) Inadequate adoption of modern agricultural practices and use of technology inefficient use of available technology and inputs. (v) Agriculture is mainly rain-fed. There has been low level of public investment in irrigation-related infrastructure (vi) There has been widening economic disparities between irrigated and rain-fed areas (vii) Increased vulnerability to world commodity price volatility following trade liberalization. This had an adverse effect on agricultural economies of regions growing crops such as cotton and oilseeds (viii) Uneven and slow development of technology (ix) Lack of adequate incentives and appropriate institutions (x) Degradation of natural resource base (xi) Rapid and widespread decline in groundwater table, with particularly adverse impact on small and marginal farmers (xii) Terms of trade turned against agriculture from 1999–2000 to 2004–05 and reduced profitability of farming quite sharply.

It is high time to reconsider the potentials of agriculture, which supports the majority of the population, before it is too late. Higher public investment in agriculture along with properly implemented land and tenancy reforms would lead to improved purchasing powers in the rural areas, particularly in the hands of the rural poor. An increase in effective demand can revive growth of the Indian economy, which has recently faced threat from the global economic and financial downturn.

The rural women empowerment has many a success stories for improving socio-economic status of rural poor. Most of the states are far behind in self help groups creation and wide spread implementation in villages.

Indian agriculture is shifting towards use of commercial energy sources very fast which is very risky. Now time has come to practice quickly towards increasing human and animate energy. The popularization of non-conventional energy sources should get priority in rural areas. The sources such as wind, solar, bio-energy, hydro electric and power from agricultural wastes such as *gober gas*, NADEP compost, wormi-compost as a partial substitute to high energy consuming agro-chemicals. This needs integration.

Recycling of used water, watershed management, conservation of rain water at rural levels practicing sprinklers, drip irrigation systems and cultivation of rain-fed crops such as, millets, oilseeds, pulses be popularized to meet the water deficit.

The sustenance of agriculture sector is certain with "Integrated Intensive Forming System (IIFS), Integrated Plant Nutrient Management (IPNM), Integrated Irrigation Management System (IIMS) and Integrated Pest Management (IPM).

In the last but not the least, the policy and planning be such that in coming five year plans, major emphasis needs to be diverted towards improvement of agricultural sector and rural areas where about more than 68 percent population is struggling hard for survival. The back bone of national growth depends on rural development. May this get of attention of one and all to improve the socio-economic status of the rural people. I hope so.

MILLETS - SUSTAINING FOOD AND NUTRITIONAL SECURITY FOR ALL

Prof. T. C. Poonia[1]

Key Words: Millet, climate change, food security, organic farming.

Abstract

Food security can be studied from three different views viz., availability of food, access and its absorption. Everything is going in good condition in Indian agriculture but there is a growing evidence of chronic and absolute poverty, malnutrition and under-malnutrition in significant portion of population. Our population is growing at a rate of 1.8 to 1.9 per cent a year with a changed consumption pattern. The main reason is that shift of consumption pattern is from a balanced diet to inadequate and faulty diets. The signs of *climate change* have also begun to shown in reduced production of coconut, mango and wheat. Value-addition through processing of these nutritious cereals should also be explored and popularized to make them popular among the consumers. The best way to achieve a better food security is to mix the millets into food basket with effective market policy is the need of hour.

Millets consists of sorghum, pear millet, finger millet and other minor millets such as *proso*, *kodo*, foxtail and barnyard millets. Sorghum is grown abundantly in Decan plateau (Marathwada in Maharashtra, Telangana in Andhra Pradesh and north Karnataka). Rajasthan is well known dominant home for pearl millet (Bajra). Southern Andhra Pradesh, Tamil Nadu, Orissa and Southern Karnataka are home to the finger millet. Uttarakhand and other hill and tribal areas cultivate a range of small millets such as foxtail, proso, kodo and barnyard millets. These regions form the main production as well as consumption belts in India with less than 20 per cent actually entering the long distance market channel. India is the top consumer of millets in the World as Indians eat 42 per cent of millets produced globally. A much scope is exists for millet's cultivation in eastern India.

Hobble agriculture

Future on Millets

India's population is growing at a rate of 1.8 to 1.9 per cent a year. If this trend continues, the populations will double itself in less than 40 years. In contrast, after achieving a self sufficient image in food grain production via green revolution, per capita of arable land

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is shrinking. Water use efficiency is still, on the whole, low. In addition to the gradual decline in per capita availability of land and water, various forms of biotic and abiotic stresses are spreading. Climate change is another peril to world agriculture as well as its policies. The belief alone may not be enough. But in case of climate change and its adverse causes give a signal to wake up quickly. A study by ISRO and *Vadodara's* MS University earlier of 2009 year reported that the sea has moved inland by around 15 and 90 metres in *Valsad* and *Danti*, respectively in the last decade.

The first signs of *climate change* have also begun to shown in Gujarat where coconut, mango and wheat production reduced considerably. Blame it on rise of temperature and changing pattern of rainfall and not on human beings greedy nature that is responsible for this change. Wayward and erratic rainfall, devastating flood, loss of livelihoods, land degradation, loss of forests, deepen water table, disturbance of aquatic balance and rising costal areas salinity are the few signs of climate change. It is the millions of poor who already bearing the brunt of climate change. Its impact revealed that wheat and mango production has dipped between 8-31% and 12%, respectively in Gujarat alone. Here clearly a great need to adopt millets than wheat, rice or others to feed the mushrooming population.

With the livelihoods of nearly 70 per cent of its population dependent on the agriculture sector which generates about 28 per cent of its GDP and over 15 per cent of its exports, the country's economy is particularly dependent on healthy agricultural growth. But in past four decades, the cropped area of nutritious cereals and their production as well as consumption is decreasing drastically. Before we make an estimate of our future foodgrains requirement we must ask a basic question as JRD Tata often used to do: *:What we want; bare survival or vigorous growth?*". That is, should we plan just a continue with the present state of mere survival or aspire for an India full of strong, vigorous and well built citizens as we find in well developed countries.

Food security can be studied from three different view points. First is the availability of food, which depends upon production and distribution; second, access to food that is guided by purchasing power; and third, food absorption. On the other hand, there is growing evidence of chronic and absolute poverty, malnutrition and under-malnutrition in significant portion of population. The main reason is shifting consumption pattern from a balanced diet to inadequate and faulty diets.

About 26% of the Indian population is deficient in calories and 28% in protein. The widespread prevalence of nutritional deficiencies such as protein-energy malnutrition, vitamin-A deficiency, iron deficiency, anemia, iodine deficiency and diabetes (referred to as five big problem) are prevalent among children and women. Over half of our children are

malnourished and are suffering from moderate to severe degree of stunting (as per UNICEF report - India has over 61 million stunted children distantly followed by China with 12 million). Our 30 per cent of newly born babies in India have low birth weight which indicates the level and spread of under-nourishment in women in India. And if, inspite of such widespread malnutrition and under feeding, the country is able to export foodgrains, it is because one third of our people are unable to purchase foodgrains according to their requirements due to their poverty. Although Green Revolution reduced overall poverty and ensured food security at the macro level but not completely at the household level. Malnutrition all among the life cycle should be recognised as a national problem. A unique research based analysis on diabetes made by Dr. Mayur Patel (Diabetologist at Ahmedabad) reported that, the silent killer which threatens to have a whopping more than 8.5 crore Indians in its grip by 2030.

The consumption of nutritious cereals in constantly coming down owing to rapid urbanization, changing food preferences, rising incomes, sedentary life style, supply of the cereals at subsidized prices through Public Distribution System (PDS), social status attached to fine cereals and time constraint of urban women to prepare food. Further all nutrition programmes viz., PDS, *Antyodaya* Anna Yojana, *Annapurna* Scheme, Mid-day-meal Scheme, Food for work etc. supply either rice or wheat to alleviate hunger. Micro-nutrient problems are not covered by these schemes.

During 1987 and 1998, the average decline in urban sorghum consumption was highest in Andhra Pradesh (-76.36 per cent) followed by Rajasthan (-73.90 per cent) as far as rural sorghum consumption is concerned, the decline was highest in Tamil Nadu (-95.62 per cent) followed by Madhya Pradesh (-83.96 per cent). Moreover this decline is more in urban sector than rural sector and too in high income and middle income groups than in low income group.

Remember we are the 128th in 'Nutritional Index' in the world, worse than South Africa. There is huge malnutrition we have to deal with.

Raising the level of "nutrition", "standard of living" and improvement to public health are the primary duties of State (Article 47 of the Indian constitution). Macro nutrients such as carbohydrates, fats, proteins and over 30 micro-nutrients are essential for a proper growth and development. In India poor section as well as non-poor population, suffer from multiple rather than a single micronutrient deficiency.

According to the recommendations of National Institute of Nutrition (NIN) to achieve a minimum energy requirement of 2738 k cal/day/head, a balanced diet containing at least

460 grams of cereals apart from pulses, vegetables and milk, should be consumed. Accordingly per capita requirement of cereals will be around 165 kg per head per annum. But the average annual cereal consumption is hovering around 135 kg per head, moderately lower than the NIN recommendations. Millet's, the poor man's crop, will turn out to be a major solution to these three national threats – food security, climate change and diabetes. The millet's are known for their role as a shield against food and nutritional deficiency disorders and are better designated as nutritious cereals. The anemia (iron deficiency), B-complex vitamin deficiency like stomatitis, glossitis and cheilosis (riboflavin deficiency) can be effectively tackled by in take of less expensive but nutritionally rich food grains like sorghum and millet's. Stunted growth is a result of long-term poor nutrition in nearly in early childhood.

As these cereals are consumed largely by local poor, they guard them against food and nutritional insecurity imposed by various agronomic, socio-economic and other factors. These are excellent dual-purpose fodder crops. These crops sustain cattle population in dry tracts, which otherwise have no other alternate fodder source. Although, their supply is increasingly become a problem in drought years.

These nutritious cereals are cultivated in harsh environments with poor soil and water conditions. Owing to their severe drought tolerance, their cultivation in drought-prone areas is effectively providing food and fodder security through risk aversion on sustainable basis. The importance of fodder for livestock may increase manifold in the event of increase in demand for milk and livestock products. During drought, it will help in generating employment in low rainfall areas where crop alternatives are absent or limited. As an assured source of income, these cereals offer a role as buffer cash at times of distress to meet urgent cash needs.

A nutritious analysis of millet's vis-a-vis major grains like rice and wheat have shown that compared to rice, they have 30-300% more nutritional elements such as calcium, minerals, iron, fibre, beta-carotene and other micronutrients. Sorghum and millet's are rich in starch content (56-73% in sorghum and 63-71% in pearlmillet). The protein content of both sorghum and pearl millet is comparable that of wheat. Pearl millet is rich in fat. The millets are rich in iron and phosphorus and pearl millet in ash content. The whole grains are rich in B-complex vitamins while deficient in vitamin-A and vitamin-C. The sorghum grain contains 3 per cent crude fat which is higher than in rice and wheat. Lysine is an important amino acid present in sorghum (which rice lacks) ranges between 71 to 212 mg/gm of nitrogen and that of pearl millet is 159 to 380 mg/ 100 gm of protein. Pearl millet is also rich in theonine, metheonine and cystine. Sorghum is a rich source of B-complex especially niacin (vitamin-

B_6) but also contain thiamine and riboflavin. In case of pearl millet, thiamine and riboflavin content are comparable to sorghum but niacin content is lower.

Sorghum contains 7.6 to 9.2 % of dietary fibre and pearl millet contains 20.4 % of the same which along with poor digestibility have a direct bearing on consumer acceptability. Thus the nutritious cereals are comparable or even superior to the fine cereals, and therefore, the inclusion of these cereals would definitely ensure the fulfillment of dietary requirement.

Compared to irrigated commodity crops currently promoted by policies, millet's require just around 25 per cent of the rainfall demanded by other crops such as sugarcane, rice and banana. They hardly burden the demands for irrigation and power. Millet's can also grow on skeletal soils that are less than 15 cm deep. It does not demand rich soil for survival and growth. Millet's production (pure organic in nature) is not dependent on synthetic fertilizers either.

The area under pearl millet is relatively constant due to its adaptability to harsh habitat such western Rajasthan where there is no competitive crop. "Rice and wheat become will become completely unviable in the context of climate change. With the projected increase of 2°C, wheat will disappear from the farming scene. Rice, which needs standing water for cultivation, is one of the highest emitters of methane, a green-house gas (GHG). Thus, both wheat and rice will loss their importance in the food basket of the country."

Ragi *roti* and Jowar *roti* have been popular traditional delicacies of Karnataka. But monoculture cropping had taken over most parts, leading to a sharp decline in millet varieties.

The decreasing area and production can be attributed to factors such as cultivation in harsh climate, low remuneration from cultivation of these crops, categorized governmental policies (lack of input subsidies and out put price incentives of otherwise provided for rice, wheat and oilseeds), fierce competition from commercial crops like introduction of irrigation facilities and better access to markets.

Niche Areas of Priority

Earlier, in most dry parts of Karnataka, millet-based multiple cropping systems used to be very common. Women primarily work on these farms, while men work on the major crops. They grow ragi, little millet, mustard, castor, pulses like *tur dal* and green gram, all on a small patch of half of one acre. This system is called *Navdanaya* (Today's so ever called crop diversification). This system has three broad advantages- firstly women are employed, they grow everything they need in their kitchen on their small farm, secondly, the crop does

not fail due to vagaries of weather, and thirdly, there is food security always. This is also good for diabetics.

To avoid some precarious situations, a part of output subsidy be diverted to nutritious cereals and stock of these cereals is raised, then there will be more takers for it, especially in the areas where it is preferred choice as staple. Also use of nutritious cereals in school noon meal schemes can be promoted. The problem of low shelf-life of some of these cereals can be over come when these cereals are targeted as PDS within three-four months after harvest. Rice and wheat supply may be regulated once the nutritious supply is ceased. Establishment of effective market is the need of hour. Unlike rice and wheat, the under-developed market network of nutritious cereals is not regulated. It should be regulated immediately.

The concept of health food and organic farming is catching up very fast the world over. Consumers in the developed countries are prepared to pay a premium for the organic food. These cereals may become a part of fully organic food as they are produced without using any synthetic fertilizers or any other agro-chemicals. A large mass scale awareness campaign about these cereals consumption should be carried out. Moreover, the barriers of low social status attached to these nutritious cereals should be removed by terming them as health foods.

Value-addition through processing of these nutritious cereals should also be explored and popularized to make them popular among the consumers. Millet's are a crop that can be controlled by the poor and hence, are answer to the agrarian crisis in India that has resulted in over 1.5 lakh farmer suicides within the past decade.

There are some innovative approaches on which major focus should be given are that introduction of sorghum in rice fallows, especially in non-conventional areas appears to be potentially promising for southern and eastern parts of the country with planting in late December to January that ensures high fodder yield to meet the feed demand in these areas. Owing to water shortage in coastal areas, especially Andhra Pradesh, Orissa and also MP and Chhatisgarh successful cultivation is now becoming very difficult. In these regions, dual purpose sorghum can effectively fit into the system to mitigate fodder and grain sorghum. There are niche areas of summer sorghum and Pearlmillet cultivation in Nanded and Pune district of Maharashtra and Bidar district of Karnataka. Pearl millet cultivation with limited irrigations during summer has tremendous scope in Gujarat and Tamil Nadu where it can fetch very high yields and income.

Development of crop varieties with desirable bio-chemical properties, increased palatability and short duration for millets for rainy season is the need of hour. Pearl millet

and sorghum grain can be used as potable alcohol preparation. Quantity of sugarcane molasses is inadequate. Therefore, sweet sorghum crop can be raised in four months with minimal inputs (especially water) can be an alternative. Pearlmillet, due to its rich protein content can be used for preparation of several protein-rich diabetic foods with higher fibre content (anti-oxidants) in various bakery products like bun, bread, cakes, cookies and biscuits that should target the urban consumers. Millet can make good malt as an adjunct in brewing industry. Sorghum beer is popular world-over, but India is yet to catch-up with big possibility.

To encourage the processing industry involving the value-addition, concessions in the form of subsidies/tax exemption in procurement of raw materials, production and marketing spheres and tax holidays should be given. Economic zones may be identified based on comparative advantages. The cultivation of millets is confined to regions where the prospect for cultivation of other crops is ruled out due to poor soil fertility and water availability. Such a scenario is most likely to continue. Hence to stabilize of crops yields under marginal production environment development of suitable genotypes is the most prioritized goal of crop improvement research. Encouraging the higher input usage in nutritious cereals cultivation is suggested. Although, coverage of hybrids is very good in case of both pearl millet and sorghum, subsidy for procurement of hybrid seed may be given to the farmers. Obviously, the policy on subsidy to fine cereals, and the PDS favouring only fine cereals, and now the liberalisation and globalisation – all are biting hard the prospects of millet crops and their producers who are largely marginal farmers. At society level, village level grain banks among self help groups should be promoted through participatory approaches.

The integrated role of various nutrients in the soil, plant, animal and human system has not been fully understood. Soil health is the first critical factor for plant growth has been well known. Nutritional oriented plant breeding with inclusion of organic farming is the need of the hour.

Widening of food basket to enhance local accessibility to food, using the productive resources of difficult regions, where production of major food crops is not possible, for ensuring the food security of vulnerable section of the people and conservation of agro-biodiversity of under-utilized crops are issues relevant to tackle hunger, poverty and malnutrition. The policies and funding support on ground at national and international levels on the under-utilized crops begs for greater awareness among policy makers and donor organizations concerned with elimination of hunger and conservation of agro-biodiversity. In the case, the best way to achieve a better food security and to solve other related problems is to mix the millets into food basket and Indian farming systems.

PESTICIDES IN FOOD CHAIN AND THEIR IMPACT
Vis-à-vis Animal and Human Health

R. S. Chauhan[1]

In the thirst of modernization and industrialization man has contributed pollution to the life and ecology of plants, animals and microbes. Increased demand for food and fiber has lead to the chemicalization of agriculture and we have reached on such a stage that modern agriculture is dependent on high yielding varieties, which can only be grown under the influence of fertilizers and pesticides. Pesticides are the man made chemicals which are being used to produce enough cheap food. In India, 38,000 MT of technical grade pesticides are used annually to control pests and plant diseases. The pesticides are classified as insecticides, fungicides, weedicides, herbicides, nematodicides and rodenticides; of which insecticides constitutes 77% of the total pesticides used in different agricultural and animal husbandry practices and in public health operations.

Majority of these pesticides are beneficial when used for specific purposes, handled properly and applied as per the recommendations of the manufacturer. However, over the years, there has been a mounting fear and concern that indiscriminate and disproportionate use of pesticides may lead to their residues in food chain which may exert their harmful effects in human beings and animals. In an ideal pesticide application, the chemical should fall exactly on the target and be degraded completely to harmless compounds but this never occurs and only some part of the pesticide hits the target pests while remaining drifts into the environment.

If we look retrospectively, we find that the use of pesticides started during Second World War when these hazardous and toxic poisons were considered as chemical weapons. A Swiss scientist Paul Muller invented DDT in the year 1939 which was considered as a wonder chemical that kills the insects, pests and was found wonderful in malaria control programmes. But soon after the discovery of DDT, its harmful effects also came into the knowledge of the scientists. In 1944, A famous biologist found harmful effects of DDT in birds, which produced thin shelled eggs, easily broken in nests resulting into failure of reproduction and decline of bird population.

The amount of pesticides used in India is very low (only 0.5 kg/ha) as compared to other developed countries (Table 1), even then we have much higher pesticide residues in food of our country.

[1] Director, Institute of Biotechnology GB Pant University of Agriculture & Technology Patwadangar–263 128 (Uttarakhand).

Table 1.Consumption of pesticides in different countries

	Country	Consumption (kg/ha)
1.	India	0.5
2.	Korea	6.6
3.	USA	7.0
4.	Germany	3.0
5.	Japan	12.0
6.	Europe	2.5
7.	Mexico	0.75

There is a gradual increase in production and consumption of pesticides during last few decades. The pesticides consumption increased from 2353 MT during 1955 to 75033 MT (technical grade) in the year 1991-1992 and which is again in the decline phase with the adoption of integrated pest management practices and the pesticides consumption level declined to the level of 43020 MT (technical grade) in the year 2003-2004 (Table 2).

Table 2. Consumption of pesticides in India

	Year	Pesticides (MT)
1.	1955-56	2353
2.	1960-61	8620
3.	1970-71	24320
4.	1980-81	54775.49
5.	1991-92	75033
6.	1995-96	61260
7.	1996-97	56114
8.	1997-98	52239
9.	1998-99	49157
10.	1999-00	46195
11.	2000-01	43584
12.	2001-02	47020
13.	2002-03	48350
14.	2003-04	43020

Source: Directorate of Plant Protection and Quarantine, Faridabad

About 20% of Indian food products contain pesticide residues above tolerance level compared to only 2% globally. No detectable residues are found in 49% Indian food products compared to 80% globally. It is all because of following reasons which needs to be looked in order to reduce the level of pesticide residues in animal products and other food material below MRL value. Table 3 includes the MRL in meat and eggs.

Table 3. Maximum residual level (MRL) {mg/ kg (ppm)} of some commonly used pesticides in animal products.

	Name of the pesticide	Animal product	Maximum residual level mg/kg (ppm)
1.	Aldrin/ Dieldrin	Meat Egg	0.2 0.1
2.	Benomyl	Meat Egg	0.1 0.1
3.	Carbendazim	Meat Egg	0.1 0.1
4.	Chlorpyriphos	Meat Egg	0.1 0.1
5.	Carbofuran	Meat Egg	0.1 0.1
6.	Chlorfenviphos	Meat Egg	0.2 0.2
7.	Cypermethrin	Meat	0.2
8.	2,4-D	Meat Egg	0.05 0.05
9.	DDT	Meat Egg	7.0 0.5
10.	Edinfenphos	Meat Egg	0.02 0.01
11.	Ethion	Meat Egg	0.2 0.2
12.	Fenthion	Meat	2.0
13.	Fenvalerate	Meat	1.0
14.	Fexachloricyclohexane (HCH)	Meat Egg	2.0 0.1
15.	Lindane	Meat Egg	2.0 0.1
16.	Monochrotophos	Meat Egg	0.02 0.02
17.	Phenthioate	Meat Egg	0.05 0.05
18.	Primiphos methyl	Meat Egg	5.0 0.05
19.	Carbofuran	Meat	0.1
20.	Phenthoate	Meat Egg	0.05 0.05

Reasons for more pesticide residues in India

1. Indiscrimate use of pesticides

The use of pesticides is comparatively more in certain crops while in some it is negligible (Table 4). The farmers use pesticides more frequently and in increased doses than the recommended doses or procedures. It leads to the presence of high amount of residues in food commodities.

Table 4. Pesticides share in different crops

	Name of the Crop	Percent share of pesticides
1.	Cotton	52-55

2.	Rice	17-18
3.	Vegetables/ Fruits	13-14
4.	Plantation	7-8
5.	Cereals/oil seeds	6-7
6.	Sugarcane	2-3
7.	Others	1-2

2. Improportionate use of pesticides

The pesticides are used improportionately in India in relation to places and the amount of pesticides residue varies from one place to another. Tamilnadu consumes 1.2-2.0 kg/ha of land followed by Andhra Pradesh and Punjab where 0.8-1.2 kg is the rate of consumption. Pesticide residues in the feed and fodder are solely responsible for their accumulation in animal and poultry. The states like Tamilnadu, AP, Punjab, Haryana, and Karnataka have highest use of pesticides in order to get more production while on the other hand the states like Bihar, West Bengal, North eastern states have lowest use of pesticides. It is because of iIletracy of farmers, poor economic conditions or due to lack of awareness. So the food commodities in high using states have more residues of pesticides.

3. Lack of education

Most of the farmers or labours working in the agricultural fields are either illiterate or having low formal education. They are not able to understand and read the instructions mentioned on pesticide containers or in the literature supplied with them. Their tendency is to use comparatively higher quantity of pesticides than recommended by the scientists/ manufacturers. They ignore the required dilution factor and use much higher concentration of the pesticides. They are even not aware of the harmful effects of the pesticides and do not properly dispose the used containers of the pesticides.

4. Lack of extension activities

Inspite of Krishi Vigyan Kendra, Krishi Gyan Kendras and a network of extension workers of the Government/ NGO's, there is a lack or deficiency in proper extension activities in India. The farmers are not fully aware about how to use pesticides, what precautions they should take in order to reduce the acute and chronic effects of pesticides? Farmers do not keep proper difference between the last application of pesticide and harvesting the crop, which leads to increased level of pesticide residue in food items and ultimately in animal products.

5. Inadequate literature supplied by the manufacturers

The pamphlets/ literature supplied by the manufactures along with the pesticide packing is incomplete and inadequate. Though it is written in many regional languages/ scripts but the printing, letter size and quality of paper is so poor that even an educated person cannot read and understand it what to talk of farmers or labours. It has been observed that one of the reasons to use a much higher concentration than the recommended ones is lack of proper literature.

6. For more production and profit

Most of the farmers have impression in their mind that spray/use of more pesticide will lead to higher production. Therefore, the desire of more production and profit leads to indiscrimate use of pesticides in crops which ultimately enters in the food chain.

7. Lack of safer pesticides

So far very few pesticides have been discovered which are harmless to human being or other domestic animals. Therefore, farmers have to use the available pesticides only which have a very narrow safety margin.

8. Use of banned pesticides

In our country most of the banned pesticides (Table 5) are available in market and are used in various agricultural operations. This is primary because of the failure of Govt. to formulate and implement effective policies regarding the use of pesticides. Secondly, the socioeconomic condition of farmers does not allow to strictly monitoring the use of dangerous pesticides in agriculture and animal husbandry. These pesticides have been banned because of their acute/chronic harmful effects on the animal/human health. Thus their use adds to the misery and poor health of farmers and consumers.

In spite of ban, DDT and BHC are still produced in India and we have 77% DDT and 95% BHC in India out of their total production in world.

Table 5. Pesticides banned in India[1]

	Name of the Pesticide
1.	Aldicarb
2.	Aldrin
3.	Benzene Hexachloride (BHC)
4.	Calcium cyanide
5.	Captafol 80% Powder* Use banned w.e.f. 17.7.2003

[1] Source: Directorate of Plant Protection and Quarantine, Faridabad

6.	Chlordane	
7.	Chlorobenzilate	Use banned w.eJ. 17.7.2003
8.	Cibromochloropropane	
9.	Copper Acetoarsenite	
10.	Dieldrine	Use banned w.e.f. 17.7.2003
11.	Endrin	
12.	Ethylene Dibromide	Use banned w.e.f. 17.7.2003
13.	Ethyl Mercury Chloride	
14.	Ethyl Parathion	
15.	Heptachlor	
16.	Maleic Hydrazide	Use banned w.e.f. 17.7.2003
17.	Menazone	
18.	MehtomyI 12:5% L	
19.	Mehtomyl 24% L	
20.	Nicotine Sulphate[1]	
21.	Nitrofen	
22.	Paraquate Dimethyl Sulphate	
23.	Pentachloro nitrobenzene (PCNB)	
24.	Pentachlorophenol (PCP)	
25.	Phenyl Mercury Acelate (PMA)[2]	
26.	Phosphamidon 85% SL	
27.	Sodium Methane Arsonate (MSMA)	
28.	Tetradifon	
29.	Toxafen	
30.	Trichloro acetic acid (TCA)	Use banned w.e.f. 17.7.2003

9. Man is ultimate consumer

Man is the ultimate consumer of pesticide residues. Through fodder, water, air and other feed stuffs pesticide residues reaches in animals and then through milk, meat, egg and other animal products accumulates in human being. Various pesticide residues have been reported from animal products in our country important among them are DDT, Carbaryl, Hepatochlor, PCB etc. These pesticide residues in animal products and other food items ultimately get accumulated in the man especially in the adipose tissue, blood and lymphoid organs. Most of research on pesticide toxicity has been directed towards the assessment of their acute effects. When fed to man or animals at very low doses daily for months or years,

[1] Manufactured in India, for export only.
[2] Manufactured in India, for export only.

these accumulated pesticides in body, may harm the normal functions causing various diseases in man and animals.

Status of pesticide residues in India

The presence of pesticide residues have been detected in various items and in food chain. The levels of the pesticides are found much higher than expected level because of heavy contamination of environment. A list of commodities is given in which very significant levels of pesticides are recorded (Table 6). Besides, there are human milk, fat or tissue samples screened for the presence of pesticide residues were also found to have very significant levels of harmful pesticides. The BHC has been found from 0.120 to 1.22 PPM in human fat samples. Heptachlor, an organochlorine pesticide was found to be 0.425 PPM and DDT from 0.195 to 1.695 PPM. Even human breast milk is not free from DDT, which was found to have even 2.39 PPM levels. Similarly human blood was found to have a much higher concentration of 12.00 PPM as against of 0.050-PPM safe levels (no effect levels).

Table 6. Pesticide residues in food chain

	Items	Pesticide residues detected
1.	Soil and water	Permethrin, cypermethrin, fenvelerate, deltamethrin, DDT, Aldrin, Dieldrin, BHC, Heptachlor, Lindane, Endosulfan
2.	Air	DDT, BHC
3.	Fodder (Lucerne)	Monocrotophos, Phosphomidon, Endosulfan
4.	Cattle feed	Cypermethrin, DDT, BHC
5.	Pasture & Hay	DDT, Aldrin, Dieldrin, BHC, Heptachlor, Lindane
6.	Rice, wheat flour, oils	DDT, BHC
7.	Dairy Products, Baby milk powder, Butter, Ghee, Cow/ buffalo milk	DDT, BHC, HCB, PCB, Heptachlor
8.	Meat, Eggs	DDT, heptachlor, PCB, Carbaryl
9.	Liver, Kidneys, Hair, skin	Cypermethrin
10.	Vegetables	Endosulfan
11.	Adipose tissue of man	BHC, DDT, PCB, HCB, Heptachlor, Aldrin
12.	Human breast milk	BHC, DDT, Aldrin, Heptachlor, HCH
13.	Blood of man	BHC, DDT, Aldrin, Heptchlor, HCH

The primary concern of the chronic low dose toxicity in man and animals is related to the carcinogenic, teratogenic, mutagenic, immunotoxic, immunopathological and/or neuropathic effects of pesticides. The perusal of literature in this regard reveals the studies directed towards only one or two pesticides while in nature, when a large number of pesticides are present and their combined effect has not been measured; which of course will

give very dangerous view. Various Pathological effects of low doses of pesticides in animals and man are as under:

1. Immunopathological effects

Immunopathological effects of pesticides in animals and man are classified under acquired immunodeficiency or immunosuppression, autoimmunity and hypersensitivity.

a) **Acquired Immunodeficiency:** Most of the pesticides studied during last two decades are found to exert immunosuppressive effect on both the wings of immune system i.e. humoral and CMI. Organochlorines, organophosphates, carbamates and synthetic pyrethroid pesticides were found immunotoxic at "no adverse effect dose" levels in poultry, sheep, and in bovine calves. However, the organochlorines are comparatively much more harmful to immune system. They are considered to be the cause of vaccinal failures or occurrence of disease epidemics in animals due to lowered immunocompetence. It has also been reported that a state of immunosuppression for a longer period may also lead to the development of neoplasms as the immune surveillance mechanism becomes defective. Such animals also exhibit recurrent bacterial infections due to defective phagocytic machinery of the body. Immunosuppressive state of animal for a longer duration may also lead to development of cancers in the absence or defective immune surveillance in body. Since the pesticides affect specific as well as paraspecific immune system adversely, the immuno surveillance in body becomes defective. Though, there is no direct correlation but for an example, there is an increased incidence of eye cancer (squamous cell carcinoma of eye) in cattle and buffaloes in western UP during last few years. Similarly the occurrence of canine venereal tumours also increased in dogs during last decade. It is an indication of the adverse effects of polluted environment and may be related with a state of immunosuppression.

b) **Autoimmunity:** Pesticides are also known to initiate autoimmune reactions in body particularly organochlorine group of pesticides binds with certain proteins of the body to become antigen leading to initiation of an autoimmune response in body. Autoimmune glomerulonephritis or autoimmune hemolytic anemia or autoimmune rheumatoid arthritis are such mainfestations in animals and man. Lindane when fed with 'no adverse effect dose' level in lambs for a period of 4 months resulted in autoimmune glomerulonephritis as has been detected by the presence of immunecomplexes in glomerular basement membrane using indirect immunoperoxidase techniques.

c) **Hypersensitivity:** Hypersensitive reactions are reported due to consumption of pesticide contaminated food stuffs. Pesticides may act as haptens but antibodies against them have

been detected in body. Eczema in man was found due to maneb, 2,4-D and 2,4,5-T. DDT has also been known to cause type I hypersensitivity reaction. The dust of pesticides is cause of allergic respiratory disorders like asthama. Cutaneous allergy has been known to occur due to contact of pesticide contaminated food items. However, the studies showed a depression of CMI response on delayed type hypersensitivity reaction using chemical allergens.

2. Carcinogenic effects

Some pesticides exert their carcinogenic effects either directly or indirectly through their metabolites. Most of organochlorine pesticides like dieldrin, gamma isomer of BHC, DDT and PCB may cause cancer in liver and lung. However, there is a lack of sufficient literature to support this belief that the pesticides are having carcinogenic effects. Indirectly, a state of immunosuppression for a longer period is helpful in increasing the susceptibility of an animal for malignancy. Since many pesticides are known to cause mutation in chromosomes of man and animals, it is considered that they may also lead to carcinogenicity.

3. Mutagenicity

Pesticides may cause alterations in structure or number of chromosomes resulting in translocations, mutations and chromosomal breakage. The altered chromosomal number may become lethal during fetal stage. Several pesticides like DDT, Endrin, PCB and HCB are known to cause chromosomal aberrations. The mutagenic effect of pesticide poses a more serious threat to the future of human race.

4. Teratogenicity

The accumulation of pesticides in body tissue and congenital birth defects in children has not been well correlated so far. However, there are certain pesticides which causes teratogenic defects in animals. Carbaryl, thiram, propoxur, parathion, leptaphos, 2,4-D, lindane and diazinon are having teratogenic defects in animals. In mice, cypermethrin, alphemethrin and malathian are found to exert birth defects in baby mice.

5. Neuropathy

Most of the organophosphates, organochlorines carbamates may cause neutrotoxic effects in man and animals including increased irritation, loss of memory, in coordination of movement, ataxia, delayed response, convulsions, spasms and paralysis. Such changes appear due to demyelination of nerves in central and peripheral nervous system. Pesticide residues are also responsible for marked behavioural changes in man and animals.

6. Nephropathy

The pesticide residues present in food stuff may act as hapten and when they bind with certain body proteins, they may become antigenic. This antigenicity in responsible for initiation of immune response in body and a continuous presence of antigen and antibodies in body may lead to the formation of immune complexes. The immune complexes when produced in excess are deposited in glomerular basement membrane leading to glomerulonephritis, commonly known as renal failure for which patient needs dialysis after a regular interval to survive.

7. Hepatotoxicity

The pesticide residues in food may harm liver tissue as they are metabolized here. There are instances of chronic liver disorders leading to cirrhosis. Certain pesticides are not so dangerous but their metabolites cause severe damage to hepatic parenchyma. The cirrhosis once starts; it never stops even after withdrawal of the primary cause.

8. Reproductive Disorders

It has been observed that the pesticides are lethal to dividing cells of genitalia. They may cause abnormalities in sperms leading to decrease their ability for fertilization. On the other hand the ova become defective and not able to implant on the uterine surface leading to early abortion or miscarriage. DDT has been found to cause weak egg shell in birds leading to their decreased population. The pesticide residues in food, thus may ultimately lead to sterility, early abortion, still births or repeat breeding.

9. Recurrent infections

Animals having reduced immunocompetence due to pesticides are more liable to attract infections very frequently. A good treatment provides relief to animal but soon after recovery, the same disease occurs again due to immunosuppressive state of animal. Needless to emphasize that most of the antibiotics are bacteriostatic, which do not kills the organism but prevent their growth. In such conditions the suppressed growth of bacteria flares up just after withdrawal of the antibiotic therapy in the absence of defective immune system of body due to pesticides.

