



Agriculture Practice a Sustainable Development for Future

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Abstract

Agriculture has been an integral part since the onset of civilization in different parts of the world. The traditional practice of harvesting is said to be beneficial in terms of increasing the life expectancy and health standards of the individual. The paper tries to explore the various challenges in stabilizing agriculture as a long lasting practice of sustainable development for future. It discusses the cumbersome of modernisation in the upcoming generation. The paper ends with a note on how the utilization of organic manure is an asset which leads to prosperity of the country.

Keywords: Traditional Practice; Life Expectancy; Health Standards; Sustainable Development; Modernisation

Introduction to Agriculture and its Practice

Agriculture as a traditional practice has been prevalent since the dawn of civilization. The evolution of human race has seen the utilization of various tools and majority of the population involved in agriculture. Agriculture as an initiative of self-sustenance has contributed to being recognised as the backbone of the country since generations. For hundreds of thousands of years, our ancestors had survived by hunting animals and gathering edible wild plants. But starting about 11,700 years ago, people began to use wild plants in ways that changed the plants themselves, a process called domestication. People began to alter their environments as they cultivated those plants. The result was the profound landscape and cultural transformation we know as Agriculture (John Carey, 2023) [1].

Historical overview

Agriculture, the cultivation of food and goods through farming, produces the vast majority of the world's food supply. It is thought to have been practiced sporadically for the past 13,000 years, and widely established for only 7000 years. In the long view of human history, this is just a flash in the pan compared to the nearly 2,00,000 years our ancestors spent gathering, hunting and scavenging in the wild. During its brief history, agriculture has radically transformed human societies and fueled a global population that has grown from 4 million to 7 billion since 10,000 BCE, and is still growing. From as early as 11,000 BCE, people began a gradual transition away from a hunter-gathering lifestyle toward cultivating crops and raising animals for food. The shift to agriculture is believed to have occurred independently in several parts of the

world, including Northern China, Central America, and the Fertile Crescent, a region in the Middle East that cradled some of the earliest civilizations. By 6000 BCE, most of the farm animals we are familiar with today had been domesticated, and by 5000 BCE, agriculture was practiced in every major continent except Australia (Hillel D, 1991) [2].

Traditional agriculture

Traditional agricultural practices have been an integral part of food production in India since ages. These practices have potential to mitigate the adverse effects of climate change with spatial and sequential diversity. It covers mainly three aspects of traditional farming in Indian cultivation, biological method of pest management and locally available sustainable practices of crop protection. Double cropping, mixed cropping, crop rotation, agro forestry, use of local varieties and resources with host pathogen interaction are some of the prominent traditional agricultural practices in India which have to be strengthened in view of the environment and food security. Such practices have a significant role in achieving the sustainability of agriculture by improving nutritional quality (Sanoj Kumar Patel, Anil Sharma, Gopal Shankar Singh, 2020) [3].

Modern changes

Promoting sustainable agriculture is crucial for achieving Goal 2: Zero Hunger, as it ensures that food production is efficient, environmentally friendly, and economically viable in the long term. Sustainable agriculture encompasses a range of practices, policies, and technologies that contribute to achieving this goal. By focusing on the significance of sustainable agriculture and fostering a deeper understanding of the complex challenges associated with achieving Zero Hunger, this overview emphasizes the need for multi-dimensional strategies that encompasses environmental stewardship, social equity, and economic viability in agricultural systems. Furthermore, it explores the potential of emerging technologies such as precision agriculture, agroforestry, and digital platforms to revolutionize food production while minimizing environmental impact. Through a nuanced analysis of best practices and policies, the goal is to inspire collaborative efforts and informed decision making to-

ward building resilient and sustainable food systems that can effectively address the global challenge of hunger and malnutrition (Andualem Muche Hiywotu, 2025) [4].

Role of agriculture and food security

Ensuring food security has become an issue of key importance to countries with different degrees of economic development, while the agricultural sector plays a strategic role in improving food availability. Typological groups of countries were separated using Ward's method. It results from the analysis that the greatest problems with maintaining food security are observed in the developing countries with a high share of agriculture in their Gross Domestic Product (GDP), adverse conditions hindering agricultural production and deficient infrastructure. Based on research results desirable and tailored strategies for food security improvement in individual clusters were developed. Promoting investments in agricultural infrastructure and extension services along with adopting measures aimed at increasing the households purchasing power, especially those in rural areas, appear to be key drivers for improving both food availability and food access (K Pawlak, 2020) [5].

