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GREEN REVOLUTION: AN IMPACT ON THE ENVIRONMENT

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Abstract: **In the pre-indeoendence period, Indian agriculture was usually described as a gamble with monsoons. There used to be a great. deal of uncertainty about crop prospects, as monsoons played a decsive role in determining agricultural output and resulting in widespread famine and misery. As the green revolution was launched in Indias, substantial increase and production of food grains was achieved through the use of improved crop varieties and higher levels of inputs of fertilizers and plant protection chemicals. If society wishes to reduce environmental problems by recycling organic materials, it must either subsidize their use or offer some incentives to the farmer.**

Keywords: **Green Revolution, Indian agriculture, fertilizers, plant protection chemicals, environmental problems, organic materials.**

1. INTRODUCTION

Agriculture has been the basic source of subsistence for man over thousand of years. It provides a livelihood to half of the world's population even today. According to the food and Agricultural Organisation (FAO), People in the developing world, where the population increase is very rapid, may face hunger if the global food production does not rose by 50-60 per cent by the year 2040 AD. The contribution of developing countries to world Agricultural production in 1975 was about 38 per cent, while that of developed countries, which account for 33 per cent of world's population, was 62 per cent. Only those countries which can match the demand of the increasing population with increase production can escape mass hunger.

1.1. The Green Revolution

After the green revolution was launched in India, substantial increase in the production of food grains was achieved through the use of improved crop varieties and higher levels of inputs of fertilizers and plant protection chemicals. But it has now been realised that the increase in production was achieved at the cost of soil health and that sustainable production at higher levels is possible only by the priper use of factors which will help to maintain the fertility of the soil. In fact, about 60 per cent of our agriculture land currently under cultivation suffer from indiscriminate use of irrigation water and chemical fertilizers. The gravity of environmental degradation resulting from faulty agricultural practices has caused alarm among the concerned farmer scientists and conservationists and greater viable and sustainable farming systems has become a necessity. There has been a series of seminars and policy conference on this issue. One such alternative agriculture system which will help to overcome the problems of soil degradation and declining soil fertility is organic farming and ecological agriculture.

1.2. Indian Agriculture before the Green Revolution

Our traditional farming systems were characterised mainly by small and marginal farmers producing food and basic animal products for their families and local village communities. Farming was highly decentralised with indivisual farmers deciding on the types of crops to grow depending on climate and soil condition. These traditions consisted of methods of controlling pests and disease, and for building soil fertility and structure in their own ingenious ways, since farming did not include the use of chemical pesticides or fertilizers. Rather, soil health and pest control were achieved using practices such as shifting cultivation, conservation, the use of animal manures and farm wastes and the introduction of legumes into crop rotations. By growing a mixture of crops in the fields, early farmers insulated themselves from total crop failure caused by weather or pest epidemics. Even, Alexander walker, resident at baroda in Gujrat, wrote in 1820 that green fodder was being grown throughout the year; intercropping, crop rotation, fallowing, composting and manuring were practised; all these allowed continued farming on the same land for more than 2000 years without drop in yields. further, the crops were relatively free from pests. one of the reasons for the decline in their sustainable system of agriculture was the land revenue colleted by the British. A tax of 50 per cent and sometimes as much as 63 per cent revenue was collected and hence more than a third of the irrigated land went out of production. Similarly, an environmentally stable form of tree and forest conservation, which had been developed over the ages, crumbled. Even sacred groves were turned into coffe, tea, teak wood and sugarcane plantations. hence, from 1865 through 1900 India experienced the most severe series of protracted farmines in its entire history.

2. MATERIALS & METHODS

To increase the agricultural production in the country and to meet the requirement of the expanding population, it became imperative to change the methodologies. These involved the use of high-yielding varieties and higher fertilizer dosages; increasing the irrigated area and intensive cropping; bringing large areas under one crop; growing crop in non-conventional areas; and changing the crop sequence. The green revolution followed the development of commercial agriculture in the developed countries after World War II. Chemical companies that developed highly toxic and life damaging chemicals for the purpose of warfare, decided to turn their attention on the chemical control of insect. pests and unwanted plants in the farmers fields. In addition the production of petroleum based fertilizers by oil companies was used to replace composts and manures. The food grain production increased dramatically as the policies of green revolution began to take effect. By the year 2040, India will need to produce 230 million tons of food grains on 140 million hectares of agricultural land in order to feed an estimated 1.5 billion Indians.

