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Organic Farming for Sustainable Environment: Review of Existed Policies and Suggestions for Improvement

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ABSTRACT

Environmental policies framed across the globe consider the importance of organic farming in achieving sustainable development of environment. Due to rises environmental concerns in modern agricultural practices, the role of organic farming has risen considerably with its net sale of 40 billion US dollars every year. But the organic sector yet to achieve its full potential. Organic farming is in direct relationship with environmental sustainability due to its role in enhancing natural health of environment. This paper intends to analyze the applicability of organic farming sector in achieving sustainable environment, historical developments in the organic farming and review of global policies in the respective sector with some concrete suggestions for the improvement of organic farming.

Keywords: Organic farming, Sustainable development, Agriculture, Environment, Policies.

INTRODUCTION

In modern age, increasing pollution levels in every sphere of life is the key challenge in sustainable development of our environment. Increasing demands and lavish life style of people causes environmental deterioration. Our agricultural system is also affected by pollution. Modern agricultural practices such as use of synthetic fertilizers, pesticides etc. to maximize crop yield contributes in environmental pollution. These approaches ultimately disturb the nutrient balance of soil and therefore reduce soil fertility. To deal with the existing problem, Organic farming provides a natural way of crop cultivation by using environment friendly, animal and plant based local organic resources that are highly enriched in nutrients required for crop plants. It enhances the microbial activities and increases soil health. Organic farming is an efficient and promising agricultural approach for environmental sustainability as it provides yield stability, improved soil health, no environmental concerns, organic food and reduction in the use of synthesized fertilizers. There are different agricultural approaches working on reducing environmental concerns but use of organic farming, no doubt, the best scientifically proved environment friendly approach in maintaining environmental balance of our agriculture and ecological systems.

Organic Farming and Ancient Scriptures

Organic farming evolves thousand years ago. Ancient farmer's starts crop cultivation along the river belts by using natural resources. Indian scriptures Ramayana, Rigveda, Mahabharata etc. briefly mention the organic agricultural inputs by the farmers at that time [(1)]. Ramayana mentions the cycling of dead things and stinking garbage material that returned to earth in the form of materials that nourishes the earth [(2)]. Description of kamadhenu cow is found in Mahabharata (5500 BC) which was related to its role in agricultural practices [(3)]. Likewise, in 300 BC, Kautilya mentions about oil cake and animal excreta in Kautilya Arthashastra [(4).] Varahmihir in Brihad-Sanhita mentions different types of manures and manuring methods for a

variety of crops [5]. There is mention of organic and green manure in Rigveda and Atharva Veda-II respectively [3]. Major developments (Figure 1) in the organic farming (Ancient period) is presented below:

