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Organic livestock farming: An overview

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Abstract
Organic farming is a production system which avoids the use of synthetic fertilizers, pesticides, insecticides, growth regulators, and livestock feed additives. The basic objectives of organic farming are environmental, social, and economic sustainability. Organic livestock production focuses on cultural, biological and mechanical methods to ensure environmentally safe and chemical residue-free foods, along with high animal welfare standards. There are numerous reasons for preferring organic products and adoption of organic farming. These can be broadly categorized according to the benefit to different beneficiaries like Consumer benefits, Producer benefits, Environmental benefits and Social and economic benefits. The organic dairy sector continues to be a fast-growing segment as organic milk gives a feeling of safety and environmental protection to consumers, and the global demand for organic products is creating a new export opportunity for developing countries. Now a day, quality and health-conscious consumers are increasing and they need environmentally safe, chemical-residue-free healthy foods, along with product traceability and a high standard of animal welfare. The review can be helpful for researchers and decision-makers to the export demand for livestock products it is necessary to provide inputs to the organic farmers in the form of technical knowledge how to certify which is mandatory in organic production system.

Keywords: Organic livestock, consumer benefits, environmental benefits, opportunity, certification, organic production

1. Introduction
Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It underlines the utilization of administration practices in inclination to the utilization of off-farm inputs, considering that territorial conditions require privately adjusted frameworks. This is proficient by utilizing, where conceivable, agronomic, natural, and mechanical strategies, instead of utilizing engineered materials, to satisfy a particular capacity inside the framework (Codex Alimentarious, 2007). Organic animal husbandry is defined as, a system of livestock production that promotes the use of organic and biodegradable inputs from the ecosystem in terms of animal nutrition, animal health, animal housing and breeding. It deliberately avoids the use of synthetic inputs such as drugs, feed additives and genetically engineered breeding inputs (Chander *et al.* 2011) [17].
Organic livestock production focuses on cultural, biological and mechanical methods to ensure environmentally safe and chemical residue-free foods, along with high animal welfare standards (Codex Alimentarius, 2007).
The term 'Organic farming' is a production system which avoids the use of synthetic fertilizers, pesticides; insecticides, growth regulators, and livestock feed additives. The basic objectives of organic farming are environmental, social, and economic sustainability (Stockdale *et al.* 2001) [51]. Organic Dairy farming implies raising milching animals on organic feed (i.e. pastures developed without the utilization of composts or pesticides), have admittance to pasture or outside, alongside the limited use of anti- toxins and hormones (Oruganti, 2011) [42].
Organic agriculture as a production system which avoids or largely excludes use of

synthetically compound fertilizers, pesticides, growth regulators and livestock feed additives. Instead of synthetic inputs such farms relay mostly on crop rotations, crop residues, animal manures, off farm organic wastes and aspects of biological pest control to maintain soil productivity and tilth to supply plant nutrients and to control insects, weeds and other pests (Lampkin, 1990) [35]. Organic livestock farming promotes the use of organic and bio-degradable inputs from the ecosystem. These inputs include the component like animal nutrition (organically grown, good quality food and species-specific diets), animal health (good management, prevention and stress-free environment), animal housing and breeding (animals should not be caged, tethered or confined in buildings, clean bedding, natural light, adaptable breeds are to be chosen). Use of synthetic inputs like drugs, feed additives and genetically engineered breeding inputs should be avoided as much as possible (Chander *et al*. 2011) [17]. In organic livestock farms there should be harmonious relationship between land, plants and animals. Animals should be raised organically from the last trimester of pregnancy or from birth. Breeds chosen for organic farming should be adaptable to local conditions. At the time of disease occurrence mostly homeopathic and ayurvedic (world's oldest holistic healing system) treatments are to be preferred. As far as possible allopathic medicines and genetically engineered products are to be avoided (IFOAM, 2009).

Characteristics of Organic Livestock Production

Animal production is an important part of organic farming that aims at achieving a balanced relationship between the soil, the plants and the animals in a farming system. It deliberately avoids the use of synthetic inputs such as drugs, feed additives and genetically engineered breeding inputs (Chander *et al*. 2011) [17]. Organic livestock management shall aim to utilize natural breeding methods, minimize stress, prevent disease, progressively eliminate the use of chemical allopathic veterinary drugs (including antibiotics), and maintain animal health and welfare. Animal health and well-being through better living conditions, improved welfare measures and good feeding practices are ensured through a set of standards and the maintenance of written records by organic livestock farmers. Better management practices and prevention of illness are emphasized over treatment. Animals are marketed as having been raised without the use of persistent toxic pesticides, antibiotics or parasiticides.