Cowpathy in control of harmful effect of pesticides

Cowpathy is just like any other system of medicine such as Homeopathy, Allopathy or Naturopathy. In this, the human or animal ailments are treated with products of cow also known as Panchgavya means five things derived from cows i.e. milk, ghee, dahi, urine and dung. In our ancient literature of Ayurveda it is described as Panchgavya Chikitsa. In recent years, interest has been generated among scientific community of the world to develop or

scientifically validate the Indigenous Technical Knowledge (ITK) as an alternate therapeutic or preventive approach. As is evident from the trends of modern allopathic treatments particularly the development of resistance in microorganisms and side effects, the alternative system of medicine gains momentum not only in India but WHO also established recognition to such systems. In fact in the western world also, scientists/ clinicians are facing problem in handling the multiple drug resistance in microorganisms, presence of antibiotic residues in food chain and/or associated allergies and autoimmune disorders in man. As per WHO, the twentieth century wonder drugs "antibiotics" will not remain useful and become almost ineffective by the year 2020, then one has to think over the alternative therapeutic approaches to control the infections. In fact most of the antibiotic drugs are bacteriostatic in nature and as such they do not kill the bacteria rather they stop or check their growth and bacteria have to be destroyed by the body's own defence mechanism known as "Phagocytic System" through macrophages (monocytes of the blood). During last few years it has been observed that the efficiency of these macrophages reduced drastically as a result of the environmental pollution and presence of pesticides, heavy metals, fungal toxins etc. in the food chain. That is attributed to the heavy use of agrochemicals in agriculture and poor storage conditions of food grains. Any how deficient functioning of macrophages leads to inefficacy of antibiotic drugs, development of resistance in bacteria, recurrent infections, and or decreased immune status of an individual. Recent researches showed that cow urine enhances the immune status of an individual through activating the macrophages and augmenting their engulfment power as well as bactericidal activity. This research opened a new era in medical science and CSIR has got a patent from US on cow urine for its bioenhancing properties and its use in tuberculous patients. Along with traditional therapy of tuberculous drugs, if one also consumes cow urine, the antituberculous drugs act faster even in low doses and thereby reducing the cost of treatment and its duration. Very recently, researches have found that use of cow urine along with the antibiotics prevents the development of resistance in microorganisms against the antibiotics. This is thought that the cow urine blocks the R-factor, a part of plasmid genome of bacteria responsible for the development of antibacterial resistance. Several scientists from different laboratories of CSIR, AIIMS, G.B. Pant University Pantnagar, and IVRI, besides NGOs are working on different medicinal properties of cow urine. In fact there are several medicinal preparations available with NGOs who are also marketing cowpathy drugs under FDA license and some of the NGOs are even not able to cope up with the demand of the public. Several students of M.Sc., M.V.Sc., M.D. and/or Ph.D. are working on the medicinal properties of cow urine and other products of cow. It has been found to enhance the body's immunity and resistance power to fight with infections.

Cow urine has antioxidant properties and thus it neutralizes the oxidative stress produced in body through action on free radicals. It has been found to repair the damaged DNA and thus is effective for the cancer therapy. Scientists proved that the pesticides even at very low doses cause apoptosis (cell suicide) in lymphocytes of blood and tissues through fragmentation of DNA and cow urine helps the lymphocytes to survive and not to commit suicide, it also repairs the damaged DNA. Besides, in poultry cow urine enhances the immunocompetence of birds and provides better protection along with vaccination. It also increases egg production, egg shell quality and egg weight. Moreover, by using cow urine in poultry ration one can enhance the productivity that too without using antibiotics and the fear of antibiotic residues in poultry products.

On the basis of chemical fingerprinting through modern equipments like HPLC, it has also been observed during the scientific research that the urine of Indian cows are highly effective and almost nil or few medicinal properties are present in the urine of crossbred, exotic cows, buffaloes, etc. The Indigenous cow urine contains "Rasayan" tatva, which is responsible to modulate immune system and act as bioenhancer. It is not only the cow urine which is a wonder product by cow but others like dung, milk, ghee and curd are also equally effective for various ailments and other operations. Cow urine as such and/or after addition of neem leaves is a wonderful biopesticides.

Such biopesticides are safe to use, do not accumulate in the food chain and as such do not have the harmful effects like chemical pesticides. Cow dung is excellent farm yard manure and if processed and prepared vermi-compost, very small amount of vermi-compost is sufficient for a large field. Similarly, many medicines are prepared from the cow milk, ghee and curd. However, again the problem is same, scientific validation of these products is required.

Cowpathy is an age old system of medicine described in ancient Indian literature 'Ayurveda' as 'Panchgavya Chikitsa". In Ayurvedic system, medicines are prepared either from plants or from animals besides the use or certain metals. The Ayurvedic medicines of animal origin are mainly prepared from cow products. The high profile medicine 'Panchgavya' is prepared from five materials received from cows that includes milk, Dahi (curd), Ghee (butter oil), urine and dung. The ability of indigenous cow urine is tested for its immunomodulatory properties in mice, rat and avian lymphocyte cell culture system for the first time and the results are presented in Table 1.

Table 1. Percentage of increase in immunity through various parameters in comparison to control

	Parameters	Percent increase in immunity
1.	B-cell blastogenesis	59.5 %
2.	T-cell blastogenesis	64.0 %
3.	Serum IgG level	19.8 %
4.	Serum IgM level	19.0 %
5.	Serum IgA level	0.53 %
6.	Macrophage Functions	104.0 %
7.	DTH reaction	126.0 %
8.	Interleukin 1 level	30.9 %
9.	Interleukin 2 level	11.0 %

The urine of indigenous cow is also compared with the urine of other animals such as crossbred cows, buffaloes, goats, exotic cows and hill cows. It has been observed that the urine of indigenous and hill cows is quite effective as far as the immunomodulation is concerned the goat urine is also effective but upto the 50% of the cow urine. This finding is further supported by the presence of "Rasayan" in the urine of indigenous cows (Table 2).

Table 2. Analysis urine through chemical fingerprinting (HPLC)

	Characteristics	Indig-enous cow	Hill cow	Goat	Exotic cow	Cross-bred cow	Buffalo
1.	Tridos har	√	√	√	√	X	√
2.	Madhur ras	√	√	√	√	X	X
3.	Madhur vipak	√	√	√	X	X	√
4.	Katu ras	√	√	√	√	X	√
5.	Tikta ras	√	√	√	X	√	√
6.	Kashay ras	√	√	√	√	√	√
7.	Raktas shodhak	√	√	√	√	√	√
8.	Deepan	√	√	√	√	√	√
9.	Pachan	√	√	√	X	√	√
10.	*Rasayan*	*√*	*√*	*√*	*X*	*X*	*X*
11.	Amhar	X	√	√	√	√	√
12.	Vat viridhi	√	√	√	√	X	X
13.	Hepatoprotective	√	√	√	√	X	√
14.	Stress reliever	√	√	√	√	X	√
15.	Effect on blood calcium level	√	X	X	√	X	X

Strategies to combat with pesticide residues related problems

A. Government level

1. The farmers should be advised about the harmful effects of pesticides so that they should minimize the use of pesticides in crops. They should judiciously use the pesticide in

terms of their quantity and frequency.

2. It should be assured that the pesticides produced in country should be distributed proportionately so that the indiscriminate and improportionate use can be avoided.
3. All emphasis must be laid on the development of Bio-pesticides like viral, bacterial or fungal pesticides or pesticides of botanical origin like Neem or Tulsi or of cow urine based pesticides, which can be used in crops to kill the insect pests without polluting the environment.
4. The harmful pesticides like some organochlorines, organophosphates and carbamates must be banned strictly in India, their production, import or use should be completely banned.
5. To reduce the effect of pesticide residues, some herbal preparations should be developed which can overcome the immunopathological, neuropathic or nephropathy effects, there are many herbs mentioned in our Indian ancient literature, which can be scientifically validated to prevent and control the harmful effects of pesticides. This will certainly give a new direction to the world not to depend on synthetic things.

B. Household level / Individual level

1. Avoid the use of chemical pesticides in house such as mosquito repellents, cockroach killers, sprays, mats, coils, etc. All of them are harmful to the body responsible for making body susceptible to various kinds of ailments.
2. Avoid to use synthetic chemicals, dyes, flavouring agents, preservatives, antifungal and antibacterial agents in food items.
3. Use fresh foods as far as possible and after proper cleaning. Vegetables should be kept in lukewarm water with 0.89% salt for at least 30 min before use.
4. Avoid the shining vegetables fruits such as tomatoes, brinjal, lady's finger, apple, etc.
5. Try to have such vegetables/fruits/cereals/pulses which are grown under organic farming.

INTELLECTUAL PROPERTY RIGHTS: IMPACT ON AGRICULTURE

Plant Breeder's and Farmer's Right

J.P. Lal and Prem Kumar[1]

1. Introduction

IPRs refer to the legal ownership by a person or business of an invention/discovery attached to particular product or process which protects the owner against unauthorized copying or imitation. The intellectual property rights have existed and were practiced in every society from time immemorial. Man has always been reluctant in disclosing certain kind of information to ensure its effect for a longer time. Social institutions, sanctified by various moral traditions did prevent certain social classes from gaining access to specific aspect of knowledge systems. It is reported that in Murshidabad, West Bengal, there was a tradition of sending baskets of a particular variety of mangoes to the rulers but only after puncturing the seed with a thin needle so that these mangoes could not be cultivated outside the local region.

Intellectual property rights (IPR) have become important in the face of changing trade environment. At present traders face several problems such as high investments in research and development (R&D), risk associated with innovation, geographical barriers to trade, need for rapid changes in technology. In an ideal situation, an inventor should get a reward that is proportionate to the benefit accruing to the society from its invention.

The inventor and society will ordinarily stand opposite each other on the question of the proportion that should go the inventor and the quantum of the benefit accruing or likely to accrue from the invention. There is massive evidence to support the fact that appropriate legal protection acts as an incentive for productive research (World Bank, 1990). After industrial revolution, the nature, scope and extent of intellectual property protection has, increased manifold. Intellectual property rights (IPRs) generally allow right holders to exclude the unauthorized commercial use of their inventions by other persons.

2. Intellectual Property Rights and Agriculture

Intellectual property rights (IPRs) are the legal rights generally allow right holders to exclude the unauthorized commercial use of their creations/inventions by third persons. The rationale for the establishment of a legal framework on IPRs is that it is a signal to society that creative and inventive ideas will be rewarded. These rights are awarded by the State and

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are monopoly rights implying that no one can use these rights without the consent of the right holder. IPR are largely territorial rights except copyright, which is global in nature. IPRs have fixed term except trademark and geographical indications, which can have indefinite life provided these are renewed after a stipulated time specified in the law by paying official fees.

Intellectual property rights can broadly classified into patents, trademarks, geographical indications and industrial designs.

Patents are probably the most important IPR today for agricultural goods and services as they provide, wherever these are available, the strongest protection for patentable plants and animals and biotechnological processes for their production. Patentable products have to meet the criteria of patentability, viz., *novelty*, i.e. that which is not known in the prior art, *non-obviousness* i.e. that which *involves an inventive step and usefulness* i.e. that which is industrially applicable. Indian Patents Act, 1970 (as amended in 2005) has excluded from patentability "plants and animals as a whole or any part thereof other than microorganisms but including seeds, varieties and species and essentially biological processes for production or propagation of plants and animals"; and, "any process for medical, surgical, curative, prophylactic (diagnostic, therapeutic), or other treatment of human beings, or any process for a similar treatment of animals to render them free of diseases or to increase their economic value or that of their products"

A trademark is a distinctive sign, which identifies certain goods or services as those produced or provided by a specific person or enterprise. Trademarks may be one or combination of words, letters, and numerals. They may also consist of drawings, symbols, three dimensional signs such as shape and packaging of goods, or colours used as distinguishing feature. Today trademark has become almost synonymous with 'brand'. In research laboratory equipments bear trademarks that are well known to workers in their field. India has a Trademarks Act, 1999. Overall there are 42 classes distinguishing the good and services. There 34 classes of goods and 8 classes of services.

Geographical Indication is a new concept in India; and prior to the Geographical Indications of Goods (Registration and Protection) Act, 1999, that there was no specific law governing GIs of any agricultural, natural or manufactured goods. The term Geographical Indications (GIs) for purpose of TRIPs agreement have been described as indications which identifies such goods as agricultural goods, natural goods or manufactured goods as originating, or manufactured in the territory of a country, or a region or locality in that territory, where a given quality, reputation or other characteristics of such goods is essentially attributable to its geographical origin. Different types of agricultural goods such

as Darjeeling tea, Coorg orange, Mysore betel leaf, Nanjanagud banana, Palakkadan Matta rice have already been registered as GIs in India.

3. IPR and Plan Protection

Many countries have developed plant breeders' rights to reward conventional plant breeding efforts. In pursuance to the TRIPs agreement, India has enacted "Protection of New Plant Varieties and Farmers' Rights (PPV&FR) Act, 2001, a *sui generis* system of plant variety protection. *Sui generis* means one-of-its-kind. Such *sui generis* rights include plant breeders' rights (PBRs). It aims at protecting a number of rights that have a bearing on Indian agriculture.

Plant Breeders' Right

Plant variety protection, also referred to as a "plant breeder's right," is an exclusive right granted to the breeder of a new plant variety to exploit that variety. It is a form of intellectual property right and is an independent *sui generis* form of protection tailored to the protection of new plant varieties. The certificate of registration of a variety issued under the PPV&FR, 2001 shall confer an exclusive right on the breeder or his successor or his agent or license, to produce, sell, market, distribute, import or export of the variety.

Breeder's Exemption

The provision of use of material of a protected variety (the initial variety) for the development of new variety is known as breeder's exemption. Under the UPOV Act, 1978 all new varieties evolved using a protected variety were exempted from protection under this provision. The scope of breeder's exemption has limited by bringing an '*essentially derived variety'* under the cover of PBR protection in UPOV Act, 1991

Farmer's Rights

The *Sui generis* system adopted by India is unique as it consist farmer's right concept and genuinely addresses the concerns of farmers as breeders, conservers, innovators etc. Indian PPV&FR Act, 2001 gives following rights to the farmers, for their contribution in the economy, conservation of genetic resources and in developing new varieties.

- Farmers' right to register traditional varieties.
- Farmers' right to save, use, resow, exchange and sell (selling of branded seed of a protected variety under the act is prohibited).
- Farmers' right for reward and recognition
- Farmers' right to claim compensation for under performance of a protected variety from the promised level under given conditions.

- Protection against innocent infringement.
- Benefit sharing for use of biodiversity conserved by farming community.

Farmer's Privilege

PBR system generally allows the farmers to use the material of a protected variety harvested on their own farm for planting their next season crop without obligation to the PBR holder. Under UPOV Act, 1978 there was explicit provision for farmer's privilege while UPOV Act, 1991 has made this as 'optional' and each member state can either allow or disallow this privilege.

3.1 Negative Impacts of IPRs vis-à-vis Agriculture

Using the agricultural domain as an example, Cullet, in panel organized by Trade - Human Rights - Equitable Economy (3D) on 13 March 2008, at the Palais des Nations in Geneva in collaboration with Office of the High Commissioner for Human Rights (OHCHR) and the International Environmental Law Research Centre (IELRC) noted three instances of how current Intellectual Property Rights (IPR) impact human rights. First, by restricting access to knowledge, IPR favour monopolies. Second, IPR allow agribusiness to patent genetic modifications of seed lines.

While these IP protections help businesses reap profits from innovation, they also restrict access to and use of many seeds. Thirdly, the IP regime fosters the commercialization of agriculture, promoting monoculture and cash crops over subsistence farming. Such IP restrictions and favouritism of big business interests have devastating impacts on the human right to food and protection of traditional knowledge.

4. Problems India Faces

At present technological advances are taking place at a faster pace in several fronts. In the contemporary world, the technology has become the most important resource to any nation. Adoption of new technologies and new products, invention, innovation, investments in risky ventures, intensive R&D activity, etc. are the major processes in making a nation wealthy and technologically superior. In the present race of technological superiority, a strong patent system is vital for protecting the interests of inventors.

Due to its weak patenting system and lack of patent culture India is facing several problems. Two of our most serious problems are (i) external pressure to change our patent laws and (ii) theft of our traditional intellectual property e.g. patenting of the medical properties of *neem,* and turmeric (*haldi*); and of Basmati rice as Kasmati or Taxamati. The first one is the case of theft and the second one is violation of geographical appellation.

Whatever is being said about *neem* is more emotional than factual. We have been neglecting our Ayurvedic and Unani medicinal systems in a planned way. There are in all 63 patents on *neem* in the world (mostly in Japan, Germany and USA) and only 8 are in India.. It is illegal to obtain patent on properties/qualities known for several centuries. Traditional Knowledge Digital Library is an excellent effort in this regard. However, our patent laws do not declare traditional knowledge a national intellectual property.

The case of turmeric (*haldi*) is a clear case of theft. This has been possible due to non-resident Indian. Most Indians are aware of the healing property of turmeric (*haldi*). As Americans did not know, therefore, a patent could be obtained. This only highlights the weakness of US patent laws.

5. The Path Ahead

India has now developed a sound IPR regime that presents a very promising future not only for the protection of her traditional knowledge and traditional cultural expressions but also for those who are willing to invent their intellectual labour and skills in various fields of human action and endeavour in general and agriculture in general.

It should be borne in mind that under the system of TRIPs the two guiding principles are the ones related to national treatment and most favoured nation treatment which aim at providing equal protection as also non-discrimination in matters of protections. Most of the fraudulently got patents about elements of Indian agriculture and traditional knowledge became reality since Indian law on the point was either non-existent or lacked compatibility with American or European laws.

However, within last ten years or so, India has strengthened her laws on biodiversity, traditional knowledge, geographical indications, plant varieties, patents and trademarks so much so that in this newly created climate, the Indian innovators can get protection under foreign systems simply because the innovators of those nations may get the same level of protection in India. This has induced immense possibilities of progress in Indian agriculture sector also, that is, en route IPR.

Environment and Equitable Society

A brief survey of peoples' movements in India

Dr J P Mishra[1]

1. Environment and the Man

Nature precedes, as also pervades the man. The Nature and the God (the Purush), says Geeta, are primordial; and all the good and the evil have originated from the Nature[2]. The man, when he first came on Earth must have found himself surrounded (protected) by the Mother Nature. Much before he learnt to clothe himself and to live in the company of other men, he was always in close contact with nature. However, as he came out of the mother earth's lap and in the company of other homo sapiens he started being less and less caring for the nature and, ultimately, began even to plunder the 'mother' for his selfish ends. So much so that when his folly dawned on him he had spoiled much of the wealth and grandeur of the mother.

The journey of man towards civilization is a saga of plunder and exploitation of Mother Earth. The more civilised he became towards his fellow beings, the more savage he turned towards the nature.

The Indian philosophy sees the Supreme Being's presence everywhere and, therefore everything in the Universe-ranging from the minutest particles to the mighty mountains, the micro-organisms to the big animals, grass blades to dense forests- are but His dwelling places[3]. For an Indian, everything was nothing but a manifestation of God's grace which ought to be dealt with respect, care and caution; and be utilized judiciously should there be a need, and for this he always entertained a deep sense of gratitude towards the Almighty. In such a scenario, the nature and its forces were looked upon with utmost reverence. The king was regarded as the shadow and representative of God on earth and as such it was his bounden duty to ensure that only that which the nature left (for our own use) ought to be

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[2] See, Geeta: XIII/19.

[4]Vedvyasa says in Mahabharata: "The knowledge that the Supreme Spirit dwells in the heart of every living creature is the abiding root principle of all dharma". Quoted by S. Radhakrishnan in his book 'Religion and Society' (Harper Collins India 1947, published by Indus 1995) at p.107.

utilized[1]. With such an outlook towards nature it was simply unthinkable that somebody would act in a way unfriendly to the environment.

Contrary to the East, the life in West was, and still is, marked by luxury; and every endeavour-whether by the individual or by the State- has the enhancement of luxuries of day to-day living as its principal aim. Jeremy Bentham, whose work in the field of law is an all-time classic for Britain in particular and the world of jurisprudence in general went on to say that man is governed by the two forces of pleasure and pain and he likes all that gives him pleasure and avoids that which gives or is likely to give him pain[2]. Naturally, according to the great jurist's analysis, the man will try his utmost to satiate his lust by plundering earth's resources rather than worshipping it and saying: "The Earth is my mother; I am son of the (mother) Earth."[3]

During one of his earliest encounters with nature, narrates the Holy Bible, Adam, the first man, could not resist his temptation and ignored even the command of the Almighty because the fruit in the Eden Garden proved to him too alluring to keep him disciplined. The God cursed him to go to the mortal world- the world we live in.[4]

There is, thus a striking similarity in the messages coming from the Holy Book as also the great jurist that was Bentham: the incident narrated by the former depicts the nature of Adam, the first man, and, the portrayal by the latter explains the man's nature in the modern age. The message is loud and clear that man is not going to care for Earth even a bit so long as the latter continues to satiate the lust of the former.

1.1 The Present Scenario

[1]See Ishavasyopanishad, in its first mantra, declares: "Whatever living or non-living is there in the world is pervaded by the God. Keeping this in mind make use of (everything in) the world in a selfless manner. Do not have lust for it all. Who does this all belong to? That is, every thing in this world belongs to God alone; and the man can only make a judicious utilization of the worldly things.

[2]See, Bentham's Theory of legislation, published by Lexis Nexis Butterworths (Sixth re-print 2004 of the French of Etienne Dumont translated by Richard Hildreth), at p. 1.

[3]*Mata prithivi putroham prithivyah*.

[4] See, **The Holy Bible**. *Genesis* **I/26** And God said, Let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth. **I/28** And God blessed them and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth. **I/29** And God said, Behold, I have given you every herb bearing seed, which is upon the face of all the earth, and every tree, in the which is the fruit of a tree yielding seed; to you it shall be for meat. **I/30** And to every beast of the earth, and to every fowl of the air, and to every thing that creepeth upon the earth, wherein *there* is life, *I have given* every green herb for meat: and it was so.

The present scenario is simply horrible. The scientific, technological and industrial developments made the concerned nations richer, more advance and more powerful in the eyes of other nations of the world. This induced among these 'less powerful' nations a sense of competitiveness and they started making all-out efforts to come in the fore-front which could be done only by adopting the ways and means that might help them achieve their newly perceived goal. For this, they tried to adopt the measures adopted by the front-runners. When there were models of success before them it was quite natural for them to follow these models rather than discover any *sui generis* models for them. In the blind race of industrialisation and modernisation this latter type of nations, at least so it thought, simply could not afford to think of nature and environment. An unstoppable race began to scale new heights of scientific and technological innovation so as to leave other nations behind.

But, then, the environmental degradation outweighed the nature's in-built capacity to offset the effects of man's folly. Increasing level of emissions of Chlorofluorocarbons (CFC s)[1], Ozone Layer Depletion[2], Green House Effect[3], Global Warming[4], Climate Change[5] and such other symptoms brought the man out of slumber. Concerted efforts for restoration of

[1]As the name suggests these are the organic gases involving atoms of Carbon, Fluorine and other gases. The use of refrigerators, air-conditioners etc result in the emission of CFCs which deplete the ozone layer in the upper atmosphere exposing the world to the dangerous effects of ultraviolet radiation of the sun.

[2]The ozonosphere lies between the height of 15 and 30 kilometers from earth's surface. The CFCs decompose the ozone present in the ozonosphere thus reducing its concentration there. This phenomenon is called the ozone layer depletion, and the portions of the ozonosphere with lowest level of ozone concentration are often referred to as ozone holes meaning that these points are the least resistant to the ultraviolet radiation coming from the sun towards the earth. The first such ozone hole had been spotted more than a decade ago near the North Pole in that portion of ozonosphere that lay directly above Canada.

[3]In areas where there is less availability of sunlight, the plants are grown inside glass chambers called green houses. The sun light that enters these glass chambers can not escape the chamber and thus the plants get the heat required for their growth. Viewed thus, a green house lets the heat enter, but does not allow it to escape fully. When the gases released through various industrial, scientific etc processes go in to upper atmosphere, they form a blanket there that lets the solar heat come to the earth's surface but does not allow the solar heat reflected from earth's surface to go back fully. As a result a portion of this reflected solar energy is trapped in the earth's atmosphere itself. Thus the earth's atmosphere is, it may be said, behaving like a green house chamber. This is termed as the Green House Effect. Carbon dioxide (CO_2), Sulphur dioxide (SO_2), Nitrous Oxide (NO_2) etc are the examples of green house gases.

[4]The temperature of the world is constantly rising as a result of green house effect at the rate of about 1 degree centigrade per 25 years. This is termed as Global Warming.

[5] Due to global warming, the ice on the poles is melting at a faster rate which is causing a rise in the level of sea water, and there is an apprehension that coastal areas may be submerged. The micro-organisms and other forms of plant and animal life may be lost for ever, unable to adapt to changed temperature. The global warming also affects the concentration, and, degree and timing of condensation of gases in the atmosphere which ultimately results into off-season rains, heavy rains and floods, and draughts. This is called the phenomenon of Climate Change.

nature's pristine glory[1] notwithstanding, the fact is that every nation is adding something regularly in terms of pollution whether it is in the Western or the Eastern part of the globe. As shall be seen below[2], every such (polluter) nation has its own logic for this 'dirty' deed and this has made the problem more complicated because every party swears to work for the environment, but at the same time shows its firm unwillingness to budge even an inch from its already adopted course of action. Therefore, every country worth her salt is equally a polluter, thanks to the ever-increasing appetite of her residents as also policy-makers to devour the sacred Mother Earth. And, the result is there for everybody to see[3]. However, the fact can hardly be ignored that the more advanced a nation is, the more addition it makes to the environmental decay; which is tantamount to saying that per capita share of pollution is more in a rich country in comparison to that in a less developed (or, in other words, a less rich country)[4].

The state of affairs is marked by incessant efforts by rich and developed nations of the world to appropriate more and more of the earth's treasure at any cost. The situation is best summed up by a report, from news agency Reuters, quoting government sources, which states that Russia has planted a flag under the North Pole in her apparent bid to control a greater area in the Arctic that is believed to be rich in natural resources:

"Russia staked a symbolic claim to the resource-rich Arctic on Thursday (that is, 2 August, 2007) when submersible dived beneath the ice directly under the North Pole and

[1] For example, the Conventions on Biological Diversity, Climate Change, and Forest Management; the Rio and Stockholm Conferences; United Nations Environment Programme etc.

[2]The North, that is, the developed world wanted a reduction of 20 percent in the emission of green house gases(with 1992 as base year) by the year 2005, a ban on deforestation in the tropical forests (which mostly belong to South, that is, the under- developed world), control of population explosion in South, payment by South in lieu of providing transfer of technology to arrest environmental degradation, no provision for compulsory contribution for fighting pollution, and that industrialized nations be not held responsible for environmental degradation (and, hence, not liable to pay for it).The South had the opinions polar-opposite on all these points because it felt that all the degradation was due to North and, therefore, the latter should pay for its restoration, provide technology free of cost to the former to fight pollution, and that the North must make compulsory contribution to undertake pollution control measures. Also, the South did not agree that population growth was a cause of increasing pollution and maintained that it was basically due to the fact that the North was over-consuming the (about 65 %) available energy resources of the world leaving the South high and dry. Plus the South asserted its sovereign right over tropical forests which, it claimed, could be exploited by the nation concerned for the welfare of its people.

[3] At the Earth+5 Summit held in 1997 in New York to take stock of the situation, it was reported that during the five years since 1992 a total of 112 billion tons of CO_2 had entered the atmosphere increasing the concentration by two percent.

[4] The Brundtland Commission's Report observes: "An additional person in an industrial country consumes far more and places far greater pressure on natural resources than an additional person in the third world."

planted a Russian flag on the seabed. The rust-proof titanium flag was planted on the seabed 4261 meters under the surface of the Arctic Ocean, Itar-Tass news agency quoted Vladimir Strugatsky, Vice-President of Russia's polar exploration association, as saying from a support vessel.

Russia wants to extend the territory in the Arctic (so) that it controls right up to the North Pole. The region is believed to hold vast untapped oil and gas reserves." [1]

1.2 The Inter-dependence of Man and Nature

Nothing is more apt to describe the one-ness of man and nature than what the Indian philosophers had perceived long ago: "The Earth is my mother; I am son of the (mother) Earth." The bond of love and affection, of care and caution, and of peaceful co-existence that defines the innate relationship of mother earth with his sons was aimed at ensuring the safety and prosperity of both. In fact both were living in perfect harmony. On the one hand nature nourished the man by providing food and shelter, but on the other the man protected the nature in that he had a strong sense of obligation for whatever he got from nature and, like he did in case of Almighty, he worshipped earth.[2]

Another illustration given by *Manusmriti* is equally important wherein the ancient scholars have been referred to as saying that the Earth is the wife of the King *Prithu*- whence she derives her name, that is, *Prithivi*- meaning thereby the king was duty-bound to protect the dignity and sanctity of the earth much in the same way as was a husband towards his wife.[3]The law-givers in the ancient period commanded the men to behave themselves in a way that was the least harmful to the animals, insects, trees, plants, and every kind of plant and animal life. *Manusmriti*, at one place goes to the extent of saying that even an ill person- who is supposed to be gripped by the thought of his being unwell and, hence, less caring for others simply because he is not in his very self owing to the influence of the disease- should walk carefully so that he does not harm any insects etc.[4]It needs no further argument to conclude that with such laws every step taken by the humanity on its way to progress was adding something to the biological diversity and, therefore, to the nature's glory.

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[1] The Hindustan Times, Lucknow Edition; 4 August, 2007, Friday has published this report.

[2] The oldest of the four Vedas, the Rig Veda, has its prithivisukta with hymns devoted to the mother earth, almost in the same fashion in which it contains purushsukta- the chapter containing hymns depicting the origin of life of men from the body of the Purush, that is, Paramatma.

[3] See Manusmriti: IX/44.

[4]Ibid: VI/68.

2. Equitable Society

Equitable means that which is just, or, consistent with the principles of justice and right.[1] Therefore, roughly speaking, an equitable society is a just society. A society, in which every body is getting his due in a way that leaves ample opportunity for others to get what is due to them, may be termed as an equitable society. Lord Krishna says: "I am like the thread running through the pearls that make a garland."[2] Analogically, then, if equity were the thread and social institutions the pearls; the garland would be what we may call an equitable society.

Equitable society is one where every member is vigilant towards his rights but, at the same time, conscious towards the rights of other members of the society. That is, he does not clamour for the protection of his own rights only, but is also anxious to see that the rights of others are equally protected.

It is more difficult to discipline a group of men than that of wolves unless they, that is, the former have a common interest, said Jeremy Taylor.[3]Therefore, there has to be a legal system defining one's rights and duties individually as also collectively. Likewise, there may be individual and collective goals to cherish. Needless to say, that collective goal is the realization of an equitable society. For this, the law-maker has to be very vigilant to ensure that the inter-institutional as well as intra-institutional bonds in a society are based on the principle of equity rather than the individual notions of the law-maker about what is just and right.

In a democracy, the people are the author of law: a job which they do through the representatives they elect. The people are the best judge of their interests and, thus it is they wherein should vest the law-making power. No other system of governance follows this principle more than the democracy does. The Constitution of India is an example of this democratic philosophy embodied in the supreme law of the land. "We, the people of India …give it to ourselves", declares the preamble to the Constitution. It expresses the firm resolve of the people to constitute India into a socialist, secular and democratic republic; and

[1]See, Black's Law Dictionary, op. cit. p. 578. The other two meanings are: existing in equity; available or sustainable by an action in equity, or under the rules and principles of equity.
[2] See, Geeta: VII/7.
[3] Jeremy Taylor, Works, XIII. 306. Quoted in Salmond on Jurisprudence (Twelfth Edition by P. J. Fitzgerald, published by M/s N. M. Tripathi, Bombay), p. 88.

to secure for the people the equality, justice and freedom.[1] In short, it sets forth as its goal the establishment of a society defined by the principles of justice and right, that is, an equitable society.

2.1 Environment as a Component of an Equitable Society

The concept of an equitable society presumes that there is an equitable distribution of resources. The resources may be either man-made or natural. The environment is affected by both.

The ever-increasing pace of scientific and technological development has had its tremendous impact on our lives. This has made the man dependant on facilities provided by the products of scientific and technological revolution, so much so that life today possibly can not keep moving unless added and, of course, accelerated by the said facilities. These activities are increasing everyday since so is our anxiety to get more and more modernized. As a result the nuisance as well as the pollution is increasing exponentially. The layer of CFCs near the Ozone layer is not only depleting that layer but also trapping the solar radiation reflected from the Earth's surface, which would normally have gone back in the space above.

And, for all these activities, the exploitation of natural resources is almost inevitable. This leads us to the threshold of another problem, namely, to protect the resources for the coming generations also; so that they may not face a crisis of resources for their survival. In other words, it is our duty to see that while appropriating the nature's bounty for our progress and development we do not acquire the ways which may create a problem for the future generations. The principle that every generation is entitled to an equal access to the natural resources, and that it is also duty-bound not to encroach upon the said right of the coming generations is referred to as inter-generational equity and shall be taken up in a little more detailed way in the sections below.[2]

The Environment Protection Act, 1986 states that 'environment (a) includes water, air and land; and (b) the inter-relationship which exists among and between-(i) water, (ii) air, (iii) land, (iv) human beings, (v) living creatures, (vi) plants, (vii) micro-organisms, and (viii)

[1] See, the Preamble to the Constitution of India.
[2] See 3.3(iii) infra.

property.'[1] Therefore, it is obvious that anything which is jeopardizing any of these elements is likely to have an adverse impact on the environment.

On the one hand, the law has to ensure that the natural resources are tapped and utilized in a way that serves the common goal in the best possible manner; and on the other it has to remain wary of its impacts on our environment; especially because, the right to a healthy environment has been globally recognized as a fundamental right of man. It, therefore, follows that unless the society is an equitable one, all the rights of man-including the right to a healthy environment-can not be properly protected. Or, equivalently, unless the right to a healthy environment is ensured, there is the risk of the all-important right to life being reduced to a nullity; because, as has been very aptly remarked by the apex court in M C Mehta vs. Kamalnath[2], the pollution of air, water and land affects the quality of life and amounts to the violation of right to life.

3. Environment and Indian Law

In Ancient India, the environmental ethics was a principal component of the body of law; and therefore the way of living was designed in a fashion that had an in-built mechanism to protect the earth and its resources.[3]

In the mediaeval ages, the human activities increased almost exponentially and concerns began to be expressed about the conservation of various elements of nature albeit with a different perspective. The laws were made to regulate the conduct of human beings with respect to pollution of water and air, and also in factories and forests.[4] But these were meant to establish an atmosphere which was free from nuisance and, to ensure that the industrial activities should go unabated or the forest produce be exploited without any hindrance. In short, the law in the mediaeval ages was conditioned to facilitate the exploitation of natural resources in a peaceful and amicable way; and the end of law was to maximize the exploitation of resources and utilization of fruits of technological development to the optimum level in a way that created the least nuisance. As such, there was no attempt

[1] Ibid, Section 2 (a).
[2] M C Mehta vs. Kamalnath, (2000) 6 SCC 213: AIR 2000 SC 1997.
[3] See f. ns. 3-5 supra.
[4] For example, one can have a look at Indian Penal Code, 1860;Forest Act,1927; Factories Act, 1948;and the provisions of Law of Torts which took care of such issues only if the same were covered under the heads like, say, nuisance, negligence, strict liability, occupier's liability etc.

to visualize these activities in terms of their impact on atmosphere because the atmosphere was still too pure to be taken care of.

The modern India helplessly saw her resources being utilized by the British, and even after she became free the same laws continued to be in force for quite some time. The things took a turn for better once the then Prime-Minister of India, Mrs. Indira Gandhi, participated in the Stockholm Conference and championed the cause of developing and under-developed nations and attracted the world attention towards their problems:

"Mrs. Indira Gandhi, the then Prime-Minister of India, was the first head of State to address the International Conference on Human Environment at Stockholm in 1972. She, voicing her concern about degrading environment, opined that problem of pollution, poverty and population must be tackled together. Thus, the subject of environment started receiving a lot of attention since then."[1]

Back home, she took several measures to improve the health of environment. The 42nd amendment to the Constitution of India introduced the Fundamental Duties one of which obliges every Indian to protect the nature, environment and forest and wild life.[2] It also brought about certain changes in the Directive Principles of State Policy where the protection of forest and wild life as also of environment were specially mentioned[3]. Now, the protection of environment, forest and wild life became a core issue to be taken notice of by the policy makers. Besides, a committee chaired by Mr. N D Tiwari was constituted which 'submitted its report in 1980 and made far-reaching recommendations' as a result whereof independent ministry at Centre and Department at the States came in to existence.[4]

Now there are a number of enactments meant for protection of water, air, forest, wild-life, bio-diversity, and environment.[5] Besides these, Public Liability Insurance Act, 1991; National Environment Tribunal Act, 1995; National Environment Appellate Authority Act, 1997 and a number of other Acts are there to protect the environment as well as the interests

[1] See, Prof. Satish C. Shastri: Environmental Law in India (First Edition 2002: published by Eastern Book Company, Lucknow), p. 12.
[2] 51-A (g): "It shall be the duty of every citizen of India…..to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures."
[3] 48-A: "The State shall endeavour to protect and improve the environment and to safeguard the forest and wild life of the country."
[4] Prof. Shastri's book gives an interesting detail of these developments. See, ibid, pp. 12-14.
[5] Environment Protection Act, 1986; Biological Diversity Act, 2000; Forest Act, 1927; Water Act, 1974; Wild life Protection Act,1972; Air Act, 1981; and Forest Conservation Act, 1980; Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Rights) Act, 2006 among others.

of those who have fell victim to handling of hazardous substances or any other polluting activities.