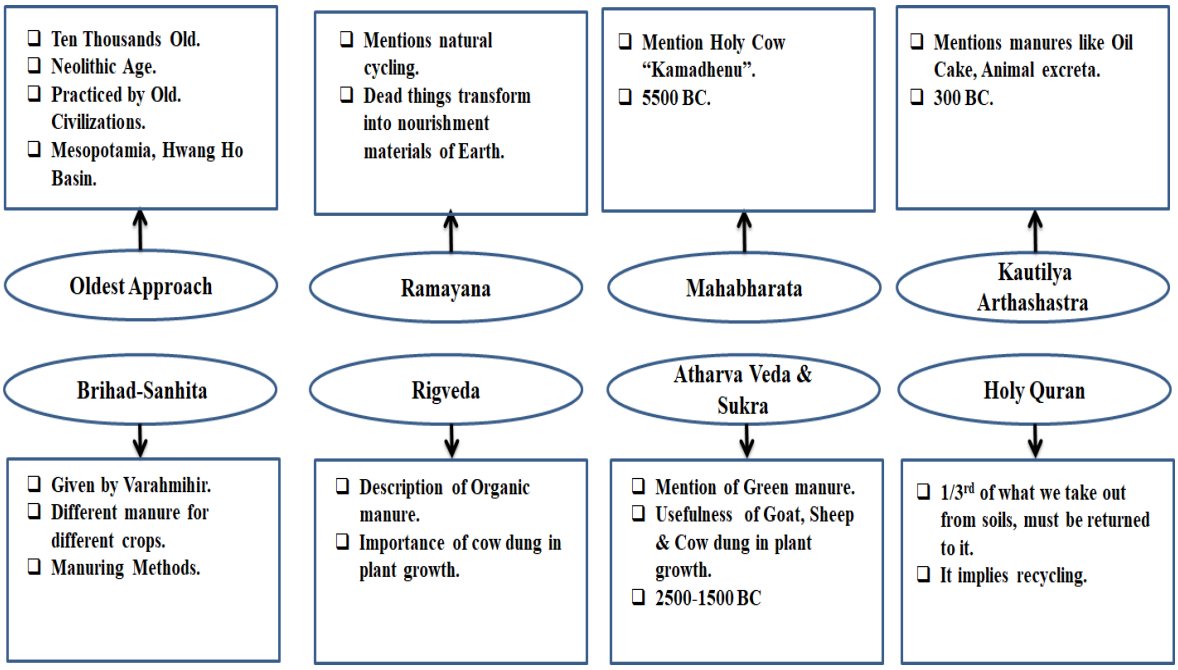

Figure1. Historical view of major developments in the organic farming (Ancient period).

Organic Farming and Modern Period

Modern era of organic farming emerged in Germany in the year 1924. Rudolf Steiner has started a course on "social scientific basis of agricultural development" where he considered human being as the integral part and parcel of natural equilibrium and focuses on harmony with nature [6]. Pfeiffer developed biodynamic agricultural system with the applications of Rudolf Steiner theory of agriculture [7]. In the year, 1930, Hans Mueler, a political personality of Switzerland encourages the organic agricultural practices and Maria Mueler uses organic approach in cultivating orchards [8]. Sir Albert Howard lays the foundation of organic farming movement and summarized his 25 years research work at Indore city of India in his book titled "An Agricultural Testament" which was based on ancient composting practices. He firmly establishes relationship between health of soil, plant and animal with his experiments [9]. In Japan, Mokichi Okada starts natural agricultural approach in the year 1935. He emphasizes the coordination between nature and agricultural production by increasing soil humus so as to get more yields by saying no to use of synthetic agrochemicals and fertilizers [10]. Similarly, Rodale J.I from United States starts practicing organic farming. He practically demonstrated the rebuilding of natural soil fertility and publishes his magazine "Organic Gardening" in 1942 [11]. Development in organic farming starts in the period of 1970-1990 [8]. The area of organic farming starts expanding worldwide in 1960s [12]. Particularly, its expansion starts from the oil crisis developed in 1973 and people became aware of importance of organic agriculture and its importance to environment [13]. New ideas, social transformations, protests and developing alternate life styles were at its peak in these years. People now start thinking about sustainable development through environmental protection, proper source utilization and organic food by natural agriculture. In the year, 1970, the principles of ecological agriculture were introduced by William Albrecht which was

helpful in expanding the concept of organic agriculture [14]. Consequently, IFOAM was established in 1972. It was the largest NGO that works for the expansion of organic agriculture [15]. Different institutions and organizations (e.g. FNAB, FIBL) of organic agricultural importance were established during this period. These institutions implement standards for organic products and paly their role in spreading people awareness [16]. Gradually, different countries start adopting legislations on organic agriculture. Oregon and California State of United States framed laws on organic farming in 1974 & 1979 respectively [17]. Similarly, France starts framing the policies based on organic agriculture in the year 1985. In 1990s, developments in the field of organic agriculture entered in the new growth phase. Various trade organizations came into existence and the government and non-government organizations start emphasizing the use of organic agriculture instead of chemical fertilizers. In this period, the largest and the first BioFach fair was organized in Germany which provides largest marketing platform for organic products [18]. The United States government implemented regulations on organic food in the year, 1990 and the regulations of European Union on organic agriculture were adopted by European commission in 1991. These regulations were adopted by all EU member countries since the year, 1994. The organizations like FAO and IFOAM in year 1999 regulate the organic products production; it's processing with promoting marketing and standard labelling by setting guidelines on organic products. These initiatives and legislations helps in expanding the role of natural resources in agricultural system and the environmental protection which in turns paves the way for sustainable development [17,19] The major developments in the field of organic farming (Table 1) discussed below:

