An Indian Perspective of Sustainable Agriculture: A Mirage or A Concrete Truth

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Abstract

The needs and deeds of man often clash with each other. For the fulfillment of man's essential needs, nature has provided plenty of resources, but the reckless exploitation of natural resources endangers the survival of our future generations. This realization lead to development of the idea of sustainable development. Sustainable agriculture is an essential part of sustainable development. India is predominantly an agricultural nation which witnessed the success of Green Revolution. But, now Indian soils and waters have been degraded and we are now at cross roads where we have to choose between the conventional input intensive and environmentally insensitive agriculture and the nature friendly sustainable agriculture. But, there are certain doubts regarding, whether the sustainable agriculture will be able to bear the population pressure. The answer is yes, it is possible to produce enough food by using sustainable strategies.

Key words: Sustainable development, Sustainable agriculture, Soil degradation, Irrigation practices, Loss of crop diversity, Green revolution and Organic farming.

Introduction

'Sustain' means keep on going, but with a conscience i.e. whatever we are doing should be done while keeping in view its consequences. We have a right to utilize the resources, which Mother Nature has provided for our benefit. But that does not provide us with the excuse for selfish exploitation of resources. The Brundtland Report also emphasized on this theme while defining sustainable development. It contains within it two key concepts:

• The concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given;

• The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and the future needs (Brundtland Commission, 1987).

We should fulfill our basic needs and not desires. The desires are endless and sometimes even destructive. We all want to live the American Dream, which is that we want plenty of everything and everything in supersize. But, do we really need everything in supersize? More important is that, can developing nations like ours afford this supersizing and wastage of food!

The success of Green Revolution may have made India self-sufficient in food grains, but for how long? The rising population numbers, our soils sick status, depleting and polluting groundwater resources, changes in climate, environmental degradation and on top of this our new habit of patronizing big food outlets and adopting food wasting trends may all add up to spell trouble for Indian's self-sufficient status in food. Therefore, there arises a need to make our agriculture sustainable. In simple words, sustainable agriculture is one which fulfills man's food requirements without exhausting soil, water and other natural resources. It not only aims for commercial gains, but also considers the welfare of farmers and farming communities.

According to Pretty (1999) sustainable agriculture is multi-functional within landscapes and economics – it produces food and other goods for farm families and markets, but it also contributes to a range of public

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goods, such as clean water, wildlife, carbon sequestration in soils, flood protection, and landscape quality.

Francis and Youngberg (1990) defines sustainable agriculture as a philosophy that guides us to develop integrated, resource conservation, and equitable farming system based on previous experience and current knowledge. The overall goal of sustainable agriculture is to achieve food security while restoring soil resources, improving water quality, mitigating climate change and preserving soil/natural resources for long term use (Mishra, 2005).

Pretty (1997) mentioned that sustainable agriculture strives to achieve the minimization of use of external harmful inputs in agriculture and to replace them with natural processes like nutrient cycling, nitrogen fixation, etc..

Objectives

This research paper has following objectives:

1. This research paper highlights the problems resulting from chemically intensive agriculture being faced by India at national and regional levels.
2. It also emphasizes that how sustainable agricultural practices can provide solution to these problems.
3. It also stresses on the need for adopting sustainable measures at national and at regional levels.

Methodology

This is an analytical geographic thought paper on sustainable agriculture in general and it's feasibility in India in particular. This paper presents the views of different scholars and authors of this paper on sustainable agriculture. The qualitative thoughts presented have been supported by quantitative data presented in table form which has been modified where ever required.

The Study Area

India, the seventh largest country of the world, is located in South Asia and it lies entirely in the northern hemisphere. It is fringed by Arabian Sea in the west, the Bay of Bengal in east and the Indian Ocean in the south. Certain states of India like Punjab and Haryana that are now suffering from adverse effects of chemical intensive agriculture and other environmental problems have been studied at regional level. These states once celebrated the success of green revolution and now they can be pioneers of the sustainable revolution.