4. People's Movements for Environment

Laws are made for the people, and not the vice versa. Therefore, it is the people who are the best judge of whether there is a need of law in a particular field; or whether the existing law in a given field needs an amendment; or, in extreme cases, whether the existing law is no law at all and must be done away with. Ordinarily, the law-making is done by the Legislature where the people's representatives sit to voice the concern of the people they represent. However, sometimes the people feel that they need to arouse the government from its slumber in order that their interest may be protected. If the situation is such that the representatives are likely to prove of no avail, the people themselves take the responsibility to come forward. Such a collective campaign on the part of the common man, without any governmental help, in the direction of realizing what is due to them often takes the form of a mass movement. In a democratic set up, since it is the government of the people, by the people and for the people; the mass movements acquire a greater significance. The environment being one of the prime concerns of the masses, the issues related to it also were first championed by the people themselves.

This section refers to some early efforts by local people to protect the trees, the role of non-governmental organizations in fighting for environment-related issues, and the efforts of public-spirited individuals who have successfully fought for common issues.

4.1 The Chipko Movement

It is one such movement which remains unparalleled for its selfless and devoted approach for the protection of the nature in general and the trees in particular. It is one initiative by the local people which shows they are out to protect trees even at the cost of their lives. The genesis of this movement is traced back to the year 1731 A.D. when 359 people, led by one Amrita Devi and her 4 family members, 'sacrificed their lives to save trees of the village (popularly known as Green Khejris)'.[1] These people believe that trees and animals are their brethren; and one may see deer etc roaming freely in villages inhabited by these people- the Bishnois.

[1] See, Satish C. Shastri, *op. cit.* p. 8.

This movement was taken recourse to by hundreds of men and women in the hills led by an environmentalist Sunder Lal Bahuguna-in the latter half of the last century-when they embraced and stuck to the trees to save them from being felled. This movement, known as Chipko Movement, represents the utmost love of man towards nature and the environment.

4.2 Movement for Silent Valley

The Palghat district in Kerala is privileged to have virgin forests believed to be the most priceless specimen of 50 million years of evolutionary history, which is otherwise famous as the Silent Valley. It is the home of not only several endangered species but also of a number of plants and herbs of immense medicinal value.

So, when the State of Kerala embarked upon the Silent Valley Hydro-electric Project; people from different walks of life-scientists, researchers, professors, social activists and others- joined hands to launch a movement to save the pristine glory of the Silent Valley. The Society for the Protection of Silent Valley moved a petition in the Kerala High Court to restrain the State of Kerala from going ahead with a project which was environmentally hazardous and ecologically disturbing. The petitioners' standpoint was supported by the reports of scientists and experts of ecology; and even the task force appointed by the National Committee on Environment Planning and Coordination had concluded that the ecosystem in question was too fragile to be restored by the measures scheduled to be taken to complete the project.

The High Court, however, declined to intervene saying that it would not substitute its judgment on 'whether a national asset is to be more conveniently utilized as a hydro-electric project with prospects of greater power generation or retained in its pristine glory'.[1]

However, it goes to the credit of the environmentalists who succeeded in garnering support for the cause not only in and outside Kerala but even on an international level[2], which forced the Central Government to decide in favour of ecology and environment. Following the centre's directive the Kerala Government declared in November 1983 it had scrapped the Silent Valley Project.

4.3 Narmada Bachao Andolan

[1] Society for Protection of Silent Valley vs. Union of India (Unreported judgment of Kerala High Court-O.P.Nos.2949 and 3025 of 1979); quoted by S C Shastri, *op. cit*., p.31.

[2] These organizations were Kerala Sastra Sahitya Parishad, and Friends of the Trees (in Kerala), Save Silent Valley (in Bombay), World Wild Life Fund (in UK and Switzerland), and International Union for Conservation of Nature (IUCN), among others.

This is perhaps the most world widely acclaimed mass movement launched by Ms Medha Patkar; who had initially been there as a researcher, but later changed her mind and devoted her life to the cause of hundreds and thousands of those who were likely to fell victims to several dams proposed to be built over the river Narmada in order to provide irrigation facilities to the people of Madhya Pradesh and Gujrat.

The movement found support from several non-governmental organizations around the globe, and when the point was made clear to the World Bank authorities that the benefits of the project were out-weighed by the misery of those whose lands and dwellings were sure to be submerged by the reservoirs created by the dams, the WTO decided to cancel the loan it had granted earlier. So did Japan who had also sanctioned loan for this project.

The movement did get much publicity but it could not undo the project even after a legal battle. The most that has been done so far is that some reduction has been granted in the height of the dam. However, this has not satisfied the activists who claim that the dam is equally detrimental to the ecology of the concerned areas as also to the victims. According to an estimate:

"The Narmada Valley Project if and when complete, will rank as the largest irrigation project ever planned and implemented as a single unit anywhere in the world. By the year 2040, the project authorities hope to complete 31 major dams (11 on the Narmada and 20 on its tributaries), 135 medium dams and 3000 minor dams."[1]

The Sardar Sarovar Project (SSP) in Gujrat and the Narmada Sagar Project in Madhya Pradesh, which have been at the centre of the storm created by the activists and environmentalists, happen to be among the 31 major dams mentioned above.

However, the Supreme Court of India[2] cleared the project in the year 2000 by a 3:2 majority holding that in view of the increasing need of water for the growing population the construction of the Sardar Sarovar Project (SSP) is in the public interest and that there would be no violation of the right of the displaced persons if they were suitably rehabilitated.

4.4 Tehri Dam Project

Like the Narmada Project, the Tehri Dam Project too could not be stopped despite spirited fight of hundreds of people led by Sunder Lal Bahuguna, and despite the warning

[1] See, Environmental Law and Policy in India: Cases, Materials and Statutes, by Shyam Diwan and Armin Rosencranz (Second Edition, Oxford university Press, Third Impression 2002), p.441.
[2] Narmada Bachao Andolan vs. Union of India: AIR 2000 SC 3751.

from experts that the area being a seismic zone it would not be a very wise step. The Tehri Bandh Virodhi Sangharsh Samiti's hopes to get a respite from the Supreme Court did not fructify.[1]When the project came to completion nearly hundred villages including the historic Tehri village were submerged. The project is likely to fetch a supply of 500 cusecs of water to the National Capital Territory of Delhi, and, generate 2400 MW of electricity; besides creating immense irrigation facilities.

5. Conclusion and Suggestions

It is obvious that the present policy is all about striking a balance between the efforts being made in two apparently different directions, namely, environment and development; and quite often the two do not appear to meet. The environmental issues appear as those related to the protection of forest and wild life, the ecology, the rivers, the hills and the like. The developmental issues present themselves as thermal projects, hydro-electric projects, industrial areas, special economic zones, residential areas with multi-story buildings, construction of skyscrapers amidst heavily populated areas etc.

When the polluter is the government; it defends its action by saying that in a welfare state like ours it is the duty of the government to ensure to all its citizens the right to life, health and nutrition; while in case of polluter being an individual or a group of individuals (under which are covered also the private enterprises, industries, factories etc), the right to livelihood, freedom of trade and commerce, freedom of expression, freedom of religion, life and personal liberty, and even the right to equality serve as defence.

Suggestions

1. Right to a clean and healthy environment must be made a fundamental right so that it may become a powerful weapon in the hands of the people and make the prospects of success bright for the peoples' struggles for environment.

2-Public hearing should be made compulsory for all those projects that are likely to pose a potential danger to the ecology and environment rather than restricted to a few defined categories of projects.

3- While dealing with environment and development, a holistic view of the situation-regard being had to our economy, resources, population, the level of development, the social ethos and mores- should be taken rather than ape the model of some other nation.

[1] Tehri Bandh Virodhi Sangharsh Samiti vs. State of Uttar Pradesh: 1992 Supp (1) SCR 44.

4-With respect to an issue having enormous impact on the environment, a more informed and dispassionate approach from the government as also the masses is the need of the hour so that such important issues are not converted into either the means to gain cheap popularity or the weapons of petty politicking

5-There should be induced an element of technicality in judiciary by exposing the judges to some training programmes on the latest trends of scientific and technological developments vis-à-vis the environment and ecology is essential, besides attaching to it permanently a team of experts from the field of environmental sciences and technology, in particular, and from the fields of science and technology in general so as to ensure speedy disposal of cases through judgments which are legally, scientifically and technologically sound.

6-There is an urgent need to gear up the enforcement mechanism so that it delivers goods; because even a good law will not prove worth its salt if it is either badly implemented or not implemented at all.

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Public Interest Litigation in Agriculture

Dr Anand Kumar Tripathi[1]

1. Introduction

India's agriculture sector is the backbone of economy and makes the country self-sufficient. It is nothing less than a boon for all of us that India is self dependant in this area. Climate is one factor responsible for this pleasant achievement; because, in different parts of the country at a time, there may be different types of climate which helps in increasing the agro productivity. These natural phenomena always promoted our schemes in all walks of life. Be it rural development or advancement of agriculture sector it can be seen across country. Agriculture is the only basis of the development which has shown its place at height.

Although farmers provide livelihood to all of us yet it is lamentable that they are worried about their livelihood. Can't we think about the root cause of this pathetic condition of farmers? Certainly we can but only thinking would not be a proper solution. The Constitution of India guaranteed to all citizens a decent and dignified life. Article 21 says that no person shall be deprived of his personal life and liberty except according to procedure established by law.[2] The meaning of this provision is very extensive and is applicable having its widened feature. But it is more on paper and less in reality.

In the administration of justice every stakeholder has hisr own importance and responsibility. Our democratic system is based on the faith of the people and sidelining the voice of the people lofty ideals of democracy cannot be achieved. Every responsible person of the country talks of the lamenting situation of farmers in agriculture sector; the naked truth is that nobody is taking care of this important issue.

India has a geographical area of 328.73 million hectares; of which reported area for land use is 306.04 million hectares. The net area cultivated is about 142.60 million hectares i.e. about 46.6 per cent of the total reported area. Since nearly 50 million hectares of area is sown more than once, the cropping intensity works out to 135.1. Forests account for about 68.97 million hectares i.e. 22.5 percent of the total reported land area. Also nearly 13.97 million hectares are cultivable wastelands and 9.91 million hectares fallow lands. Only about

[1] Assistant Professor, Raksha Shakti University, Gandhinagar, Gujarat.
[2] Part III of the Constitution of India.

30 percent of the total cropped area is irrigated and the remaining area is rain fed. The available statistics further shows that only about 66 percent of the gross cropped area is under food crops and nearly 34 percent area under non-food crops. Cereals and pulses account for nearly 52.93 per cent and 12.64 percent of the total area respectively. Fruits and vegetables occupy nearly 4.24 percent of area.[1]

There are about 402.5 million rural workers of which 127.6 million are cultivators and 107.5 million are agricultural labourers.[2] In other words, pure agricultural workers constitute nearly 58.4 per cent of the total rural workers, of which 31.7 percent are owner cultivators and 26.7 percent are mainly agricultural wage earners[3] The latest available agricultural census data[4] also reveal that about 78 percent of operational holdings in the country are marginal and small, having less than 2 hectares. About 13 percent holdings have 2 to 4 hectares and 7.1 per cent have 4 to 10 hectares of land.[5]

2. Constitutional Mandate

The Government of India has passed a number of laws in order to promote farmer's standards in agriculture field but with the advent of modern technology the intension of law givers became insufficient to meet the challenges of farmers in India. They play a significant and crucial role in agriculture development. Despite their importance to agricultural production, farmers face severe handicaps. It poses a big question as to how the problem of farmers can be eliminated. It is submitted that agriculture is the backbone of economy but farmers of India are the most vulnerable group of society. Most of the farmers are not in a position to redress their grievances because of various reasons i.e. due to ignorance of law, poverty and illiteracy etc.

It is the duty of government to provide legal access to all its citizens without making any excuse. As per the provision of Article 39-A[6] to the Constitution of India it is the duty of the state to provide equal justice and free legal aid to the citizens of India.

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[1] Haque 2003
[2] Source : Registrar General of India, New Delhi, 2001
[3] Agriculture Statistics at a Glance, sourced from Registrar General of India, New Delhi 2001.
[4] Govt. of India, Agricultural Census Division, Ministry of Agriculture 2002.
[5] As per the Census of India 2001.
[6] The State shall secure that the operation of the legal system promotes justice, on a basis of equal opportunity, and shall, in particular, provide free legal aid, by suitable legislation or schemes or in any other way, to ensure that opportunities for securing justice are not denied to any citizen by reason of economic or other disabilities.

However, owing to its technicalities and ambiguities, law is left very far behind the famers; and the latter does not help the former. In this regard judiciary could not sit like spectators and from time to time judiciary has played its dynamic role making path breaking judgments. In Article 32 and 226 of the Constitution remedies are given to the citizen for the protection of their fundamental rights.

The writ jurisdiction of Supreme Court can be invoked under Article 32 of the Constitution for the violation of fundamental rights guaranteed under Part – III of the Constitution. Any provision in any constitution for fundamental rights is meaningless unless there are adequate safeguards to ensure enforcement of such provisions. Since the reality of such rights is tested only through the judiciary, the safeguards assume even more importance. In addition, enforcement also depends upon the degree of independence of the Judiciary and the availability of relevant instruments with the executive authority.

3. PIL: How?

The question of locus emerges here. Who will initiate the issue: farmers or an sympathiser on their behalf? Now the strict rule of locus standi has been liberalised and third persons on behalf of others may file litigation for the protection of fundamental rights. The liberalisation of locus standi brought a big change in the society.

Justice P N Bhagwati has been instrumental in evolving the concept of public interest litigation in India. Social change is the necessity of any society. In India it is done through Public Interest Litigation. Many of the NGOs and Kisan Unions are working for the welfare of farmers viz. Bhartiya Kisan Union[1], Narmada Bachao Andolan[2] and Fertile land protection Movement etc.

3.1 Land Acquisition and PIL

Due to urbanisation these days, there villagers migrate from rural areas to urban areas which is creating huge problem for the famers. Also, the area of agriculture land is being encroached by the government. In state of Haryana a PIL was filed by an NGO[3] wherein the Supreme Court issued notices to the Centre and Haryana on a PIL accusing the Bhupinder

[1] Founded by Chaudhery Mahendra Singh Tikait
[2] Founded by Medha Patekar
[3] Fertile Land Protection Movement

Singh Hooda[1] government of resorting to large-scale acquisition of fertile agricultural land, forcing an already low water table in the NCR to decline at a rapid pace.

A Bench comprising Justices J M Panchal and H L Gokhale also issued notices to the environment ministry, NCR Planning Board, Central Ground Water Board, Haryana State Infrastructure and Industrial Development Corporation and the Gurgaon commissioner on the PIL filed by an NGO 'Fertile Land Protection Movement'. The acquisition of fertile land and the coming up of large residential and industrial structures has led to scarcity of potable water, the PIL said and accused the government of turning a blind eye to the social impact of such acquisition.

"The state of Haryana has been acquiring more and more fertile agricultural land (recently more than 1,000 hectares) for the purpose of extending the industrial township called Industrial Model Town, Manesar, at Gurgaon. The said extension is contrary to the notifications of M o E F issued to protect the environment," the PIL said.

Governments all over the world are facing public distrust regarding the safety of GE foods, since the public does not trust the food safety testing procedures, whereas the governments claim them to be safe. An increasing number of Indian NGOs, farmers' organizations and common citizens are becoming vocal in their criticism of Genetically Engineered (GE) crops and foods. Farmers have set ablaze fields where trials of genetically engineered crops were being conducted and questions have been asked in Parliament about the status of such crops and foods in India.[2]

4. GMOs and PIL

New Delhi based non-profit organization[3] filed a Public Interest Litigation in the Supreme Court of India asking that the rules pertaining to genetically modified organisms be radically amended so that the constitutionally guaranteed rights of every citizen to life, health and a safe environment are ensured. Gene Campaign's PIL also asks for setting up a High Power Committee to formulate a National Policy on Genetically Modified Organisms (GMOs) through a multi-stakeholder consultation process.

[1] Chief Minister of Haryana.
[2] Dr. Suman Sahai, President, Gene Campaign, New Delhi.
[3] Ibid.

Dr. Suman Sahai, President, Gene Campaign, says they took this action since all attempts by Gene Campaign to engage in a dialogue with the policy makers failed to produce any response nor was there any move to listen to stakeholder concerns. Gene Campaign has been asking for greater transparency and participation in the decision-making on GM crops. The NGO's principal concern has been the lack of technical competence, transparency and accountability in the policymaking and regulatory bodies, which could have damaging consequences in a new technology area like GM crops.

That many countries involved with GM crops have been going through a review of their GM policies and systems of regulation and oversight in the light of new evidence is now well-known. "India must do the same", says Sahai.

India's current regulations are based on rules developed in 1989. Since then many international instruments such as Agenda 21 (1992), the UN Convention on Biological Diversity (1992), the Biosafety Protocol (2001), the UNEP Technical Guidelines on Biosafety (1995) and UNIDO Code of Conduct for the Release of Organisms into the Environment (1991) and the International Treaty on Plant Genetic Resources (2001) have been developed, signed or ratified by the international community.

"These international instruments have certain provisions that are not reflected in current regulations. For instance, the Bio safety Protocol provides for public participation in the decision making process concerning genetically modified organisms. India has signed and ratified this protocol but our regulatory system does not have any window whereby public can participate. Neither is there a systematic opportunity for the public to obtain relevant information (like field trial data) so that they are well informed to participate", says Ujjwal Kumar, policy analyst at the Gene Campaign.

On the other hand, many countries such as the UK, Australia and New Zealand have recently revised their regulatory mechanisms. Regional initiatives like adoption of OAU Model Legislation on Safety in Biotechnology, 2001 are also examples of countries' response to recent international developments. The Indian environmental groups engagement with New Delhi to revisit its regulatory regime has "fallen on deaf years", says Suman Sahai.

Campaign has approached the Supreme Court to seek relief in the interest of public health, environmental safety and livelihood security of farmers, and to request the Supreme Court to adjudicate on the question of developing a competent and transparent system to oversee GM crops in the country.

The major grounds raised in the PIL are:

- That the rules of 1989 are arbitrary and unconstitutional, specially violative of Article 21 of the Constitution of India, which guarantees the right to life.
- That the regulatory agencies set up under the rules of 1989 lack technical competence, and the system is devoid of transparency, and accountability. There is also no public participation, nor any provisions for ensuring it. The rules themselves are deficient in dealing with potential environmental, health and socio-economic risks posed by the GMOs to the Indian people;
- That the rules do not incorporate principles and provisions under various international instruments, such as the Bio-safety Protocol, Convention on Biological Diversity etc., which India has signed / ratified;
- That most countries, including developing countries, are setting up new regimes or revising the existing ones in light of the latest international developments, and that India should also do the same.

Petitioning the Supreme Court as the gateway of last resort is an approach being taken by many civil society groups in India. Faced with a governing system that does not respond to ecological, human rights and transparency concerns as quickly it may in other matters, many NGOs eventually knock the doors of the Supreme Court. But it is one thing for the Supreme Court to adjudicate on questions of a Constitutional nature in specific matters that arise from conflicts of interest in an otherwise functional regulatory system. Some would regard the situation with regard to state of our environmental regulations to be a failure in the responsive of the governance process itself.

"The higher judiciary in India has the primary responsibility to judge whether or not Government’s actions or omissions violate the Constitution. The SC and HCs have been

already directing the executive to act in lines of the spirit of the Constitution, and that is protection of fundamental rights. In the present case, not having an effective regulatory regime hampers people's fundamental right to health and a clean environment. Public participation in decision making on subject matters like environment and health is also a fundamental right of people under Article 21. Seen in that light, the Supreme Court is empowered to direct the Indian Government to bring the Rules of 1989 in consonance with the Constitution of India," argues Kumar[1].

"Also, the current rules also do not incorporate various principles of environmental jurisprudence (such as polluter-pays principle[2] and inter-generational equity) that the Supreme Court has upheld in the past as part of the Articles 21 and 14", he adds.

The PIL has asked the Court to direct the government to observe a moratorium on all permissions, approvals and trials concerning GMOs, particularly of crops for which India is a Centre of Origin/ Diversity. The petitioner has also pleaded that until the rules are amended and a regulatory and monitoring system put in place, no commercial cultivation should be allowed.[3]

In addition to this a famous PIL was filed in the name of GM Compaign Vs Union of India[4] wherein the legality of UPOV[5] was challenged because it is observed that this Act was against the interest of Farmers. The UPOV has no notion of farmers rights, food security, livelihoods and related concepts so crucial to not just the Indian condition but to the condition of all developing countries. The Indian Plant Varieties Act in its first version had as a result of its UPOV parentage, also neglected to address the issues fundamental to Indian agriculture and farming communities.

Even today the Act remains a flawed legislation because although the title has been expanded to Plant Variety Protection and Farmers Rights Act, to send the signal about concern for farmers, the inequities that were originally drafted into the bill continue to be there in the Act. The philosophy and language of the draft legislation is not Indian. It is

[1] Ujjwal Kumar,Gene Campaign organized a National Symposium in November 2003 at New Delhi
[2] Vellore Citizen's Welfare Forum Vs Union of India,(1966) 5 SCC 281.
[3] India Together:January 2004; Gene Campaign - www.genecampign.org
[4] Writ Petition (Civil) No.114 of 2004 in the Supreme Court of India
[5] Union for the Protection of New Plant Varieties

anchored in the WTO and UPOV. The preamble itself states that this Act is being drafted in order to comply with the requirements of the TRIPs regime. In fact the Act opens with the text….to provide for the establishment of an Authority to give an effective system for protection of the rights of plant breeders and farmers, and to encourage the development of new varieties of plants and to give effect to sub-paragraph (b) of paragraph 3 of article 27 in Part II of the Agreement on Trade Related aspects of Intellectual Property Rights. The purpose of the Act is to encourage the development of new plant varieties, as it is in UPOV, not to provide conditions to ensure food security.

The Indian Act also sets out to essentially protect the rights of the Breeder as in UPOV. Farmers Rights found mention in the Act only after aggressive campaigning by groups concerned with agriculture, food security, the issues of agriculture and Intellectual Property Rights. Gene Campaign and others who lobbied to get the original draft of the Bill re-examined and introduced suggestions for strengthening Indian interests, were consistently opposed by the lobby of the seed industry which had just as much interest in keeping the Bill weak on issues like Farmers Rights and strong on Breeders Rights

Navdanya is an NGO which is actively monitoring the GM related activities and development in India Freedom from Genetically Modified Organisms (GMOs) and conducted field surveys on the performance of Bt. cotton every year during the field trials as well as after its commercialization and proved companies and governments' claims deceitful and fallacious. Through The Research Foundation for Science, Technology and Ecology (RFSTE), a Public Interest Litigation (PIL) was filed in the Supreme Court in 1999 against US seed giant MONSANTO and Indian authorities for the illegal and unauthorized introduction of GMOs in India through field trials of these crops, bypassing and violating environmental laws, without involving and informing the local authorities and the local public.

Navdanya has also been involved in and leading campaigns against GMOs on an international level. During the WTO Hong Kong Ministerial, Navdanya joined 740 other organizations in presenting their opposition to WTO's attempt to undermine the right of individual countries to take appropriate steps to protect their farmland, environment and consumers from the risks posed by GM foods and crops. In India RFSTE and other

concerned groups have demanded that the Government fulfil their obligation towards the Indian farmers, Indian consumers, our environment, our diversity and our very agriculture by imposing a 10 years moratorium immediately on the impending release of GMOs in this country. We therefore must act fast. Let's get together and demand for complete ban on GM seeds and foods in India. In this regard judiciary did its job to meet the challenges and disposed of the case on its merit and suitability.

5. Miscellaneous Issues relating to Agriculture and PIL

Minimum support price

In a matter regarding MSP (Minimum Support Price) PIL was filed in Bombay High Court stating that the minimum support price (MSP) for farmers was low. A division bench of Chief Justice Mohit Shah and Justice Roshan Dalvi asked the petitioners to make the required corrections in the PIL while asking the state and Union government to respond to the petition.[1]

Farmers' suicide

Concerned over incidents of farmers' suicide in the State, a farmer has moved the Orissa High Court seeking CBI probe into all those unfortunate incidents in which the poor farmers were forced to take such extreme steps.

In a PIL filed in High Court Jati Pradhan[2], has urged the court to direct the CBI to probe into all suicidal deaths of farmers reported in the State recently and file a report to the court within a stipulated date.

Mr. Pradhan has also urged the court to direct all district collectors of the State, who are implicated as opposite parties in the PIL, to pay compensation to the family members of the farmers, who have committed suicide due to acute poverty and loan burden. Mentioning the Orissa Human Rights Commission as another opposite party, the petitioner has also asked the court to direct the OHRC to lodge a complaint and investigate into as to why the farmers in the State are committing suicide.

[1] Shibu Thomas, TNN Nov 17, 2011, 01.09AM IST.
[2] A farmer and Secretary of Balangir Krushaka Mahasangha, Cuttack, Orissa.

Similarly, the petition also seeks direction to State agriculture and revenue secretaries to ban loans to all farmers for agricultural purposes, which are not covered under adequate insurances and also regulate private financers who are hoodwinking the farmers. In the petition it was argued that the district collectors should also have a control over all the private financers in their respective districts and monitor the finances disbursed to the farmers and the modes of the loan repayments. The High Court however, has not taken any cognizance of the PIL yet.

In one of its historical judgments the Andhra Pradesh High Court cancelled the central government's notification on the NREGA wages that are lower than the minimum wages revised by AP State Government. Andhra Pradesh Vyavasaya Vruthidarula Union (APVVU)[1] had filed a Public Interest Litigation (PIL) with the High Court of AP challenging the central government NRGEA wages notification which is the clear violation of Minimum Wages Act of AP. On 3rd July-09, the High Court passed the order for payment of minimum wages as per the Minimum Wages revised by AP government.

Minimum wages

As per the Minimum Wages Act 1948, the wages has to be revised once in every 3 years, but in practice no state governments in the country revise the wages on time without the workers agitations. Further, there is no historical evidence in Andhra Pradesh that the Minimum Wages Act 1948 is implemented ever for the rural workers (so called unskilled and agricultural workers!). For instance, the government of AP has revised the minimum wages in year 2002. As per the Act, the next revision should have been in the year 2005. After series of campaigns by various mass organizations, it is revised only in the year October, 2008. That means, the rural workers of AP are deprived of the wage increase one time in between 2002 and 2008.

Whenever the wages are increased for rural workers', it is only possible because of the collective efforts of workers' negotiations /agitations locally with the farmers and contractors. So, as usual, the government of AP has revised the wages in October 2008 (GO,

[1] P.S. Ajay Kumar, Secretary; Andhra Pradesh Vyvasaya Vruthidarula Union (APVVU)

No 93) but did not have political will to implement even in NREGA program. APVVU, being a state level federation of agricultural workers unions involved extensively for the implementation of NREGA, challenged the central government notification of minimum wage (Rs. 80) that is lower than minimum wages (Rs. 119 zone 1, Rs 112 for Zone2&3)of AP.

The High Court of AP suspended the Central government Notification of 2009 of January for 8 weeks and asked the Centre and State governments to file fresh affidavits. Mean time the wage should pay in NREGS according to AP state G.O. 93/ October 17nth of 2008.

Ecological and health related impacts

In the field of food and agriculture there are various serious concerns about the ecological and health impacts of GMOs. The campaign by NGOs through PIL is going on against the commercialization of GM crops and food in India and being highlighted the dangerous effects of these crops and foods on our biodiversity, environment and health. We are seriously involved in enlightening the public at large on its harmful effects. Many progressive social legislations and Judgments will remain paper tigers, if they are not implemented. Therefore, the role of social movements and trade unions is to see how the workers are organized to actualize the objectives of Acts like NREGA, Minimum wages Act, Equal Remuneration Act, Land Reform laws, Right to Information Act , SC& ST (prevention of Atrocities) Act, Bonded labor (abolition) Act, Domestic Violence Act and so on. We have many progressive Laws without proper implementation, on the other hand, there are still many repressive Laws exist in the country, always implemented against the poor and vulnerable.....

Contrary to the three myths i.e. the myth of feeding the hunger, protecting the plant and food safety, that are being used to make genetic engineering the dominant technology used in the production and processing of food, our research and campaigns have highlighted the deepening crisis of hunger and starvation, debt and farmers suicides caused by high cost but unreliable GM and hybrid seeds.

6. Conclusion

Many of the public interest litigations highlighting rampant illegal construction on agricultural land and farmhouses, land acquisition, excavation of sand are pending before the court while some have been finally decided. The ray of hope towards judiciary is still present in the mind of farmers. This hope echoed most beautifully in these words of Justice Krishna Iyer: "The judicial activism gets its highest bonus when its orders wipe some tears from some eyes." So let us hope the PILs succeed in wiping even more tears from the eyes of the toiling farmers who seem presently on the brink of a disaster.

LIVESTOCK POPULATION, MILK PRODUCTION AND HOUSING PATTERN

Studies of Different Farm Categories

N.K. Tripathi and others[1]

Key words: - Land holding, Livestock population, Milk production, Housing pattern.

Abstract

Three blocks and two villages from each block, representing Varanasi district of Uttar Pradesh, were randomly selected to collect information regarding landholding, livestock population, production and housing pattern of different farm categories. Information was collected from all categories of household by personal interview. The average landholding in all the five categories were no land, 1.45, 3.71, 7.68 and 13.99 acres out of which more than 98 percent land was under irrigation in different farm categories. In study area the famous of F_5 farm categories had more number of cattle (2.5), followed by F_1 (1.58), F_2 (1.83), F_3 (2.25) and F_4(2.08). On an average the number of cows reared were more 2.5 by large category whereas the number of buffaloes reared were more by small (3.08) and medium (2.91) categories of farmers in survey area, F1 and F2 farm category farmers maintained less number (1.75 and 1.66) of buffaloes than the other farm category. The adult male buffalo was maintained by only F1 farm category (0.25) in Sakaldiha block form breeding purpose whereas other categories did not maintained buffalo bull. The average number of female cattle and buffaloes (milch and dry) were approximately 1 and 1.4, respectively in surveyed area. Out of total 71.2 percent cattle and 69.4 percent were under milking. The average milk yield during the one location of approximately 323.61 to 353.33 days was reported 1444.03 to 2001.67 Kg in cows of different farm categories. The milk yield in buffalo varied between 1836 to 2266.42 Kg during a location period of 338.33 days approximately.

Introduction

India has basically been an agricultural country and it is likely to continue to be so far a long time to come with livestock. At present 70 percent of Indians are dependent for their

[1] Assistant Professor, CSAUA&T, KVK Lakhimpur Kheri (UP); along with S.K. Pathak, AGM, Pratisha Industries, Hyderabad(AP); A. K.Singh, Scientist, KVK Ambarpur, Sitapur (UP); and A.K.Mishra, Senior Scientist, CARI, Barielly (UP).

livelihood on agriculture. Seventy percent small and marginal farmers hold 80% of total livestock population and 30 percent of the total land holdings in the country.

Though the cattle population is quite large, i.e. around 184 million, the number of milch cow is only 56 million with as average production of 187 Kg per annum. The buffalo population is 62 million, of which 34 million are milch buffaloes with an average production of 1000 Kg per annum. Livelihood of small and marginal famers of mainly depends upon agriculture. Livestock can substantiate a major share of farmer economy for the substance of agricultural community. The creation of thousands of employment opportunities throughout the year by adopting animal husbandry on large scale shall also be a part of the objectives of animal husbandry. Although there has been a substantial increase in milk production over the years the corresponding increase in human population has brought per capita availability of 154 g milk per day, which far lower than the recommended level of 280 g per day by the Nutritional Advisory Committee of ICMR.

Crop and animal production are the basis of the rural economy, which mainly depends upon the type of soil, availability of water, climatic conditions and type of animals and food habits of the area and climatic conditions. At present, therefore it has been realized to identify and study of different agro climatic regions or zones within the state as well as the country and to develop the zone specific technologies for bringing about the economic development of zonal agricultural sector of which animal husbandry is one of the important components.

Therefore, present study was undertaken to know the livestock population, there production and housing pattern in different farm categories of Varanasi district of UP to evaluate the importance the livestock, there population and upgrade the livelihood of rural people

Materials and Methods

The present study was conducted in district Varanasi of UP which in involves the typical agro climatic features of plains. Three blocks, namely, Chakiya, Sakaldiha and Sahabganj and two villages from each block were randomly selected using random number table as the district and the blocks, respectively. The villages selected were Kamati Kalan, Devtapur from Chakiya block, Ganjbasani, Kateharal from Sakaldiha block and Semara, Atay from Sahabganj block. The selection of households in selected villages was based on land holding, for this purpose all the households in the selected villages were categorized in to five farm categories viz. land less (F_1), marginal (F_2), small (F_3), medium (F_4) and large farmers (F_5) having no land, 0.0 to 2.5, 2.5 to 5.0, 5.0 to 10.0 and more than 10 acres of land

respectively. Two farmers from each farm categories were randomly selected from each village of the respective block. Primary data used in this study were collected from all categories of households by personal interviews on presented schedules specially prepared for this purpose. All the objectives were fulfilled with help of simple table analysis of aggregate values and percentage of data. The average was taken separately for each category for each block separately and the district for all five farm categories to analyze the situation.

Results and Discussion

The average made over district level from the survey area in different blocks indicated that average land holding in the said five categories were ranged between 0, 1.45, 3.71, 7.68 and 13.99 acres out of which more than 198 percent land was irrigated under different farm categories. The present finding of land holding was in agreement with the finding of Singh (1988), Bahadur (1988), Akhtar (1991) and Prabhakaran and Rajendra(1993).

Livestock Population in Relation to Land Holding

Farm category wise average livestock population and there composition in three studied blocks has been presented in Table2. It was observed that F_1 farm category of the Chakiya block recorded on average only one cattle. The number of cattle in F_2 and F_3 categories were 1.5 and 1.75 respectively while the number of cattle in F_4 and F_5 was higher i.e. 2.25 and 2.5 then F_1, F_2 and F_3. The study reveals that in Chakiya Block, none of the categories of F_1, F_2, and F_3 and F_4 farmers maintained bullocks for different agricultural operations, it might be due to that the agricultural operations depends upon tractors. The F_5 farmer's category maintained 0.25 adult male for breeding purpose.

In Sakaldihan blocks similar trend was observed but the F_1 and F_4 farm category had less number (2.0) cattle than F_2 and F_5 farm categories. The number of adult male in F_2, F_3 and F_4 farm categories were 0.25, 0.5 and 0.5, respectively. In Sahabganj block the average number of cattle in F_1, F_2, F_3, F_4 and F_5 farm categories were 1.75, 1.75, 2.0, 2.0 and 2.5 respectively. In study area the farmers of F_5 category has more number of cattle (2.5) followed by F_1 (1.58), F_2 (1.83), F_3 (2.25) and F_4 (2.08). Raut and Singh, 1973, Nair 1977, Prasad et al. 1991, Rajendran and Prabhakaran (1993) were also reported that as land holding increases the number of cattle also increases. The number of buffaloes maintained in the surveyed area where little high than those cattle. Highest number of buffaloes was maintained by F_3 (3.75) and F_4 (3.00) farm categories ion Chakiya block whereas, it was highest for F_5 (2.25) farm category in Sakdihan block. On average the number of cows reared were more 2.5 by large category whereas, the number of buffaloes reared were more by

small(3.08) and medium (2.91) farm families in surveyed area. It was also observed that in the study area, cattle and buffaloes were maintained for milk production for home consumption as well as for sale. Similar results were also reported by Acharya et al (1986) and Akthar (1991).

Farm Categories Vs Production Pattern

The average number of female cattle and buffalo (milch and dry in Table -3) was approximately 1.0 and 1.4 respectively in surveyed area. Out of the total cattle 28.8% was dry and rests were under milking. Out of total buffalo surveyed 69.4% were milch and rest 30.6% were dry. The milk yield of per day varied between 4.39 to 6.0 Kg in cow and 5.86 to 6.82 Kg in buffalo in survey area during study period. The average milk yield per buffalo per day observed in the present investigation was higher than that reported by Pandey and Mishra (1985) and Akthar (1991). The average yield during the one location of approximately 323.61 to 353.33 days was reported to be 1444.03 to 2001.67Kg in cows in different farm categories. The milk yield in buffalo varied between 1836 to 2266.42 Kg during the lactation of 338.33 days approximately in the survey area.