Table 1: Major developments in field of Organic Agriculture in modern period

Major Developments	**Time Period/ Year**	**References**
Botanists Albert Howard & Gabrielle Howard starts Organic Movement and founded Institute of Plant Industry.	1921	[20]
Emergence of Organic farming in Germany.	1924	
Development of agricultural course on "Social scientific basis of agricultural development" by Rudolf Steiner.		[6]
Concept of "Biodynamic Agricultural System" developed by Pfeiffer.	-	[7].
Encouragement to Organic agriculture by Hans Mueler in Switzerland.	1930	[8]
Mokichi Okada Start Organic agricultural approach in Japan.	1935	[10]
Albert Howard published "An agricultural Testament".	1940	[9]
Publication of Organic Gardening magazine by Rodale J.I from USA.	1942	[11]
Worldwide expansion of Organic Farming.	1960	[12]
William Albrecht propounded principles of "Ecological Agriculture".	1970	[14]
Establishment of IFOAM.	1972	[15]
Legislation on Organic Farming by State of Oregon, USA.	1974	[17]
Legislation on Organic Farming by State of California.	1979	
Organic policies by France.	1985	[17,19]
BioFach Fair organized by Germany.	1990	[18]
Regulations on Organic food by USA.		
Adoption of EU regulations by European Commission,	1991	[17,19]
EU regulations adopted by EU member countries.	1994	
Regulation of production, processing, marketing and labelling of Organic products by FAO and IFOAM.	1999	

Building Elements of Organic Farming

The approach of organic farming is depended upon variety of building elements (Table 2). Organic manure, Crop rotation, Vermicomposting, Nitrogen fixing microorganisms, organic residue, crop residue, bio fertilizers, bio pesticides, kitchen waste, sludge and biogas are some of the main elements. These are proved to be very useful in maintaining soil health and texture. Their use is ecofriendly and helps in developing sustainable agriculture.

Table 2. Building elements of organic farming.

Building Elements	Role and Impacts	References
Organic Manure	Supply nitrogen to crops. Enhance Organic Matter in soil. Improve soil fertility, physical structure. Increases microbial activities. Protection against erosion and leaching. Higher essential nutrients for plant growth. Senji, Sunhemp, Cluster Bean, Clover, Cowpea, Fava Bean, Lupin etc. are some of the commonly used green manure crops in organic farming.	(21–24)
Crop Rotation	Helps in pest control. Control on weeds and crop diseases. Maintenance of soil fertility. Improve soil stability. Higher yields. Water Conservation. Healthy environment for biotic-abiotic interactions in soil. Reduction in soil and water contamination. Lesser dependency on chemical fertilizers.	(25)
VermicompostingKitchen waste and Sludge	Nutrients enrichment of soil. Pathogen Inhibition. Improve biological and physiochemical properties of soil. Helps in restoration of friendly microbial species. Improve soil aeration. Cost effective technology for improving soil health.	(26)
Nitrogen fixing microorganisms *free living* *Symbiotic*	Free living (*Cyanobacteria, Nostoc, Anabena, Clostridium, Azotobacter*) and Symbiotic bacteria (*Rhizobium, Frankia, Azospirillum*) initiates root nodule formation. Helps in Conversion of Ammonia to Nitrate and finally to Nitrogen. Therefore, ensuring nitrogen availability in soil.	(27)
Organic and Crop Residue	Helps in mineralization of insoluble plant minerals. Act as carbon source for soil microorganisms. Enhance water holding capacity. Regulation of soil temperature. Act as buffering agent.	(28)
Bio-fertilizers	Enhance nutrients uptake in the rhizosphere of plants. Regulate nutrient balance of soil. Conversion of insoluble phosphate in soluble forms.	(29)
Bio-Pesticides	Ecofriendly approach in pest management. Protect plants from variety of diseases. Helps in controlling soil born fungal pathogens. Less toxic with high specificity.	(30)

Apart from these, the organic agricultural approach follows some basic principles of Health, Ecology, Fairness and Care (Figure 2). These principles are the core of organic agriculture that ensures sustainable development [31].