Organic fertilizers

Organic fertilizers are used to improve soil fertility and crop productivity. The application of organic fertilizers improves soil health and plant growth by improving the soil organic matter (SOM), soil structure, aggregate stability, nutrient uptake, water holding capacity, cation exchange capacity, nutrient use efficiency and microbial activities of soil. The application of organic fertilizer improves the leaf water status, nutrient uptake, nutrient homeostasis, synthesis of chlorophyll, osmolytes, hormones and secondary metabolites, antioxidant activities and gene expression, resulting in improved tolerance against drought, salinity, heat, and heavy metals. Therefore, this review will put forth new directions for researchers working on the use of organic materials to improve soil fertility, crop productivity and tolerance against abiotic stresses (Y Liu, 2024) [6].

Warehousing maintenance

Warehousing requires the classification, controlling and management of inventory as well as processing of related information. Adopting efficient and reasonable warehouse management measures to achieve effective management and control of materials is a key means to flexibly adjust the supply and demand of storage materials and reduce operating costs. There remains a gap in understanding of benefits and barriers to the full adoption of Industry 4.0 technologies and decision support systems (DSSs) in warehouse management. Adequate financial support, new knowledge and skills are required to be able to ensure the successful implementation of Industry 4.0 in warehouse management (Lihle N. Tikwayo, and Tebello N.D. Mathaba, 2023).

Issues of agriculture

Indian agriculture towards 2030 is a comprehensive open-access volume that critically examines the future trajectory of India's agricultural sector. The transcending of the post-Green Revolution paradigm, emphasizing the need of structural reforms, technological innovation, and inclusive policies. The agricultural practices must evolve to promote sustainability, enhance farmers incomes, and ensuring nutritional security. The integration of ecological considerations into farming practices and the necessity of governance reforms to support these changes (PM Chepkosgei, 2025).

Climate change

Climate change is one of the significant global environmental issues, a threat to sustainable development and its widespread, unprecedented impacts disproportionately burden the poorest and the most vulnerable populations. Today, greenhouse emissions (GHG) are 50% higher than the levels in the 1990's (Saurabh Sonwani and Pallavi Saxena 2022). Increasing earth's surface temperature, changes in precipitation pattern, frequent tropical storms, drought flood, forest fire, sea level rise and melting of glaciers are important markers of changing climate observed across the world (Pallavi Saxena., *et al.* 2022). To reduce the impact of such climate driven extreme events, the United Nations have recognized the role of developing countries in climate change mitigation and adapta-

tion under Sustainable Development Goals (SDG's) to take urgent action to combat climate change and its impacts (Pallavi Saxena, Saurabh Sonwani, Sirkku Juhola, Florent Louis, 2024).

Debt burden of farmers

Farm debt is arguably the most compelling problem in Indian agriculture today. In the recent past, the concern that has arisen and received significant concern from farmers who are in the rural areas is debts. Most farmers are faced with fluctuating fortunes occasioned by low harvest income, variability in production, increased cost of produce, and lack of access to fairly cheap credit. The financial loss not only disorients their economic status but also has social consequences that have an effect on the overall aspects of social life. The situation of farmer indebtedness have been recently linked to rural poverty, struggles to meet basic requirements, and rises in farmer suicides to stress the importance of a deeper examination of this problem (Oum Kumari, Sanju Shekhawat, Manisha Choudhary, 2025).

Droughts and famines

India witnessed some of the most famous famines during the late nineteenth and early twentieth centuries. These famines caused millions of deaths primarily due to widespread crop failure. Soil moisture drought affects food production and food security in India before the widespread advent of irrigation in the midtwentieth century. However, the crucial role of soil moisture famines in India has received little attention, perhaps due to the general absence of long-term observations (Vimal Mishra, 2019).

Myths of agriculture

A myriad of misinformation and disinformation has relegated the Indian agriculture to a dark corner. No other sector remains as misrepresented and misunderstood as the Indian agriculture sector. Foreign funded environmental NGOs have played a malicious role in creating and sustaining most of the myths and misconceptions about Indian agriculture. Dispelling the deep-rooted myths and misconceptions about Indian agriculture and bringing to the fore the sunny side of Indian agriculture is the need of the hour (Centegro, 2023).

There's no future in agriculture

The best future is in agriculture. All human beings need food to survive. Not only are the numbers of Agri-graduates increasing, the numbers of young farmers getting out on the farms are also increasing. They are trying out new innovations in their fields. According to a report from the Food and Agriculture Organisation of the United Nations, the two major drivers of food demand -population and income-are increasing from year to year. The world population is expected to reach 9.1 billion by 2050. Globally farmers must increase food production to meet the needs of the larger population. Agriculture not only provides food and raw material but also huge employment opportunities to many people, not just today but in future too. Creation of future for agriculture lies in the hands of farmers and youths (Priyanka B.N., 2023).