The dry period of cows were observed to be more (about four months) than buffaloes (about 3.5 months) in the survey area. The average milk yield of cows in the study area was lower because of Desi or Crossbred cows. It was also observed that calving interval of buffaloes in al study block was equal for cattle and buffalo.

Housing Pattern of Dairy Animals

It was found that on an average 25% of landless farmers and Pucca house and 75% maintained their animals under Kucha house/huts. Pucca houses were those houses made up of cement and concrete and Khaprail and 75% farmers maintain their animals in corners of their residence in F_1 farm categories. In survey area large farmers had 92% Pucca floor as compared to medium 75 % and marginal, small 67% in their cattle shed. Pucca floor was made up of brick soling and washable, but only 25% of families had no drainage in cattle shed. It was further observed that all the farm families had manger to feed their animals, 42-92 % of the farmers in the study area had Pucca manger and rest of the farmers had Kucha manger.

Table : 1 Land holding size of Different Farm Categories

Farm Categories	Chakiya Block			Sakaldiha Block			Sahabgunj Block			Overall		
	Average land holding /Family	Irrigated (%)	Un-irrigated (%)	Average land holding /Family	Irrigated (%)	Un-irrigated (%)	Average land holding /Family	Irrigated (%)	Un-irrigated (%)	Average land holding /Family	Irrigated (%)	Un-irrigated (%)
F_1	-	-	-	-	-	-	-	-	-	-	-	-
F_2	1.45	100	-	1.62	95.38	4.62	1.30	100	-	1.45	98.46	1.54
F_3	3.82	100	-	3.52	98.58	1.42	3.80	96.05	3.95	3.71	98.21	1.79
F_4	7.92	100	-	7.32	99.32	0.68	7.82	98.72	1.28	7.68	99.35	0.65
F_5	15.12	100	-	13.50	98.52	1.48	13.37	98.32	1.68	13.99	98.95	1.05

Table : 2 Livestock Population in relation to Land holding.

Species	Farm Categories	Chakiya Block				Sakaldiha Block				Sahabgunj Block				Overall			
		Adult Female	Adult Male	Young Stock	Total	Adult Female	Adult Male	Young Stock	Total	Adult Female	Adult Male	Young Stock	Total	Adult Female	Adult Male	Young Stock	Total
Cow	F_1	0.50	-	0.50	1.00	1.25	-	0.75	2.0	1.00	-	0.75	1.75	0.92	-	0.66	1.58
	F_2	0.75	-	0.75	1.50	1.25	0.25	0.75	2.25	1.00	0.25	0.50	1.75	1.00	0.16	0.66	1.83
	F_3	1.00	-	0.75	1.75	1.25	0.50	1.25	3.00	0.75	0.50	0.75	2.00	1.00	0.33	0.92	2.25
	F_4	0.75	-	1.50	2.25	1.00	-	1.00	2.00	1.00	-	1.00	2.00	0.92	-	1.16	2.08
	F_5	1.00	0.25	1.25	2.50	1.25	0.50	0.75	2.50	1.00	0.25	1.25	2.50	1.08	0.33	1.08	2.50
Buffaloes	F_1	1.00	-	1.00	2.00	0.50	0.25	0.75	1.50	0.75	-	1.00	1.75	0.75	0.08	0.92	1.75
	F_2	1.25	-	0.75	2.00	1.25	-	0.50	1.75	0.75	-	0.50	1.25	1.08	-	0.58	1.66
	F_3	1.75	-	2.00	3.75	1.50	-	0.50	2.00	2.25	-	1.25	3.50	1.83	-	1.25	3.08
	F_4	1.75	-	1.25	3.00	1.25	-	0.75	2.00	1.75	-	2.00	3.75	1.58	-	1.30	2.91
	F_5	1.50	-	1.00	2.50	0.75	-	1.50	2.25	1.50	-	1.25	2.75	1.25	-	1.25	2.50

Table :3 Farm Categories Vs Production Pattern

Blocks	Farm Categories	Cow							Buffaloes						
		Average no. of milch animals	Average no. of dry animals	Milk Yield (Kg)		Average Lactation period(Days)	Average Dry period (Days)	Average Calving Interval (Days)	Average no. of milch animals	Average no. of dry animals	Milk Yield (Kg)		Average Lactation period (Days)	Average Dry period (Days)	Average Calving Interval (Days)
				Per Day	Per Lactation						Per Day	Per Lactation			
CHAKIYA	F_1	0.25	0.25	4.50	1305.00	290.00	135.00	425.00	0.75	0.25	6.33	1938.33	305.00	110.00	415.00
	F_2	0.50	0.25	6.50	2052.00	317.50	152.50	470.00	1.25	0.25	7.00	2275.00	326.66	96.67	423.33
	F_3	0.75	0.25	7.00	1683.33	332.50	110.00	442.50	1.25	0.50	4.80	1735.00	356.25	115.00	471.25
	F_4	0.50	0.25	4.00	1402.50	350.00	130.00	480.00	1.25	0.50	5.70	2154.00	373.75	90.00	463.75
	F_5	0.75	0.25	6.50	2355.00	350.00	96.66	446.66	1.00	0.50	5.60	1962.50	320.00	100.00	420.00
SAKALDIHA	F_1	1.00	0.25	4.33	1503.75	341.25	125.00	466.25	0.50	-	5.75	2037.50	355.00	125.00	480.00
	F_2	0.75	0.50	6.00	1898.33	318.33	116.67	435.00	1.00	0.25	6.25	2180.00	353.33	100.00	453.33
	F_3	1.25	-	5.30	1734.50	321.25	108.75	430.00	0.75	0.75	6.33	2040.00	360.00	105.00	465.00
	F_4	0.50	0.50	5.75	1918.75	335.00	127.50	462.50	0.75	0.50	7.16	2545.00	360.00	126.66	486.66
	F_5	0.75	0.50	5.16	1805.00	350.00	100.00	450.00	0.50	0.25	8.00	2913.75	367.50	115.00	482.50
SAHABGUNJ	F_1	0.75	0.25	4.33	1523.33	353.33	130.00	483.33	0.50	0.25	5.50	1950.00	355.00	135.00	490.00
	F_2	1.00	-	4.37	1466.25	335.00	117.50	452.50	0.75	-	5.66	1955.00	343.33	120.00	463.33
	F_3	0.75	-	5.75	2115.00	370.00	140.00	510.00	1.25	1.00	5.80	1865.00	322.50	105.00	427.50
	F_4	0.50	0.50	4.0	1828.5	375.00	135.00	510.00	1.25	0.50	5.60	1836.00	320.00	120.00	440.00

				0	0										
	F_5	0.50	0.50	5.50	1845.00	335.00	120.00	455.00	1.75	0.75	6.85	2266.42	331.25	105.00	436.25
OVERALL	F_1	0.67	0.25	4.39	1444.03	328.19	130.00	458.19	0.58	0.17	5.86	1975.27	338.33	123.33	461.66
	F_2	0.75	0.25	5.62	1805.69	323.61	128.89	452.50	0.92	0.17	6.30	2136.66	341.10	105.56	446.66
	F_3	0.92	0.08	6.02	1844.28	341.25	119.58	460.83	1.08	0.75	5.64	1897.66	346.25	108.33	454.58
	F_4	0.50	0.42	4.58	1734.58	353.33	130.83	484.16	1.08	0.50	6.15	2178.33	351.25	112.22	463.47
	F_5	0.67	0.42	5.72	2001.67	345.00	105.55	450.55	1.08	0.50	6.28	2380.89	339.58	106.67	446.25

TABLE : 4 Housing Pattern of Dairy Animals.

Blocks	Farm Categories	Shed			Floor		Manger	
		Pacca%	Katcha%	Incorner%	Pacca%	Katcha%	Pacca%	Katcha%
CHAKIYA	F_1	25	75	75	25	75	50	50
	F_2	50	50	50	50	50	50	50
	F_3	75	25	50	75	25	50	50
	F_4	50	50	50	75	52	75	25
	F_5	100	-	25	100	-	100	-
SAKALDIHA	F_1	50	50	75	25	75	25	75
	F_2	50	50	75	75	25	50	50
	F_3	100	-	50	75	25	75	25
	F_4	100	-	100	75	25	75	25
	F_5	100	-	50	100	-	75	25
SAHABGUNJ	F_1	-	100	75	25	75	50	50
	F_2	75	25	75	75	25	75	25
	F_3	50	50	50	50	50	75	25
	F_4	75	25	50	75	25	100	-
	F_5	75	25	75	75	25	100	-
OVERALL	F_1	25	75	75	25	75	42	58
	F_2	58	42	67	67	33	58	42
	F_3	75	25	50	67	33	67	33
	F_4	75	25	67	75	25	83	17
	F_5	92	08	50	92	08	92	08

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FARMER' RIGHTS AND TRIPS MANDATE REGARDING AGRICULTURE

A Critical Analysis in Indian Perspective

Rajeshwar Tripathi[1]

Globalization and introduction of technology in agriculture has paved the way for IPR in agriculture. IPRs, by giving incentive to technology, have led to the development of agriculture; but it affects the farmers' rights also towards their natural resources. Before the introduction of IPRs in agriculture, the farmers' were independent with respect to their seeds and harvest. If there was ownership of anyone it was of the farmers' only. But this IPR regime has changed this concept drastically. Therefore it becomes necessary to protect the farmers' right.

The WTO Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) along with other fields affects the field of agriculture also. Under the TRIPS provisions member countries are under obligation to provide certain IPR protection in the field of agriculture. In India, agriculture contributes to about 26% of the total GDP and more than 50% of the population is dependent on Agriculture.

Farmer's Rights

Even since the Food and Agriculture Organization (FAO) setup an independent commission on plant genetic resources in 1983. India has been championing the cause of farmers against rising intellectual property rights protection in agriculture to check the adverse effects of this regime on the farmers' rights. It is recognized world over, particularly from the biodiversity rich developing countries including India, that farmers are singularly responsible for creation and conservation of genetic resources in all crop plants which provide the bedrock and springboard of global agriculture. No new plant variety can be developed now or in future without these genetic resources and traditional knowledge. Hence, F.Rs. are defined as the rights arising from the past, present and future contribution of farmers in conserving, improving and making available plant genetic resources, particularly those in the centers of origin of diversity.

While TRIPS makes no provision for protection of farmer's rights, the PGRFA treaty, while not defining farmer's right at the international level, puts the onus on member states to make farmer's rights a reality. However, the treaty indicates to some element, which makes up the farmer right that include the protection of traditional knowledge, equitable benefits

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sharing and the right to participate in decision concerning the management of plant genetic resources.

To protect the farmers rights FAO in 1983 adopted a resolution called the International Understandings on PGRs to ensure that PGRs of economic and social interest, particularly for agriculture, will be preserved and made available for plant breeding and for scientific purposes. The undertaking invoked the universally accepted principle that plant genetic resources are a heritage of mankind and consequently should he available without restriction.

The importance of FRs, in earning a livelihood ensuring a harvest and contributing to the household food security of people, increases with the rising dependency on agricultural linked subsistence and the magnitude of their resource scarcity. In no case, no one should be deprived of his own means of subsistence, asserts Article I of the UN Covenant on Economic, Social, and Cultural Rights.[1]

In 1989 an FAO interpretation endorsed the concept of farmers' rights acknowledging "that farmers of all regions have made an enormous contribution to the conservation and development of PGRs which constitute the basis of plant production throughout the world". In the field of agriculture, farmer's rights are the countervailing force to breeders' rights and patents on seed and plant material. Farmer's rights in the context of monopoly, control of the food system become relevant not just for farming communities, but also for consumers. Farmer's rights are necessary not just for the survival of the people but also for the survival of the country.[2]

TRIPS Agreement and Farmers Rights

The trade related aspects of Intellectual Property Rights (TRIPS) Agreement provides for IPR protection in agriculture by Article 27.5.3(b), which states that parties may exclude from patentability plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological processes. However, parties shall provide for the protection of plant varieties either by patents or by an effective sui generis system or by any combination thereof.[3] Thus, it provides two forms of IPRs protection in plant, patents and a sui generis system which are as under-

(a) **Plant Patents: -** The first part of Article 27(5) (3) (b) requires that parties should allow the patenting of plant and animals produced through 'non biological' and ' micro-biological processes'. The reference is quite evidently to the new biotechnologies of genetic engineering. However, while the moving of species across barriers through genetic engineering techniques can be defined as 'non-biological' in the sense that such

mixing of genetic material would not happen in nature. Thus, under the TRIPS provision a plant produced by non biological process can be patented.

(b) A sui generis system: - According to TRIPs, the members have to provide protection for plant variety either through patents or through an effective sui generis system or by combination thereof. Thus TRIPs offers three options for protection of plant varieties.[4]

1. Not to exclude plant varieties from patentability
2. To exclude plant varieties from patentability and grant *sui generis* rights for the protection of plant varieties
3. Provide protection to plant varieties through patents and sui generis system.

However, as regarding effective *sui generis* system TRIPs does not define it. But literary a *sui generis* system means "of its own kind". Thus, under a *sui generis* system members may enact of its own legislation to protect plant variety. TRIPs agreement which only says about “effective” in regard to *sui generis* protection is also not defined. But in the context of Article 27 of TRIPs agreement and other relevant conventions it is understood that, for being an effective *sui generis* system it must provide some minimum protection which is in the spirit of the UPOV Convention, the convention on breeders' rights.

Plant Variety Protection and Farmers' Rights Act, 2001

One of the significant effects of IPRs on Farmer’s Rights is regarding protection of plant varieties. Article 27(3)(b) of TRIPs agreement provides for the protection of plant varieties either by patent or by effective *sui generis* system. Since India is a party to TRIPs agreement, therefore it had to make provision regarding plant varieties protection, either by patent or by *sui generis* system. However, the Indian Patent (Amendment) Act, 2002, under S.4 (j) emphatically excludes plants and animals in whole or in part thereof other than micro-organisms, seeds, varieties, species and essentially biological process for production or propagation of plants and animals from patentable subject matter. Thus, post WTO patent regime of India does not allow patenting plant varieties and species. Hence, commitment of India to Article 27(3) (b) of TRIPs agreement took to the obvious choice of an effective *sui generis* system for the protection of plant varieties. Therefore, India has enacted a *sui generis* system for the protection of plant varieties through the Plant Variety Protection and Farmers Rights Act, 2001. India is one of the first countries in the world to have evolved an intellectual property rights legislation simultaneously granting rights to both breeders and farmers. At the international level, a *sui generis* system was first established in 1961 for the protection of new plant varieties.[5] The Indian PPVFR Act establishes a unique system by

extending the concept of Plant Breeders Rights (PBRs) currently applicable to new varieties of breeders to the varieties held by farmers, NGOs and public sector institutions. This law emerged from a process that attempted to incorporate the institutions, non-governmental organizational and farmers within the property rights framework.

Under the system of dual rights the breeders are rewarded for their innovation by having control of the commercial market place but without being able to threaten the farmers' ability to independently engage in their livelihood and supporting the livelihood of other farmers. Further the commercial scope offered under PBR is not significantly affected by the grant of RR and FR.

Healthy balance between the PBRs holder and public good

All IPRs are expected to ensure a healthy balance between the private gains arising from the exclusive right and the public benefit expected to flow with the working of IPRs. The exclusive right underlying the PBR, while allowing a kind of monopoly on the commercialization of the propagating material of a registered variety, requires that such propagating material is made accessible to the needy farmers and that it benefits them either as increased income or as other tangible societal gains.

Although, the empowerment of farmers and rural communities and to protect their rights over genetic resources has been a major objective of the PPVFR, but the effective protection of variety bred by farmers is still a gray area.[6]However, it is necessary to protect the farmers' right as owners of genetic resources or as breeders of these varieties. The best way to address this issue could be to register farmers' materials and facilitate their change and use by plant breeding programmes.

The benefits arising from commercialization of varieties based on these genetic resources should be shared with farmers. In essence, it can be said that PPVFR makes a shift associated with a transformation of farmers as breeders and reproducers of their own seed supply to farmers as consumers of proprietary seeds from the seed industry. It is also a shift from an agriculture based on millions of farmers as autonomous producers to an agriculture system controlled by agro- business firms, which will control both inputs and output. It will led, to some extent, the food insecurity, biodiversity erosion and uprooting of farmers from the land

IPRs and Agricultural Biodiversity

The impact of IPR in agriculture with reference to biodiversity is very significant. Biodiversity and agro-biodiversity, in particular, is of primary importance for the

sustainability of agricultural systems in the long term. Agro-biodiversity is of special importance because it directly contributes to feeding people. Agricultural biodiversity, in form of biological resources, constitutes a primary input to agricultural production systems and the majority of agricultural products have evolved through the selection and collection of plant and animal species.[7] In this context, landraces, which are geographically or ecologically distinct, crops or animals selected by farmers for their overall economic value, are of special importance.

IPRs in agriculture have an inherent tendency to displace landraces because protected varieties generally reduce crops resilience to pests and diseases.[8] Therefore, protection of agro-biodiversity is necessary not just for the insurance of agriculture but also for an economic imperative because, without it, the farmers will lose their freedom and option for survival. Thus, the ecological vulnerability of agricultural monocultures has made the conservation of agricultural biodiversity an imperative for protection of farmer's rights. The convention on biological diversity is a framework treaty which seeks to regulate the conservation and use of biological resources to protect biodiversity. Its three main goals are- the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits derived from the use of genetic resources.

The Biological Diversity Act, 2002 of India

In order to implement and give effect to the Convention on Biological Diversity (CBD) the Indian Parliament enacted the Biological Diversity Act, 2002. This Act is a step towards prevention of global hijack of Indian biodiversity and associated traditional knowledge. The patenting of Neem, basmati and turmeric by foreign firms rose alarm in public in India. Even so India's genetic wealth of 47,000 species of plants and 81,000 species of animals certainly needs an appropriate legislative framework for its protection, conservation, access, and judicious utilization.

The Biological Diversity Act, 2000 defines the term 'biological diversity' which refers to the variability among living organism from all sources and the ecological complexes of which they are part and includes diversity within species and between species and eco system.[9] The expression "agro-biodiversity" is defined to mean "biological diversity of agriculture related species and their wild relatives".[10] The Act provides for conservation of biological diversity, sustainable use of its components and fair and equitable sharing of the benefits arising out of the use of biological resources and knowledge. For this purposes, the Act provides for establishment of National Biodiversity Act with respect to benefit sharing arising from access to agricultural plant resources. Both the NBA and the authority, constituted under the PPVFR Act, are empowered to deal with the matter of benefit sharing

in respect of agro biodiversity.[11] This overlap may diminish at the time of grant of IPRs where the NBA does not have authority to deal with such requests or grant the rights.

The act also makes exception in relation to the exclusion of 'value added product' from biological resources. The 'value added products' are defined as those which may contain portions or extracts of plants and animals in unrecognizable and physically inseparable form.[12] However, the qualification[13] used to describe such products may pose some practical problems in respect of traditional herbal mixtures. These herbal mixtures may contain various plant extracts blended together in such a way as to make each component an unrecognizable and physically inseparable. Thus, these herbal mixture and the biological resources used for them could be commercially exploited without being subjected to the requirements of the Act, as they would fall outside its purview. Therefore, it appears that the Act precludes the companies, which are engaged in the formulation of herbal mixtures and other products based on herbs and plant portions.

Prior informed consent

To protect the agro-biodiversity and farmers rights the Act, under s. 6 clearly says that no person shall apply for any IPR in or outside India for any invention based on research or information on biological resources obtained from India without the approval of the NBA. This provision is in consonance with the long standing demand of making amendment to the agreement on TRIPS to incorporate the requirement of prior informed consent and disclosure of country of origin of biological resources. This provision is in consonance with the Indian Patent Act, 1970.[14]

The Indian Biodiversity Act does not provide effective measures for protection of biological resources and is heavily biased against the interests of tribal and local communities, who are the guardians of the associated knowledge. Further, there is no direct involvement of local communities and tribes. The regulations prescribed for Indian nationals and organizations also seem to encourage commercial exploitation of resources rather than giving inputs to the conservation of biodiversity or the benefit sharing with the local communities.

Geographical Indication and Farmers Rights

One of the advantages of IPR in agriculture is protecting geographical indications. The potential value of geographical indication is in protecting plants and germplasms that are specific and unique to geographical region. Most commonly, a geographical indication consists of the name of the place of origin of goods. Agricultural products typically have qualities that are derived from their place of production and are influenced by specific local

factors such as, climate and soil. In this way G.I. protects agricultural product which have some inherent quality and thus protects the interests of farmers also.

IPRs, Ag-biotechnology and Farmers' Rights

The IPRs are an important instrument of public policy that can provide incentives for investment in technological development. On the other hand, agricultural biotechnology can contribute to the growth of agriculture by developing high yielding seeds. Therefore, it becomes important to analyze the effect of IPR on agricultural biotechnology with respect to farmers' rights. Indian agriculture, which is moving from green revolution towards evergreen revolution, it is the agricultural bio-technology, which is playing the main role. In green revolution, the production was increased but the input cost rose, therefore, its impact on crop diversification was negative.

However, IPR protection restricts unauthorized copying of patents and monopoly in international marketing. These things, therefore, led to substantial conflicts between business ethics and humanitarian concerns because farmers cannot save seeds of their crops at the end of the crop season. It may, therefore, pose a potential threat to the farmers' rights. However, after having studied the peasant farmers' fate, the FAO has resolved that farmers should be allowed to derive benefits from the improved breeding and IPR through protection of farmers' rights.

Conclusion and Suggestions

The plant variety protection and farmer' rights Act, while providing protection for plant varieties, gives some exception regarding farmer's rights but this is not sufficient. The PPVFR gives farmer' the right to save, use, exchange, share and sale farm produce of a protected variety but does not give the right to sale of branded seed. This is against the farmers' right, especially in case of branded seeds containing IPRs protection, are of high quality and which cannot be re-sown again. Therefore, it makes the farmers not only to depend on seed companies but it also affects farmers' rights.

One of the main problem with IPRs protection is that it deals with all in equal manner which is against the principle of equity because only equals can be treated equally not unequal's. There is a big difference between the farmers' of developed and those of developing countries and also between farmers' of large and small farm holding in the same country. IPRs' do not take care of such things regarding nature of farming and the economic status of farmers'.

The defensive strategies can also be used in conjunction with the introduction of disclosure and prior informed consent requirements, which provide further avenues to ensure that their knowledge and resources are not unduly acquired in patented invention and protected variety. For this purpose the positive mechanism of farmers' rights can be linked to the fact that the determination of farmers' rights should imply limitation on patents or plant breeders' rights. Thus, public interest, food security or environmental conservation can constitute possible grounds for restricting the rights of IPRs holders with a view to strengthen farmers' control over their resources and knowledge. Further the dissemination of knowledge and awareness regarding IPRs protection and plant varieties should be made among farmers. In Ag-biotechnology and plant breeding, public sector contribution should be increased. More subsidies should be given for branded seeds in order to protect the indigenous farmers' rights.[15]

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[2] Vandana Shiva. "Agricultural Biodiversity, Intellectual Property Rights and Farmers Rights". Economic and Political Weekly, (1996),p.1621.
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[4] Malathi Lakshmi kumaran, "Plant variety protection: salient features". Published in book edited by S.K. Verma and Raman Mittal. Intellectual property Rights, ILI, Delhi, (2004) p.73.
[5] Meenakshi Prajneshu, "IPR in Sugar Cane Research", 7Journal of Intellectual Property Right, (2002) p.414 .
[6] In PPVFR Act, Farmers variety can also be protected as an "extent variety", which shall include varieties 'traditionally cultivated and evolved by farmers or a wild relative, land race, or a variety about which farmers posses common knowledge", Protection of such variety is simple as no passport data fee are required.
[7] Lori Ann Throop, "Linking agro-biodiversity and food security: The valuable role of agro biodiversity for sustainable agriculture", 76 International Affairs 265(2000) 62.
[8] Dr. Philippe Cullest, "Food security and intellectual property rights in developing countries", p.5, http://www.ielrc.org/content/w0303 pdf visited on 3/3/07
[9] See S.2, The Biological Diversity Act, 2000.
[10] See, explanation to s. 13 of the Biological Diversity Act, 2000. S. 13(1) of the Act makes provision for committee of the National Biodiversity Authority.
[11] See, Sec. 8 of the Biological Diversity Act, 2002.
[12] P. Brahmi., R.D. Dua and B.S. Dhillon, "The Biological Diversity Act of India and agro- biodiversity management 86 Current Scienct 5, March (2004) p. 48.
[13] See. Sec. 2 (p) of the Act.
[14] See, Sec. 3(p) of the Amendment Act states that an invention which, in effect is traditional knowledge or which is an aggregation or duplication of known properties of a traditionally known component or components is not to be deemed an invention capable of being protected by a patent under the Indian Patent Act, 1970
[15]

EVALUATION OF TURMERIC (*CURCUMA LONGA* L.) VARIETIES

R.S. Negi and others[1]

Key words: Agro-ecological zone, genotype, rhizome

Abstract

Ten varieties of turmeric (Curcuma longa L.) were evaluated at Instructional farm Krishi Vigyan Kendra, Satna during 2006/07 and 2007/08. The data recorded on yield and yield attributing characters revealed that number of primary rhizomes were highest in Suroma, while the numbers of secondary rhizomes were found highest in Barua Sagar. The variety Suroma recorded the highest average weight of mother rhizomes (66.52 g). The average weight of primary rhizome (147.82 g) was also highest in Suroma followed by Azad haldi-1(142.17 g) and Barua Sagar local (147.49 g). The yield per plant was also highest in Suroma (258.69 g). The rhizome yield was maximum in Suroma (227.64 q/ha) followed by Azad haldi-1(218.94 q/ha) and Barua Sagar Local (217.89 q/ha). The primary rhizome showed major contribution towards yield in most of the varieties. Thus on overall basis, the varieties Suroma, Azad Haldi-1 and Barua Sagar were found suitable for cultivation in Kaymore Plateau and Satpura Hills –agro ecological zone of Madhya Pradesh.

Introduction

Spices are high value and export oriented commodity crop, which play an important role in agricultural economy of the country. The agro climatic zone- Kaymore Plateau and Satpura hills comprising of 7 districts Satna, Seoni, Sidhi, Katni, Panna, Jabalpur and Rewa has tremendous potential for production of spice crops. More over turmeric being a shade loving plant can be successfully grown amidst old and less economical mango orchards. Intercropping of turmeric amidst mango orchards can turn these less economical orchards into profit making. In spite of the fact that the climatic conditions of the region along with sizable area under old mango orchards which provide suitability for turmeric cultivation, no major break through has been noticed in boosting its cultivation primarily due to lack of suitable varieties. Keeping in view the potentiality of turmeric cultivation the present trial was conducted to identify high yielding varieties suitable for Kaymore Plateau and Satpura hills zone of Madhya Pradesh.

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Materials and Methods

Ten varieties of turmeric were evaluated at instructional farm of Krishi vigyan Kendra, Satna (MP) during the year 2006/07 and2007/08. The experiment was laid out in randomized block design with three replications. The plot size was 3x2 m with row to row spacing of 45 cm and plant to plant 25 cm. The seed rhizomes of each variety were sown during last week of June. Each plot was mulched with 10 cm thick layer of Butea *monosperma* leaves. 20 t FYM and NPK @ 90: 60 :80 kg/ ha were applied. The full dose of FYM, P and K and half dose of N were applied at the time of sowing and remaining amount of N was applied in two equal splits i.e. 40 and 75 days after sowing. The earthing up was done after 40 and 75 days of sowing. Standard cultural practices were followed to raise a good crop. The observations were recorded on growth and yield characters at the time of maturity. The data of the two years were pooled and subjected to statistical analysis (Panse and Sukhatme, 1967)

Results and Discussion

The mean data of 13 quantitative characters is presented in table 1. The data reveals enough variability for the characters. The plant height varied from 68.05 cm (Azad haldi-1) to 102.50 cm (Pant Pitambh). The numbers of clumps were highest in Pant Pitambh, Sudarshan and Barua Sagar. The number of primary rhizomes was highest in Suroma (6.58) while the secondary rhizomes were highest in Barua Sagar (11.42). The variety Pant Pitambh had maximum length of mother rhizome (6.84 cm) followed by Azad Haldi-1 (6.83 cm). The length of primary rhizome was maximum in variety Saguna (9.48 cm) followed by Swarna (8.67 cm), Soniya (7.50 cm) and Barua Sagar (6.92 cm). The variety Saguna recorded the highest length of secondary rhizomes (5.51 cm). Nirmal and Yamgar (1998) also reported such variation in number and length of primary and secondry rhizome

The variety Suroma recorded the highest average weight of mother rhizomes (66.52 g). The total weight of primary rhizomes was also highest in Suroma followed by Azad Haldi-1. The yield per plant was highest in Suroma (258.69 g), Azad Haldi-1(248.79 g) and Barua Sagar (247.61 g). The primary rhizome showed major contribution towards yield per plant in most of the varieties. The yield varied from 118.13 q/ha (Sudarshan) to 227.64 q/ha (Suroma). Similar Variability in quantitative characters among the genotypes has also been reported earlier by Yadav et al. (2005) in turmeric. It was also noticed that there were few spots of leaf blotch on almost every variety at the time of maturity. But this disease could not show any adverse effect on the yield.

Conclusion

Thus on overall basis the varieties Suroma, Azad Haldi-1 and Barua Sagar Local were found suitable for cultivation in Kaymore Plateau and Satpura hills zone of Madhya Pradesh. However, the variety Suroma was found the most superior genotype.

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Table. 1 Performance of different genotypes of turmeric under Kaymore Plateau and Satpura Hills - Agro ecological region M P

Name of variety	Maturity period	Plant Height (cm)	No. of clumps	No. of primary rhizomes/ plant	No. of secondary rhizomes/ plant	Length of mother rhizomes (cm)	Length of primary rhizomes (cm)	Length of secondary rhizomes (cm)	Weight of mother rhizome (g)	Weight of primary rhizomes (g)	Weight of secondary rhizomes (g)	Yield per plant (g)	Yield q/ha
Pant Pitambh	252	102.50	5.08	5.17	8.33	6.85	6.39	4.38	54.86	121.91	36.57	213.34	187.75
Suroma	211.5	83.90	4.25	6.58	8.83	5.52	5.94	3.74	66.52	147.82	44.35	258.69	227.64
Roma	236	81.67	3.50	5.33	8.42	5.13	5.12	3.51	44.69	99.31	29.79	173.79	152.94
Sudarshan	185	96.54	4.92	6.08	9.83	4.75	6.05	3.67	34.52	76.71	23.01	134.24	118.13
Swarna	209	74.24	4.50	5.00	10.08	6.82	8.67	4.43	47.96	106.57	31.97	186.5	164.12
Saguna	191	85.26	3.42	6.17	9.33	4.83	9.48	5.51	50.35	111.89	33.57	195.81	172.30
Soniya	218	91.79	3.75	5.83	10.5	5.37	7.50	4.26	46.15	102.55	30.76	179.46	157.92
Barua Sagar	180.5	70.65	4.58	5.33	11.42	5.50	6.92	3.35	63.67	141.49	42.45	247.61	217.89
Azad Haldi-1	205.5	68.05	3.58	5.42	9.0	6.84	4.37	4.09	63.97	142.17	42.65	248.79	218.94
NDH-18	226	82.40	3.67	5.97	9.17	6.59	6.65	3.79	36.58	121.94	36.58	195.1	171.70
SEd	11.57	4.49	0.22	0.30	0.48	0.31	0.33	0.21	2.74	6.31	1.89	10.93	9.62
CD(0.05)	24.32	9.44	0.46	0.63	1.00	0.65	0.70	0.44	5.76	13.26	3.98	22.96	20.20

RURAL WOMEN AND ENVIRONMENTAL MANAGEMENT

Dr. Aparana Singh[1] and Dr. Amar Singh[2]

Key word- Biotechnology, Physiotherapy.

Abstract

Environmental problems are becoming serious in India because of the interacting effects of increasing population density, industrialization and urbanization, and poor environmental management practices. Lack of political commitment, lack of a comprehensive environmental policy, poor environmental awareness, and functional fragmentation of the public administration system, poor mass media concern, and prevalence of poverty are some of the major factors responsible for increasing the severity of the problems. Environmental problems in India are highly complex, and management procedures have to be developed to achieve coordination between various functional departments and for this, political leaders have to be convinced of the need to initiate environmental protection measures

Introduction

Life, nature and the planet Earth have been generally portrayed with female features throughout different civilizations and times. The notions of fertility, nativity, beginning, birth and renewal have always been associated with females, because of their natural function of conceiving, thus ensuring the continuity of species. Their role as caretakers in the growth of children and in the daily provision for the family's subsistence has also made women the primary users of natural resources for non-commercial purposes in the preparation of food, clothes, shelter, utensils and medicines.

Nature and its wonders have also inspired art and creativity, making women the talented, but unknown, authors of thousands of craftworks (Deda and Renata, 2004). The strong link between women and nature is therefore not only a romantic or mythological notion. Women, through their uses of natural resources for building, cultivating, breeding, nourishing and healing, have preserved biological diversity and developed knowledge of surrounding environ, which have been transmitted from generation to generation, helping to enhance livelihood security.

In addressing some key environmental problems, women play a dominant role. Women, through their roles as farmers and as collectors of water and firewood, have a close connection with their local environment and often suffer most directly from environmental problems (Akwa 2009). Women's direct contact with environment has produced their deep-

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knowledge about the environment. Thus, women have served as agriculturalists, water resources managers, and traditional scientists, among others. Women are not only knowledgeable about the environment, they are also protective and caring (Akwa et. al., 2008). Women, being primarily responsible for domestic and household management, interact more intensively with both the natural environment and build the environment more than men. Consequently, they are more likely to suffer from a degraded home, neighborhood, and city environment and to shoulder more of the burden that goes with living in poor housing and communities with inadequate residential and health infrastructure, since they spend more time at home and its immediate vicinity (Etta, 1999).

Since women, as opposed to men, play a pre-eminent role in the care and management of the home and its environs, the household environment can be said to be engendered. Moreover, the home and neighborhood environments are especially critical to the health and well being of children, the elderly and among active adults, women. Adult men tend to spend more time away from home, and thus face fewer of its environmental hazards. For many women, especially those categorized as housewives or homemakers, the place where they live is also the place where they work (Muller and Plantenga 1990).

Women, Environment and Challenges

A lot of studies on women and environment have shown that women are significant actors in natural resource management and they are major contributors to environment rehabilitation and conservation. There is little evidence to suggest that women are inherently more conservationist than men (Agarwal, 2000). Women have recorded successes in solving environmental problems all over the world. In India, the women realized that degradation of productive land has led to the erosion of top soil; the choking of water drainage was causing salinity and loss of food crops. They collectively lease degraded land (Deda and Renata, 2004).

It is special relevance to women, children and the elderly that in many cities in low income developing counties the most significant environmental health hazards tend to be encountered within people's houses and neighborhoods. The immediate environmental threats for the residents of these cities are not long-term global warming, cumulative exposure to carcinogens or even decade-long desertification but rather the life and death immediacy of malaria, respiratory illness, and diarrhea. Their threats are derived in part from household environments characterized by indoor air pollution, a bug-filled outdoors, near-the-door faeces, and far-from-the door water. There are also the dangers connected with the use of insect sprays, uncontrolled sewage, and ambient air pollution (Kates 1994, Benneh et al., 1993; Songsore and McGranahan 1993; McGranahan and Songsore 1994).

Dankelman and Davidson (1987) observed that women play a key role in managing their natural surroundings and adopt several mechanisms to deal with the kinds of

environmental crisis they face. They, however, observe that the responses of governments have not been significant. A lot has been said about women activities in environment improvement and protection. Moser (1991) distinguishes between three roles for women:

- As managers or maintainers of the natural environment,
- Rehabilitators of the natural environment in the sense of sustainable development, and
- As innovators in the use of appropriate technology in the creation of new environments.

Women Contribution in Surrounding's Environmental Management

Women are always at the center of the management of the communal water resources and household water requirement. Etta (1999) conducted a survey at Maroko Low-Income Settlement in Lagos and found that at the communal level, women are always in-charge of the control and management of communal taps or water points. At times they lock the taps to prevent children from damaging the water pipes. At the household level, the burden of fetching water for cooking, washing etc. Women's roles in agriculture include production and distribution, planting and cultivation, weeding, hoeing, harvesting and storage, marketing, and home preparation and distribution of foods. In Asia, women provide fifty to ninety per cent of the labor force for rice cultivation. All over the world, women contribute to agricultural production. They produce more than half of all the food that is grown (FAO, 1996; Akawa Labarish, 2009).