Sustainable Agriculture: A Mirage or A Reality

Some of us are not yet ready to accept that we live in an unsustainable world. In, 2011 the world population has crossed the 7 billion mark. These rising numbers are what make this world more unsustainable. There is a need to curb these rising population numbers as well as to educate the masses to maintain a reasonable lifestyle, if we want to achieve our dream of a sustainable planet. The term 'Sustainable Development' was first used in 1980 in the World Conservation Strategy. It is development, which achieves ecological sustainability while striving to meet society's other needs. This goal of sustainable development was also adopted by United Nations under Agenda 21 of the 1992 'Earth Summit' held at Rio de Janerio.

Today, sustainable development has become widely accepted term, but when it comes to its implementation, there arises certain problems. These problems with sustainable development have been often enough stated. As currently defined, it is so broad and generally applicable that its inherent vagueness renders it inoperative, and open to conflicting interpretations (Dovers and Handmer, 1992). The ambiguities in definition of sustainable development leads the private companies and policy makers to claim that they wish to do the right thing (conserve the nature), whereas, they may be in reality attempting to do something else (make more profits which help in their own company's growth).

O'Brien (1999) rightly remarked that the sustainability will be the driving force for 21st century industry much as automation was for 20th century industry and steam was for 19th century industry.

Bonnelt (1999) stated that a large part of the appeal of 'sustainable development' is that ostensibly it brings into harmony two political attractive but potentially conflicting notions:

i. The idea of sustaining that which is valued, but which is currently endangered through depletion, pollution and so forth;

ii. The idea of accommodating ongoing human aspirations to develop, i.e. in some sense to have more or better.

The definition of sustainable development emphasizes on a healthy relation between society, environment, and economy (as seen in Fig.1). The society, economy and environment interact with each other to fulfill man's desire. It is interesting to note that if this interaction between them is done without any foresight then the output is depletion and degradation of valuable natural resources. But, if man adopts judicious practices while interacting with nature then he can achieve sustainable development.

A Model of Sustainable Development Source: Azapic, A. & Perdan, S. (2000)

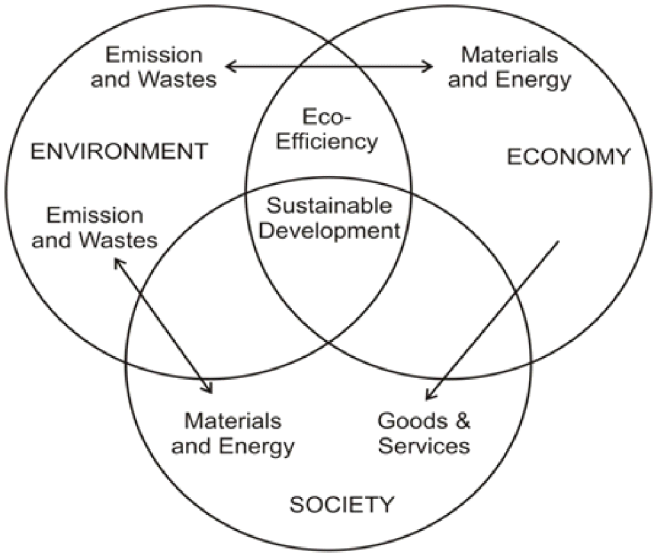

Fig. 1

The three pillar approach to sustainable development, based on its environmental, social and economic dimensions, has done little to reduce the complexity of the concept and has itself introduced a contradiction. The three dimensions were originally introduced with the aim of identifying areas in which social, economic and environmental goals interact such that environmental issues might be more fully integrated into development decisions (Holmberg and Sandbrook, 1992).