This achievement, through remarkable, has also costed us dearly. Along with the increase of food grain production pesticide consumption in India also increased considerably. In 1932 nearly 200 metric tons of chemical peticides were used, but by 1975 it was 25,000 metric tons, an astounding 375 fold increase over 30 years. It is estimated that this will touch 200,000 tins by the year 2000. Despite increasing use of pesticides, annual crop lossed due to pests still amount to more than Rs. 15,000 crores.

Consumption of chemical fertilizers has gone up seven times in the last 20 years, but production has only increased a miserable two-fold while we now have enough food ourselves and are concentracting on broadening our food exports, we have apparently sadly overlooked on equitable food distribution to our hungry millions. It is quite unfair to balance our country's trade deficit, caused by expanding imports of petroleum-based products with food exports at the expence of making the same available for local consumption. The modern agricultural techniques such as use of synthetic fertilisers and peticides are continuing to destroy stable traditional ecosystems and the use of high yielding varieties of crop has resulted in the elimination of thousand of traditional varieties, with the concurrent loss of genetic resources. In the past, our fore-farthers were consuming chemical-free foods, but now a large quantities of chemical residues getting into the food chain and toxic residues in agricultural commodities is an issue of major concern to everybody.

Our major concern is to meet the internal demands of farm production without degrading the productive environment. Sustainability issue have become highly relevant even under the low input use situation. There is hardly any scope of finding new land area suitable for cultivation. Since the ability of the land to produce food is limited and the limits of production are set by soil and climatic conditions, there are critical levels of population that can be supported in perpetuity from any given land area. Any attempt to produce food in excess for the restrictions set by soil and climatic consition will in the long term, result in failure Degradation of land, hunger and eventual reduction in Population are the outcome of such practises. However, the application of technological innovations in the form of new seeds, fertilizers irrigation and

suitable management strategies has bailed such catastrophic prediction in the past. This underscores the tremandous potential of science and shows the possibility of meeting the demands put on our farm production systems without reducing its sustainability, through scientific research.

The progress in Indian agriculture during the last 40 years can be broadly classified under three areas: First, progress in developing the research and educational infrastructure, essantial for generation and testing technologies suitable for different agro-ecological regions; secondly, a reasonably efficient input production and delivery system for the production and distribution of seeds fertilisers and other inputs. Thirdly, evolving policies essential for stimulating higher production by small farmers and increased consumption by the riral and urban poor. Thanks to these steps, growth of food production has on the whole remained above the rate of population growth. Statistics on agricultural production in India from 1960 to 1988 show that during the peried (a) the gross cropped area increased marginally; (b) the area under irrigation nearly doubled; (c) the high yielding variety programme, initiated at the national leve; in 1966, increased to nearly 39 per cent of the cropped area; (d) the total food production increased from 74 millions tonnes to nearly 192 millions tonnes; and (e0 both the fertilisers and pesticide to fertilizer remained nearly constant at 1:100. Interestingly, the use of pesticides in the public health sector which has higher than in the agricultural sector until 1966, become almost aqual in 1970 and declined significantly thereafter.the number of pesticide used in agricultural sector has always been more diversifield than in public health sector which used only DDT,HCH and malathion.