Women play a significant role in the management of flooding either by clearing bushes, digging gutters, or baling water. At times they pay laborers to do sand filling for them. Flood management could be at the household level or community level. During the rainy season many houses get waterlogged and streets are flooded. So women play a vital role in environmental management. Women's involvement with environmental management and problems make them participate actively in keeping drainages around them clean and free from trash and sand. Solid waste management is a key issue in both rural and urban areas. Women are engaged in environmental management by cleaning the environment and keeping it clean, especially in terms of garbage disposal. In our homes women can categories the soled waste in terms of bio-degradable and non degradable, recyclable and non recyclable. They can actively engaged in '4R' (Reduce, Resuse, Recover, Recycle) mechanism.

Women take an active part in preventive measures against environmentally transmitted diseases and waterborne diseases, such as malaria, diarrhea, cholera, cough, cold, measles etc because in the slum areas or urban informal sector or rural areas, most houses do not have latrines and so the residents do use drainage or polythene bags and later throw them on the streets, drains, or anywhere they can which is cause of different types of diseases. The need to protect biological diversity (forest) has been realized. We have greater women's participation in environ management through tree planting, rehabilitation, or protection.

Women in ours homes planted useful tress ranging from vegetables, fruits, medicinal plants etc.

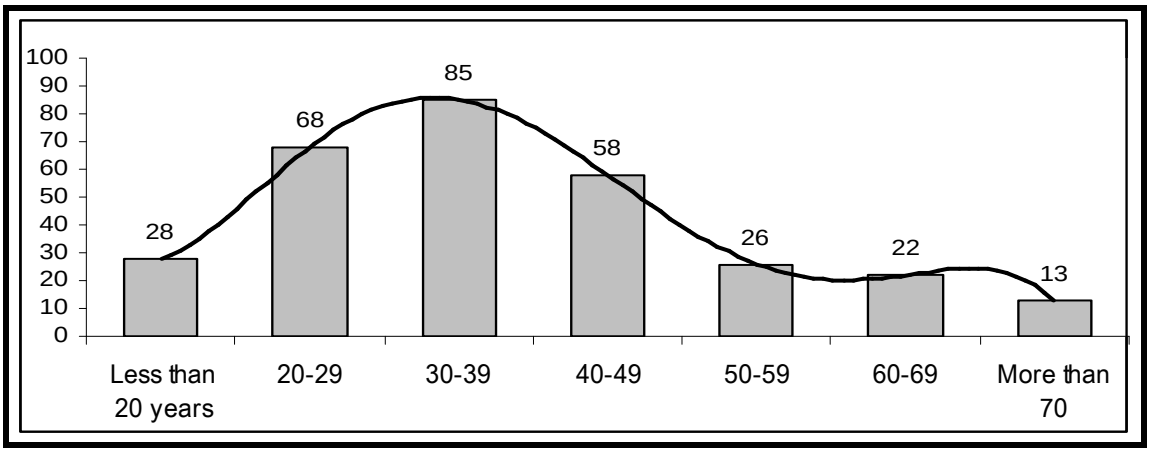
Methodology

In this paper we make use two types of data, primary and secondary. The first are the secondary source materials obtained from past studies on women involvement in environmental practices and management. The second is primary data obtained through a questionnaire, survey of 300 women of five villages of Satna district of Madhya Pradesh. The names of villages are Rajaula, Mohakam-Garh, Paraha, Pathra and Paldev. The women respondents were randomly selected from the various wards and settlements in the study area. The data were analyzed using percentages.

Table 1: Age and marital status of the surveyed women, engaged in environmental management

S. No	Age Group	Number	Percentage (%)
1.	Less than 20 years	28	9.34
2.	20-29	68	22.67
3.	30-39	85	28.33
4.	40-49	58	19.33
5.	50-59	26	8.67
6.	60-69	22	7.33
7.	More than 70	13	4.33
	Total	300	100
	Material Status	Number	Percentage (%)
	Married	207	69
	Unmarried	93	31
	Total	300	100

The results of the questionnaire survey of women's participation in environmental management in above stated villages are given. The age and marital status of the women is shown in Table 1. Only 9.3% of the women surveyed are below the age of 20 years. Majority of the women (51%) are in their middle ages (20-39 years).



Picture 1: Age and marital status of the surveyed women, engaged in environmental management

The implication of this age distribution is that most of the women are still in their prime ages and, hence, energetic to take an active part in environmental management activities. Marital status indicates that 69% of the women are married, while only 31% are single. This high proportion of married women in the study area suggests that they are likely to be more responsible in protecting and keeping the environment clean because of their roles as home keepers.

Table 2: Women Involvement in Environmental Management

S.No	Activity	Number	Percentage %
	Involvement in farming		
	Yes (Direct + Indirect)	197	65.67
	No	103	34.33
	Planted Trees in the last 5 years		
	Yes	174	58
	No	126	42
	Planted Place		
	Around the compound	183	61
	On the form	71	23.67
	School, colleges and others	46	15.33
	Species Planted		
	Fruit trees	95	31.67
	Flowers	115	38.33
	Vegetable and others	90	30
	Frequency of Cleaning the Environment		
	Daily	213	71
	Weekly	56	18.67

	Occasionally	31	10.33
	Major Activity in Environmental Cleaning		
	Weeding	60	20
	Sweeping	187	62.33
	Cleaning Drainage and others	53	17.67

According to (Table no.2), a majority of the women surveyed (65.67%) are involved in farming .This confirms findings from other studies that women participate greatly in food production, especially in rural areas. As earlier established in the discussion, women contribute significantly to land/soil conservation.

One of the ways protecting the environment and reducing hazard, such as windstorms and erosion, is by planting trees. In the study area, the survey revealed that 70% of the women have planted trees or flowers in the last five years. This again buttressed the previous findings that women are actively involved in tree planting. When asked where the trees or flowers were planted, about 61% indicated their compounds, 23.67% planted trees on the farm, while 15.33% planted theirs in school, colleges and other places. Fruit trees (e.g. mango, papaya etc.) constitute the bulk of the trees planted by majority of the women. This is done with the twofold objectives of protecting the environment and also providing fruits for the household. Women are main actors in environmental sanitation of homes and communities. About 71% of the women surveyed indicated that they clean their surroundings daily, 18.67% do it weekly, while 17.67% do it occasionally. When asked the major activity they perform in cleaning the environment, the majority (62.33%) indicated sweeping. This is followed by weeding (20%) and clearing of drainage and others (17.67%).

Conclusion

To enhance women's participation in environmental management for sustainable development the challenges should be provided to face the women. Women should be encouraged to participate in committees on environmental protection projects, programmes, and policies to address gender imbalances in decision making. Women's access to land and other resources should be ensured and not undermined. Environmental education is required for the generality of rural women for sustainable development.

Environmental education will produce change in attitude of the public, as well as increase specific knowledge and curiosity. A special training for separation of household generated solid waste should be organized for women and girls. Separation of plastic from

municipal solid wastes and recycling of plastic will help to reduce the contribution of plastic to the solid waste problem, as well as eliminate the unsightly littering. Women education and access to education for girls should be seen as a policy priority. Educated women will contribute more significantly to bridging the gap between environment and development. Empowerment of women in sustainable human development and in relation to the protection of the environment must be recognized and sustained.

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EFFECT OF PIG WASTE ON P^H AND TDS IN AQUACULTURE POND

Kamla Shankar shukla[1] and Dr. Chhotey singh[2]

Abstract

The present study was conducted to give an account of daily variation in water quality parameters like Temperatures, Transparency, Total dissolved solid and p^H. The washings of piggery (without solid waste) incorporated directly in to 0.2 hectare aquaculture pond which was stocked with IMC. Water quality parameters taken for examination for three days in a week at one day interval from three selected places entry point (T-1), center point (T-2) & opposite corner of entry point (T-3). In the study it was observed that the washings and left over of 11 pigs did not affects the physico-chemical properties of pond. All the parameters examined were in congenial range. Water temperature fluctuated in between 28.5 to 34.5 ^{0}C, transparency is in between 14 to 25.5 cm as sacchi disc visibility with maximum at T-3 & minimum at T-1, pH ranges in between 7.69 to 7.88, the maximum level reached at 6: 00 pm.TDS ranges between 0.96 to 1.19 g/l. All the parameters recorded higher at entry points than center and other corner ends.

Introduction

A sustainable technology is the need of the nation to get higher production from existing agricultural land and water. In this regard, integrated farming offers a possible solution and holds a great promise and potential for augmenting production, betterment of rural economy and employment generation, and finally improving socio-economic status of weaker rural community. For long sustainability of the production potential there is a need to integrate all available resources and production system to each other. This integration not optimizes the production but also reduces the system oriented pollutions. Integrated Fish farming system has received considerable attention in recent years in many developing countries of Asia, and Africa, America (Panama and Brazil) has also introduced this system in large scale. Some of the east European country (Hungary, Czechoslovakia, and Poland) have expanded and improve the technology considerably. Utilization of by product of one farming system another farming system is a need of today. Not only for sustainable farming but also to keep environment clean in which we are habituating. If we are unable to use there by products, that petrify our local environment with bad odour, pollute air with the production of noxious gases. The washing of pigs when accumulated in pits in open air it produces several hazards to the human beings like, Malaria, Asthmas and noxious gases.

So, the safe disposal of their by products through proper manner and recycled them to earn more benefit without polluting the environment. It is also necessary to manage water

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quality of ponds integrated with pig waste. The nutrient and over loading of manure produces much stress to aquatic life when the water quality get putrefied. Tolerance in relation to the fishes possess through a limit of water quality. There water quality parameter when disturbed then it causes aquatic life and even they lose their equilibrium and ultimately they die. So, the farmers must be conscious about their alteration and keep eye to manage regularly.

Water quality management

Fishes are in equilibrium with potential disease organisms and their environments. Changes in this equilibrium, viz. determination in water quality (environment) can result in fish becoming "stressed" and vulnerable to disease. It is there fore important to know about water quality parameters and their management, which have influence on growth and survival of the aquatic environment.

The fishes are ectotherms as heat is obtained from their external environments. Therefore the body temperature of culture animals is usually the same as that of the water temperature. Temperature will affect all chemical and biological parameters.

The hydrogen ion concentration in water gives an account of the extent of acid and base present in the pond. Ph will vary depending on a number of factors. Firstly the ph levels of the pond water will change depending on the aquatic life with in the pond. Carbon dioxide produced by aquatic organisms when they respire has an acidic reaction in the water. Suboptimal ph has a number of adverse effects on culture animals. It can cause stress, increase susceptibility to disease, low production level and poor growth. A sign of suboptimal ph includes increase mucus on the gill surface of fish, damage to the eye lens, abnormal swimming behavior, fin ray, poor phytoplankton and zoo plankton growth and can even cause death. The optimum ph range is in between 6.5-8.5. High ph occurs probably due to high nutrient inputs. The ph affects metabolism and physiological process of fish. Ph also exerts considerable influence on toxicity of ammonia and hydrogen sulphide as well as solubility of nutrient and there by water fertility.

Transparency is the result of several factors including suspended soil particles, planktonic organisms and humic substances produced through decomposition of organic matter. It is measured by sacchi disc visibility. Optimum sacchi disc visibility of fish pond is considered to be 40-60 cm. Turbidity resulting from plankton is generally desirable.

Main objective of the project work is to asses the effect of piggeries waste on the water ph and TDS of fish pond

- To study the suitability of water quality for fish farming
- To study the judicious recycling of organic wastes for the production of high quality protein at low cost.

- To analyze the water quality of aquaculture pond which receives waste of pig.

Materials and methods

The aquaculture pond of Krishi Vigyan Kendra Ganivan, Chitrakoot, was selected for the study of the physico-chemical characteristics of pond water which is connected with pig sties through bricks channel. The site is located at 132.98 km above mean sea level of 80^0 40' and 81^0 84' longitude and 24^0 52' and 25^0 25'.latitude. The pig and poultry houses are located at pond embankment.

The average populations of pigs during study were 1 piglet, 7 sows, and 3 boars. The average weight of sow and boars are 68 kg. The pigs were fed on wastes of agriculture and green fodders. The pig feeding materials constituted with Rice brawn, soybean meal and green fodder. The total consumption of feed was on an average 56.25 kg/day as dry weight and consumption of green fodder was 15 kg/day.

The waste produced by pig units during 24 hours study is 110.25 kg as wet weight. The wastes of the unit collected and composted near pig sties in a pit & heap, only washings and left over goes directly in to the study pond through a bricks channel.

The total area of selected pond is 0.2 hectare (50 x 40 meter) with average depth of water is ranging in between 1.2 meter. The fish species cultured in pond are *Catla Catla*, *Labeo rohita* and *Cirrhinus mrigala*. They feed only on natural fish feed (plankton) and pig wastes goes directly from pig sites to the pond. The fresh water supplied to maintain the pond water level by bore well through PVC pipes.

Sample collection Method:

The pond is divided in three parts which is described below-

T1 - Entry point of the waste.

T2 - Central area of the pond.

T3 – Opposite corner from entry point.

Sample was collected from all the selected points from 50 cm depth through water samplers at 6:00 am, 1: 00 pm, and 6: 00 pm from pond treated with pig washings & left over.The analysis of the water quality parameters completed in between 8th to 12th May, 2008.

Data Collection

The examination of the water quality parameters completed in three times in between 8th to 12th May, 2008 at one- day interval from all the points at 6 AM, 1 PM and 6 PM daily. The sample was taken from the depth of 50 cm from the surface of water & 2 meter away from Embankments on both ends and central area.

The water sample collected from the pond was stored in polythene containers of 5 liter capacity. pH and TDS estimation completed immediately after collection of sample. The Temperature and Transparency recorded in situ by Thermometer and Sacchi disc.

The following data were collected-

1- Water quality parameters:

(a) Physical Parameters: Temperature (ambient and water), Transparency.

(b) Chemical Parameters : pH, TDS

Methods of analysis:

Parameter	Method
Temperature(ambient & water)	As per standard methods of examination of water and waste water
pH	
TDS	
Tranceparency	

Results and Discussion

Physico-chemical parameters of water play a significant role in the biology and physiology of fish. In the present study the water quality parameters of integrated pond remained within the favorable range required for Fish farming. All the metabolic and physiological activities and life processes of aquatic organism are greatly influenced by water temperature. The water temperature of the pond ranges between 28.5^0C -34.5^0C that was in the suitable range. The Indian major carps thrive well in the temperature range of 18.3^0C - 37.8^0C (Jhingaran, V.G.1991).

Transparency of the study pond was ranging between 14-23.5 cm. this is congenial in range. The transparency of treatment pond is lower because abundance of plank tonic organisms and stocked fishes. In integrated fish farming organic pollutants released into the pond would minimize the light penetration and D.O. (Salt et al, 1995). The nutrient value like NPK and organic carbon in pig waste is with in the range of recommendation (Woynarovich, E., 1976) presented the composition of fresh pig manure. The availability of nutrients was able to produce natural fish food for cultured animals. Singh (1996) also reported that pond productivity could be maintained for longer periods through the use of pig manure in comparison to cattle dung. It is recommended that faecal matter released by 30 to 40 pigs in integrated forming is sufficient to provide nutrients for one hectare ponds and there is no need for application of manure and supplementary feed from out side.

The total dissolved solid was fluctuated in morning, noon and evening hours. This is higher due to movement of stocked fishes and addition of pig waste in treatment pond. The P^H of the integrated pond was in suitable range that was ranges in between 7.69 to 7.88. There is little difference in the p^H of treatment pond at different sampling points. The highest

pH was recorded in evening hours. P^H range of water in between 6.5 and 9.0 as recorded day break is most suitable for fish growth. (Swingle, 1967 a)

A. Dhawan and S S. Kaur (2002) suggest that pig dung even at a higher dose (36t/ha/year) did not have any adverse effect on the physicochemical Parameters of water. The results of all the parameters examined in respect of water quality such as temperature (ambient and water) transparency, TDS, pH of aquaculture pond integrated with pig waste are presented in Table-1 to 3 in details.

At 6:00 AM:-

The summery of result of water quality parameters at 6:00 am shown in table-1. In morning hours the average ambient temperature ranges in between 28-30°C with mean temperature of 29.17°C on pond sites. The water temperature of T-1 is ranges in between 28.5-29.5 With an average of 28.83^0C, but at point T-3 this was 29°C where as point of T-2 showed higher temp. That was 29.17°C.

The table 1 showed transparency is lower in treatment pond. The mean transparency of treatment pond showed that at the entry points (T-1) the transparency was lowest and at last point (T-3) transparency was highest. Value of transparency at T-1, T-2, and T-3 was 15, 16.17 and 17.25 cm. respectively transparency was lower due to Plancktonic abundance.

TDS level in treatment pond showed higher value at T-1 and lowest at T-3 sampling point. The level of TDS was 1.07, 1.06, 1.05gm/lt. at T-1, T-2 and T-3 respectively. The TDS is higher at Entry point. The Ph value of integrated ponds at all the sampling points showed slight differences at different sampling points. This parameter was ranges in between T-1, T-2 and T-3 found Ph value of 7.77, 7.74 and 7.70 respectively in morning hr.

Table: 1- Summery of results of pond water quality at 6: 00 am from 08-12/05/08

Sl.	Para meters	Mean & Ranges	T-1	T-2	T-3
1	Ambient Temp.°C	Mean	29.17	29.17	29.17
		Ranges	28.5-30	28.5-30	28.5-30
2	Water Temp.°C	Mean	28.83	29.17	29.00
		Ranges	28.5-29.5	29.0-29.5	29.00-29.00
3	Transparency cm	Mean	15.00	16.17	17.25
		Ranges	14.0-16.5	14.5-18.0	15.5-19.5
4	Total dissolved solids (gm/lt.)	Mean	1.07	1.06	1.05
		Ranges	0.99-1.19	0.98-1.16	0.96-1.16
5	PH	Mean	7.77	7.74	7.70
		Ranges	7.73-7.79	7.72-7.77	7.69-7.71

At 1:00 PM:-

The water quality parameters at 1.00 pm in noon shown in tables-2. The average ambient temperature ranges in between 41-43°C with mean temperature of 42°C at pond sites and the water temperature of treatment pond ranges in between 33-34.5 °C, but at point T-2 & T-3 is equal which was 33.67°C where as at point T-1 shows lowest value that was 33.50°C.

The table- 2 shows transparency of control pond is higher than the treatment pond. The mean transparency of treatment pond showed that at the entry points (T-1) the transparency was lowest and at last point (T-3) transparency was highest. Value of transparency at T-1, T-2, T-3 was 18, 20.83 and 22.17cm. Respectively transparency was lower due to plancktonic abundance and entry of pig wastes.

TDS of treatment pond showed higher value at T-1 and lowest at T-3 sampling point. The level of TDS was 1.13, 1.12, 1.11gm/lt.respectively at T-1, T-2 and T-3.

The Ph value of the pond at all the sampling points showed slight differences. The Ph value of T-1, T-2 and T-3 found 7.80, 7.79 and 7.78 respectively at 1:00 pm in treatment pond.

Table: 2- Summery of results of pond water quality at 1: 00 pm From 08-12/05/08

Sl.	Para meters	Mean & Ranges	T-1	T-2	T-3
1	Ambient Temp.°C	Mean	42.000	42.000	42.000
		Ranges	41-43	41-43	41-43
2	Water Temp.°C	Mean	33.500	33.670	33.670
		Ranges	33-34	33-34	33-34.5
3	Transparency cm	Mean	18.000	20.830	22.170
		Ranges	15-20	16.5-25.0	18.5-22.5
4	Total dissolved solids (gm/lt.)	Mean	1.130	1.120	1.110
		Ranges	1.05-1.19	1.05-1.16	1.04-1.15
5	PH	Mean	7.800	7.790	7.780
		Ranges	7.78-7.84	7.78-7.83	7.76-7.81

At 6:00 PM:-

The results of water quality parameters shown in tables-3 at 6.00 pm in evening hours, the average ambient temperature ranges in between 39-40°C with mean temperature of 39.33°C at all points and in both pond. And the water temperature of control ponds ranges between 33.83 to 34°C in control and in treatment pond temperature ranges in between 31.5-32.33°C.

The table -3 shows that the transparency of treatment pond showed that at the entry points (T-1) the transparency was lowest and at last point (T-3) transparency was highest.

Value of transparency at T-1, T-2, and T-3 was 16.67, 17.83 and 19.1 cm. respectively transparency was lower due to plancktonic abundance

TDS level in treatment pond shows higher value at T-1 and lowest at T-3 sampling point. The level of TDS was 1.14, 1.13, 1.11gm/lt.respectively at T-1, T-2 and T-3.

The Ph value of the pond at all the sampling points showed little differences. The ph value at point T-1, T-2 and T-3 found 7.83, 7.81 and 7.82 respectively in evening but it was higher than morning and noon.

Table: -3 Summery of results of pond water quality at 6: 00 pm from 08-12/05/08

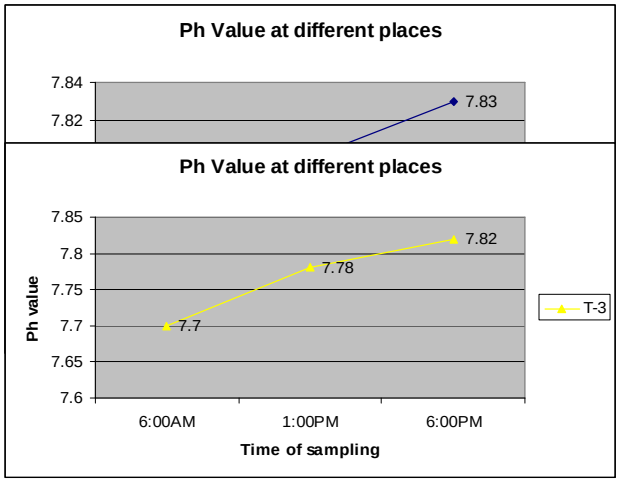
Sl.	Para meters	Mean & Ranges	T-1	T-2	T-3
1	Ambient Temp.°C	Mean	39.330	39.330	39.330
		Ranges	39-40	39-40	39-40
2	Water Temp.°C	Mean	32.330	31.500	32.170
		Ranges	32.0-32.5	31.0-32.5	32.0-32.5
3	Transparency cm	Mean	16.670	17.830	19.100
		Ranges	16-18	16.55-20.5	17.0-21.5
4	Total dissolved solids (gm/lt.)	Mean	1.140	1.130	1.110
		Ranges	1.1-1.16	1.09-1.16	1.05-1.14
5	PH	Mean	7.830	7.810	7.820
		Ranges	7.80-7.88	7.80-7.84	7.81-7.83

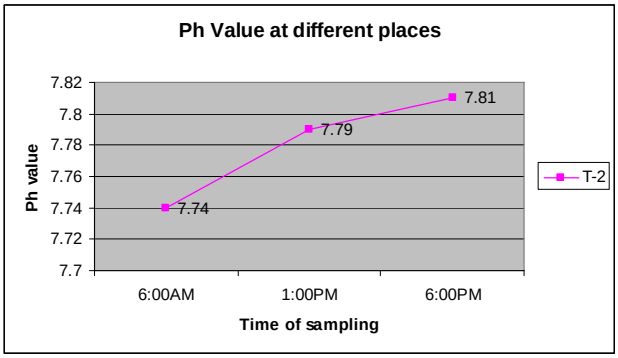
Summery and Conclusion

Water quality includes all physical, chemical and biological factors that influence the beneficial use of water. There are many water quality variables in pond fish culture. All other things being equal, a pond with good water quality will produce more and healthier fish than a pond with poor quality. Water quality within an aquaculture pond is continuously changing depending on certain conditions.

The aquaculture pond integrated with pig waste was analyzed in the present study. Study shows that the all physico – chemical properties of pond water were, with in the favorable range. The prime objectives of the study was to measure transparency, Total dissolved solids, ambient temperature, water temperature, Hydrogen ion concentration.The present study revealed that if the aquaculture pond integrated with washings and left over of 50-55 pigs/ha. Could not disturbed the water quality and it is more economic, ecologically balanced and sustainable system of recycling of organic waste. The farmers of Bundelkhand region should adopt integrated pig-fish farming system to utilize available by products and earn more profit from limited man power and land. It is also suggested that the integrated

pond should be under close monitoring. To maintain and manage water quality lime and disinfectants should be applied and replace at list 25% of water monthly to keep environmental parameter congenial to aquatic animals.





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ADVANCES AND FUTURE STRATEGIES IN LAYER BREEDING

M C Kataria and others,[1]

Abstract

The long term Intensive selection for egg number over the years has resulted in a reduction of phenotypic and genotypic variations in egg production. Egg production now about to approaches the biological limit of one egg per day, but in early production and late production genetic variation is still high. Including these traits in the selection criteria will improve the egg production in commercial birds. Considerable research has been carried out on egg weight, eggshell strength and internal quality of the eggs and improvements have been made as a result of selection.

Today's high yielding egg type chickens are three or four way crosses involving different strains and/or breeds being used for commercial exploitation. The majority of commercial egg layers are the strain or line crosses of White Leghorn (WLH). Strain cross or inbred hybrids of WLH origin are used for the production of white-shelled eggs. Crossbreeding involving White Leghorn as male parent and Rhode Island Red (RIR) or New Hampshire or Black Australorp as female parent is used for the production of commercial layers for tinted-shelled eggs. RIR, New Hampshire and Australorp are most commonly used for production of brown shelled eggs. Breeders of egg-type chickens focus on to: Increase efficiency of egg production per hen housed; optimal external and internal egg quality; low feed cost per egg or per kg egg mass and Low mortality and high adaptability to different environment.

All leading egg-type breeders today probably use a combination of cross- line (cross combination using different lines, strains or breeds) and pure-line records for pure- line improvement. Combinations of pure-line and line –cross data for breeding value estimation allow more genetic progress than selecting on pure-line or cross-line information alone. Part period egg production (up to 40 wks) remained a criterion of selection for the improvement of egg type chicken for more than three decades since the beginning of 4th five-year plan. Number of egg type breeders demonstrated the efficacy of part record EP in the form of an index utilizing individual own performance and performance from relative. Genetics progress might be possible due to high positive genetic association between part and total egg production. Later in the beginning of last decade longer period production records (64 wks egg production) was utilized as selection criterion. Recent molecular genetic studies resulted in identification of QTL affecting different economic traits and identification of candidate

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genes causing variation in performance among birds. In future these findings will play a major role in further genetic improvement of layers without any negative effect.

The poultry breeding programs are based upon two primary components, one is academic and another is commercial. Academic poultry breeders have concentrated largely on research and monitoring the operation of the poultry industry whereas the commercial enterprises have dealt with development and sales. The poultry industry developed rapidly during the second half of the 20th century as a specialized, cost-effective sector of agriculture. There is every likelihood that the demand of eggs will continue to grow since this is among the most widely accepted sources of animal protein available on the earth. This will need larger layer populations with better production potential. Therefore, the concerted efforts to develop genetically superior germplasm would greatly strengthen egg production in coming years.

However, the major International poultry breeders are located in temperate countries. In chicken layer breeding, only three breeding programmes have survived. As a poultry breeder, it is essential that one should know the consequences of breeding on the properties of the population. Egg production has always been the cornerstone of the selection criteria applied to egg laying stock. Long term selected stocks are the result of many generations of testing and selective breeding for traits governed by multiple genes. Many valued heritable characteristics in the poultry breed, belong in this category. These include egg production, rate of lay, egg size, feed efficiency, fertility, hatchability, viability, disease resistance, body size and shape and behavior characteristics.

The selection methods and mating system are two important tools in the hands of the breeder for augmenting the production and productivity of the birds. Biological evolution or natural selection is a relatively slow process in which fitness of birds in a specific environment is the selection criterion. Artificial selection programs attempt to direct and accelerate biological changes in animals using selection criteria that will tailor those birds for human needs and desires. The primary goal of the breeder is to alter gene frequencies and distributions by employing selection and various mating systems.

Conventional Methods of Selection and Breeding Techniques

By careful selection and breeding of their birds, the famous chicken breeders around the world have made their mark leading to development of high yielding commercial layers. There are number of breeding strategies; the poultry breeder can use to improve his stock. However, first we have to know about chosen breeds and what traits are important. It is useless to try to breed good quality fowls from stock, which are of poor quality and riddled with faults (the exception to this is when we are trying to breed very rare breeds where stock is in short supply). Any bird should not be discarded if it carries a fault that may be easily rectified with judicious breeding. Whole bird should be observed before making a final

judgment; however, the advice of an experienced breeder may be helpful. It is always wise to find a mentor who is experienced with the chosen breed. If one decides that the birds aren't good enough to use, they may be discarded and replaced by the best quality birds. The methods which may be employed to breed fowls are Line breeding, Out-crossing, cross breeding and Compensatory mating. Other strategies worth considering are Single mating, Double mating and Artificial insemination. Most breeders use combinations of these methods and develop their own working model.

Part period egg production (up to 40 wks) remained a criterion of selection for the improvement of egg type chicken for more than three decades since the beginning of 4th five-year plan. Number of egg type breeders demonstrated the efficacy of part record egg production in the form of an index utilizing individual own performance and performance from relative (Kolstad 1980, Ayyagari *et al*., 1983, Gowe and Fairfull 1985, Johari *et al* 1995, Kataria *et al* 1995 and 2000).

Genetics progress might be possible due to high positive genetic association between part and total egg production (Bohren *et al*, 1970, Gowe and Fairfull 1985, Muir 1990, Mallikarjuna, 1998 and Roy, 2003). Poultry breeders have tried alternative selection strategies to cross the barrier of physiological expression of egg production after achieving the targets for annual egg production based on part record egg production, which lead to the release of various commercial varieties in the markets by public and private sector.

Various workers have studied the optimum length of part period egg production as a criterion of selection by statistically examining the record of various lengths (Dhaliwal and Acharya 1972, Gowe and Garwood 1980, Hanafi and Labban 1984, Singh and Mohanty 1986). McMillan *et al* (1989b) used post peak weekly egg production record of various lengths ranging from 16 to 40 weeks after age at first egg to predict the full record egg production of individual pullets.

Mallikarjuna (1998) tested the efficacy of various part record to predict annual record and concluded that the efficiency of part record selection would be increased with the increase in the duration of part record from 40 to 44 weeks of age. Roy (2003) compared the efficiency of annual egg production record after skipping for 1-d/wk, 2-d/wk and 1wk/4-wk and also various lengths of extended part record with the total annual egg production and concluded that skipping for 1wk/4wk and 48-wk part record would be better criteria of selection in improving annual egg production.

Use of alternative breeding strategies

Leading poultry breeding companies across the globe are maintaining several lines and the preceding lines are continuously taken over by new lines. The commercial stock produced from crosses of four lines meaning that pure breeding is on the grand parent level.

Presently poultry breeding is limited to a few international companies. Such companies are doing intensive data recording, parameter estimation and testing of strains according to the breeding goals as they see in the coming years. This has lead to the development of highly producing commercial stocks, with the consequence approaching selection plateaus. Selection plateaus the extreme level of production which can result either due to extension of genetic variability or physiological limits of one egg per day (Al-Murrani, 1974). International reputed poultry breeders have tried to cross the barrier of this Physiological limit utilizing alternative breeding strategies.

Today's modern layer considerably outperforms on the international scene (Anderson, 1996), the egg number have increased from 270 to over 340 eggs between 1950 and 1993 (a 28.8% increase). This represents an average increase of about 1.8 eggs per year. Simultaneously, there has been improvement in egg mass by 42.7%, egg weight by 11.7% and Feed efficiency by 32.4%. Egg shell strength remained unchanged and albumin quality has improved slightly. Fertility and hatchability have also improved slightly. Since selection in layer is largely for fitness traits, most of the problems plaguing broilers have been avoided. Due to the nature of the important-traits in layers, change has been slower than in broilers.

As the uniformity in breeding goals and breeding strategies is a threat to domestic animal diversity, there is definitely a need for more long term breeding goals and a large variety of local breeding goals, for example heat tolerance, disease resistance and to add consumers interest for local variety besides alternative breeding objectives for alternative environments, possible example are separate strains bred for free range production systems and for ecological production systems etc.

According to Preisinges and Flock (1998), the genetic variation is not critical even after many decades of selection for eggs production, however decreasing. Restriction in mating plans, balanced family size and high effective population size are the key tools to sustain genetic variation and progress with in closed population. At the point of time when peak production is reaching its biological limit, the breeding goals are redefined towards overall productivity. To-day largest poultry breeding companies of the world are doing intensive selection in a wide range of environments in many different pure lines.

Oviposition time as selection criteria and importance of continuous light for laying hen

Each hen has a characteristic oviposition pattern (Lillpers and Welhelmson 1993). Even though two hen's partial year performance record may be identical, the persistency of laying may differ greatly (Muir, 1990). Poor layers have many laying sequences in comparison to high producing hens with short intra-sequence interval; which often lay their eggs earlier in the light period (Yoo *et al* 1988). There are number of reports on the use of oviposition time, being included to form an index for selection of high producing egg type breeding stocks. The results indicated that rate lay including oviposition time are useful as

selection traits (Yoo *et al* 1988, Lillper and Welhelmson 1993 and Kenji Noda *et al*, 2002). The hen selected for increased egg production under 23 and 24^{th} light-dark cycle have probably altered their photoperiodic response (Gowe *et al* 1988). There are reports that under continuous light (CL), the mean intra-clutch interval (CIM) decreased beneath 24h and the variability of intervals tended to show a steep increase (Yoo *et al* 1986). The high producing hens those with short intra sequence interval often lay their eggs earlier in light period than the less productive hens (Yoo *et al* 1986, 1988).

Possible future ban on cage production

Elson (2002) reported about the possibility of abolition of cage management system in many of the European countries due to pressure applied by the animal welfare activities. Considering the changing scenario of poultry management system, the recording of eggs will become more cumbersome job in future. Therefore, under present circumstances there is a growing interest for floor lying type due to possible ban on cage production. It will be more important for future egg type chicken breeders to include a variety of possible production environments in breeding strategies. There is large number of companies in business, to include new breeding strategies in selection programme. Recently Kathle (2000) presented the results of selection against feather picking demonstrated in 12-lines of egg layers.

Group Selection

Current practices of selection for improved production performance of egg type chicken in individual laying cages could be detrimental if the birds are housed in multiple bird colony cages due to competitive interactions. A new selection procedure called “group selection” would overcome this problem and will also greatly reduce mortality due to cannibalism. These results are of tremendous importance to primary breeders, which have lead to change in their selection methods. Muir (1996) tested group selection as a method to produce Co-operative genotype adapted to battery cages as opposed to conventional battery cages. The results were encouraging leading to increase in egg production (H.D.) while mortality decreased sharply (Muir and liggett 1995, Craiz and Muir 1996).

Multi-Stage Selection

When traits are expressed for selection at different ages or there are large difference in the cost of measuring traits, selection by independent culling levels may give rise to a higher aggregate economic return than IS because all traits are not measured on all individuals. However, general solutions for optimum I.C.L. are not possible and specific solutions require numerical integration. It should be noted that I.C.L. for each trait ignore superiority in other traits. In addition to this, too intense early culling can seriously affect genetic gain in traits to be recorded later in the life of the birds and too feeble an intensity at early culling can incur significant additional costs. XU and Muir (1991, 1992) developed a new I.C.L. procedure

using orthogonal transformation of the original traits furnishing optimum truncation point for each trait resulting in better genetic gain than conventional I.C.L. selection.

Use of knowledge based on molecular genetics

The newer knowledge in major genes, gene mapping and QTL (quantitative trait loci) theory is so far mainly on experimental level. It is still to be seen if the identified gene will have any major influence on the running of practical breeding programmes and how molecular genetic knowledge will influence the breeding programme for quantitative traits.

Future Strategies

- Number of techniques using alternative selection and breeding strategies as mentioned earlier in the text would be of potential value to future poultry improvement.
- In addition to this, animal welfare activities may dictate that poultry be selected for adaptation to variable production environments.
- Poultry breeding is becoming increasing costly hence multistage selection may allow more cost effective breeding programs.
- Molecular genetics techniques would be promising for revolutionary change in poultry improvement techniques.
- Use of better statistical packages and computer facilities will lead to the accuracy of selection and better selection intensity.

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AGRICULTURAL POLICY

(Salient Points)[1]

Even today two thirds of Indian population is dependent on agriculture for a livelihood. It is therefore futile to think about a prosperous Bharat without a lively and throbbing agricultural sector.

Although the share of agriculture in Gross Domestic Product has dropped from over 50% during the 1950s to about 19% in 2007-08, agriculture still employs over 52 per cent of the labour force of the country, and over 70% of the Indian rural work force.

The primary responsibility of agriculture is to make adequate nutritious food available to all. In addition, Agriculture should generate raw materials for an industrial activity geared towards Sustainable development. Continued enhancement of food grain production and productivity is essential.

1. Cultivation

1. Geo-climatic regions in the country should form the basis for the policy formulation and the implementation plans for the agricultural production.
2. We should move towards organic agriculture. FAO says “Organic agriculture is defined as a holistic food production management system, which promises and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological and mechanical methods, as opposed to using synthetic materials to fulfill any specific function within the system."
3. Use of improved local seeds, natural and plant based insecticides and various types of organic fertilizers (compost, green fertilizer etc.) should be encouraged. Use of hybrid seeds, dangerous and experimental genetically modified seeds, chemical insecticides and pesticides etc. should be discouraged and progressively reduced.
4. Agriculturists should be encouraged to become self-reliant and policies should be in place to provide them the necessary technical guidance and training.