The term 'sustainable development' has become so widely used that it is in danger of meaning nothing. It has been applied to all manner of activities, in an effort to give those activities the gloss of moral imperative, the cachet of environmental enlightenment. "Sustainable" has been used variously to mean 'politically feasible', 'economically feasible', 'not part of a pyramid or bubble', 'socially enlightened', 'morally desirable' and, at its most diffuse, 'sensibly farsighted' (Zencey 2010). Dobson (1996) found in his research that there were at that time more than 300 available definitions for sustainable development and sustainability. Thus, there is less concordance and comprehension, about the usage of the term 'sustainable' by various organizations like N.G.Os, government, etc.

If this trend continues then the sustainable development will become a mere supplement to the concept of economic growth. The term sustainable development implies to many people that the present kind of resource utilization, space allocation, and the like can be continued with only minor modifications. That is, society can indefinitely continue the loss of biodiversity and the further loss of old growth forests, groundwater aquifers, and ecological habitat. This misconception is one reason why the term 'sustainable use of planet' may be more appropriate than 'sustainable development' (Cairns,1997).

We need to make a distinction between our needs and desires. We should make a conscious effort of creating an ecologically sustainable planet. So, we need to concentrate on sustainable agriculture. But, it is being contemplated worldwide that the yields from sustainable agriculture will be insufficient to feed the human population. A study conducted by Catherine Badgley et.al. (2007) nullifies these suspicions. They compared yields of organic versus conventional food production for a global data set of 293 examples and these estimates indicate that organic methods could produce enough food to sustain current human population and has a potential of feeding even larger population numbers, and that too, without increasing agricultural land. They found that organic agriculture can provide almost as much food on average at a global level as is produced today (2,641kilocalories/person/day as opposed to 2,786 kilocalories/person/day after losses). They also estimated an increase of 50% (4381 kilocalories/person/day) in global food production by adopting organic farming.

Need For Sustainable Agriculture at Regional Level

Punjab is a modest size state located in north-western part of India. The success of green revolution in Punjab granted its farmer a celebrity status. Their devoted efforts resulted in remarkably high level (797.18%) increase of crop production during the years 1960-1961 to 1999-2000(Singh and Kaur, 2013). These spectacular increases in food grain production was made possible by intensive use of inputs like chemical fertilizers, insecticides, pesticides, adoption of wheat-rice monoculture, exploration of water resources and the result is that we are facing today a host of ecological problems like depletion and pollution of ground water, loss of crop diversity and biodiversity, soil salinity, toxicity and micro nutrient deficiency in soils of Punjab. Today, out of Punjab's total land area of 5036000 hectare about 228840 hectare (4.54 % of total area) is suffering from different kind of problems (Punjab State land Use Board, 2003). The introduction of high yielding varieties of seeds since mid-1960's resulted in increase in consumption of chemical fertilizers. The ingenious use of these chemical fertilizers causes soil degradation and contamination of underground water resources. The consumption of chemical fertilizers in Punjab was only 5 thousand nutrient tonnnes in 1960-61, which rose to 13.14 lakh nutrient tonnes in 2000-01 and 15.53 lakh nutrient tonnes in 2004-05. The soil pollution increases not only by use of chemical fertilizers, but also due to reaction products and residues. Similarly, the pesticides and insecticides also pollute the soil. Most of the chlorinated pesticides are non-biodegradable which means they leave behind harmful residues which harm our environment. Thus, these chemical concoctions help the farmers to increase crop yield, but in the long run they degrade our soil resources.

Our present agriculture practices are also degrading and depleting our water resources too. Certain areas in different states of India are facing various problems like acute water shortage, waterlogging etc. Rapid expansion of irrigation in Punjab and Haryana states has resulted in serious amount of ecological destruction through water logging and accumulation of salts in the soil profile. The problem is even more acute in the central inland basin due to poor water management (Hassan and Inderjeet, 2000). According to Singh (1984) an estimated land area of 450 thousand hectares of Haryana was suffering from salinity, alkalinity and water logging problem.

