**Sustainable Agricultural Growth achieved with advanced computing technologies**

Anwesha Sinha

Dept. of CSE, JK Lakshmipat University, email: [sinhaanwesha16@gmail.com](mailto:sinhaanwesha16@gmail.com)

**Abstract**

India ranks 2nd worldwide in farm output. Yet GDP from agriculture in India decreased to 3743.90 IND billon in the 2nd quarter of 2016 from 4235.42 IND billion in the 1st quarter of 2016 as reported by the Central Statistical Organization, India. India saw a boom rise in agriculture during Green Revolution around 1967 to 1978. Hence India needs another such kind of revolution or scientific agriculture out of minimum and sustainable use of resources like land, water.

Here comes into action the use of rainwater harvesting, mulching, drip irrigation, reuse of waste water, simple and reasonable water purification methods like slow sand filtration, ceramic filters, bamboo charcoal, solar sterilization, solar distillation. Use of some crops which do not use much water like tapery-beans which can adopt to drought conditions, black-eyed pea, okra, snap beans, pole beans which can be set to small amounts of moisture. The lands which have low water table may use deep rooted crops like tomatoes, squash, melons. In general, vegetables ought to be given no more water than they need rather than as much as they can withstand. The proper use of soil health card scheme which promotes soil test based and balanced use of fertilizers to enable farmers release higher yields at lower cost may help in knowing the soil health to the farmers.

The proper use of land is a must by using techniques like crop rotation, cover crops, terrace farming, organic farming, natural pest predators, bio-intensive integrated pest management. While some of the techniques should be avoided like monoculture, fallow land, avoiding some plants which inhibit growth of other plants by releasing chemicals that is allelopathy as seen in broccoli residue which interferes with growth of related crops such as cabbage or cauliflower that follow. In order to increase the agriculture revenue of India, the growth of agriculture is a must.

**Keywords**: Rainwater Harvesting, Reuse of Waste Water, Water Purification Methods, Soil Health Card Scheme, Crop rotation, Cover Crops, Terrace Farming, Natural Pest Predators,Neem Coated Urea Scheme, Computer and Agriculture

1. **Introduction**

The economy of India is the 7th largest economy in the world measured by nominal gross domestic product (GDP) and the third largest by the purchasing power parity (PPP). Agriculture is the backbone of the Indian economy as it contributes about 16% of the total GDP & 10% of the total exports. India is mainly an agricultural country as an approximate of 60% of land is arable in India. Thus, contributing it to the 2nd largest country in terms of total arable land. Thus, India exports surplus food and agricultural product from the agro-based industries. Green revolution also played a major role in the growth of Indian agriculture since its launch around 1967 to 1978 by the research establishments in Mexico and the Philippines. It produced dramatic results like nearly doubling the wheat production in few years, yielding HYV seeds like rice IR8. It is said to have averted famine conditions in India and Pakistan. But to our distress the current scenario is that Indian GDP from agriculture is decreasing from 2011 to 2016 as reported by the Central Statistical Organization, India. There could be many reasons to blame on the agricultural growth. Thus, here comes into existence the demand of new revolution, a sustainable agricultural development.

An overall view of sustainable agricultural development means meeting the needs of today without compromising the future needs. This could be achieved by independence on water in farming, reuse of waste water by purifying water through various methods like slow sand filtration, ceramic filters, bamboo charcoal, solar sterilization, solar distillation, or by rainwater harvesting, or by the proper implementation of the Pradhan-Mantri-Krishi-Sin chai-Yojana. Other factor may include soil health and land issues like soil irrigation which is caused by the faulty practices of agriculture like monoculture, shifting cultivation. There is an urgent need of healthy agricultural practices like crop rotation, multiple cropping, terrace farming, use of cover crops, use of natural pest predators, use of soil health card scheme, neem coated urea scheme.

1. **Independence of Water in Farming**

Use of some crops which do not use much water like tapery-beans which can adopt to drought conditions, black-eyed pea, okra, snap beans, pole beans which can be set to small amounts of moisture. The lands which have low water table may use deep rooted crops like tomatoes, squash, melons. In general, vegetables ought to be given no more water than they need rather than as much as they can withstand.

1. **Reuse of Waste Water**

The basic drawback of agriculture is due to lack of irrigation facility. In order to overcome it purification of water and reuse of water is a must.