2. Irrigation

[1] EMD & National Policies(Agri), Prepared by Ekatma Vichar Kendra and Deendayal Prerana Kendra (Draft no.00 dtd.23.1.2009)

1. Save every drop of water to use it effectively. Also give attention to the drainage.
2. Irrigating all the agricultural land, subject to practical feasibility, is essential.
3. Water-conservation planning must be done in an integrated way
4. Emphasis should be on completing the half-finished irrigation schemes
5. All the works of an irrigation project relating to the command area, canals and necessary bunds should be done in parallel and finished at the same time. Command Area Development Authorities also should work in this manner to expedite actual and full benefits.
6. If water is to be diverted from the basin of one river to that of the other, this should be accorded priority.
7. Irrigation projects on the rivers flowing through more than one state should be considered as a national project and hence should be executed by a national agency.
8. Standard guidelines for water sharing (e.g. total run off, silting formula etc.) need to be reviewed to reflect the insight gained so far.
9. Emphasis shall be on the small sized dams and micro-irrigation
10. Village councils should be encouraged to play the primary role in revitalizing the traditional forms of irrigation and thus ensure proper water management. The role of Government is conceived to be only that of a catalyst.

3. Weather

1. Information about weather and expected changes should be disseminated continuously to the agricultural community so that it can make use of this information for enhancing their production. This information should be available in a timely and reliable manner.
2. Weather monitoring and prediction technology should be continuously modernized and, if necessary, more radars and super computers should be deployed.
3. Weather information and seasonal pattern of agriculture should be collated to get a right cropping scheme. Simultaneously right crop rotation schemes should also be considered.

4. Green Revolution

1. Green revolution has so far taken place in only some parts of the country. Some negative fallout has also been noticed (such as salination of soil). The envisaged increase of food grain production would require extension of the Green revolution to all parts of the country in a manner such that the problems noticed so far are not replicated.

2. The main obstacle for achieving second green revolution is neglect of non-cereals by the government
3. Cultivation of vegetable & fruits is 5 to 8 times more profitable than cereals.
4. Output of vegetables & fruits up to 40% is wasted due to lack of storage and food processing facility.
5. The following must be initiated
    a. Provide incentives to the entire spectrum of non-cereals
    b. Provide infrastructure by way of cold storages and processing facilities
    c. Without reducing present incentives for cereals, provide the same to the non cereal sector

5. Genetically Modified Products

1. The programme for genetically modified products in the agricultural sector should preferably be in the public domain. Participation of the private parties shall be with the prior approval of the relevant national authority.
2. Foreign agencies should not be involved in this experimentation within the country.
3. Evaluation of the GM seeds, products from the public sector agencies, Bharatiya private agencies or foreign agencies should be by an independent government body with representatives from the voluntary agencies and the medical field.

6. Agro-finance

1. Farmers should be provided with adequate and timely loans for the farming activity.
2. Small and marginal farmers must get priority in loan disbursal
3. Timely returns of farm loans should be incentivised
4. Crop loans must be disbursed as required particularly for small and marginal farmers.
5. A scheme should be introduced to for rich and plantation farmers to progressively change over to normal loan system on commercial basis
6. All agro-credit schemes should be merged to form one integrated scheme with provisions for specific cases
7. All poverty alleviation schemes in the rural area should similarly be operated in an integrated manner
8. The applications under any poverty alleviation scheme should be either accepted only through a voluntary agency (VA) or one VA must be assigned this application for evaluation and monitoring.

9. All defaulters of loan shall be legally debarred to contest any election or hold any office in any public body for a certain period
10. Suitable agricultural crop insurance schemes shall be introduced progressively

7. Agricultural Price Support

1. The price an agricultural produce commands in the market is central in making the agricultural operation as well as farmer welfare viable. This price must be based on the cost of production plus 20 to 30% profit. 10% of extra cost should be added for special crops under the scheme
2. Commission on Agricultural Costs and Prices (CACP) should announce the support prices 3 months before the sowing season
3. Major crops shall be purchased by public agencies at support prices as they come to the market. Full money for small and marginal farmers should be paid immediately on purchase.
4. About 25 commodities are presently covered under the minimum support price scheme. There is a need to expand the coverage to include import sensitive commodities such as horticulture crops
5. CACP should be an independent body free from political interference as well as commercial influence

8. Agro-marketing

1. The private sector in the agro-marketing field should operate totally on the competitive basis.
2. The cooperative sector should be able to operate in a competitive environment and take initiatives in the interest of farmers by increasing their direct participation in the marketing to get better benefits and control over these activities.
3. Normally, the government should not directly participate in the marketing activities except in special circumstances

9. Agricultural Trade, Exports

1. All restrictions on movement of agricultural produce in the country shall be removed. Under special circumstances, some restrictions may be desirable and the government can impose these as and when required.
2. Important thing is to avoid dominance by MNCs in the export and import. The internal trade should be closed to MNCs.

3. There is a tremendous scope for exports. But first catering to the local market and then export should be the policy. New opportunities exist for exports in horticulture, floriculture, dairying, and sericulture.
4. Good Agricultural Practices for the farm sector will have to be enforced to do well on the export front.

10. Crop Insurance

Agri-insurance, weather-based crop insurance protection has to be rationalized in the light of the experience gained to make it more effective.

11. Terms of Trade

1. The prices of agricultural goods should not be intentionally suppressed in comparison to the products of the industrial goods. Establishing a link between general price levels of agricultural and industrial goods is desirable.
2. Giving favourable treatment to agriculture product prices may be a better way to inject consumer power and transfer resources in the rural area rather than subsidies.

12. Agricultural Subsidies

1. Reduce or eliminate agricultural input subsidies or sops. This gives rise to dependency syndrome.
2. Subsidies can be obviated by ensuring remunerative prices for farm produce
3. Change direction of policy support – from the politically easy culture of subsidy to the more difficult one of investments that increase productivity and risk-taking capacity of small producers in competitive markets.

13. Agricultural taxation

1. Generally, the tax applicable on agriculture income shall be at a lower rate and also the initial tax exemption limit shall be more for the agricultural income. This is essential so that talented persons are attracted to the farming and also it is subject to vagaries of the monsoon. Those having agricultural income, as an additional income must be charged at the normal rates.

14. Rural Employment

1. During the peak-work season of agriculture, other rural employment schemes should not be operated so that the farming work does not suffer.
2. The land along the railway track in rural areas can be given for tilling on reasonable terms to create rural employment and increase agricultural production.

3. Drawing marginal farmers and landless into low-tech manufacturing industries will be increasingly necessary as cultivation related work cannot absorb all rural persons even during peak agricultural season. 72 per cent of the population involved in agriculture is facing the challenges of stagnant growth and depletion of resources.
4. In rural areas, the employment can be considered at the family level. This can be operated on a pilot basis and then extended, if found more beneficial
5. New schemes should not trigger the process of urbanization when that is not the aim.
6. Rural employment will have to be increased to check flight to cities from rural areas.

15. Social Forestry

1. It is desirable that one third of the available national land be under the forest. All out efforts have to be made to reach this.
2. In Maharashtra there is concept of Deorai, a forest attached to and exclusively reserved for a Mandir or Samadhi which is not touched by the local populace. Efforts should be made to extend this concept to all the shrines in the country.
3. Local self-governments should be encouraged through various schemes to increase forestland by using barren land, unused government land and old forestland.
4. While developing forests, long life trees like neem, arjun, harad, behada, peepal, saagwan etc. should be planted. Medium term and short term trees like subabul can be planted. These can be used as fuel.

16. Animal Husbandry

1. Slaughter of cow and its progeny should be banned. Provision should be made for cow protection, development and rearing.
2. Availability of dry grass in the unirrigated and green grass in irrigated areas should be ensured.
3. To maintain the purity of Bharat-based cow progeny, crossbreeding shall be done only among Bharatiya cow progenies.
4. The local breeds shall be improved to increase the quantity of milk yield and also the period of lactation.
5. The cow urine should be used for medicines and the cow dung can be use for fertilizer, gas, and electricity production.
6. Milk production provides a supplementary income to the farmers. They should be provided with the technical guidance to enhance the yield.
7. Veterinary care should be provided

8. Buffalo, goat, rabbit, chicken etc. rearing also shall be encouraged
9. The relevant technology in this field shall be made available to all the concerned in this field. R&D effort shall be instituted by the government and also by private and cooperative entities.

17. Agro-based Industries

1. Agro-based industries and ancillaries shall be established in the rural areas near the production centers of the agricultural raw materials to promote balanced regional economic growth.
2. The mass production shall be arranged through large number of cottage of tiny units and not through large scale automated units to boost employment.
3. Information on availability of machines, and the technical know-how should be made available through some institutional arrangements.
4. Units in the rural area should be reserved for the tiny and cottage sector
5. The output of such units shall be, as far as possible, marketed through a cooperative network.

18. Cattle Economy

1. It has been the Bharatiya tradition to rear the cow and other cattle animals. The development of overall cattle economy for the rural sector can give boost to the local economy.
2. The milk economy is booming in many states. But this should be developed on the local breed as base to give an overall boost.
3. Cattle make abundant organic manure available to farmers. This is the way in future to reduce excessive dependence on chemical fertilizers diesel etc.
4. Many experiments on organic farming are currently under way perhaps they would produce breakthrough results enabling implementation on a mass scale. It is therefore necessary to coordinate, monitor and encourage these efforts.
5. Medicinal values of cow urine and dung is also getting established.
6. The use of tractive effort of the oxen is under experimentation and deserves encouragement.

19. Agri-Extension Programmes

1. The information and research from the agricultural universities and other laboratories in the field of agriculture shall be disseminated to the farmers in the villages through

various means like mobile lab, projector-van, exhibitions, visits of experts to farms, training programmes etc.

2. Farmers should be invited to visit the agricultural universities and laboratories as well as demonstration farms
3. The Krishi Vidnyan Kendras (KVKs) already in operation shall be fully operational
4. The agricultural universities should oversee this extension program in a systematic manner.

20. Law & Revenue Procedures

1. The definition of Agriculture as given in the Maharashtra University Act 1983 shall be widely accepted.
2. The land tilled by the tiller, its produce and all related matters should be streamlined in a separate law.
3. All records relating to the land under agriculture shall be created and stored in district and state revenue offices
4. Every year during the monsoon season, the land sowing and related records shall be created afresh and stored in revenue offices. These and old related records pertaining to the area shall be available in every village.
5. All existing laws relating to the agriculture shall be collected together and, if necessary, recodified in an integrated manner
6. An administrative arrangement to correlate all matters relating to agriculture, analyze and take quick decisions is essential. This should be implemented at the earliest

21. Land Reforms

1. The rights of the actual tillers of land must be secured
2. Land ceiling should rigorously applied. Interests of widows handicapped the old and soldiers should, however, be secured.
3. The land fragmentation should be prevented legally. Basic minimum land unit must be determined for the area and that must be maintained. E.g. one hectare with water and three hectares monsoon fed.

22. Cooperative Sector in Agriculture

1. To promote initiative and creativity in the agricultural sector, the cooperatives shall be encouraged in the agricultural sector.
2. The loan disbursal to the agriculture sector as far as possible be done the local cooperative sector which is familiar with the local situation.

3. Cooperative sector should be associated with the deliberative and management bodies like planning commission, NABARD etc.

4. There shall be one model central cooperative law to cover the entire cooperative sector

5. There should be no political interference in the cooperative sector and provisions like barring executive posts in the cooperative sector for those holding political party or government post should be introduced.

6. A RBI committee should review the working of the cooperative sector regularly and present the report for public information and debate,

23. Agricultural Education

1. In the rural areas, the secondary and higher secondary level should include education, both theory and practice, related to the various facets of agriculture. Traditional methods of agriculture, natural agriculture, agro-astronomy, production and use of organic manure etc. should be included suitably.

2. It should also include introduction to the agro-industries, particularly those based on the local produce.

3. The research should be carried on all potentially beneficial and environmentally compatible method including traditional, natural, intensive etc.

4. All the old manuscripts on agriculture should be republished with translation and due research.

24. Information Technology

1. Scheme of making agriculture related information through an IT kiosk in a village should cover all the villages at the earliest. Through interactive systems, agricultural experts can answer the queries of the villagers.

2. IT also can be used to educate even unlettered masses through audio-visual lessons.

25. Energy

1. Decentralized production of power of say 160kW, to cater to 400 families, should be encouraged after establishing its viability. Natural gas produced locally or supplied through national grid can be supplied through meters.

2. R &D relating to the power production through use of animal power needs to be supported as then cow economy will be further viable.

3. Application of solar and wind energy needs to be promoted with no or minimum amount of subsidy.

26. Agro-Technology

1. Local appropriate technology shall be encouraged and kept up to date by constant R D.
2. Cheaper methods of storing grains, fruits and vegetables should be made available in the rural areas. Coolers base on solar or wind energy should be introduced
3. Simpler test methods to assess chemical in the agricultural produce should be standardized for use by local populace in the rural areas.
4. Socially and ecologically destructive technologies like terminator seed need to be banned.
5. Converting of wasteland to cultivable land through use of technology

27. International Aspects, W.T.O

1. International treaty like WTO can be harmful to the national agricultural sector and all out efforts have to be made to guard the interests of agriculturists as well as consumers. E.g.

- The patent law should not become an albatross around the local seed producers. The right of the farmers to use their own seed must be guarded.
- The provision of compulsory import of 3% of your requirement of food grains must be opposed

2. The goal of complete food security must be secured at all costs.
3. Foreign ownership of land should never be allowed
4. The international treaties should not become operative unless passed by the parliament. Constitutional amendment should be made to this effect.

28. Agricultural Productivity & Self-reliance

1. Present food security can only be maintained with continuous increase in productivity. Also self-reliance in major items like cotton is also to be aimed at.
2. Better seeds, better soil-crop correspondence, optimum use of water, use of organic manure and eco-friendly pesticides/ insecticides, crop planning, besides improved sowing and harvesting practices as well enhanced general awareness as well as commitment to land are key to improvement in productivity. All these need to be monitored and ensured in an adequate manner by governmental and voluntary efforts.

प्राचीन भारतीय कृषि का सतत् विकास एवं संसाधनों की सीमांत उपयोगिता का सिद्धान्त

डॉ0 अंकित अग्रवाल*

सारांश

वर्तमान भौतिकवादी युग में मानव का ध्यान केवल तीव्र विकास पर केंद्रित है, जिसने भविष्य की खाद्य-आवश्यकताओं के साथ-साथ मानव जीवन को भी खतरे में डाल दिया है। इसके परिणाम-स्वरूप मानव वर्तमान में भी पारिस्थितिकी परिवर्तन, ग्रीन हाउस प्रभाव इत्यादि अनेकों समस्याओं का सामना कर रहा है। इन पारिस्थितिकी परिवर्तनों ने हमारी कृषि व्यवस्था को भी दुष्प्रभावित किया है। दूसरी ओर हमारे कृषक भी फसल की सुरक्षा, तीव्र विकास एवं अधिकाधिक उपज प्राप्ति हेतु कीटनाशकों, रासायनिक उर्वरकों इत्यादि का प्रयोग कर रहे हैं, जो भू-उर्वरकता तथा मानव शरीर दोनों के लिए अत्यन्त हानिकारक है। यदि हमनें इस प्रकार के अंधाधुंध विकास को नहीं रोका, तो मानव प्रजाति का भविष्य खतरे में पड़ जायेगा। इन परिस्थितियों में हमें विकास का एक ऐसा मार्ग चुनना होगा, जो हमारे भविष्य को सुरक्षित रखने के साथ-साथ वर्तमान विकास की निरंतरता को भी बनाए रखे। इस परिदृश्य को ध्यान में रखकर अनेकों विद्वानों ने बहुत से सिद्धान्त प्रस्तुत किये हैं। इस लेख में 'कृषि का सतत् विकास एवं संसाधनों की सीमांत उपयोगिता का सिद्धान्त' प्रस्तुत किया जा रहा है, जिसे हमारे पुर्वजों ने कई युगों के अथक प्रयास के बाद खोजा था। प्राचीन भारतीय कृषि व्यवस्था में संसाधनों के सीमांत उपयोग की परिकल्पना के साथ सतत् विकास का सामंजस्य स्पष्टतः दृष्टव्य होता है, जो वर्तमान परिप्रेक्ष्य में हमारे लिए भविष्य की सुरक्षा के साथ-साथ विकास की निरंतरता बनाए रखने में सहायक हो सकता है।

उद्भव एवं विकास

मध्य पाषाणकाल के उत्तरार्द्ध में जब मानव खाद्य-संग्रहक से खाद्य-उत्पादक की भूमिका में परिवर्तित हो रहा था, तब से भारतीय आर्थिक जीवन में एक मौलिक क्रांन्ति प्रारम्भ हो गयी थी, जो भिन्न-भिन्न युगों में विकसित तथा सुसंगठित हुई। खाद्य-उत्पादन के प्रथम चरण में मानव नदियों के साथ-साथ पहाड़ों से नीचे उतरा तथा नदियों के किनारे कृषि प्रारम्भ की। वे इस चरण में खेती करते, फसल काटते तथा बाढ़ आने पर खाद्य-संग्रह कर पुनः उच्च स्थानों पर जाकर बस जाते थे।

मानव जीवन में कृषि क्रान्ति का सर्वप्रथम पुरातात्विक साक्ष्य हमें मेहरगढ़ (काल-I, नवपाषाणकाल) से प्राप्त होता है। भारतीय उपमहाद्वीप में गेहूँ तथा जौ की खेती 9000 ई0पू0 काल से होने लगी थी।[1] बोलन घाटी मे स्थित मेहरगढ़ से 8000-6000 ई0पू0 काल में इनकी खेती के पुरातात्विक साक्ष्य प्राप्त हुए हैं।[2] इस चरण में मानव ने अपनी खाद्य-आवश्यकता पूर्ति के साथ ही

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उत्पादन तकनीक को समझना भी प्रारम्भ कर दिया तथा इन तकनीकों को अगली पीढ़ी को हस्तांतरित किया। ज्ञान के इस हस्तांतरण ने कृषि को विकसित अवस्था तक पहुँचाने का आधार तैयार किया। धीरे-धीरे मानव ने स्थायी रूप से मैदानी क्षेत्रों मे रहना प्रारम्भ कर दिया तथा इस प्रभाव से द्वितीय चरण में 'विश' की स्थापना हुई।

अब मानव जनसंख्या तथा उसकी खाद्य-आवश्यकता में वृद्धि होने लगी। बढ़ती जनसंख्या की आवश्यकता-पूर्ति हेतु भारतीय उपमहाद्वीप के विद्वानों ने सामुहिक कृषि पर बल दिया, यही से मानव विकास का तृतीय चरण प्रारम्भ हुआ। कृषकों की सामुहिकता के परिणामस्वरुप 'विश' के विस्तार रुप में जो इकाई बनाई गयी, वह ग्राम कहलायी। 7000 ई0पू0 काल में, स्थायी ग्रामीण जीवन के विकास को कृषि आधारित नवपाषाणिक संस्कृति ने आधार तथा कृषि हेतु विकसित तकनीकों ने बल प्रदान किया।[3] भारतीय उपमहाद्वीप में कृषि का आधारभूत विकास सिन्धु काल से पूर्व ही हो गया था।

मानव जनसंख्या, अनुभव तथा आवश्यकता में वृद्धि के साथ-साथ विकास के चतुर्थ चरण में तकनीकों का भी विकास हुआ। सर्वप्रथम सिन्धु काल में सूत कताई व सूती वस्त्र बुने जाने प्रारम्भ हुए थे। डा0 साहनी द्वारा मोहनजोदड़ो के उत्खनन से प्राप्त कपड़े का टुकड़ा कपास का प्राचीनतम् साक्ष्य है।[4] ताम्रपाषाणिक एवं सिन्धु संस्कृति के कृषकों ने नवीन कृषि उत्पादों तथा तकनीकों की खोज कर अधिशेष उत्पादन प्राप्त किया। अधिशेष उत्पादन को मानव कल्याणार्थ हमारे पूर्वजों ने उन क्षेत्रों तक पहुँचाया, जहाँ कृषि उत्पादन मानवीय आवश्यकता से कम था। कृषि उत्पादों के इसी निर्यात से भारतीय व्यापार का प्रारम्भ हुआ।

खाद्य-उत्पादों के निर्यात के परिणामस्वरूप अनाज की मांग में पुनः वृद्धि हो गयी। इस मांग की पूर्ति हेतु वैदिककालीन मानव ने पंजाब तथा पश्चिमी उत्तर प्रदेश की उर्वरक भूमि में खेती का विस्तार किया। तत्कालीन कृषकों को सिंचाई प्रौद्योगिकी का ज्ञान भी था।[5] निरन्तर शोधों के परिणामस्वरूप तत्कालीन विद्वानों ने वन्य-सम्पदा का औषधीय लाभ समझा तथा मानव हितार्थ उनका प्रयोग प्रारम्भ किया। तत्कालीन ग्रन्थों में बरगद एवं पीपल जैसे वृक्षों की पूजा तथा उनके रोपण का वर्णन तथा कुछ अन्य पौधों का आयुर्वेद की समग्र चिकित्सा प्रणाली में उल्लेख[6] वैदिककालीन विद्वानों के इस दृष्टिकोण को स्पष्ट करता है। आर्य मानव कल्याण में कृषि के महत्व को समझते थे।[7] वैदिक काल में भूमि, पानी तथा श्रम को कृषि के महत्वपूर्ण कारक के रुप में स्थापित किया गया था। अथर्ववेद में भूमि को प्राकृतिक स्रोतों के पालक तथा पौधों के वाहक के रुप में महत्वपूर्ण माना गया है।[8]

वैदिककालीन विद्वानों ने निरन्तर शोध कर विभिन्न क्षेत्रों का व्यापक ज्ञान प्राप्त किया तथा उसे ग्रन्थ रुप में संकलित किया। यह परंपरा उत्तर वैदिक काल में भी निरन्तर बनी रही, जिससे मानव ज्ञान में अत्यन्त वृद्धि हुई। संहिता तथा ब्राह्मण ग्रन्थों के साथ-साथ लौह प्रौद्योगिकी का अविष्कार तथा प्रचुर प्रयोग उत्तर वैदिक काल की प्रमुख उपलब्धि थी, जो भारतीय कृषि में 'हरित क्रांन्ति' के समान लाभकारी हुई। हल में लोहे के फाल लगाने से कृषक उत्तर प्रदेश तथा बिहार की कठोर भूमि पर भी सरलता से कृषि का विस्तार कर पाये।[9] 600 ई0पू0 काल में राजनैतिक शक्ति के रुप में उदित सोलह महाजनपदों में से अधिकांश का केन्द्र उत्तर प्रदेश तथा बिहार था। मगध साम्राज्य की स्थापना से पहले ही उत्तर प्रदेश तथा बिहार में लौह युग स्थापित हो चुका था तथा कृषि भूमि का विस्तार सम्पूर्ण उत्तर भारत में हो चुका था।

धीरे-धीरे मगध साम्राज्य भारतीय उपमहाद्वीप में महाशक्ति की तरह उभरा। इस अवधि में किसानों ने अधिकतम फसल प्राप्ति हेतु श्रम का सीमांत उपयोग किया। इस हेतु बड़े कृषक अपनी श्रम क्षमता से अधिक कृषि भूमि को उत्पादन के आधे हिस्से के आधार पर उन श्रमिकों को देने लगे, जिनके पास अपनी श्रम क्षमता से कम भूमि थी। महावग्ग के अनुसार कभी-कभी बौद्ध संघ अपनी भूमि को उत्पादन के विभाजन के आधार पर खेती हेतु देते थे। यह प्रणाली कृषि के विस्तार के साथ-साथ भूमिहीन किसानों के लिए भी लाभप्रद थी।

निरंतर बढ़ती जनसंख्या तथा उनकी आवश्यकता-पूर्ति हेतु विद्वानों ने कृषि के दो महत्वपूर्ण आयामों 'प्राकृतिक स्रोत' तथा 'श्रम' के मध्य सामंजस्य बनाना प्रारम्भ कर दिया। शोधी स्वभाव के ये विद्वान जानते थे कि अधिकांश 'प्राकृतिक स्रोत' भूमि से ही प्राप्त होते हैं अतएव उन्होनें भू-व्यवस्था को कृषि का आधार तत्व माना। कौटिल्य ने भी भूमि की महत्ता को स्वीकार करते हुए उसे कृषि के साथ-साथ 'अर्थ' का भी मूलाधार माना।[10] मौर्यो ने मिट्टी के आधार पर भूमि को वर्गीकृत किया तथा मौसम विज्ञान के अनुरूप उस पर कृषि की।[11] भारत मे प्रत्येक वर्ष दो बार वर्षा होती थी, इसके अनुरूप ही इस क्षेत्र मे दो बार उपज उगायी जाती थी। तत्कालीन कृषि के संदर्भ में युनानी राजनयिक मेगस्थनीज ने अपनी पुस्तक 'इंडिका' मे लिखा था:

> 'भारत में कई विशाल पहाड़ तथा उर्वरक मैदान है, जो फलों तथा पेड़ों से भरपूर हैं... मिट्टी का अधिकांश भाग सिंचाई के अंतर्गत आता है तथा वर्ष में दो बार वर्षा होती है।'[12]

पुनः मेगस्थनीज भारतीय समाज को सात वर्गो में विभक्त कर कृषकों को दूसरे स्थान पर रखता है।[13] वह यह भी कहता है कि कृषक युद्ध के दौरान भी अछूते रहते थे।[14] मेगस्थनीज के उपरोक्त शब्द तत्कालीन कृषक की अच्छी स्थिति तथा कृषि आधारित विकसित अर्थव्यवस्था का संकेत देती है। निश्चित रुप से मौर्य साम्राज्य एक विकसित अर्थव्यवस्था के रुप में उभर रहा था।

उत्तर मौर्यकाल में कृषि का वैज्ञानिक एवं तकनीकी विकास दक्षिण भारत में भी स्पष्टतः दृष्टव्य होने लगता है। आर0 एस0 शर्मा के अनुसार प्रथम दो शताब्दियों में कृष्णा तथा गोदावरी के डेल्टा क्षेत्र में धान के पौधों का प्रत्यारोपण व्यापक रुप से अभ्यास में था।[15] इस काल में तमिल लोग चावल, गन्ना, बाजरा, नारियल, कपास, केला, इमली, चंदन इत्यादि फसलों की एक विस्तृत श्रृंखला उगाते थे।[16] इस काल में कई जल भंडारण प्रणालियां बनायी गयी थीं। इस अवधि के दौरान कृष्णा नदी पर बनाया गया बाँध कल्लनी (1–2 शताब्दी ई0) वर्तमान में प्रयुक्त सबसे प्राचीन जल विनियमन संरचनाओं में से एक है।[17] इस अवधि में दक्षिण भारतीय कृषि के विकास के परिणामस्वरुप अधिशेष उत्पादन में तीव्र वृद्धि हुई। कुषाण जैसे तत्कालीन शासकों ने इस अधिशेष उत्पादन को संसार के अन्य भागों तक पहुँचाने में महत्वपूर्ण सहयोग दिया, इसके परिणामस्वरुप तत्कालीन कृषि अर्थव्यवस्था और अधिक मजबूत हो गयी।

स्थापनाः

गुप्तकाल के प्रारम्भ तक भारतीय कृषि नियमित तथा सुसंगठित हो चुकी थी। तत्कालीन कृषक भूमि का सीमांत उपयोग कर निरंतर विकास तथा भविष्य की सुरक्षा हेतु अधिकतम् उपज प्राप्त कर रहे थे। इस प्रयोजन के लिए, गुप्तकालीन कृषक भूमि को गुणवत्ता, मिट्टी, प्रजनन इत्यादि के आधार पर वैज्ञानिक दृष्टि से वर्गीकृत करते थे। कृषि क्षेत्र के विकास ने जहाँ एक ओर फसल आधारित भू नामकरण को उत्पन्न किया, वहीं दूसरी ओर गुणों के आधार पर भूमि–विभाजन ने भूमि के सीमांत उपयोग तथा भू–चयन में सरलता को प्रोत्साहन दिया।

द्वितीय शताब्दी ई0पू0 के विद्वान पतंजलि ने भूमि को दो भागों क्रमशः क्षेत्र तथा गोचर में विभक्त किया।[18] शिलालेखों में 'क्षेत्र' शब्द का प्रयोग विशेष रुप से कृषि भूमि हेतु किया गया था।[19] इस गुणाधारित वर्गीकरण का विकसित रूप हमें अमरकोश में दृष्टव्य होता है, जिसमें भूमि के 12 प्रकार यथा उर्वर (उपजाऊ), ऊसर (रेहयुक्त नोमी मिट्टी की भूमि), मरु (रेगिस्तान), अप्रहत (बंजर), शाहल (हरि–भूमि), पंकिल (कीचड़ युक्त), जलप्रायम्नुपम् (नम भूमि), कच्छ (कछारी), शर्करा

(कंकरीली), शर्कावती (बलुई), देवमातृक (स्वंय सिचिंत भूमि) तथा अदेवमातृक वर्णित[20] हैं। इस विभक्तिकरण से कृषि भूमि की अलग पहचान करना अत्यन्त सरल हो गया था। गुप्तकालीन कृषकों ने इस वर्गीकरण के आधार पर कृषि योग्य भूमि की पहचान कर उसे मात्र कृषि हेतु आरक्षित किया। जुनागढ़ का अनुदानपत्र, दामोदरपुर, पहाड़पुर तथा बैग्राम के ताम्रपत्र इत्यादि अधिकांश लेखों में दानप्राप्तकर्ता को बंजर भूमि देने का ही उल्लेख है।[21]

इसके अतिरिक्त समकालीन लेखकों ने कृषि योग्य भूमि का वर्गीकरण भी किया, जिससे तत्कालीन कृषक द्वारा वैज्ञानिक तकनीकों तथा कृषि के मध्य संबंध स्थापित करने के प्रयास का पता चलता है। कृषकों का यह प्रयास सतत् विकास हेतु अत्यन्त महत्वपूर्ण सिद्ध हुआ। कृषि भूमि को गुप्त काल में भिन्न-भिन्न आधार पर बाँटा जाता था, जिनमें से एक आधार बीज परिमाण था। महाभाष्य में वर्णित प्रास्थिक (धान्य की एक प्रस्थ बीज बोने योग्य भूमि) द्रोणिक, खारिक इत्यादि[22] शब्द इस ओर संकेत करते हैं। इस वर्गीकरण के आधार पर तत्कालीन कृषक को भूमि की उर्वरता का पता चल जाता था।

गुप्तकालीन ग्रन्थों में भूमि को फसल के आधार पर भी विभाजित किया गया है। तत्कालीन साहित्य में वर्णित मौदगीन (मूँग का खेत), शालेय (धान का खेत), ब्रैहेय (ब्रीही का खेत), यव्य (जौ का खेत), यवकई (जई का खेत), तिल्य (तिल का खेत), भोग्य (पटसन का खेत), माष्य (उड़द का खेत) इत्यादि[23] शब्द इस वर्गीकरण को स्पष्ट करते हैं। यह वर्गीकरण मिट्टी, आर्द्रता इत्यादि जैसे प्राकृतिक तत्वों पर आधारित था। फसल आधारित यह वर्गीकरण तत्कालीन कृषकों के भौगोलिक ज्ञान तथा उस ज्ञान के सीमांत उपयोग के दृष्टिकोण को स्पष्ट करता है, जो परवर्ती कालों के कृषकों हेतु आदर्श रूप में स्थापित हुआ।

उपरोक्त वर्गीकरण के आधार पर कृषि योग्य भूमि तथा उसकी क्षमता को जानने के बाद भू-उर्वरता को सुरक्षित रखना गुप्तकाल में कृषकों का दायित्व माना जाता था। इस हेतु कृषक खेत को दो या अधिक बार जोतता था।[24] भूमि की आद्रता के संरक्षण के लिए जुताई के बाद खेत की मिट्टी को काष्ठ द्वारा समतल किया जाता था।[25] वराहमिहिर द्वारा जमीन की तैयारियाँ, एक पेड़ की कलम दूसरे पेड़ पर लगाने, पेड़ों के मध्य दूरी, मौसम के अनुरूप वृक्ष को पानी देने जैसे तकनीकी विषयों का विस्तृत वर्णन[26] किया जाना भी तत्कालीन कृषक के उपरोक्त दृष्टिकोण तथा कृषि में वैज्ञानिकता के समावेश का परिचायक है।

तत्कालीन समाज प्राकृतिक स्रोतों की प्राप्ति में भूमि के साथ-साथ श्रम के महत्व को भी स्वीकार करता था। इस काल में खेतिहर मजदूर व कृषक हेतु सहयोगपूर्ण वातावरण बनाना राज्य का दायित्व था, जिसे राज्य अच्छे से निभा रहा था। राज्य द्वारा परिश्रमी कृषकों को पुरस्कृत तथा कृषि को क्षति पहुँचाने वाले को दण्ड दिया जाता था। जो कृषक बंजर भूमि को परिश्रम व लागत से कृषि योग्य व उपजाऊ बनाये, ऐसे कृषक को उस भूमि पर 7-8 वर्ष तक कर रहित उपभोग का अधिकार मिल जाता था। वहीं कृषि उपकरण एवं बाँध इत्यादि तोड़ने वाले को 100 पण या अधिक अर्थदण्ड का प्रावधान था।[27]

गुप्तकालीन राज्य बीज एवं उपकरण इत्यादि कृषि आवश्यकताओं की पूर्ति हेतु ऋण भी देता था। कृषकों की तात्कालिक कृषि आवश्यकताओं की पूर्ति हेतु साहूकार भी ऋण देते थे। कृषि कार्यों के समय साहूकार ऋण वापसी का अनावश्यक दबाव न बनाये, यह ध्यान रखना राज्य का दायित्व था। इस प्रकार के सहयोगात्मक वातावरण में कृषक अपनी क्षमता का पूर्ण उपयोग कर अधिकतम संभव उपज प्राप्त कर रहे थे। परिणामस्वरूप भारत में कृषकों की दशा उन्नत थी। फाह्यान[28] तथा सुगंयुन[29] भी भारत में कृषकों की संभ्रान्त दशा को पूर्णतः स्वीकार करते हैं।

उपजाऊ भूमि तथा किसानों के अधिकतम प्रयास भी उच्च गुणवत्ता के कृषि उपकरणों के बिना अच्छी उपज प्राप्त नहीं कर सकते थे। इस तथ्य को ध्यान में रखकर समकालीन विद्वानों ने कृषि की परिभाषा में भूमि तथा श्रम के साथ-साथ कृषि उपकरणों की महत्ता को भी स्वीकार किया। पतंजलि के अनुसार 'कृष' मात्र जोतने को ही नहीं अपितु प्रतिविधान (बैल, बीज की व्यवस्था एवं देख-रेख इत्यादि) को भी कहते हैं।[30]

गुप्तकाल में कृषि उपकरणों का तकनीकी विकास अपनी पराकाष्ठा पर था। अमरकोश में हल एवं उसके अवयवों, जमीन पोली करने का हंगा, कुदाल तथा दराती के पर्यायवाची शब्द[31] तथा हलों की बनावट[32] इत्यादि का वर्णन इसे स्पष्ट करता है। बृहस्पति स्मृति के अनुसार फाल का वजन 12 पल होना चाहिए तथा यह आठ अंगुल लम्बा तथा 4 अंगुल चौड़ा होना चाहिए।[33] तत्कालीन ग्रन्थों में ऐसे सूक्ष्म विषयों पर चर्चा गुप्तकालीन तकनीकी विकास की उच्च अवस्था को दर्शाता है।

तत्कालीन समाज में बैल का भी महत्वपूर्ण स्थान था। गुप्तकाल में जिस व्यक्ति के घर में हल, बछड़ा तथा बैल होते थे, उसे सम्पन्न माना जाता था।[34] कृषि उपकरणों का कृषक समृद्धता से संबंध

तत्कालीन समाज में कृषि उपकरणों के महत्व को स्पष्ट करता है। कृषक भी बैलों की क्षमता का सीमांत उपयोग करते थे। गुप्त काल में दोनों कार्य यथा हल चलाने तथा गाड़ी खींचने में प्रयुक्त 'गो' को आदर्श माना जाता था।[35] इस काल में युवा बैल 'उक्षा'[36] एवं वृद्ध बैल 'बलिवर्द'[37] कहलाते थे। सभवत: बलिवर्द का कृषि कार्यों में प्रयोग नहीं होता था। यह तत्कालीन कृषक की नैतिकता के साथ-साथ कृषि में उत्तम संसाधनों के प्रयोग के दृष्टिकोण को भी दर्शाता है। समकालीन लौकिक साहित्य में वर्णित बैलों का विभाजन तथा आदर्श बैल के मापन जैसे तथ्य कृषि संसाधनों के सीमांत उपयोग के दृष्टिकोण को दर्शाते हैं।