The monoculture of wheat and rice are also very taxing on soil nutrients. The story of rice in Punjab is of rising from almost zero to hero in one decade, the 1970s, and then of hero cum villain for the next two decades. While maintaining its heroic status of continuously increasing the production and contributing significantly to the country's food security system it has also been acquiring the characteristics of a villain, exploiting of natural resources there by threatening the very sustainability of its domain over the Indian food security system (Singh and Kalra,2002).

The 1986, Johl committee report conveyed the distressing tale of decline in productivity levels and degradation of environment due to dominant rice-wheat cropping pattern. The dire situations lead the committee to recommend the diversification of cropping pattern to make Punjab's agriculture sustainable. But, no concrete steps have been taken by government, yet to diversify Punjab's agriculture.

Thus, the charm of Green Revolution in Punjab is waning away as the input costs are increasing and the profits are declining. Also, the intensive use of chemical

fertilizers leaves residual effect in food grain, as a result of which food grains from Punjab are not accepted in international market. The decline in profit of wheat-rice crop rotation has some disillusioned progressive farmers to try new crops. For many this gamble has paid out. Mr. Mohinder Singh, a progressive farmer of village Kanganiwal (Ludhiana), is renowned as a scientific farmer. He keeps on experimenting with different crops and guides other farmers. Similarly Mewa Singh, a farmer of Kolar and the president of Punjab banana growers association, started growing bananas in 2007 and received rich dividends. A group of progressive farmers from Jalandhar have formed a confederation of potato seeds farmers (POSCON) and have exported 5000 tonnes of potatoes to Russia this year and after tasking success there, they are now planning to explore new markets in Ukraine, Azerbaijan, etc. Many other farmers of Punjab are also diversifying and making informed decisions to adopt the cultivation of turmeric, pulses, fruits, floriculture and other crop suitable to physiography of Punjab. What motivated them to think out of the box was their instinct of survival. They realized that this wheat-rice rotation is not sustainable for long run. These few enlightened farmers are proving that it is possible to earn while conserving our resources. It can also be emphasized here that the agricultural universities and related institutes can play a role by helping farmers to make such informed and progressive decisions.

Need For Sustainable Agriculture at National level:

Punjab and Haryana farmers have helped India in becoming self-reliant in food grains. But the rising population of India and environmental degradation are becoming obstacle for maintaining the self-reliant status. In 1995, Lester Brown and Halkane of World Resources Institute predicted by 2030 A.D India will be forced to import 40 million tonnes of food grains. The soil resources of India are enormous as 9 out of the 12 soil orders which describe the soils of planet earth, occur in India. However, some of the soils have severe constraints towards meeting the challenge of 21st century. Wind erosion is a serious problem in arid and semi-arid regions, including the states of Rajasthan, Haryana, Gujarat and Punjab. It is noted that it takes nature 130 to 400 years to create a layer of one centimeter top soil (Mishra, 2005). The loss of fertile top soil by water erosion is estimated to be about 5334Mt a year; out of which 29% is lost permanently to sea, 10% deposited in irrigation resources and 59% is deposited as alluvium in different places (Dhruvanarayana and Babu, 1983). Nearly 21.6 Mha of land has been degraded due to waterlogging and development of alkalinity and salinity in India (Tomar, 2005).

Table 1: Soil Resources of India and Soil Related Constraints

Soil Order	Land Area (M ha)	% of Total Area	Soil Related Constraints
Alfisols	44.29	13.5	Weak soil structure, crusting, compaction, erosion by water
Aridisols	14.07	4.3	Drought stress, nutrient depletion, wind erosion, desertification, secondary salinization
Entisols	92.13	28.0	Erosion, nutrient depletion, low soil organic matter
Inceptisols	130.37	39.8	Erosion, low soil organic matter, nutrient imbalance
Mollisols	1.32	0.4	-
Ultisols	8.25	2.5	Erosion by water, nutrient imbalance, acidification, P fixation
Vertisols	27.96	8.5	Massive structure, poor tilth, drought stress, water erosion
Histosols	0.002	-	High organic matter
Others	9.67	2.95	
Total	328.06	100	