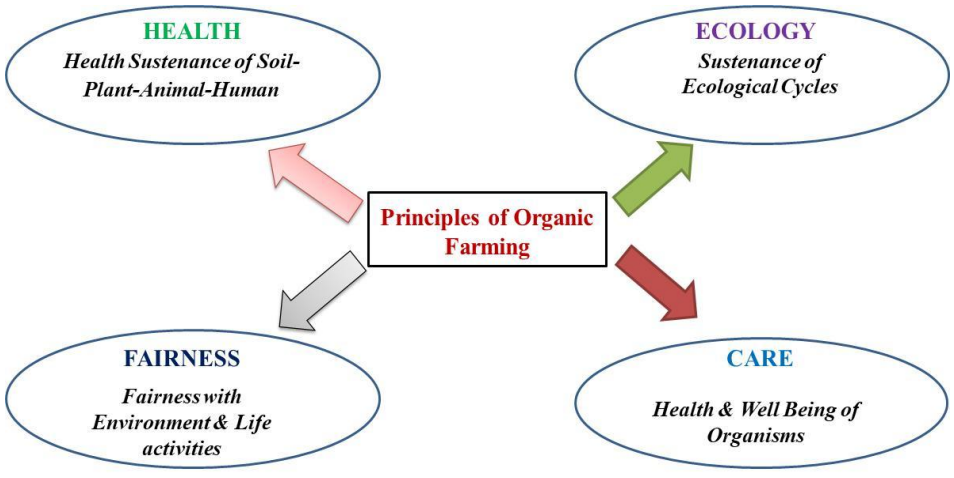

Figure 2. Core principles of organic farming.

Organic Farming as natural tool for environmental protection

In organic farming, more emphasis is given to the environmental health. Due to its nature friendly approach, it helps in reducing soil, water and air pollution. Therefore, acts as natural tool for environmental protection and sustainable development [32]. Farmer's uses crop

rotation, bio fertilizers etc. to maintain enrichment of nitrogen and other essential crop nutrients. Use of chemicals in the field is prohibited and ecofriendly products are taken into consideration. Vegetables are also grown in the field using the organic farming approach, ensuring availability of organic vegetables in the food markets. Figure 3 clearly describes the role of organic farming as natural tool for environmental protection.

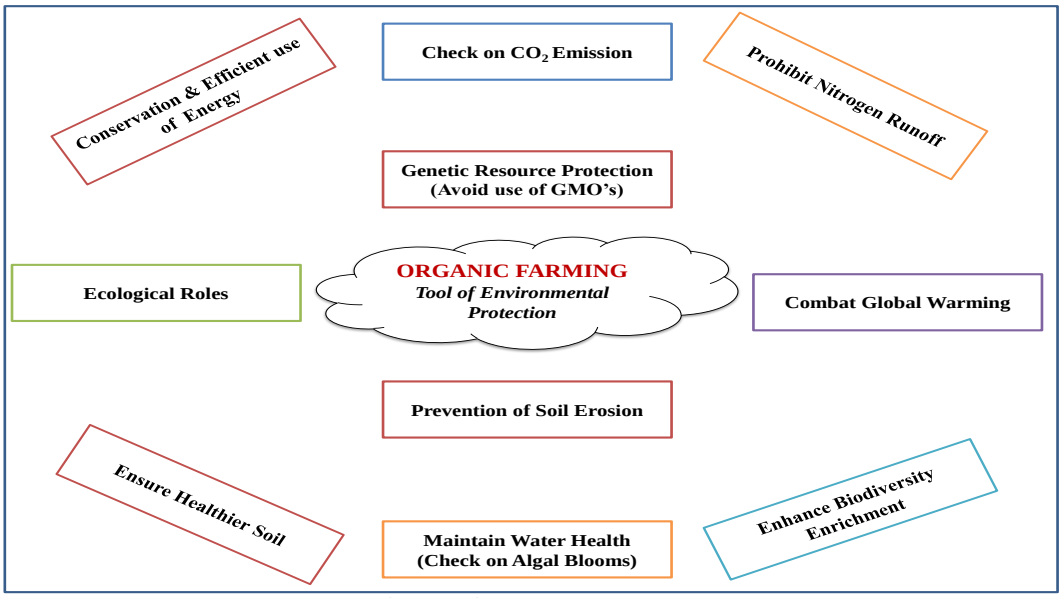

Figure3. Role of organic farming in Environmental Protection.