Reasons for adopting organic livestock farming

Organic livestock farming is not a production method meant to solve all problems in livestock production. It is primarily a production method for a specific premium market, demanding high quality standards during the entire production process, advanced management qualifications and certification standard (Sundrum, 2001) [53]. These markets demand the farm to table know-how of the production process of the products. There are numerous reasons for emergence of the organic farming but the principal reasons being the health concerns, environmental and sustainability issues. There are numerous reasons for preferring organic products and adoption of organic farming. These can be broadly categorized according to the benefit to different beneficiaries-

- Consumer benefits
- Producer benefits
- Environmental benefits
- Social and economic benefits

Consumer benefits

A large number of the conventional foods has put a question mark on food safety and has increased the public health related issues e.g. out breaks of the prion diseases like Bovine Spongiform Encephalopathy (BSE) and Creutzfeldt-Jakob Disease (CJD) (Bear, 1997). As in case of conventional animals sometimes there is use of blood meal and bone meal and sometimes these meals are contaminated with the of blood and bones from the infected animals that increases the chances of spreading the disease organism (Watson and Redman, 1999) [54]. Presence of dioxins (persistent environmental pollutants) mostly in conventional livestock products can cause reproductive and immunological changes in humans and can also lead to fatal disease like cancer. In addition, more than 90% of exposure of these dioxins is through food mainly from meat and dairy products, food processing, manufacturing of herbicides and pesticides.

Absence of antibiotic-resistant bacteria in the organic animal foods has made them safe to consume e.g. *E. coli* O157: H7 antibiotic resistant bacteria having increased incidences in conventional livestock products and can cause fatal diseases like Hemolytic Uremic Syndrome (HUS) in humans. Organic foods are poison and chemical residue free as there is no use of synthetic inputs like pesticides, herbicides etc. (Pathak *et al*. 2003). Analyses of pesticide residues in produce in the United States (US) and Europe have shown that organic products have significantly lower pesticide residues than conventional products (Benbrook *et al*., 2001) [7]. There are high pre- consumers human health costs to conventional agriculture, particularly in the use of pesticides (Conway *et al*. 1991) [22]. It is estimated that 25 million agricultural workers including the livestock farmers in developing countries are poisoned each year by pesticides (Jeyaratnam, 1990) [32].

Producer benefits

Organic livestock farming depends least on off- farm expensive inputs. Feeds and fodders for animals are to be grown in farm itself and intern manure produced by animals is used in the same farm to increase soil's fertility. In organic farms those species of animals are used that are disease and drought resistant so that farm can sustain during changing climatic conditions (Chander *et al*. 2011) [17]. The organic livestock products have added value when compared to their conventional counterparts for that reason consumers are motivated and are ready to pay higher prices for organically grown foods. The various motivating factors for the consumers to buy organic products are health consciousness, environmental reasons and food safety concerns. According to some reports organically-grown animals are having lesser disease incidences than conventional ones significant or on par reproductive performances with conventional animals (Reksen *et al*. 1999) [47] and also have comparatively less use of veterinary drugs than conventional animals.

Environmental benefits

As the world is becoming concerned about environmental protection, one of the basic standards of organic farming is tailored reduce environmental pollution and nutrient loss at farm level markedly (Sundrum, 2001) [53]. There has been large-scale and rapid destruction of fertile agricultural soils in many countries including India as a result of the very processes which attempted to increase agricultural productivity (GoI, 2008). Soil conservation is more in organic farms as there is maintenance of the soil cover, less soil erosion and hence less leakage of synthetic residues in water

bodies. Organic farming also proves to be climate friendly as there is less emission of greenhouse gases like CO2 (as organic soils has more ability for carbon sequestration that decreases environmental carbon dioxide), nitrous oxide (as most of nitrogen in organic soils remain fixed) and methane (organic animals produce less methane due to low stocking densities and more use of roughages). Presence of large diversity in organic farms play role in nature protection. There is also no use of genetically modified organisms (GMO) in organic plants and animals because as per rules of organic farming GMO's de- emphasize the diversity and causes unnatural addition to genetic pool of plants and animals.

Social and economic benefits

In India the employment share from the agricultural sector declined from 64.8% in 1993-94 to 48.9% in 2011-12. In organic farms there are 10-20% more employment opportunities as there is less appliance of machineries and non-renewable sources of energy. Most of jobs are done manually thus increasing employment opportunities. Livable wages, more healthy and safe conditions are provided to laborers.

Need of Organic Farming

The interest in organic crop and livestock farming remerges in recent time due to growing concerns about the conventional farming paradigm that relies on synthetic inputs to maximize yields which poses threats to the environment and health. Intensive farming by introduction of exotic species, land clearing, vegetation fragmentation, habitat change and soil erosion has been one of the main causes of biodiversity decline (Bengtsson *et al*. 2005) [9]. On the other hand, consumers are increasingly seeking environmentally safe, chemical residue free healthy foods, along with product traceability and a high standard of animal welfare, which organic production system can ensure (Chander *et al*. 2011) [17]. It is also considered as only feasible alternative and interesting option for sustainable agriculture in developing countries because it offers a unique combination of low external inputs and technology, environmental conservation and input/output efficiency (Augustine *et al*. 2013) [2]. Organic agriculture addresses these public demands, and has the potential to improve the health and welfare status of an animal, and to diminish environmental pollution of agricultural production (Sundrum, 2001) [53].