Source: Velayutham and Bhattacharya (2000)

Agrochemicals pollute the environment primarily because of their wasteful application and due to the fact that crops use them inefficiently. Fertilizers use efficiency is revealed to be only 30-35%, the remaining proportion reaches the underground water resources (Das, 2004). It is estimated that every year, 21.2 million tones of three major nutrients- nitrogen, phosphorous and potassium is removed by growing crops but the corresponding addition through chemical fertilizers fall short of this figure (Tandon, 1992) as can be seen from table 2.

Table 2: Nutrient Balance: Removal by Crops and Net Contribution of Fertilizers to Crop Uptakes

Nutrient	Source of Nutrients (million tonnes)			Efficiency of Fertilizers (%)	Contribution to Plant Uptake (%)	
	Plant Uptake	Fertilizers	Organic Manures		Fertilizers	Other Sources
Nitrogen	6.6	7.40	1.76	44	49	51
Phosphorous	3.0	3.00	0.86	30	30	70
Potassium	11.6	1.16	0.35	50	5	95
Total	21.2	11.56	2.97		23	77

Source: Tandon, 1992

This reduction in nutrient balance of soils because of soil erosion or removal by extensive crops ultimately leads to reduction in yield of crops as well as increase in input costs of farmers. The famers are forced to apply more chemical fertilizers in soil exhausted of nutrients which increase their input cost and decrease their profit margins. On top of this loss of nutrients the change in climate will also affect the yield of crops. This reduction of crops can spell doom for the human race.

This proves that Indian government should concentrate on increasing agricultural production to meet need of growing population, and the sustainability concerns warrant that this should happen without harming the environment and natural resource base of India. Thus India needs to move away from conventional agriculture to a renewable and everlasting alternative of sustainable agriculture. Majority of farmers in India are small scale farmers having farm sizes between 1 to 2 ha and therefore their involvement in any agricultural development program is most important. Many farmers in India are becoming aware of adopting innovative strategies to implement sustainable techniques on their farms. There is need of disseminating these sustainable techniques to other farmers in India and here media can play an important role.

Recommendations for Sustainable Agriculture at National and Regional Level:

To make sustainable agriculture a reality and to protect and preserve our environment we need to take some positive and progressive steps. We need to adopt crop diversification, green manures as well as utilize the help of modern biotechnology to bring about second gene revolution. Also, there is need for developing low cost agricultural technology. We also need to develop rain-fed agriculture along with sustainable man-made irrigation system. Some relevant recommendations are made below:

1. Reconsideration of traditional approaches: There is a need for studying, prompting and incorporating certain traditional approaches in our lifestyle to achieve sustainable development. Adopting certain traditional policies does not mean that we are moving backwards. But it means we are committed enough to learn and adopt sustainable and green habits.
2. Adoption of efficient soil management practices: The sustainable soil management practices can help us in improving as well as maintain the soil quality. This can be achieved by growing suitable crops, adopting judicious cropping pattern and by using green manures and crop residues.
3. Setting up seed banks: Community seed bank is an innovative concept and it aims at protecting local biodiversity and preserves traditional seeds. Many N.G.O's have helped in setting up such C.S.B in India and these initiatives need to be taken to the next level. More seed banks should be established as well as these should be interconnected for exchange of seeds.
4. Improvement of storage units: It is important for India to remain self-reliant in food grain production. We need to improve and upgrade our storage units so that the

amount of that is wasted during storage and transfer be minimized.

5. Need of green politicians: We need an army of environment friendly politicians and not 'puppets' in the hands of big capitalists. We should demand a 'green neta'.

6. Farmers exchange program: The Government of India should concentrate on organizing farmers' exchange programs as these brain storming sessions could help farmers to widen their horizon as well as acquire new skills from fellow farmers.