MATERIALS & METHODS

The increasing use of chemical fertilizers and other modern agricultural practices compromises health of human as well as our environment. The environmental concerns associated with the use of chemicals in agriculture attract the attention of world towards organic farming which provides an ecofriendly and sustainable approach in agriculture. Literature review reveals the presence of well documented literature. This paper is based upon the following methodological approach:

i) Review of historical developments in organic farming.
ii) Role of organic farming in sustainable development of agriculture.
iii) Reviewing existing global policies.
iv) Suggestions for improving policies of organic farming.

This review enlightens the specific role of organic farming in maintaining environmental health and improvement in quality of agricultural products. Methodology involves the systematic literature review of different studies and papers relevant to the present topic. It also includes the review of online content available on different websites of agricultural importance. A number of online data sources used for collection of relevant information. These are:

a) Google Scholar
b) PubMed
c) Discovery
d) Library Genesis
e) Science Direct etc.

The search keywords included "Organic farming" "Sustainable development" "Agriculture" and "Policies". The obtained results were discussed in this paper which is helpful in suggesting policy recommendations and future perspective in the concerned field.

RESULTS AND DISCUSSION

Existing global policies

Globally, many interventions, regulations in the form of government policies designed to enhance the practice and culture of organic farming. Almost every country around the world focuses on production of organic based food products.

Statics on organic agriculture around the globe is given in table 3. According to a report of FiBL and IFOAM, there is a substantial increment is observed in organic based farmlands and it will continue to grow at higher rates with positive growth trend. It has been estimated that the market of organic farming has reaches to its ever highest 97 billion USD market worth. This report is prepared from the data collected from 181 countries by the end of year 2017 [(33)]. In the current scenario USA is the leader of organic market with the net worth of 40 billion euros [(34)]. Next to USA is Germany with the market worth of 10 billion euros [(35)], followed by France and China with net market share of 7.9 and 7.6 billion euros respectively [(36)]. The French organic market achieved fastest growth rate of 18 % [(37)]. In case of producers of organic products, India is on the top with highest numbers [(38)]. These statistical data is of special importance for policy makers to understand the economic impact around the world and also helping them to design more sophisticated, people oriented policies.

Table 3. Current status and global policy initiatives in the organic farming sector.

World's Regions	Current Status of Organic Market	Policies & Legislations	References
Europe	In 2017, Organic farmland reaches up to 12.6 million ha. 250000 organic product producers reported in 2016 in EU. 2nd largest consumer of organic food (retail sales of 34.3 Billion euros). Import of 3.3 Million tons of organic food products, reported in 2018.	National action plan. EU rural development program. Main target is to double the organic land proportion. Scheme of compensation for management of organic farms.	(34)
Asia	Total cultivated organic land is 6.1 million ha (0.4% of total agricultural land). 25 % hike is observed in organic farmland area in between 2016-2017. China is on the top with largest organic cultivated area followed by India. Estimation of 9.6 billion euros market of organic farming in Asia.	Establishment of OFDC by China in 1994 for organic products certification. Establishment of CAAC (China) in 2002. China instituted CNOPS in 2005. Cluster program by Indian government "Parampragat krishi vikas yojana" brings about 500,000 acres under organic farming. India initiates value chain based organic farming scheme in northeast regions. Scheme for integrated development of horticulture (India) was implemented from 2014-15. Introduction of national mission for sustainable agriculture.	(34,39–42)
North America	Presence of 7% agricultural land. 2.2 million ha land under organic farming. In 2017, FiBL and IFOAM estimated 48.7 billion dollars net worth of organic market.	USA in 1990 passes organic food production act to regulate production and processing of organic food. Initiation of National Organic Program. USDA labelling of products.	(43,44)
Germany	8% increase has been observed in organic cultivated land. 10.91 billion Market with average growth rate of 5.5% since 2018.	Framing of Organic farming act by the German government. Establishment of BOLW for improvement of organic farming. Uniform Ecolabel on organic products is used since 2001.	(35)
Australia	Australian organic market is with net worth of 2.4 billion dollars. 88% growth rate has been observed since the year 2012. 12% of Australians are now committed purchasers of organic products.	Development of private certification organizations in the period of 1980s. These organizations come under AQIS in 1990. Establishment of BFA and NASAA for the promotion of organic practices. Adoption of national standard in 1992 which later amended in 1998.	(45,46)
Denmark	World's leading nation in organic farming. Having share of 8.4% in global market.	Government in 1987 adopted the organic farming act. In 1992, Government starts providing Grant in aid for organic research. Introduction of permanent subsidies to farmers of organic agriculture sector in 1994. Initiation of Education program of farmers working in organic fields in 1995. Permanent organic payments and flat conversions replace the permanent subsidies in 2004.	(47,48)