गुप्तकालीन कृषक उपरोक्त तथ्यों के साथ ही साथ प्राकृतिक तथ्यों का भी विशेष ध्यान रखते थे। विभिन्न क्षेत्रों में मिट्टी इत्यादि प्राकृतिक तत्वों के आधार पर भिन्न-भिन्न फसल उगाई जाती थी। रघुवंश से पता चलता है कि पाण्डव प्रदेश की मलय पहाड़ियों में काली मिर्च, इलायची एवं चंदन की लकड़ी प्राप्त होती थी तथा सिन्धु के तटवर्ती क्षेत्र में केसर पैदा होता था। अमरकोष में भी कश्मीर से केसर[38] तथा मलय पर्वत से चंदन[39] प्राप्ति का वर्णन है। ईत्सिंग के अनुसार उत्तर-पश्चिम प्रदेशों में गेहूँ, पश्चिमी प्रदेशों में जौ तथा मगध में चावल पैदा होता था।[40] वर्तमान मे भी पंजाब व हरियाणा में गेहूँ तथा बंगाल व पूर्वी बिहार में चावल पैदा होना गुप्तकालीन वर्गीकरण की निरंतरता एवं महत्व को दर्शाता है।

गुप्तकालीन कृषक अच्छी फसल प्राप्ति हेतु मौसम अनुरूप खेती करते थे। वराहमिहिर द्वारा गुप्तकालीन भारत में होने वाली मानसूनी वर्षा व तद्नुसार 3 वार्षिक फसलों का वर्णन इसे स्पष्ट करता है।[41] ये फसलें क्रमश: ग्रीष्म काल में बोई एवं सावन मे काटी, पतझड़ मे बोई एवं बसंत में काटी तथा बसंत में बोई तथा चैत्र या बैशाख माह में काटी जाती थी।[42] कृषक मौसम के अनुरूप खेतों में पानी देते थे। गर्मी के दिनों में सुबह-शाम, जाड़ों में एक दिन छोड़कर तथा वर्षा में सूखी जमीन देखकर सिंचाई की जाती थी।

गुप्तकालीन कृषक द्वारा मौसम तथा कृषि के मध्य सामंजस्य स्थापित करने से वर्षा-चक्र सदैव कृषि के अनुकूल रहता था। गुप्तकालीन कृषक सिंचाई हेतु मुख्यत: वर्षा पर ही निर्भर करता था। साहित्य में वर्षा हेतु विभिन्न यज्ञानुष्ठानों का वर्णन है, जो गुप्तकालीन कृषि में वर्षा की महत्ता को स्पष्ट करता है। महाभाष्य में जप व तप के बाद वर्षा होने का वर्णन[43] उपरोक्त तथ्यों की पुष्टि करता है। गुप्त काल में वर्षा के जल का भी सीमांत उपयोग किया जाता था। इस हेतु धान जैसी वर्षा आधारित फसलों को नदी के समीप अथवा उच्च स्थान पर लगाया जाता था।[44] समकालीन विद्वानों ने सिंचाई हेतु वर्षा का अधिकतम उपयोग करने के लिए वर्षा के मापन तथा पूर्वानुमान के तरीके खोजे। वराहमिहिर द्वारा वर्णित प्रचलित

पैमानो में वर्षा के परिमाण, खगोलशास्त्र एवं मौसम-विज्ञान के तथ्यों के प्रकाश में अतिवृष्टि तथा अल्पवृष्टि की भविष्यवाणी इत्यादि[45] उपरोक्त कथन की पुष्टि करते हैं।

गुप्तकाल में कृषि आवश्यकता की पूर्ति हेतु सिंचाई के कृत्रिम संसाधनों का भी प्रयोग किया जाता था। गुप्तकाल में कृत्रिम सिंचाई संसाधनों के उपयोग का वर्णन अफसद शिलालेख से प्राप्त होता है।[46] गुप्तकालीन भारत में कर्षण व सिंचन हेतु पारस्परिक सहयोग रहता था। नहर, नालें इत्यादि खोदने का सामूहिक प्रबंध किया जाता था। संभवत: इस कारण ही बृहस्पति स्मृति में सिंचाई हेतु प्रयुक्त तालाबों तथा कुंओं के रखरखाव का दायित्व श्रेणी संगठनों को दिया गया है। याज्ञवल्कय के अनुसार राजा को सार्वजनिक प्रयोग हेतु दूसरे की भूमि पर भी कुंआँ तथा तालाब बनाने की अनुमति देनी चाहिए।[47] स्पष्टत: गुप्तकालीन समाज का प्रत्येक वर्ग कृत्रिम सिंचाई संसाधनों के विकास का विशेष ध्यान रखते थे।

गुप्तकाल में सिंचाई संसाधनों के विकास हेतु राजकीय स्तर पर भी प्रयास किये जा रहे थे। जूनागढ़ अभिलेख में 5वी शताब्दी ई0 में स्कन्दगुप्त द्वारा सुदर्शन झील की मरम्मत करवाने का उल्लेख[48] गुप्तकालीन राजकीय प्रयासों को स्पष्ट करता है। कम वर्षा वाले तथा नदीविहिन क्षेत्रों की सिंचाई आवश्यकताओं की पूर्ति हेतु राज्य नहरों तथा झीलों का निर्माण करवाता था। खारवेल के हाथीगुम्फा लेख में नहर निकालने का उल्लेख[49] उपरोक्त कथन की पुष्टि करता है।

सिंचाई के इन सभी संसाधनों का तत्कालीन कृषकों ने सीमांत उपयोग किया। इस हेतु प्रत्येक कृषक अपने विभाजित क्षेत्र के चारो ओर आड़िया तथा पानी हेतु छोटी-छोटी नालियाँ बनाता था।[50] तत्कालीन शासक भी सिंचाई के संसाधनों के सीमांत उपयोग हेतु नदियों तथा नहरों के जल-प्रवाह को नियंत्रित रखने के लिए बाँध बनवाते थे। जुनागढ़ अभिलेख में सुदर्शन झील पर बाँध बनवाने का उल्लेख इन प्रयासों को स्पष्ट करता है। नारद द्वारा दो प्रकार के बाँधों क्रमश: बंध्य (अतिरिक्त पानी रोकने हेतु) तथा खेय (सिंचाई हेतु भूमि खोदकर बनाये गये) के निर्माण का वर्णन तत्कालीन तकनीकी विकास को स्पष्ट करता है। गुप्त समाज के आपसी सहयोग के परिणामस्वरुप सिंचाई संसाधनों का कम लागत में तेजी से विकास हुआ।

गुप्तकालीन विद्वान जानते थे कि विभिन्न कृषि उपकरणों तथा उन्नत सिंचाई प्रणाली के साथ-साथ उपज सुरक्षा भी अच्छी फसल प्राप्ति हेतु अत्यन्त आवश्यक कारक है। अतएव उन्होनें कृषि

उपज सुरक्षा हेतु व्यक्तिगत, सामाजिक व राजकीय स्तरों पर उत्तरदायित्व विभाजन की परिकल्पना स्थापित की। गुप्तकाल में कृषक व्यक्तिगत स्तर पर कृषि उपज को पशु-पक्षियों से बचाने का प्रयास करता था। खेतों के चतुर्दिक गहरी खाईया खोदी जाती थी, जो जल से भरी रहती थीं, जिन्हे फांद सकना पशुओं के लिए दुष्कर होता था।[51] खेतों को पक्षियों से बचाने हेतु प्रायः लड़कियां गोफन लेकर इक्षु (गन्ना) की मेड़ पर बैठती थी।[52] कृषक पशुओं को डराने के लिए खेतो में मानव पुतलों का भी प्रयोग करते थे।

खेती की फसल की सुरक्षा भू-स्वामियों का भी दायित्व था। नारद के अनुसार सड़क या मार्ग की ओर से खेत में ऐसी बाड़ लगानी चाहिए, जिसे सुअर तोड़ न सके, घोड़ा लाँघ न सके व ऊँट देख न सके।[53] यदि बाड़युक्त खेत में पशुओं द्वारा फसल को हानि पहुँचायी जाती है, तो गोपालक उसकी क्षतिपूर्ति के लिए जिम्मेदार था।[54] गोपालक कृषक को क्षतिपूर्ति न दे, तो राज्य उसे वसूल करवाता था। राज्य मानव से कृषि को होने वाली हानि को रोकने के लिए उत्तरदायी था, इस हेतु राज्य मानवों द्वारा कृषि को हानि पहुँचाने पर दण्ड तथा कृषि प्रोत्साहन पर लाभ देता था। इस काल में कृषि के विकास हेतु सामाजिक विधानों का भी निर्माण किया गया था। मनु ने तड़ागों का विक्रय पत्नी-पुत्र के विक्रय के समान पाप कर्म बताया तथा याज्ञवल्क्य ने इसे उपपातकों में शामिल किया।[55] सामाजिक विधानों में सिंचाई यन्त्रों को हानि पहुँचाना निंदनीय बताया गया ताकि कृषि में सिंचन की समस्या उत्पन्न न हो।

प्राचीन भारतीय समाज कृषि के हर संभव लाभ को प्रोत्साहित करता था। तत्कालीन समाज मानव जीवन में पर्यावरण के महत्व तथा उसको मानव अनुरूप बनाये रखने मे वृक्षों की महत्ता को जानता था, इसलिए तत्कालीन समाज वृक्षारोपण को प्रोत्साहित करता था। भारतीय विद्वान यह भी जानते थे कि मानव ऐसे वृक्षों के रोपण में अधिक ध्यान नहीं देगा, जो उसे प्रत्यक्ष लाभ न दे। अतः तत्कालीन विद्वानों ने पर्यावरण हेतु लाभप्रद परन्तु प्रत्यक्ष लाभ न देने वाले वृक्षों को धार्मिक अवधारणाओं से जोड़ दिया। समकालीन ग्रन्थों मे मंगलमय वृक्षों के रोपण का निर्देश दिया जाना इसकी पुष्टि करता है। इन मंगलमय वृक्षों में पीपल जैसे वृक्ष सम्मिलित है, जो वैज्ञानिक दृष्टि से वातावरण के लिए तो उपयोगी हैं, परन्तु प्रत्यक्ष लाभ अथवा व्यक्तिगत लाभ नहीं देते। वृहत्संहिता में पेड़ों की चिकित्सा पर एक अलग परिच्छेद हैं[56], जिससे तत्कालीन समाज की पेड़ एवं पौधे उगाने व उनकी देख-रेख के प्रति सजगता का परिचय मिलता है।

गुप्तकालीन कृषक ने कृषि में वैज्ञानिकता का अत्यन्त सरल समावेश किया। तत्कालीन ग्रन्थों में उड़द तथा तिल जैसे दो धान्यों को मिलाकर बोने[57] का वर्णन मिलता है, जो तत्कालीन कृषक के वैज्ञानिक दृष्टिकोण का परिचायक हैं। इस काल में कृषक द्वारा अधिक सिंचाई आवश्यकता वाली धान की फसल को नदियों व नहरों के पास उगाया जाना तथा कालिदास द्वारा वर्णित धान के विभिन्न प्रकार यथा शालि[58], कलम[59], निवार[60] तथा श्यामक भी उपरोक्त दृष्टिकोण की पुष्टि करता है।

कृषि में वैज्ञानिकता के सरल समावेश, भूमि के सतत् विकास, कृषि उपकरणों के तकनीकी विकास तथा समाज के सभी पक्षों द्वारा दायित्व निर्वहन जैसे विकास हेतु प्रेरक तत्वों की व्यापक उपस्थिति के परिणामस्वरुप गुप्तकाल में अनेकों प्रकार की फसलें उत्पन्न होती थीं। महाभाष्य में महत्व व उपज के अनुसार ब्रीही, यव, माष, मुदग, तिल पाँच प्रमुख धान्य बताये गये हैं।[61] गुप्तकालीन भारत में सर्वाधिक उपजाई जाने वाली दाल माष (उड़द) का वर्णन अमरकोश[62] तथा विष्णु पुराण[63] में भी है। उसके अतिरिक्त गुप्तकाल में मूँग, कुलथी, चना, मसूर, राजमा तथा अरहर आदि दलहनों की खेती होती थी।[64] विष्णु पुराण में मटर के 2 भेदो यथा सवीनक (छोटी मटर) तथा निष्पाव (बड़ी मटर) का वर्णन[65] तत्कालीन कृषि में मटर के महत्व को बताता है। इस काल में तिल, सरसों व अलसी जैसे तिलहन भी उगाये जाते थे।

दलहन व तिलहन के अतिरिक्त गुप्त कृषक विभिन्न प्रकार के मसाले यथा काली मिर्च[66], इलाचयी[67], लौंग[68], अदरक, हल्दी, बालछड़ इत्यादि भी उगाते थे। अमरकोश में कई प्रकार की सब्जियों का वर्णन है। कालिदास ने करेले को मूलक, कारवेल, सुषवी नाम से, परमल को पहोल, कुल्क, पटु नाम से, ककड़ी को कर्कारी, उर्वक नाम से, जमीकन्द को सूरण, कन्द, गंडीर, वास्तुक नाम से तथा श्वेत तुरई को घोषका, धामार्गत इत्यादि नाम से संबोधित किया, जो गुप्तकाल में सब्जियों की विभिन्न क्षेत्रों में व्यापक पैदावार का द्योतक हैं।[69] गुप्तकालीन साहित्य में सर्वाधिक वर्णित फल आम है।[70] इसके अतिरिक्त कालिदास ने आम के साथ-साथ जम्बू[71] (जामुन), द्राक्षा[72] (अंगूर), खजूर[73], नारियल[74] तथा बीजपूरक[75] (नींबू) इत्यादि फलों का भी वर्णन किया है।

उपरोक्त के अतिरिक्त प्राचीन भारत में कुछ व्यापारिक फसलें भी उगाई जाती थी। सर्वप्रथम आश्वलायन श्रोतसुत्र में वर्णित कार्पास (कपास) की खेती भारत में व्यापक पैमाने पर होती थी। विष्णु पुराण में रस्सी बनाने हेतु प्रयुक्त शण (सन) की खेती का भी उल्लेख है।[76] कालिदास के अनुसार गुप्तकाल में इक्षु (गन्ना) की खेती भी प्रचुर मात्रा में होती थी। रघुवंश में वर्णित गन्ने की खेती से

संबंधित गीत[77] तत्कालीन कृषि में इसके महत्व को स्पष्ट करता है। अमरकोश में नलंद (जटामासी) नामक पर्वतीय तृण का वर्णन है, जिसका रोम को निर्यात किया जाता था।[78] इसके अतिरिक्त भारत में ताम्बुल (पान)[79] तथा पुग (सुपारी)[80] की भी व्यापक पैदावार होती थी। साथ ही साथ इत्र एवं शारीरिक लेप बनाने में प्रयुक्त चंदन, केसर तथा केवड़ा (केतकी) की भी देश के कुछ क्षेत्रो मे पैदावार होती थी।

अन्ततः कहा जा सकता है कि प्राचीन भारतीय कृषकों ने भूमि एवं कृषि उपकरणों के सीमांत उपयोग तथा मौसम जैसे महत्वपूर्ण कारकों को समझकर उनका कृषि के अनुरूप प्रयोग कर मानवीय खाद्य-आवश्यकता पूरी करने में सफलता प्राप्त की। तत्कालीन कृषकों को राज्य तथा समाज से पूर्ण समर्थन मिलता था, परिणामस्वरुप वे खाद्य-आपूर्ति को अपना दायित्व मानकर कृषि कार्य करते थे। कृषि व्यवस्था का प्रबंधन एवं कृषि संबद्ध विवादों का निपटारा समाज सामूहिक रूप से करता था। ग्राम परिषदों की तत्कालीन भू-विक्रय में भूमिका[81] तथा कात्यायन द्वारा भू-विवाद से निपटारे में पहले समाज को स्थान देना उपरोक्त कथन की पुष्टि करता है।

समाज के सभी पक्षों के द्वारा अपने-अपने दायित्वों के निर्वहन तथा आपसी सामंजस्य के परिणामस्वरुप राज्य को कठोर नीति नहीं अपनानी पड़ी। ऐसी आदर्श परिस्थितियों ने प्राचीन भारत में कृषि आधिक्य तथा भूमि की उर्वरकता को सदैव बनाये रखा। कृषि अधिशेष को तत्कालीन व्यापारियों ने सर्वे भवन्तु सुखिनः जैसे सिद्धान्तों से प्रेरित होकर अन्य क्षेत्रों की खाद्य-आवश्यकता की पूर्ति हेतु निर्यात किया। जिसके परिणामस्वरूप प्राचीन भारत का सतत् आर्थिक विकास होता रहा।

वर्तमान परिप्रेक्ष्य में भी यह प्राचीन भारतीय सिद्धान्त हमारी खाद्य-आवश्यकता पूर्ति हेतु प्रभावशाली सिद्ध हो सकता है। यदि हम उपजाऊ भूमि को कृषि हेतु आरक्षित कर दें तथा ग्राम पंचायतों के माध्यम से तकनीकी रूप से विकसित कृषि-उपकरण कृषकों तक पहुँचा सके तो अच्छी उपज प्राप्त की जा सकती है। साथ ही साथ कृषकों को राज्य एवं समाज से समर्थन मिले तथा कृषक कृषि-कार्यों का निर्वहन अपना दायित्व मानकर करे, तो निश्चित रूप से हमारी खाद्य-समस्याओं का समाधान हो सकता है।

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[6] अनिल कुमार गुप्ता – *उपरोक्त*

[7] *ऋग्वेद* – 10.3.5.13

[8] *अथर्ववेद* – 12.1

[9] एम0 एस0 रंधावा – *उपरोक्त,* पृष्ठ 305

[10] *अर्थशास्त्र* – 1.1–पृथिव्या लाभे।

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[14] *वही*

[15] आर0 एस0 शर्मा – *एन्शिएंट इंडिया,* नई दिल्ली, 1977, पृष्ठ 109

[16] टी0 के0 वेंकट सुब्रमण्यम् – *एनवायरमेंट एंड अरबनाईजेशन* इन अर्ली तमिलकम्, तमिल विश्वविधालय, तंजावुर, 1998, पृष्ठ 7

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[18] *महाभाष्य* – 3.3.19

[19] उपेन्द्र सिंह – *ए हिस्ट्री आफ एन्शिएंट एंड अर्ली मिडीवल इंडिया,* परसन्स लोंगमेन, नई दिल्ली, 2008, पृष्ठ 493

[20] *अमरकोश* – 1.5–6,10–13

[21] उपेन्द्र सिंह – *उपरोक्त*

[22] *काशिकावृत्ति* – 5.1.45

[23] *महाभाष्य* – 5.2.1–4

[24] *वही* – 5.4.59

[25] प्रभुदयाल अग्निहोत्री – *पतंजलिकालीन भारत,* द्वितीय संस्करण, ईस्टर्न बुक लिंकर्स, नई दिल्ली, 2007, पृष्ठ 209

[26] *वृहत्संहिता* – परिच्छेद–55

[27] *बृहस्पति स्मृति* – 23.5; मैती, एस. के. – *इकनोमिक लाईफ ऑफ नार्दन इण्डिया इन गुप्ता पिरियड*, द्वितीय संस्करण, दिल्ली, 1970, पृष्ठ 98

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[30] *महाभाष्य* – 3.1.26

[31] *अमरकोश* – 2.9.13; 3.3.37

[32] *वही* – 9.13–14

[33] बृ*हस्पति स्मृति*, 8.79–80

[34] *महाभाष्य* – 3.1.17

[35] *वही* – 5.3.55

[36] *वही* – 5.4.78

[37] *वही* – 1.2.72

[38] *अमरकोश* – 1.6.131

[39] *वही* – 2.6.121

[40] आर.सी. मजुमदार – *श्रेण्य युग*, मोतीलाल बनारसीदास, दिल्ली, 1984, पृष्ठ 656

[41] *वृहत्संहिता* – सस्यजातक अध्याय, 2.3

[42] *वही* – 8.8–9

[43] *महाभाष्य* – 1.4.84; *काशिकावृत्ति* – 2.3.8

[44] प्रभुदयाल अग्निहोत्री – *उपरोक्त*, पृष्ठ 216

[45] उपेन्द्र सिहं – *उपरोक्त*

[46] शोभा सत्यदेव एवं अभिनव सत्यदेव– *भारतीय पुरालिपी, अभिलेख एवं मुद्रा*, भवदीय प्रकाशन, अयोध्या,2007,पृष्ठ 183

[47] श्याम मनोहर मिश्र – *प्राचीन भारत में आर्थिक जीवन*, प्रामानिक प्रकाशन, इलाहबाद, 1976, पृष्ठ 36

[48] शोभा सत्यदेव एवं अभिनव सत्यदेव – *उपरोक्त* पृष्ठ 147; एस0 आर0 गोयल – *गुप्तकालीन अभिलेख*, कुसुमाजंली प्रकाशन, मेरठ, पृष्ठ 228; पी0 एल0 गुप्ता – *प्राचीन भारत के प्रमुख अभिलेख*, भाग 1, विश्वविधालय प्रकाशन, वाराणसी, 2002, पृष्ठ 139

[49] शोभा सत्यदेव एवं अभिनव सत्यदेव – *उपरोक्त*, पृष्ठ 96; गुप्ता, पी0 एल0 – *उपरोक्त*, भाग 2, पृष्ठ 95

[50] *धम्मपद* – 80–145

[51] *नारद स्मृति* – 11.41; एस. के. मैती – *उपरोक्त*, पृष्ठ 100

[52] प्रभुदयाल अग्निहोत्री – *महाकवि कालिदास : खण्ड–3*, पृष्ठ 408

[53] *से.बु.ई.* 33, पृष्ठ 164–65

[54] *नारद स्मृति* – 11.28; मैती, एस. के. – *उपरोक्त*, पृष्ठ 99

[55] श्याम मनोहर मिश्र – *उपरोक्त*, पृष्ठ 36

[56] *वृहत्संहिता* – परिच्छेद–55

[57] *महाभाष्य* – 2.3.193

[58] *रघुवंश* – 15/78; *ऋतु संहार* – 3/16,

[59] *रघुवंश* – 1/50

[60] *उपरोक्त* – 4/37; *कुमार संभव* – 5/47

[61] प्रभुदयाल अग्निहोत्री – *पतंजलि कालीन भारत,* द्वितीय संस्करण, ईस्टर्न बुक लिंकर्स, नई दिल्ली, 2007, पृष्ठ 217

[62] *महाभाष्य* –5.2.1.4

[63] *विष्णु पुराण* – 1.6.22

[64] ओम प्रकाश – *फ्रुड एण्ड ड्रिंक्स इन एशिएंट इंडिया*, दिल्ली, 1961, पृष्ठ 172

[65] *विष्णु पुराण* – 1.6.21

[66] *रघुवंश* – 4.46

[67] *उपरोक्त* – 4.47, 6.62

[68] *कुमारसंभव* – 8.25

[69] *उपरोक्त* – 4.38; *ऋतुसंहार* – 6.28

[70] *मालविकाग्निमित्रम्* – अंक 3, पृष्ठ 291

[71] *विक्रमोवंशीयम्* – 4.27

[72] *रघुवंश* – 4.65

[73] *उपरोक्त* – 4.57

[74] *उपरोक्त* – 4.42

[75] *मालविकाग्निमित्रम्* – अंक 3, पृष्ठ 291–''ननुं सन्निहितं बीजपूरकम्''।

[76] *विष्णु पुराण* – 1.6.22

[77] *रघुवंश* – 4.20

[78] प्रभुदयाल अग्निहोत्री – *उपरोक्त*, पृष्ठ 217

[79] *रघुवंश* – 4.42; *ऋतुसंहार* – 5.5

[80] *रघुवंश* – 4.44, 6.64

[81] उपेन्द्र सिहं – *उपरोक्त*, पृष्ठ 491

वर्तमान कृषि पद्धति में बदलाव जरूरी

डा0 रमेश चन्द्र तिवारी*

सन् 1950 की भारतीय कृषि की स्थिति की समीक्षा करें तो खाद्यान्न उत्पादन मात्र 5.0 करोड़ टन था और जनसंख्या लगभग 36 करोड़ रही होगी। खाद्यान्न की कमी से होने वाले दुर्भिक्ष का इतिहास ज्ञात है। मृदा वही, जलवायु वही, किन्तु कृषि का ढ़ाचा अत्यंत कमजोर था। सन् 1966-67 से हरित-क्रान्ति का द्वार खुला और खाद्यान्नों की उत्तरोत्तर उपज बढ़ोत्तरी होने लगी। वर्तमान जनसंख्या लगभग 121 करोड़ है और खाद्यान्न उत्पादन अभी तक का रिकार्ड लगभग 24.50 करोड़ टन पहुँच गया है। अनाज उत्पादन लगभग 4 से 4.5 गुना, दुग्ध उत्पादन 6 गुना, सब्जी तथा फलों का उत्पादन 6 गुना, मछली उत्पादन 17.0 गुना तथा अण्डा का उत्पादन लगभग 27 गुना बढ़ा है। यदि स्वार्थ तथा वितरण प्रणाली आड़े न आवे तो सम्पूर्ण जनमानस के लिये भारत में पर्याप्त भोजन उपलब्ध हो। लेकिन जो कृषि उत्पादन हो रहा है क्या वह संतुलित है, मानस व स्वास्थ्य के लिए समुचित है? यह एक सनसनीखोज प्रश्न खड़ा हो रहा है। क्या वर्तमान कृषि पद्धति प्राकृतिक संसाधनों का सही उपयोग कर रही है, क्या पर्यावरण अनुकूलन को ध्यान दिया जा रहा है? यह सारे प्रश्न एक साथ उत्तर चाहते हैं।

वास्तविकता यही है कि वर्तमान कृषि पद्धति पेट भरने के लिए अच्छी हो सकती, और खाद्य सुरक्षा की दृष्टि से सही कही जा सकती है, किन्तु पोषण सुरक्षा की बात की जाय तो खेती घातक रूप में उभरकर आ रही है। यह समस्या पृथ्वी के समस्त जीवों के लिए घातक सिद्ध हो रही है।

प्रथम हरितक्रान्ति की उपलब्धियाँ तो बेजोड़ रही हैं, किन्तु अब समय की पुकार है कि कृषि वैज्ञानिक, सरकार तथा कृषक सभी यदि सम्भल कर न चले तो भारत का कृषि भविष्य अंधकारमय हो जावेगा, अनर्थ तथा कठिनाइयों से हम बच नही पावेंगे। पहले तो हम कृषि से सम्बद्ध सभी समस्याओं को इसलिए साधुवाद देंगें कि उन्होंने खाद्य सुरक्षा को कमोबेस सन्तोषप्रद स्थिति में ला दिया है। लेकिन वर्तमान कृषि की चुनौतियों की हम बात करें तो भविष्य की स्थिति निराशा के रास्ते पर जाने को मजबूर कर रही है। कुछ चुनौतियों के समाधान का रास्ता ढूढ़ना होगा, जो समय रहते मिल जाय तो सुखद स्थिति बनेंगी, भारत सम्पन्नता की सीढ़ी चढ़ता दिखाई देगा। चुनौतियों को यदि क्रमबद्ध करें तो वे हैं पोषण का अभाव, खेती वाली भूमि तथा जल की कमी, सतत या समगतिशील या सस्टेनेबल कृषि की

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समस्या, जैव विविधता का क्षरण, कृषि ऊर्जा तथा शक्ति की समस्या तथा वैश्विक स्तर पर कृषि में प्रतिस्पर्धा।

प्रथम हरित-क्रान्ति के फलस्वरूप शरीर क्रिया के सन्तुलित संचालन के लिए आवश्यक पोषक तत्वों का अभाव रहा है। कार्बोहाइड्रेड वाली धान, गेहूँ, गन्ना, आलू तथा मक्का आदि का उत्पादन और उपयोग बढ़ा। किन्तु प्रोटीन वाले खाद्यान दलहन, वसा के प्रभाव वाले तिलहन, खनिज तथा विटामिन वाली फसल व सब्जी तथा फल की कमी मानव अस्वस्थता का कारण बन रही है। जरूरी यह है कि दलहन, तिलहन, सब्जी तथा फलों व दूध का उत्पादन बढ़ाने पर ध्यान दिया जाये, जिससे संतुलित आहार मानव स्वास्थ्य के लिए प्राप्त हो सके। इस दिशा में नीतिगत तथा कृषि अनुसंधानों पर ध्यान दिया जाना चाहिए है। प्रत्येक घर तथा गॉव स्तर पर पोषण वाटिका का प्रचलन बढ़ाना जरूरी है। छोटे क्षेत्रफल में भी कलमी फलों, तथा लगभग सभी खाद्यानों की खेती की परम्परा चलाई जाये। यह एक बीघा या एक एकड़ या उससे भी छोटे क्षेत्रफल में की जा सकती है। पोषण सुरक्षा के समाधान की एक सही पद्धति है ''समेकित गहन कृषि प्रणाली'' (Integrated Intesive Farming System)। यह कार्यक्रम भारत के सभी 49 कृषि विश्वविद्यालयों लगभग 96 कृषि अनुसंधानशालाओं पर क्रियान्वित किया जाय तथा कृषकों तक इस तकनीक को पहुॅचाने के लिए लगभग 580 कृषि विज्ञान केन्द्रों को सक्रिय किया जाना चाहिए। एक ऐसी कृषि पद्धति जिसमें खाद्यान्न उत्पादन, सब्जी-फलोत्पादन, वानिकी, सल्य वानिकी, उद्यान-वानिकी, जैसे दुग्धशाला, मुर्गी पालन, सुअर पालन, भेड़-बकरी पालन, मधुमक्खी पालन, रेशम तथा लाख उत्पादन आदि समन्वित हो। यह पद्धति तभी सफल होगी जब ग्रामीण रोजगार, सहकारिता, मृदा-स्वास्थ्य ग्रामीण बाजार व विपणन्, यातायात तथा धन सम्बन्धी स्रोत व तकनीकी सहायता देने का प्रबन्ध किया जाय।

इस पृथ्वी पर समस्त जीवों को भोजन बनाकर देने वाले पेड-पौधे की आधार भूमि है। भोजन, ईधन, वस्त्र, औषधि, खाद तथा लकडी की स्रोत भूमि ही है। अथर्ववेद के अनुसार भूमि को ''माता भूमि:पुत्रोऽहं पृथव्या'' से सम्बोधन मिला है। वास्तव में जीवन का कच्चा माल खनिज, जल, वायु सभी भूमि है। पर्यावरण तथा सूर्य की सहायता से पेड़-पौधों के माध्यम से सबका पालन-पोषण भूमि ही कर रही है। किन्तु खेद है कि जाने अनजाने धरती-माँ की स्थिति यह है कि 80-90 प्रतिशत भारत की कृषि भूमि रूग्ण है। तो इस पर पलने वाले मानव तथा अन्य जीव-जन्तु स्वस्थ कैसे रह सकते हैं। यह चिंतनीय विषय है। कृषि भूमि के ऊपरी स्तर का विस्तार कट-बह जाना, असंतुलित उर्वरक प्रयोग, भूमि

में कार्बनिक पदार्थ की कमी, द्वितीयक लवणीकरण, कृषि रसायनों का अन्धाधुंध प्रयोग, एक तरह की फसलों का बारम्बार उगाया जाना, कृषिगत भूमि का अकृषि कार्यों में उपयोग इस देश को परेशानी में डाल सकता है। जिस गाँव, घर, देश की मिट्टी खराब हो जाय तथा संस्कृति लुप्त हो जाय उसका अस्तित्व मिट जाता है। मुझे प्रसन्नता है कि खाद्य सुरक्षा मिशन के अन्तर्गत 'मृदा स्वास्थ्य कार्ड' बनाने की परम्परा प्रचलित हो रही है। परीक्षण के पश्चात सटीक मृदा प्रबन्धन करके माँ को चिर स्वस्थ बनाने का संकल्प चाहिए।

'पौधों के पोषक तत्वों का समेकित प्रबन्धन' भूमि बचाने का उसे स्वस्थ रखने का एक सटीक कार्यक्रम है। इस प्रणाली में रसायनिक उर्वरकों के सन्तुलित प्रयोग के साथ कार्बनिक खादों, हरी खाद, फसल क्रम में दलहनी फसलें उगाना तथा जैव उर्वरकों का समावेश जरूरी है। रासायनिक उर्वरक दवाई की तरह है। जबकि कार्बनिक खादें मृदा का सम्पूर्ण स्वास्थ्यकर भोजन हैं। मिट्टी के जिन 14-15 गुणधर्मों का पौधों की वृद्धि के लिए अनुकूलन होना चाहिए कमोवेश उन सभी गुणों को कार्बनिक खाद अनुकूलन प्रदान करती है। जो भी पैदावार ली जाय उसमें फसल अवशेषों को भूमि को वापस करने का संकल्प लिया जाना चाहिए।

मिट्टी के अकृषि कार्यों में उपयोग पर अंकुश लगे। 'कृष्य भूमि का ह्रास, मानव का नाश' चरितार्थ न हो जाय। भूमि निर्जीव उद्योगोत्पादन का आधार नहीं यह जीवन का कच्चा माल है। इसे सुरक्षित रखकर ही हम बच सकते हैं। पूरे विश्व के भौगोलिक क्षेत्रफल के अनुसार विश्व की कृषि भूमि हमारे देश में सबसे अधिक है। विचारणीय तथ्य यह है कि इतने भूमि संसाधन पर विश्व की कुल जनसंख्या का लगभग 17 प्रतिशत तथा उतनी ही पशु संख्या का भरण पोषण यह भूमि कर रही है तथा भूमि उत्पादनों का निर्यात भी किया जाता रहा है। अत: राष्ट्र समृद्धि-भूमि संरक्षण पर निर्भर है। इसके दुरुपयोग पर अंकुश लगाना समय की आवश्यकता है।

विश्व के सम्पूर्ण मीठे पानी की मात्रा 4.5 प्रतिशत हमारे देश में उपलब्ध है जबकि 1.25 मीटर खारा पानी भारत भूमि पर बरसता है जो लगभग 40 करोड़ हेक्टेयर मीटर है। सम्पूर्ण वर्षा जल का 17.5 प्रतिशत वाष्पोर्त्सन से वापस वायुमण्डल में चला जाता है। लगभग 10 प्रतिशत जल भूमिगत जल के रूप में पुन:भरण करता है। मृदा में 27.5 प्रतिशत जल ऊपरी स्तर से भूमिगत जल के मध्य फंसा रहता है। लगभग 45 प्रतिशत वर्षा जल बहाव (run off) द्वारा बहकर नदी-नालों से समुद्र तक जा पहुँचता है। हमारे यहाँ कुल उपलब्ध जल का लगभग 78-80 प्रतिशत कृषि में उपयोग हो रहा है। इसकी उपलब्धता

में यदि औद्यौगिक इकाईयाँ आड़े आयेंगी तो कृषि उत्पादन प्रभावित होगा। सिंचाई जल का स्रोत से उपयोग स्थल तक पहुँचने में लगभग 40 प्रतिशत क्षय हो जाता है। अत: पानी की कमी से बचने के लिए चाहिए कि पृष्ठीय बहाव जल को यथाशीघ्र-यथासम्भव रोका जाय तथा संरक्षित भी किया जाय। 'खेत का पानी खेत में, गाँव का पानी गाँव में।' सिंचाई के लिए जहॉ सम्भव हो टपक सिंचाई तथा बौछारी सिंचाई विधि अपनाई जाय। कम पानी वाली फसलें उगाई जाय तथा मलजल या उपयोग किये जल का पुन: चक्रण किया जाय। इसके लिये नालों, बन्धों, फार्मों, तालाबों, झीलों में अधिकाधिक जल संरक्षण करने की विधियाँ अपनाई जानी चाहिए।

जहाँ तक सतत या सस्टेनबल कृषि की बात है 'समेकित गहन पद्धति' + 'समेकित पोषक तत्व प्रबन्धन' + 'समेकित कीटनाशी प्रबन्धन' + 'समेंकित सिंचाई जल प्रबन्धन' की सन्तुलित विधियों का प्रचलन बढ़ाया जाना आवश्यक है। इससे समय रहते जल समस्या की विभीषिका से बचा जा सकता है। एक नारा है 'more crop per Drop' 'बूंद-बूंद से अधिक उपज' इसे अमल में लाना आज की आवश्यकता है।