* 1. **Purification Of water**

Good quality and cheap water purification method is a must for the prosper of agriculture in India. Few of the methods are as under:

* + 1. **Slow Sand Filtration**

It is a type of centralized or semi centralized water purification system. It efficiently removes turbidity and pathogenic organisms through various biological, physical, chemical processes in a single treatment step. The advantage of this system is high reliability and low lifecycle costs. Moreover, neither construction nor operation and maintenance require more than basic skills. Hence slow sand filtration is a method for small to medium-sized rural communities.

**3.1.2 Ceramic Water Filters**

Ceramic water Filters are an inexpensive type of water **filter**, that rely on the small pore size of **ceramic** material to **filter** dirt, debris, and bacteria out of water.

* + 1. **Bamboo Charcoal**

Bamboo charcoal is rich in a number of minerals including potassium, magnesium, sodium and calcium. Most existing purification methods not only remove the impurities but drain out the essential minerals as well. Moreover, they are expensive and require extensive maintenance. Thus, a natural filter comprising of bamboo, gravel, pebble and other locally available natural adsorbents is a great alternative to carry out water purification.  this filter is indigenous, eco-friendly, low cost and entails minimum maintenance. It can purify about 30 liters of water per hour by the application of batch process method under maximum sunlight.

* + 1. **Solar Sterilizations**

It is mainly used to remove bacteria causing diseases. Fuel wood is scarce but solar energy is plentiful and may be used to kill bacteria. A simple and inexpensive solar device is seen to be much effective in elimination of bacteria from water supplying sterilized water. It is also seen that water need not be boiled but heated to 65°C only to make it bacteria free.

* + 1. **Solar Distillation**

Solar distillation is the use of [solar energy](http://www.appropedia.org/Solar_energy) to evaporate water and collect its condensate within the same closed system. It is basically used for desalination.

* 1. **Rainwater Harvesting**

It is the accumulation and deposition of rainwater for reuse and reduces soil erosion.

* + 1. **Surface Run-Off Harvesting**

This is done when surface runoff is caught and used for recharging aquifers by adopting appropriate methods.

* + 1. **Roof Top Rainwater Harvesting**

In this system rainwater is caught where it falls. Here roof becomes the catchments or even rain saucer could be used which looks like an upside-down umbrella and then further the water is shared in a tank or diverted to artificial recharge system.

* 1. **Pradhan-Mantri-Krishi-Sin chai-Yojana**

It was launched by NDA government. It has 3 programmers under it.

1. Accelerated Irrigation Benefit Programed of the Ministry of Water Resources.
2. Integrated Watershed Management programmed of the Ministry of Rural Development
3. Farm water management component of the National Mission on Sustainable Agriculture.
4. **Land Issues**

Not only water but also land and nutrition of soil also plays a vital role in the flourishment of agriculture in a country. The cultivation should be done in such a way that it does not hamper the fertility of soil for after use of that farm.

* 1. **Monoculture**

It is the concept of cultivation of single crop in a given area.

* 1. **Shifting Cultivation**

This concept should not be practiced as it leads to soil erosion. It is the clearing of vegetation and cultivated land for a few years and then abandoning for a new area until its fertility has been naturally restored.

* 1. **Crop Rotation**

It is the practice of growing a series of dissimilar or different types of [crops](https://en.wikipedia.org/wiki/Crop) in the same area in alternative [seasons](https://en.wikipedia.org/wiki/Season). The growth of single type of crop in a farm results in degradation of certain nutrient from the soil. It helps in reducing soil erosion and increases soil fertility and crop yield.

The advantage behind crop rotation is that it leaches the soil of one kind of nutrient is followed during the next growing season by a dissimilar crop that returns that nutrient to the soil or draws a different ratio of nutrients. In addition, crop rotation mitigates the buildup of [pathogens](https://en.wikipedia.org/wiki/Pathogen) and pests that often occurs when one species is continuously cropped, and can improve [soil structure](https://en.wikipedia.org/wiki/Soil_structure) and [fertility](https://en.wikipedia.org/wiki/Fertility_(soil)) by increasing biomass from varied root structures. The other benefit is that the crop rotation is used in both conventional and [organic farming](https://en.wikipedia.org/wiki/Organic_farming) systems.

* 1. **Multiple Cropping**

The concept behind is used to grow two or more crops throughout the year so that the field constantly has something growing on it.

* 1. **Terrace Farming**

It is used in mountains or hills. The concept behind is that when it rains, instead of washing away all of the [nutrients](https://simple.wikipedia.org/wiki/Nutrient) in the soil, the nutrients are carried down to the next level. Additionally, these steps prevent a free flowing [avalanche](https://simple.wikipedia.org/wiki/Avalanche) of water that would take [plants](https://simple.wikipedia.org/wiki/Plant) with it and destroy the all the crops on the hillside.