Efficiency Analysis

Many initiatives have been taken by the governments in the respective field but it has been observed that there is need of more consistency and farmer oriented policies. Mere policy framing is not sufficient but

their proper implementation is ensured by the responsible authorities. Beside a long list of policies and legislations, few reasons and challenges have been identified for lower efficiency of these policies. These are:

a) Lower productivity rate.
b) Lack of global standards for organic processing and production.
c) Higher consumer costs.
d) Issues in maintaining consistency in food quality.
e) Lack of required infrastructure and supply chain management.
f) Lack of awareness between the people.
g) Lack of professionals.

Suggestions for Policy improvement

Following are the suggestions that may help in improving current policies for organic farming:

Clear objectives: Authorities must go through the in-depth analysis of the policy and they have clear objectives.

Ensure Participation: Government should ensure the participation of all related stakeholders of the society. Their role in policy developments and various programs takes into consideration.

Current status Analysis: Before policy framing, it is highly recommended to undergo deep analysis of the current status of the sector and its related impacts on the society.

Assigning Responsibilities: There must be assigning of responsibilities to different agencies that work together under one leading government agency, responsible for proper implementation of the policies.

Establishment of Bridging Body: A permanent bridging body must be established that works as a bridge between Government and related agencies of organic sector.

Research and Development: Government must ensure the scientific collection of data and relevant information about the organic farming sector. This data proved to be useful in preparing policy framework for the respective sector.

Regional Standards Preparation: Cooperation of Government and private sectors is needed in developing regional standards for organic products.

Impact Assessment: Government must provide support and emphasis to the research work and studies associated with scientific impact assessment of the policies. So that, the responsible authorities aware of the policies impacts on the relevant sector.

Review of Policies: To maintain efficiency and relevancy of the framed policies, time to time policy review is must. This helps the policy makers to make changes in the legislation according to the present demand of the organic sector.

Education and Awareness: It is highly recommended to take initiatives for education and awareness of the common customer of the organic food.

Scientific Monitoring: Before implementation of policy, authorities must ensure the proper scientific monitoring of policy impacts on ground level.

CONCLUSION

Present paper highlighted the importance and utmost necessity of organic farming in the modern era of agricultural sector. It is very old and relevant agricultural practice. Many legislations and policies have been framed across the globe for the development of organic farming but some part of world is still needed the proper implementation of the policies at the regional level. With time, organic farming attracts the people across the globe. With its effectiveness, the organic sector has to deal with the persisting challenges. Therefore, it is the need of hour to frame and implement the organic sector policies with the society's stakeholder's involvement which ultimately improve the organic farming. It is concluded that proper follow up, ground level implementation, impact analysis and public awareness is the key to success of every policy. A better policy leads to sustainable

development and helpful in achieving the goal of sustainable environment.

List of Abbreviations

IFOAM: *International Federation of Organic Agriculture Movements;* **NGO:** *Non-Governmental Organization;* **FNAB:** *French National Federation of* Organic *Farming;* **FIBL:** *Forschungsinstitut für biologischen Landbau (*Research Institute of Organic Agriculture*);* **EU:** *European Union;* **FAO:** *Food and Agriculture Organization;* **GMO's:** *Genetically modified organisms;* **USD:** *US Dollars;* **OFDC:** *Organic Food Development Center;* **CAAC:** *Certification and Accreditation Administration of China;* **CNOPS:** China *National Organic Product Standard;* **USDA:** *United States Department of Agriculture* ; **BOLW:** *Bund Ökologische Lebensmittelwirtschaft ;* **AQIS:** *Australian Quarantine and Inspection Service ;* **BFA:** *Biological Farmers of Australia;* **NASAA:** *National Association for Sustainable Agriculture, Australia.*

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