जैव विविधता से सराबोर यह देश जहाँ लगभग 390 फसलों की खेती होती हो और जिसमें 49 प्रमुख फसलें हों उसकी खुशहाली में तो प्रश्न चिन्ह लगना ही नही चाहिए। लेकिन हरित क्रान्ति की एक तरफा दौड़ रास्ता भटकी हुई लग रही है। जैव विविधता के क्षरण की बात करें तो न जाने कितनी तरह की फसलों व फलों का लोप होता जा रहा है। इसे रोकना चाहिए। जैव विविधता को सुरक्षित करके ही हम स्वस्थ रह सकते हैं, तथा पर्यावरण अनुकूलन बना रह सकता है। अतएव भूले-बिसरे फसलों, फलों शाक सब्जियों का लोप न होने पाये। पशु प्रजातियों का नामों निशान मिटने की कगार पर है। राष्ट्रीय स्तर पर बनाए गए 'जीन बैंक' फसलों तथा पशुओं के बचाने में लगे हुये हैं। सराहनीय कार्य हो रहा है इसे और प्रभावी बनाने की अवश्यकता है। 'जियो और जीने दो' (live and Let live) को अमल में लाकर भारतीय कृषि को सुरक्षित तथा सुन्दर बनाये रख सकते है।

कृषि मे इधर कुछ दशकों से पशु ऊर्जा, मानव ऊजा, सौर उर्जा तथा पवन ऊर्जा के प्रयोग में गिरावट आई है। ट्रेक्टरों तथा यन्त्रों के प्रयोग के कारण पशु एवं मानव जैसे पारम्परिक ऊर्जा के संसाधनों का कृषि क्षेत्र में प्रयोग घटने से भविष्य के लिए चुनौती बन रही है। ऊर्जा के वैकल्पिक-संसाधनों के प्रयोग पर जोर देना चाहिए। छोटे पावर के ट्रेक्टरों का प्रचलन हो, कृषि अवशेषों से ऊर्जा प्राप्त की जाय, जैविक खादों को बढ़ावा देकर रासायनिक उर्वरकों की खपत घटायी जाय, हरी

खाद तथा जैव उर्वरकों का प्रचलन बढ़े, कम ऊर्जा खपत वाली फसलें जैसे दलहन, तिलहन, ज्वार-बाजरा, सांवा, मडुआ की खेती की जाय। फल-वृक्षों की बागवानी का सहारा लिया जाय। मानव तथा पशु ऊर्जा के सक्षम उपयोग के लिए साधन बनाये जाय। प्रकाश संश्लेषण से बने पेड़-पौधों को पुनः चक्रण में लिया जाय, नकि उन्हे जला दिया जाय।

वैश्विक प्रतिस्पर्धा भविष्य की कृषि में चुनौती के रूप में आवेगी। कृषि उत्पादनों का निर्यात करके धन कमाना जरूरी है। रसायनों से की गई खेती के उत्पादों का निर्यात कठिनाई पैदा करेगा। निर्यात के लिए अच्छी परीक्षण प्रयोगशालाएं, अच्छी पैकिंग, बाहर भेजने के साधनों आदि का प्रबन्ध जरूरी है। यदि वर्तमान कृषि प्रणाली में बदलाव किया जाय तो कृषि निर्यात और आन्तरिक खेती-बारी का विकास संभव है।

जहाँ तक जैविक खेती की बात है हमारे देश में सफलता पूर्वक अपनाई जा सकती है। केवल जैविक खादों का प्रयोग करके सतत् तथा पर्याप्त खाद्यान्न उत्पादन करना सम्भव नही है। इसके लिए समन्वित प्रयास की ओर ध्यान देना होगा। जहाँ जैविक खेती की जाय वहाँ खेतों की मेड़ बन्दी की जाय, उनका समतलीकरण किया जाय, सिंचाई जल का वैज्ञानिक ढ़ंग से समुचित उपयोग हो, जुताई कम की जाय तथा संरक्षक जुताई की जाय। संरक्षक जुताई में खेत से फसल कटाई करते समय फसल अवशेषों का 25-30 प्रतिशत अंश उसी खेत में छोड़ दिया जाय तथा उसका सही प्रबन्धन किया जाय। कारखानों में उत्पादित किसी भी कृषि रसायन का उपयोग न किया जाय। जैविक खेती के सभी घटकों को प्रयोग में लाने का प्रचार-प्रसार हो। हरी खाद, जैव उर्वरकों तथा कार्बनिक खादों के प्रयोग को बढ़ावा मिले। नगरों से निकल रहे जैव अपघटक कूड़ा-कचरा आदि को पुनः चक्रण मे लाया जाय। ऋषि-कृषि पद्धति पर जोर दिया जाय। जैविक खेती देश के लिए ही नही विदेशी धन कमाने का प्रमुख साधन बन सकती है। बशर्ते ईमानदारी से की जाय।

विभिन्न जलवायु क्षेत्रों के अनुसार विकसित की जा रही नई कृषि पद्धति का सहारा लेकर भारतीय अर्थ-व्यवस्था की रीढ़ कृषि को समृद्ध बनाने की अविलम्ब आवश्यकता है।

खेती में प्रदूषण कैसे रोकें
पूर्वी उत्तर प्रदेश के संदर्भ में एक अध्ययन

डॉ0 एस0 एन0 सिंह[1] डॉ0 पी0 के0 यादव[2]
डॉ0 आर0 पी0 सिह[3] डॉ0 गुरू प्रसाद सिंह[4]

सारांश

खेती को प्रभावित करने वाला पर्यावरण प्रदूषित है। पर्यावरण के सभी घटक प्रदूषित हैं। चूंकि खेती इन घटकों के सम्पर्क में है, इसलिए यह भी प्रभावित एवं प्रदूषित हो रही है। जिन क्षेत्रों में मिट्टी मुख्यत: भारी धातुओं द्वारा प्रदूषित है वहां की फसलों को भूमिगत जल तथा प्रदूषित भूमि से चारा उत्पादन के फलस्वरूप उसे दुधारू पशुओं के खिलाने के बाद पशुओं के दुग्ध एवं दुग्ध-पदार्थो मे भी भारी धातुओं की मात्रा पायी गयी है। भारी धातु द्वारा प्रदूषित मिट्टी पर सब्जी न उगायें । खाने के लिये उपयोग में न आने वाली फसल जैसे - सगंधा पौधों की अनेक जातियां नीबू घास, जावा घास, रोजा घास एवं खश उगायें। लवण और क्षारीय मिट्टी को जलकुम्भी, जिप्सम, पायराइट एवं सीवेज स्लज से सुधारें । कृषि रसायनों का कम से कम उपयोग करें। उर्वरक के प्रयोग से पूर्व मिट्टी परीक्षण अवश्य करायें। दुधारू पशुओं को प्रदूषित चारा एवं जलकुम्भी से बचावें। फसल अवशेष को जलावें नहीं कम्पोटिंग कर दें। मृत पशु को गढ्ढे में खोदकर दबा दें। मल-मूत्र को खाद में बदल दें। कल कारखानों के अपद्रव्यों में जलकुम्भी उगायें।

इस संदर्भ में ज्ञातव्य हैं कि बढ़ती हुई जनसंख्या औद्योगिक विकास आदि के कारण पर्यावरण प्रदूषित होता जा रहा है और देश के विकास के साथ यह समस्या जटिल होती जा रही है। खेती में भी प्रदूषण रूपी जहर तेजी से फैल रहा हैं क्योंकि खेती को प्रभावित करने वाले पर्यावरण के सभी घटक जैसे वायुमंडल, जल मंडल, स्थल मंडल, जैव मंडल इत्यादि प्रदूषण के शिकार हो रहे हैं। सिंचाई, जल, मिट्टी, फसलें, पशु, खाद्य पदार्थ आदि सभी प्रदूषित हो रहे हैं। खेती में प्रदूषण को नहीं रोका गया तो मनुष्य का अस्तित्व ही खतरे में पड़ जायेगा। अत: खेती में प्रदूषण को रोकना आवश्यक है। इसके लिये पर्यावरण के सभी घटकों के प्रदूषण की जानकारी आवश्यक है।

[1] असिस्टेन्ट प्रोफेसर मृदा विज्ञान
[2] असिस्टेन्ट प्रोफेसर मृदा विज्ञान
[3] एसोशिएट प्रोफेसर मृदा विज्ञान
[4] एसोशिएट प्रोफेसर दुग्ध विज्ञान
काशी हिंदू विश्वविद्यालय, वाराणसी 221005 एवं उदय प्रताप स्वायत्तशासी कालेज, वाराणसी 221002

1–वायुमंडलः– पर्यावरण का प्रमुख घटक जो खेती को प्रभावित करता है वायुमंडल कहलाता है। वायुमंडल का प्रदूषण खेती में भी फैलता है। कल–कारखानों या अन्य श्रोतों से निकली विभिन्न प्रकार की गैसें जैसे सल्फर डाई आक्साइड, नाइट्रोजन के आक्साइड तथा अन्य हानिकारक पदार्थ जैसे भारी धातु (लेड, कैडमियम, क्रोमियम आदि), अम्ल, धूल, ईधन कार्बन के कण वायु मंडल को प्रदूषित कर देते हैं। जो फसलों पर अत्यन्त हानिकारक प्रभाव डालते हैं। व्यस्त सड़कें जिन पर मोटर गाड़ियाँ अधिक चलती हैं उनके किनारे की खेती मुख्यतः भारी धातु जैसे लेड द्वारा प्रभावित होती है। इन फसलों में लेड की प्रधानता होती है। जो फसलों को प्रदूषित कर देती है। वायुमंडल में फंसे बारीक कण पत्तियों पर गिरते है तथा उनके छिद्रों को बन्द कर देते हैं। जिससे श्वसन क्रिया अवरुद्ध हो जाती है एवं पौधे मर जाते हैं।

2–जल मंडलः– प्रदूषित जल मंडल के सम्पर्क में आने वाली मिट्टियाँ, फसलें आदि सभी प्रदूषित हो जाती हैं। इसलिए जल को प्रदूषण से बचाना चाहिए। जल के प्रदूषण के अनेक कारण है। इनमें प्रमुख हैं– उद्योगों (कल कारखानो) से निकलने वाले तरल एवं ठोस अपद्रव्य तथा सामुदायिक कूड़े–कचरे, सीवेज–स्लज इत्यादि। ऐसे पदार्थों में अनेक हानिकारक धातु, विषैले पदार्थ, रोगाणु आदि होते हैं जो सिंचाई जल को प्रदूषित कर देते हैं। प्रदूषित जल मिट्टी, फसल, पशु, तथा वनस्पति उत्पाद को प्रदूषित कर देता हैं। शोध कार्यों से हमने यह निष्कर्ष निकाला है कि पूर्वी उत्तर प्रदेश के वाराणसी (मंडल) के अनेक जल श्रोत प्रदूषित हैं तथा इनमें भारी धातुओं की अधिकता है। मुगलसराय, रामनगर, शिवपुर, जी. टी. रोड आदि क्षेत्रों में लेड धातु की अधिकता है। जबकि कालीन उद्योग क्षेत्र में क्रोमियम की अधिकता है। मिट्टी तथा फसलों में भी इन धातुओं की अधिकता है। जल श्रोतों में उगने वाली जल कुंभी विभिन्न धातुओं द्वारा प्रदूषित है। यहां के कुछ जल श्रोतों में लवण तथा क्षार की अधिकता है, जिनमें सोडियम के कार्बोनेट एवं बाई कार्बोनेट भी उपस्थित हैं। बेारान की भी अधिकता है तथा कैल्शियम भी कम है।

3–स्थल मंडलः– यह खेती को प्रभावित करने वाला पर्यावरण का तीसरा मुख्य खण्ड है, जो तेजी से प्रदूषित हो रहा है। मुख्य रूप से रासायनिक उर्वरकों और अनेक कृषि रसायनों के अविवेक पूर्ण प्रयोग से मिट्टी में प्रदूषण हो रहा है। प्रदूषित मिट्टी, फसल, उपयोगी जल, जीव–जन्तु एवं सूक्ष्म जीवों आदि को प्रदूषित कर देती है। इस संदर्भ मे नाइट्रेट की विशालता उल्लेखनीय है। फास्फेटिक उर्वरकों के अविवेक पूर्ण प्रयोग से मिट्टी में भारी धातुओं जैसे कैडमियम की अधिकता हो जाती है, जो अत्यंत

हानिकारक होते हैं। कल कारखानों से निष्कासित ठोस व तरल अपद्रव्यों को बगैर उपचारित किये मिट्टी में विर्सजन से भी मिट्टी प्रदूषित हो जाती है। क्योंकि इन अपद्रव्यों में उपस्थित भारी धाातु (Cd, Pb, Cr, Hg, As,Zn etc.) तथा अन्य विषैले पदार्थ मिट्टी में आ जाते हैं। नहरों के अनेक जल श्रोतों में लवण और क्षार की अधिकता होती हैं एवं बोरान की मात्रा भी अधिक है तथा कैल्शियम की मात्रा कम है। ऐसे जल से सिंचित भूमि ऊसर हो रही है तथा इन पर फसलोत्पादन बाधित है।

शोध-कार्य से यह भी निष्कर्ष निकलता है कि इस क्षेत्र के भैंस और गाय का दूध भी प्रदूषित हो रहा है। प्रदूषित चारे, प्रदूषित जल श्रोतों व जल कुम्भियों के सम्पर्क में आने वाली भैंसों के दूध में (Cd, Pb, तथा Cr,) की अधिकता है। जल कुम्भी को ये जानवर खाते हैं, जिससे इनमें उपस्थित भारी धातु रक्त से दूध तक पहुँच जाती हैं। इसी प्रकार यह भी पाया गया कि उन्नतशील नस्ल की गायों की अपेक्षा स्थानीय नस्ल की गायों का दूध अधिक प्रदूषित है। इनमें वे धातु अधिक मात्रा में उपस्थित होते हैं जिनसे शाक-सब्जियाँ प्रदूषित हो गयी हैं। मूली, गाजर, गोभी अत्यधिक प्रदूषित है। बकरी के लीवर, किडनी, रक्त दूध आदि में भी इन धातुओं की अधिकता हो गयी है।

खेती में प्रदूषण की रोकथाम

इस क्षेत्र में शोध-कार्य बहुत कम हुए हैं। अत: रोकथाम की निश्चित विधियाँ नहीं है। फिर भी कुछ सुझाव दिये जा रहे हैं। जैसे -

1. यदि भूमि कृषि रसायनों द्वारा प्रदूषित हो रही है तो उसमें उन रसायनों का प्रयोग बंद कर देना चाहिए। उर्वरकों का प्रयोग विवेकपूर्ण ढ़ंग से करना चाहिए। मिट्टी का परीक्षण समय-समय पर कराते रहना चाहिए तथा परीक्षण परिणाम और संस्तुति के अनुसार ही उर्वरकों का प्रयोग करना चाहिए।
2. कल कारखानों तथा अन्य श्रोतों से प्राप्त ठोस तरल अपद्रव्यों (कचड़ा) को उपचार के पश्चात ही उपयोग में लाना चाहिए। इससे अपद्रव्यों से विषैले पदार्थ अलग हो जाते हैं, जिससे मिट्टी प्रदूषित नहीं होती है।
3. मल-मूत्र युक्त गंदे अपद्रव्यों का निष्कासन सीधे मिट्टी में नहीं करना चाहिए। पहले इन्हें गढ्ढे में एकत्रित कर उसमें जलकुम्भी उगा सकते हैं। बाद में जल कुम्भी का अन्य अपद्रव्यों के साथ कम्पोस्ट बना लेना चाहिए। मल-मूत्र में पोषक तत्वों की प्रचुर मात्रा उपस्थित होती है। अत:

इनसे कम्पोस्ट बनाया जा सकता है। और खेत में खाद के रूप में उपयोग करके मिट्टी को उपजाऊ बनाया जा सकता है। चीन में यह तरीका सदियों से प्रयोग हो रहा है। हम भी इसे अपनाकर लाभ उठा सकते हैं तथा पानी को प्रदूषण से भी बचा सकते हैं। कम से कम गांव के किसान खेतों में मल त्याग के पश्चात उसे अवश्य ढ़क दें । इससे जल प्रदूषण से बचा जा सकता है। तथा मिट्टी की भी उर्वरा शक्ति बनी रहेगी ।

4. सिंचाई में सावधानी:- सिंचाई के लिये जितने जल की आवश्यकता हो उतना ही जल इस्तेमाल करें अधिक नहीं। सावधानी पूर्वक सिंचाई करें, जिससे कि मिट्टी द्वारा पानी शोषित हो जाय। कृषि रसायनों तथा उपजाऊ मिट्टी की परत जल के साथ बहकर अन्य जल श्रोतों में न जाय, अन्यथा भूमि मे क्षार की मात्रा अधिक हो सकती है। अत: सिंचाई जल के प्रयोग से भूमि ऊसर हो जायेगी। ऐसा नहर के क्षेत्रों में पाया गया है।

5. जलकुम्भी का सदुपयोग: - यद्यपि जलकुम्भी स्वंय कोई प्रदूषक नहीं है। लेकिन नदियों नहरों के पानी को स्थिर बनाकर उसमें प्रदूषण की तीव्रता को बढ़ावा देती है। अत: जलकुम्भियों को समय-समय पर निकालते रहना चाहिए तथा अन्य जैव अवशेष के साथ कम्पोस्ट बनाते रहना चाहिए। जलकुम्भी में सभी पोषक तत्व समुचित मात्रा में उपस्थित होते हैं। अत: खाद के रूप में परिवर्तित होने पर इसमें मिट्टी को उपजाऊ बनाने की क्षमता होती है।

   जिप्सम और पायराइट्स के साथ जलकुम्भी का ऊसर भूमि पर प्रयोग करके उसे सुधारा जा सकता है। इस क्षेत्र में हमने ऐसे कुछ प्रयोग किये हैं, जिसके करने से ऊसर भूमि सुधर गयी और उस पर धान गेहूं की खेती आसानी से की जा रही है। जलकुम्भी जल से प्रदूषकों को भी शोषित कर लेती है तथा कम्पोस्ट में परिवर्तित होने पर खेत को उपजाऊ बनाती है।

6. खरपतवार नष्ट करने के लिए कृषि रसायनों के प्रयोग से बचें। समयानुसार खरपतवार निकाल देने से इन रसायनों के प्रयोग एवं कुप्रभावों से बचा जा सकता है।

7. जहरीले कृषि रसायनों का प्रयोग करने के पश्चात उनके पैकेट को गढ्ढ़ों में जलाकर वहीं पर मिट्टी से ढ़क दें। छिड़काव में प्रयुक्त उपकरणों को जल श्रोतों से दूर धोवें, जिससे जल श्रोत प्रदूषण मुक्त रहें।

8. कीटनाशक तथा अन्य जहरीले रसायनों के छिड़काव के पश्चात कृषि उपज को कम से कम 5 दिन पश्चात ही उपयोग में लावें या बाजार भेजें। अच्छी तरह से धोने तथा उबालने से कृषि रसायनों का प्रभाव कम हो जाता है।

9. मृत पशुओं को गढ्ढ़ा खोदकर दबा देना चाहिए, जिससे भूमि के अंदर ही अपघटित हो जायें तथा पर्यावरण को प्रदूषित न करें।

10. प्रदूषित जल श्रोतों तथा जलकुम्भी के सम्पर्क से दुधारू पशुओं को बचावें। शोध-कार्यों से पता चला है कि जलकुम्भी को दुधारू पशु जब खाते हैं तो दूध में भारी धातुओं की मात्रा बढ़ जाती है।

11. प्रदूषित मिट्टी में सगंधा पौधों की खेती:- कृषि रसायनों, कीटनाशी औद्योगिक जलमल तथा अन्य विषैले तत्वों द्वारा प्रदूषित मिट्टी में सब्जियों के स्थान पर सगंधा पौधों की खेती की जा सकती है और अपेक्षाकृत अधिक लाभ कमाया जा सकता है। क्योंकि यह बहुत महंगा बिकता है एवं निर्यात भी होता है। इसलिए सगंधा पौधे उगाये जाने चाहिए। चूंकि सगंधा पौधों में सुगंधित तेल पाया जाता है जो अधिकांशत: सुगंध के लिए प्रयोग किया जाता है। इसलिए इससे प्रदूषण का कोई खतरा नहीं है।

12. वृक्षारोपण करना चाहिए। इससे प्रदूषण को कम किया जा सकता है। क्योंकि वृक्ष कार्बन डाइआक्साइड को प्रकाश संश्लेषण की क्रिया के दौरान ग्रहण कर लेते हैं और पर्यावरण को शुद्ध कर देते हैं।

13. जैविक खाद तथा रसायनिक उर्वरकों का संतुलित प्रयोग करना चाहिए। जहाँ तक संभव हो इसका समन्वयित प्रयोग करना चाहिए।

14. अम्लीय मिट्टी का सुधार चूना एवं चूने के यौगिक द्वारा किया जाना चाहिए। ऐसा करने से प्रदूषण कम रहता है और फसल उत्पादन भी अच्छा होता है।

कृषि व्यापार को प्रोत्साहन

डा0 योगेन्द्र सिंह चौहान*
एवं डा0 रीता सिंह**

हमारे पूर्वजों ने कृषि यंत्र का नाम 'हल' रखा जिसका अर्थ भारतीय समस्याओं का 'हल'। विदेशियों ने भी कृषि को एक अलग सभ्यता के रूप में माना इस लिए नाम रखा एग्रीकल्चर जो आर्थिक, सामाजिक, राजनीतिक, धार्मिक आदि सभी को समाहित किये हुये है। वर्तमान समय में भी भारत की सम्पूर्ण आबादी के लगभग 60-70 प्रतिशत लोग प्रत्यक्ष एवं परोक्ष रूप से कृषि से जीवन यापन कर रहे।

आज से लगभग 25 सौ वर्ष पहले यूरोपीय देश यूनान का रहने वाला 'मेगास्थनीज' भारत आया। उसने अपनी पुस्तक इण्डिका में लिखा है कि "भारत में किसानों को समाज में विशेष सम्मानित स्थान प्राप्त है। राजा जब दरबार में आता है सबसे पहले किसानो तथा कारीगरों से मिलता है। युद्ध के समय में भी उनके काम में बाधा नही आने दी जाती, निसंकोच अपना काम करते है। इस तरह उपज पर कोई असर नही पड़ता। यदि कोई किसान अथवा कारीगर का हाथ काट लेता, आँख फोड़ देता तो उसका दण्ड केवल मृत्यु दण्ड ही था। नदियां बड़ी-बड़ी हैं, जो जहाजरानी के काम आती है। भारत में कभी अकाल नही पड़ता है, क्योंकि यहां के लोग ऐसी अपदाओं से बचने के लिये पहले से ही उपाय कर लेते है। रोजगार के रूप में खेती का समाज में इतना ज्यादा प्रचलन एवं महत्व है कि कभी-कभी बैलों की जोड़ी के बदले मे भी विवाह हो जाते है। व्यापार के क्षेत्र में संसार का केन्द्र बिन्दु ढांका माना जाता है। ढांके की मलमल पूरे विश्व में अपना अलग स्थान रखती है। ढांके से चलकर पूरे विश्व में एक मार्ग जाता है जिसका हर देश में नाम रेशम मार्ग है। इस मार्ग पर व्यापार के लिए ऊंट, घोड़ा, रथ, पैदल, खच्चर, आदि यात्री ज्यादा तर माल के साथ चला करते है। मनुष्य की आयु लगभग हाथी के बराबर कभी-कभी 200 वर्ष से भी अधिक होती है। लम्बी आयु का मुख्य कारण सादा जीवन, आयुर्वेदिक दवाईयों, जड़ीबुटियों आदि का उपयोग बताया है।"

इसके बाद चीनी यात्री फाहियान 405 ईसवी में भारत आया वो देखकर आश्चर्य चकित रह गया कि यहाँ पर पशु पक्षियों तक के लिये निःशुल्क चिकित्सालय खुले हुए है। जिस समय

* रिटायर्ड प्रोफेसर एवं विभागाध्यक्ष, कृषि अर्थ शास्त्र विभाग, चन्द्र शेखर आजाद कृषि एवं प्रौद्योगिक विश्व विद्यालय कानपुर नगर

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फाहियान ने नि:शुल्क चिकित्सालय की बात कही उसके 500 वर्ष बाद तक भी यूरोप में नि:शुल्क चिकित्सालयों का नाम तक नही था। यात्रियों के लिए सड़कों पर धर्मशालायें हैं जहाँ भोजन तथा ठहरने की मुफ्त व्यवस्था है।

इसके पश्चात यूरोपीय यात्री मॉर्को पोलो 13वीं सदी में भारत आया वह लिखता है कि "गुजरात के व्यापारी संसार में सबसे सच्चे और ईमानदार व्यापारी हैं। भारत की सबसे बढ़िया मारकीन तेलगू प्रदेश की है। अरब और चीन के जहाजों का बन्दरगाहों पर जमघट लगा रहता है। आयुर्वेदिक दवाईयाँ, जड़ी-बूटियाँ, सुगन्धित तेल, खाने वाले तेल मसाले, आदि तमाम उत्पाद जो भारत की कृषि से सम्बन्धित हैं उनका निर्यात होता है। माल की दस्युओं से रक्षा के लिए नाविक सेना साथ-साथ चलती है, जो आगे चलकर नेवी कहलायी मात्र भारत के पास है।

रेल्फफ्रिच एक अंग्रेज अकबर के शासन काल में भारत आया। वह आगरा और बंगाल के बीच व्यापार के लिए चलने वाली नावों का भी उल्लेख करता है। उसने स्वयं 180 नावों के एक बेड़े में आगरे से बंगाल की यात्रा की है। इस प्रकार नदियों एवं नावों के द्वारा भी देश के अन्दर की कृषि उत्पादों आदि को एक जगह से दूसरी जगह पहुँचा कर आपूर्ति किया जाता है। बाहरी अन्य देशों के लिये पानी के जहाजों की मजबूत व्यवस्था थी।

उपरोक्त सूक्ष्म विवेचना से स्पष्ट है कि जो आधुनिक विदेशी एवं देशी इतिहासकार लगातार दर्शाने की कोशिश करते है कि भारतीय आपस में सदैव लड़ते-झगड़ते रहे हैं, यह शतप्रतिशत गलत है। सम्पूर्ण राष्ट्र में माल के उत्पादन तथा वितरण एवं विदेशों में निर्यात की एक समुचित व्यवस्था थी। इसके अलावा आपसी रिश्ते जैसे मित्र, अतिथि, पड़ोसी आदि के सम्बन्ध में मजबूत मानक निर्धारित थे। विदेशी आक्रमणकारियों के आने के पश्चात हमारी कृषि एवं व्यापार तबाह कर दिये गये। यूरोपीय यात्रियों में प्रसिद्ध फ्रांस का एक चिकित्सक वर्नियर शाहजहाँ के शासन काल में अन्तिम दिनों में आया वह लिखता है कि "कभी-कभी किसानों और शिल्पकारों को जीवन की मूल आवश्यकताओं से भी वंचित कर दिया जाता है प्रान्तीय सूबेदार बड़े अत्याचारी है इन्हे असीम अधिकार प्राप्त है।"

अंग्रेजों के आने तक बहुत हद तक भारत का कृषि एवं व्यापार उन्नत स्थिति में था। सिटिलमेन्ट रिपोर्ट फर्रूखाबाद सन् 1875 में एक अंग्रेज कृषि वैज्ञानिक लिखता है कि 'कुरमी कल्टीवेटर आफ इण्डिया इस बेस्ट कल्टीवेटर आफ द वर्ड' नेता श्री सुभाष चन्द्र बोस ने भी अपने एक भाषण में स्पष्ट कहा कि भारत के किसानों को कुछ नहीं चाहिये केवल जरूरत पड़ने पर

सस्ती दर पर कर्जा दे दीजिए वह स्वयं सब करने में सक्षम है। अंग्रेजों ने सन् 1894 में किसानों से जबरिया भूमि छीनने का कानून पास कर दिया वह आज भी लागू है। हमारी सरकारें किसानों से जमीन छीनकर देशी एवं विदेशी कंपनियों को दे रही हैं।

आजादी के बाद देश का बटवारा हुआ उसमें विश्व की सर्वाधिक उपजाऊ जमीन पाकिस्तान को दी गई। जमीन 23 प्रतिशत तथा आबादी मात्र 18 प्रतिशत स्थानान्तरित हुई। कपास का उत्पादन पाकिस्तान में चला गया, लेकिन कारखाने भारत में ही रह गये। इस प्रकार भारत के साथ लम्बा खेल खेला गया। व्यापार में सर्वाधिक महत्वपूर्ण केन्द्र पूर्वी पाकिस्तान जिसे आज-कल बागलादेश कहते हैं बटवारे में दे दिया गया। भारत की कृषि को बटवारे के समय व्यापार के दृष्टिकोण से बहुत बड़ा झटका लगा।

स्वतंत्रता के बाद भी कृषि क्षेत्र को महत्व नहीं दिया गया और गलत नीति अपनायी गयी। नब्बे के दशक में एन.डी.ए. सरकार द्वारा सुधारात्मक कदम उठाते हुए कृषि ऋण पर 30 प्रतिशत से भी अधिक चक्रवृद्धि व्याज की जगह मात्र 8 प्रतिशत कर दिया गया जिसके परिणाम स्वरूप पूरे देश के कृषि क्षेत्र में व्यापक समृद्धि हुई। यह विश्व के कई देशों को अच्छा नहीं लगा। जबकी किसी भी देश में 5-6 प्रतिशत की दर से अधिक व्याज नही है। जापान आदि कई देशों मे मात्र 2-3 प्रतिशत व्याज दर है। अमेरिका अपने किसानों को पैदावार से अधिक सब्सिडी देता है। हमारे यहाँ किसानों को खाद पर भी सब्सिडी देने पर पूरा संसार विरोध करता है। इन बातों से पूरे संसार की नीति एवं नियति भारत के प्रति स्पष्ट हो जाती है। एन.डी.ए. सरकार के पश्चात पुनः ब्याज की दरो में वृद्धि प्रारम्भ हुई और मार्च 2010 के बाद दसवीं बार सरकार द्वारा ब्याज की दरें बढ़ायी गई। ऐसी परिस्थिति में भारतीय किसान किस प्रकार जिन्दा रह सकता, व्यापार की तो बात बहुत दूर की है।

वर्तमान समय भारतीय किसान महंगाई, उच्च ब्याज दर, भ्रष्टाचार, जबरिया सरकार द्वारा जमीन अधिग्रहण आदि संकटों से जूझ रहा है। इसलिए देश के कई क्षेत्र बड़े-बड़े किसानों के लिये सुसाइड जोन बन गये हैं।

सबसे मुख्य बात यह है कि विदेशियों को पूरा पता है कि जब तक भारत का किसान मजबूत रहेगा तो हमारी दाल किसी प्रकार से गलने वाली नहीं है। आजादी के दौरान भी किसानों तथा किसानों से सम्बन्धित जमींदारों का भारी योगदान रहा है। किसानों की फौज बनाकर छोटे-छाटे राजाओं तक ने अंग्रजों को सैकड़ों जगह घुटने ही नहीं टिकाये बल्कि बुरी तरह परास्त किया। जिसके परिणाम स्वरूप अंग्रेजों ने भारत की कृषि को योजना पूर्वक तबाह किया। स्वतंत्र भारत में

भी औद्योगिक घरानों को लाभ पहुँचाने के लिए विकास के नाम पर अत्यन्त अच्छी खेती की जमीन को किसानों से छीन कर बरबाद की जा रही है। विरोध करने पर गाँव के गाँव आग के हवाले अथवा उजाड़े जा रहे है। अलीगढ़ एवं नोएडा में घटित घटनायें इसकी प्रत्यक्ष उदाहरण हैं।

पूंजीवाद व्यवस्था के अन्तर्गत किसानों से जमीन छीनकर बड़ी-बड़ी फैक्टरियाँ लगाई जाती हैं तो दूसरी तरफ समाजवादी व्यवस्था के अन्तर्गत कम्यूनिष्टों द्वारा मालिक तथा नौकर झगड़ा कराकर बन्द करा दी जाती हैं। तब न फैक्टरी रहती है न ही किसानों की जमीन। किसी भी देश को नष्ट करने के लिए यह दोनों व्यवस्थायें जानबूझकर आगे-पीछे चलाती हैं। ये दोनो ही व्यवस्थायें अशान्ति और अत्याचार की जनक हैं। जिसमे पूरा देश जल्द से जल्द भूखों मरने लगता है।

इससे कोई दो राय नही किसी हद तक किसानों को कृषि वैज्ञानिकों ने पूरी-पूरी राहत देने तथा मदद करने की कोशिश की लेकिन सरकार का सही सहयोग न मिलने के कारण आज किसान, विकट संकट में फंसे हुये है। किसी न किसी रूप में एक होकर सभी की भलाई के लिये संघर्ष तो करना ही पड़ेगा।

संदर्भ

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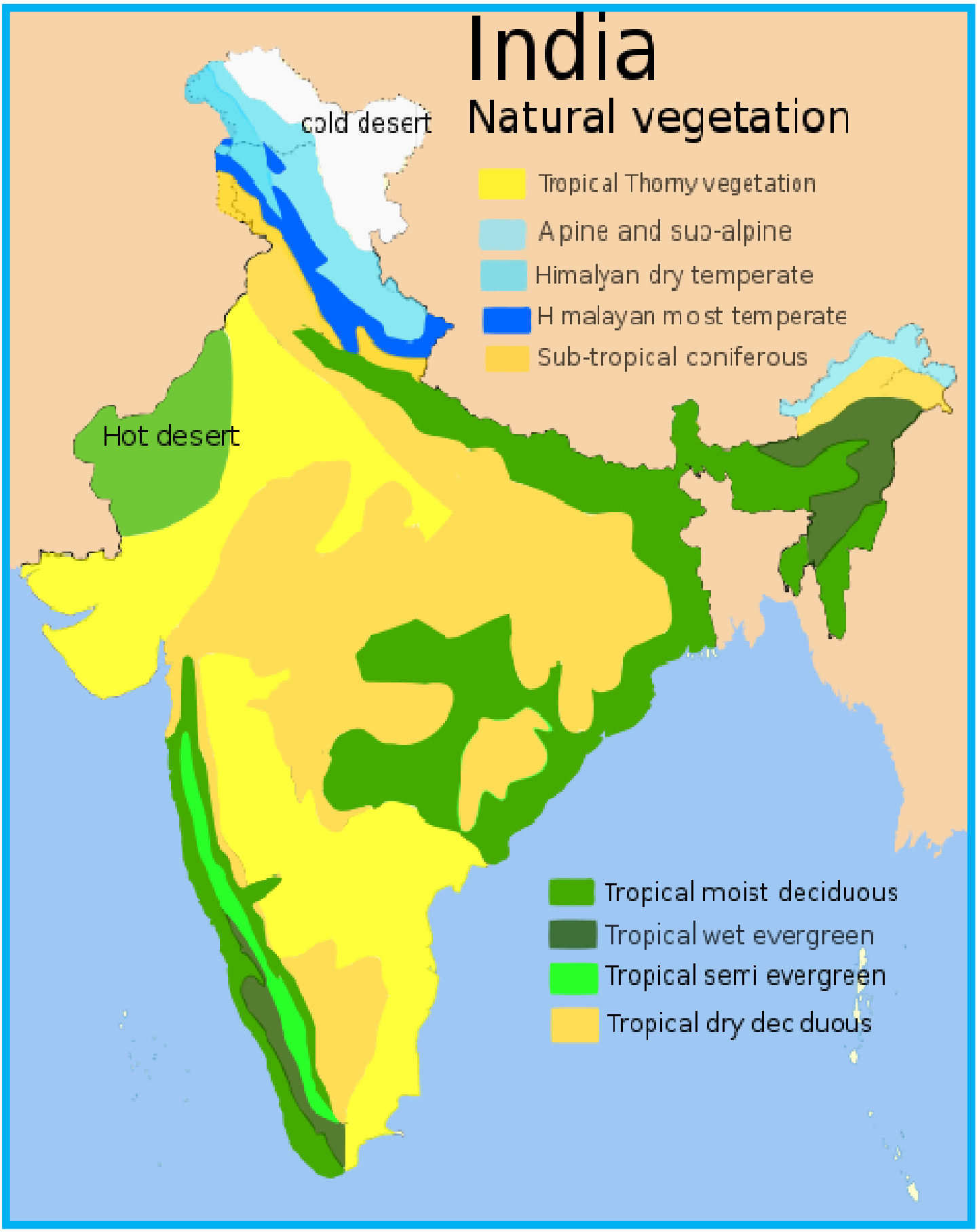
   अर्थ व्यवस्था कृषि और उद्योग


India
Natural vegetation
cold desert
Tropical Thorny vegetation
Apine and sub-alpine
Himalyan dry temperate
H malayan most temperate
Sub-tropical coniferous
Hot desert
Tropical moist deciduous
Tropical wet evergreen
Tropical semi evergreen
Tropical dry dec duous