* 1. **Cover Crops**

It is a [crop](https://en.wikipedia.org/wiki/Crop) planted primarily to manage soil [erosion](https://en.wikipedia.org/wiki/Erosion), [soil fertility](https://en.wikipedia.org/wiki/Fertility_(soil)), soil quality, water, [weeds](https://en.wikipedia.org/wiki/Weed), [pests](https://en.wikipedia.org/wiki/Pest_(organism)), diseases, [biodiversity](https://en.wikipedia.org/wiki/Biodiversity) and wildlife in an [agroecosystem](https://en.wikipedia.org/wiki/Agroecology) It is mainly grown for the production and enrichment of soil. Farmers choose to grow and manage specific cover crop types based on their own needs and goals, influenced by the biological, environmental, social, cultural, and economic factors of the food system in which they operate. The farming practice of cover crops has been recognized as climate-smart agriculture by the [White House](https://en.wikipedia.org/wiki/White_House).

* 1. **Natural Pest Indicators**

There are two ways to promote natural pest control in agriculture: crop management practices at the field scale, such as increasing within-field diversity or reducing soil and landscape management measures, which include finding the best way to set up crop and semi-natural habitats next to each other. An example to mention in detail is seen in oilseed rape e is prone to infestation of the pollen beetle, Meligethes aeneus F., resulting in the large use of insecticides across Europe. However, the beetle’s population is also controlled naturally by a range of parasitoids, which lay eggs in its larvae, thereby killing it. In the study, fields were divided into groups depending on whether they exceeded a certain level of infestation or parasitism. The researchers then tested the ability of each landscape indicator to identify which fields would be likely to have more beetles, and which would have more parasites.

* 1. **Soil Health Card Scheme**

It was launched by the government of India in February 2015. Under this scheme farmers are issued soil card which are required to improve productivity by the judicious use of inputs. All soil samples are to be tested in various soil testing labs in the country to analyze the strength & weakness of the soil and suggest measures to deal with it, all this information is to be displayed in the card.

* 1. **Neem Coated Urea Scheme**

This scheme is for agricultural trial on paddy and wheat crops with neem coated urea as source of nitrogen that has produced higher yield at research and farm level.

1. **Computer and Agriculture**

Growth is not merely the demand of agriculture today; sustainable agricultural growth is the need of todays world. Here comes into action role of computer. CAD (computer aided design) can be used for improving agricultural equipment design and performance. One can use GIS (Geographic Information System) in agriculture to use agricultural pesticides and fertilizers more efficiently Using hybrid network to build information sharing platforms (**e-governance, climate, agricultural practices, expert pools, etc**.)

Using laser induced imaging for detection of contamination of agricultural products Using 3S (Remote Sensing, GPS, and GIS) techniques for predicting landforms and climatic changes. Geographic Information Systems (GIS) are being used for developing ranking systems that evaluate land and provide a precision agriculture. These hi-tech, interactive systems give information based on a variety of factors as soil conditions, drainage and slope conditions, soil pH and nutrient status. The use of GIS is a money saver as it increases efficiency. It also leads to better decision making about where and when to produce crops Global Positioning System (GPS) based technologies also help to monitor irrigation, field, soil sampling, tractor guidance and crops. This kind of technology provides farmers with valuable information to increase the crop yield.

Using Support Vector Machine (SVM) technique for soil water content forecasting.

E-Agriculture is an emerging field which focuses on innovative ways and communication technologies (ICTs) for sustainable agricultural development an E-agriculture comprises of other related technological fields such as agricultural informatics, agricultural development and business. It aims to bestow all available technologies like computers, mobile computing, satellite systems, smart cards for the enrichment of agriculture.  
We can take advantage of technology to do the hard work, and consequently, hold less appreciation for the finished product. Moreover, there is a chance of less loss due to the work being monitored by computer.

6. **Conclusion**

Agricultural growth is a must but sustainable agricultural growth is the demand of today. While performing the farming, life cycle each step right from the crop selection, land preparation, seed selection, seed sowing, irrigation, crop growth, fertilizing, till harvesting should be performed judiciously. Care should be taken that the natural resources like soil, water should not be degraded or replenished. For the successful growth of agriculture Innovative ideas, scientific techniques and e-agriculture’s advancement is vital. With the help of computer technology and software we can easily achieve sustainable growth in Indian agricultural scenario.

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