7. Role of agricultural universities and research institutes: The agricultural universities of India should exchange information with other agricultural research institutes around the world and this valuable information should be easily available to farmers.

8. Improved educational systems: Our education systems need to be revolutionized and instead of one common national education policy, an area specific policy should be followed. The education policy should teach rural and the urban children about the concept of sustainable development and sustainable agricultural practices.

9. Setting up hi-tech laboratories in rural areas: The government needs to set up more laboratories in rural areas, where farmers can go and get their soil tested.. Also, these laboratories can test and certify farm products of local farmers which will help them to sell their products in market easily as well as get a good price too.

10. Encouraging rural youth: There is need for encouraging rural youths to take up farming instead of being lured away to metro cities. They should be provided training free of cost to become scientific farmers. Today, the Punjabi farmers are dependent on labour force from neigbhouring states as the Punjabi youth are turning away from agriculture and many have become drug addicts. But now the governments of Bihar and Uttar Pradesh have launched many developmental schemes and this hired labour is moving back. This has landed Punjabi farmers in a fix.

11. Small farmer's participation: There is a need of winning support and confidence of small scale farmers, so that they may adopt sustainable measures and this will lead to rejuvenation of small scale food production. They should be encouraged to diversify and the government should provide crop insurance to these farmers, so that they are protected if their crops fail due to climatic factors.

12. Promotion of organic farming: The excess of chemical agriculture has not only drained the nutrients of our soils but also the pockets of our farmers. Indian government has launched the 'National Project of Organic Farming' for production, promotion and market development of organic farming. But to make such projects a success, there is need for reviewing the current state of affairs in the organic agricultural sector of country. We should concentrate on the main problems in production of organic crops and the market constraints being faced by the organic farmer.

13. Incorporation of GIS and related information technology: The Remote Sensing, Global Positioning System (GPS), Geographical Information System (GIS) and other related technologies are quite promising and they can be utilized for carrying out land use planning, measuring soil degradation, watershed management and other sustainable agriculture related exercises these days up to date, and high quality information about natural resources can be obtained from satellite imageries.

14. Role of N.G.O and grass root organizations: They can play a positive role in bringing about sustainable development by inspiring farmer's self help groups.

15. Risk management and protection of farmers from varying market values: The small farmers can become dynamic and progressive only if they are provided financial insurance. If one farmer grows potatoes in one season and reaps rich dividends, then more farmers will follow him next season resulting in fall of the price of potatoes and in this process many small farmers are ruined. The agricultural institutes need to study this and help the government to stabilize the prices.

16. Innovation in chemical fertilizer industry: The one type of fertilizer for all type of soil ideology should be changed. Some innovative groups have realized this need and one such example can be citied of Tata Paras, a flagship brand of Tata Chemicals. In 2010, it launched an innovative offering 'Paras formula-Ek Mein Sab', a customized fertilizer. This is an area and crop specific nutrient which enhances crop productivity, promotes balanced application of nutrients and improves soil health. The government also needs to promote the use of biopesticides and biofertilizers by providing

cash incentives. Firm steps should be taken to slowly phase out older, low grade chemical fertilizers and these should be replaced by biofertilizers.

Discussion

Sustainable development is a positive change necessary for survival of humanity. Today, the human activities are crossing the danger line that could lead to a total environmental collapse. Sustainable agriculture is a reality and not just a mirage and it can solve our many problems. The Green revolution of 1960s helped a young independent nation like India to achieve food security and helped it to concentrate on other development goals. This revolution may have turned evil now, but when India needed a helping hand to stand upon its feet, then it was this revolution which steadied India's first steps. So, the blame is not to be shared alone by Green Revolution, but it was a result of near sightedness of the planners of that era.