Feminization of agriculture is the predominant global trend

The myth is that feminization of agriculture is the predominant trend in global agriculture, closely associated with male labour out-migration, women playing greater roles in small holder agriculture, and increased participation of women in commercial agriculture, both on the farm and in processing facilities. (Nozomi Kawarazuka, Cheryl R. Doss, Cathy Rozel Farnworth, Rhiannon Pyburn, 2022) [7].

Declining size of Indian farm leads to low production

Small-scale agricultural production is at the interface of key factors required for resilient and inclusive transformation: livelihoods, food security and nutrition, and natural resources and biodiversity. With few resources to invest in alternate soil management practices, the resultant decline in soil quality limits productivity. Extensive soil degradation also limits the effectiveness of added fertilizer. As a result, small farm size and poor soil fertility represent a double poverty trap. These challenges are exacerbated by insufficient off-farm opportunities to substitute and/or complement limited on-farm income generation. Limited off-farm opportunities, in turn, drive rural-urban migration, emphasizing the need for rural revitalisation (Sarah K. Lowder, Garima Bhatia, Benjamin Davis, 2025) [8].

Role of food controlling agencies

Food safety is a critical public health issue worldwide as the consumption of unhygienic food causes millions of illness annually. From the modest beginnings rooted in basic hygiene practices to the sophisticated frameworks of food regulatory bodies has been marked by a commitment to protect consumers from the hazards associated with foodborne illness. In India, Food Safety and Standards Authority of India sets standards, inspects food businesses, and acts against food safety violators (R Singh, 2024) [9].

Grading of Agmark standards

The entire system of Agmark, including the name was created by Archibald Macdonald Livingstone, Agricultural and Marketing Advisor to the Government of India, from 1934 to 1941. The Agmark certification is employed through completely state-owned Agmark laboratories present across the nation which act as testing and certifying centres. Image processing is widely used in biological and agricultural research with the improvement of Digital technology and significant reduction of the cost of hardware and software of digital imaging. The Machine Vision System for AGMARK would help to identify the grains and foreign matter according to their area, perimeter and major axis from the rice sample images (Priyankaran Tanck, Bipin Kaushal, 2014) [10].

Food safety standards of FSSAI

The process in formulating and developing the food safety standards is a vigorous process. The process is based on the latest developments in food science, consumption pattern, new food products and additives, changes in the processing technology the FSSAI has determined food safety standards under Food Product Standards and Food Additives Regulation, 2011, Packing and Labelling Regulation, 2011 and Contaminants, Toxins, and Residues Regulations, 2011 (Vasanthi Ajay, 2018) [11].

Impact of modernization on agriculture

Since the inception of National Economic Planning in India in 1951, sustained efforts have been made by the planners to accelerate the pace of agricultural development in the economy. The

strategy for modernisation of agriculture, widely referred to as the 'Green Revolution', has been pursued vigorously in Indian Economy since 1967. The term 'Green Revolution' indicates a package for modernisation of agriculture. The introduction of high yielding varieties of seeds for several major crops, creation and utilization of energised well irrigation facilities, use of high doses of fertilizers and pesticides, and extensive use of farm machinery directed at improving farm productivity (BH Dholakia, RH Dholakia and Ranveer H. Dholakia, 1992) [12].

Findings

- High yielding seeds may be produced in the long-run, but the excess usage of waters and fertilizers along with climate factors may play a decisive role in the future.
- People selling their generational property, in the name of development aspect or better prospects may be caveating situation in the future for an economy.
- Agricultural growth also a treasure house for the sub-sectors where the small-scale industries, thrive and are able to provide better goods for the public.
- The National Sustainable Agricultural Development Plan (2015-2030) targets zero growth of fertilizer as part of efforts to combat NPS (nonpoint source pollution) and reduce GHG (green house gas) emissions.

Conclusion

Agriculture has been an integral part of our society and would continue to do so. The traditional system of farming with the usage of organic manure has seen improvement in the quality index of individuals to a great extent. The main aim of sustainability implies to protect the resources of the present, so that future generation enjoys fruits of it, without complaining their fore-fathers for it. The consumerist culture of globalisation has led to reduction in the human life span with an added weightage of medical expenses as a by-product. To conclude, the food which an individual wishes to consume is a personal choice, but the maintenance of food quality is an ethical behaviour of the producer to a certain extent, contributes to the longevity of man's life on the planet.

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