The introduction of high-yielding varieties changed the agricultural environment leading to number pest problem of economic importance. Many of these were either unknown or were of minor importance in the early 1960's Increased irrigation, higher usage of fertilizers and wide adoption of high-yielding varieties led to the resurgence of pests. The high-yielding varieties and the monoculture practices led to material change in the pest complex. pasts and diseases such as gall midge, brown plant hopper, bacterial blight and tungro virus of rice, which were of minor importance before the green revolution, suddenly assumed major proportions; for instance, spodoptera litura on cotton, maize and tobacco; pyrilla on wheat, maize and sorghum; apple scab and codling moth on apple and karnal bunt on wheat increased the crop lossed due to pests enormously. An important aspect of the resurgence of newer pests is the time-lag between the introduction of a new variety/agronomic practice and the actual manifestation of the pest epidemic. This varies with pet and crop. For example, in the rice bacterial whlt there was apractically no time-lag in the very fordt season of the introduction of Taichung Native-1 in Andhra Pradesh in 1963, when the disease broke out. In the case of the rice tungro virus, it took four to five years before the disease manifested itself in a virulent form. It took, however a decade for the brown plant hopper to become a major pest. Similarly, every variety of hybrid bajra, when released, was through to be tolerant/resistant to downy mildew, but within a few years all proved to be susceptible. Since the high-yielding varieties were more prone to pests and diseases, use of pesticides increased and this brought about (a) widespread occurrence of pesticide residues in nearly every agricultural commodity; (b) increase pesticide resistance in vectors; (c) resistance to pesticides in stored grain pests which was first reported in 1971 and by 1979 six major pests of stored grain became resistance to a number of insecticides and fumigants; and (d) pesticide resistance in pests of agricultural importance becoming an important constraint in increasing productivity. This is true specially for the polyphagous pests such as Spodoptera litura (tobacco caterpillar); Plutella xylostella (diamond back moth) and Holicoverpa (Heliothis) armigera (American boll worm). It is suspected that Aphis craccivora (back aphid), a serious pest of pulses, and Lipahis erysimi (Mustard aphid) have also developed resistance to pesticides.

3. DISCUSSION

3.1. The ills of green revolution are stated to be:

- reduction in natural fertility of the soil
- destruction of soil structure, aeration and water holding capacity
- susceptibility to soil erosion by water and wind
- diminisshing returned on inputs (the ration of energy input to output halves every 10 years
- indiscriminate killing of useful insects, microorganisms and predators that naturally check excess crop damage by insect pests
- breeding more virulent and resistant species of insects
- reducing genetic diversity of plant species

- pollution with toxid chemicals from the agrochemicals and their production umits
- endangering the health of the farmers using chemicals and the workers who produce them
- poisoning the food with highly toxid pesticide residues
- cash crops displacing nutritious food crops
- chemicals changing the natural taste of food
- high inputs increasing the agricultural expences
- Increasing the farmer's work burden and tension
- depleting the fossil fuel resources
- increasing the irrigation needs of the land
- big irrigation projects often resulting in soil salinity and poor drainage
- depleting the ground water reserves
- lowering the drough telernace of crops
- appearance of 'difficut' weeds
- heightening the socio-economic disparities and land holding consentration
- high input subsidies leading to inflationary spirals
- increasing the political and bureaucratic corruption
- destroying the local culture (commercialization and consumerization displacing self-reliance)
- throwing financial institutions into disarray (as impoverished farmers demand write-off of loans)
- agricultural and economic problems sparking off social and political turmoil resulting in violence

3.2. Integration green revolution farming

Under this option, the basic trends of the green revolution such as intensive use of external inputs, irrigation, development of high yielding crop varieties and hybrid and mechanisation of labour inputs is obtained to limit damage to the environment and human health. For this purpose, some organic techniques are developed and combined with the high input technology in order to create integrated systems such as 'Integrated nutrient management' (INM), 'Integrated pest management' (IPM) and biological control methods which reduce the need for chemicals. Modern biotechnology is also employed to develop higher yielding, pest resistant crop varieties. This option is possible for conditions, including fertile soils, climate and availability of necessary infrastrucutral facilities like irrigation.

4. RESULT

Soil organic matter is one of the important components of the soil. The dead plant and animal remains and dead microbial tissues form the main source of soil organic matter. Various organic manures like farmyard manure, compost, green manure atc. that are added to the soil from time to time further add to the store of organic matter. These added organics undergo a series of microbial decompositions and finally humus is formed (light bulky amorphous material of dark brown to black colour) Tropical soils are generally low in organic matter loams contain less then clay soils. The low organic matter is primary due to climate particularly dur to high temperature and secondarily due to cultural practices. Organic matter increase with rainfall.in tropical and sub-tropical regions, although much organic matter is produced, it decays very rapidly. Whatever organic matter added to the soil will be decomposed (Over 90 per cent in a year) and hence it is Herculean task to raise the organic matter content of ther soil. In cultivatable soils, the organic matter content ranges from less than 1` per cent to 15 per cent.

If society wishes to reduce environmental problems by recycling organic materials, it must either subsidize their use or offer some incentive to the farmer. It is now widely felt that most efficient crop production system and probably in the long run the most economical one, consists of a combination of organic and chemical fertilizers, combining the best aspects of both types of nutrient supply

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