We can still make amends by accepting that the current farming practices are not sustainable. Acceptance is the first step if we want to make any change. We have to accept our shortcomings and we need to adopt sustainable development goals. The ESCAP report entitled 'Sustainable agriculture and food security in Asia and the Pacific' (2009) quite bluntly remarks that it is up to us that we continue with short term profits for the few through chemically cultivated, irrigation and energy intensive monoculture, with the burden of long term costs shouldered by man; or a new long term just and economically equitable agriculture to ensure food security for all. The long term food security in the Asia-Pacific region requires active participation of small farmers in a new ecologically viable food revolution.

This new sustainable food revolution will not be taxing on our soil and water resources. It will tackle the current problems of soil erosion, nutrition depletion in soils, water pollution and over exploitation of ground water being faced by many states of India.

The chemical fertilizers and pesticides being used are polluting our soils by leaving harmful residues and also the pests are becoming resistant to these chemicals. Sustainable agriculture can deal with soil and pests related problems by substituting these chemical products with greener products. Alam (2000) emphasized the need for promotion of biopesticides and biofertilizers for achieving sustainable agriculture. He further remarks that the idea of using microorganisms to improve land productivity has been around in India for at least 70 years, but it was only in the 1990s that large scale production of various biofertilizers commenced. Presently, a number of agricultural universities, state agricultural departments and commercial enterprises produce various bio fertilizers. An another added benefit of using bio fertilizers is that it can also help in preventing water pollution as the chemicals run off from agriculture is one of the major source of water pollution. Also, if before sowing a crop, the geographical conditions of that region are studied and a crop appropriate to these factors is sowed, then, also we can prevent excess depletion of our ground water resources.

The table 3 given bellow suggests some productive and sustainable strategies for solving some of the above mentioned problems being faced by our farmers.

Table 3: Strategies for sustainable agricultural management

Problems	Sustainability Strategy
1.Change or reduction in organic matter levels with time	Conservation of soil organic matter through maintaining soil C and N levels by reducing tillage, recycling plant & animal manures and by increasing plant diversity
2. Soil erosion through runoff and presence of gullies, rills etc.	Minimization of soil erosion through conservation tillage & increasing protective cover (cover crops, green fallow, etc)
3. Degradation in physical conditions of soil and water	Balance production and environment through conservation and integrated pest management systems. This can be achieved by optimizing tillage, using crop residue, efficient chemical use and by preventing agriculture run off into water resources. Also, by synchronizing available N and P levels with crop needs during the year.

4. Increase in agricultural input costs and problems of soil acidification	Better use of renewable resources through relying less on fossil fuels and petrochemicals and more on renewable resources and biodiversity (e.g. crop rotation, legumes, manures, integrated nutrient management, integrated pest management)

Source: Modified from Mishra, B. (2005)

Sustainable development approach is forward looking and is responsible. India's growing population and the fact that more than 65% of Indian population is rural and engaged in agriculture and allied sector demands that agricultural development be given immediate priority. The Indian government needs to implement a revised plan of sustainable agriculture as discussed in this paper.

Conclusion

Today, sustainability strategies are the key to overcome the environmental degradation crises being faced in India. The crux of this research paper can be concluded in following points:

1. The sustainable agriculture can be turned into a reality by adopting the above mentioned recommendations.
2. There is need of encouraging innovative thinking. So, there is a need of healthy mixing of young blood's enthusiasm with old seasoned player's experiences.
3. By adopting sustainable development, we can promote a healthy interaction between society, economy and environment.
4. Many studies have been conducted that have proved that organic agriculture if fully developed can produce food at par with conventional chemical intensive agriculture.
5. The adoption of sustainable agriculture practices like adopting green manures, biofertilizers and biopesticides, by using drip irrigation and promoting rain-fed agriculture, etc should be encouraged.
6. The monoculture of wheat and rice can also be changed if the government encourages and provides financial support to farmers for experimenting with other crops.

Thus, sustainable agriculture is a positive socio-economic change that should be whole heartedly accepted by our farmers and planners to prevent further environmental degradation.

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