Prospects of organic livestock farming in India

Organic dairy surged into the organic marketplace in the 1990s, establishing itself as a major category. In India it became visible much later (Oruganti, 2011) [42]. Some of the agro-climatic regions in India are best suited for organic milk production. These areas include the rain-fed areas of Rajasthan, Gujarat, Madhya Pradesh, hilly areas of Himachal Pradesh, Uttaranchal, Jammu and Kashmir, Tamil Nadu and whole of North-Eastern region. There are some areas in the country (especially mountain areas) and communities (certain tribes) where the green revolution technologies have so far not reached and did not adopt the use of agro-chemicals. These areas have been classified as "organic zones" (Singh, 2007) [42]. Eastern region of India also has high potential for organic farming due to least utilization of chemical inputs where it is estimated that 18 million hectares of such land is available which can be exploited for systematic organic production (Ghosh, 2006) [25]. The organic dairy farming has a good scope in the country as it is the small holder's low input, crop residue fodder-based production system contributing 70% of total milk production of the country (Kumar *et al*. 2005) [18]. Thus, these systems are expected to offer a more profitable and sustainable production system based on low input (Hermansen, 2003). [29] Education, family education, mass media exposure and innovativeness had positive and significant correlation with knowledge level of organic farming practices (Naik *et al*. 2009) [39]

In fact, the rain fed tribal, north-east and hilly regions of the country where negligible chemicals are used in agriculture have been practicing subsistence agriculture for a long period; such areas are organic by default. In India only 30 percent of total cultivable area is covered with fertilizers where irrigation facilities are available and in the remaining 70 percent of arable land, which is mainly rain- fed, negligible amount of fertilizers is being used. Farmers in these areas often use organic manure as a source of nutrients that are readily available either in their own farm or in their locality. India has around 1,426 certified organic farms, which produces approximately 14,000 tons of output annually.

Standards for organic livestock farming:

Certification process

In order to certify a farm, the farmer is typically required to engage in a number of new activities in addition to normal farming operations, study the organic standards, compliance farm facilities of production method must comply with standards, documentation, planning, inspection, fee and record keeping written day to day farming records (Yadav, 2009) [39]. In order to certify a farm, the farmer is typically required to engage in a number of new activities, in addition to normal farming operations:

- **Study:** The organic standards, which cover in specific detail what is and is not allowed for every aspect of farming, including storage, transport and sale.
- **Compliance:** Farm facilities and production methods must comply with the standards, which may involve modifying facilities, sourcing and changing suppliers, etc.
- **Documentation:** Extensive paperwork is required, detailing farm history and current set-up, and usually including test results of soil, water, feed, medicines, etc.
- **Planning:** A written annual production plan must be submitted, detailing everything from procurement to sale: source of animals, fodder, feed, medicines and farm activities, etc. Inspection - Annual on-farm inspections are required, with a physical tour, examination of records, and an oral interview.
- **Fee:** A fee is to be paid by the farmer to the certification body for annual surveillance and for facilitating a mark which is acceptable in the market as symbol of quality.
- **Record keeping:** Written, day-to-day farming and marketing records, covering all activities, must be available for inspection at any time. In addition, short-notice or surprise inspections can be made, and specific tests (e.g. soil, water, animal products) may be requested.

Conversion period

The time between the start of organic management and certification of crops or animal husbandry is known as the conversion period. The whole farm, including livestock, should be converted according to the standards over a period of three years. With regard to dairy and animal production, the length of conversion period should not be less than 30 days. Animal products may be sold as "product of organic agriculture" only after the farm or relevant part of it has been

under conversion for at least twelve months and provided the organic animal production standards have been met for the appropriate time (NPOP, 2005). A farm already growing without chemicals may be certified organic without this delay. Plant products produced can be certified organic when the national standards requirements have been met during a conversion period of at least two years before sowing or three years in case of perennial crops. Animal products may be sold as "product of organic agriculture" only after the farm or relevant part of it has been under conversion for at least one year and in case of dairy and egg production, this period shall not be less than 30 days. Animals present on the farm at the time of conversion may be sold for organic meat if the organic standards have been followed for one year (Yadav, 2009) [39].

Brought-in Animals

When organic livestock is not available, the certification programme shall allow brought-in conventional animals when calves up to 4 weeks old which have received colostrum and are fed a diet consisting mainly of full milk. Breeding stock may be brought in from conventional farms at an annual rate not exceeding 10% of the adult animals of the same species in the organic farm (NPOP, 2005).

Animal Breeds and Breeding

The certification programme shall ensure that breeding systems are based on breeds that can both copulate and give birth naturally. Artificial insemination is allowed. Embryo transfer techniques are not allowed in organic agriculture. Hormonal heat treatment and induced birth are not allowed unless applied to individual animals for medical reasons and under veterinary advice. The use of genetically engineered species or breeds are not allowed (NPOP, 2005).

Feed and Feeding

The livestock should be fed 100% organically grown feed of good quality. All feed shall come from the farm itself or be produced within the region. The diet shall be offered to the animals in a form allowing them to execute their natural feeding behavior and digestive needs. The prevailing part (at least more than 50%) of the feed shall come from the farm unit itself or shall be produced in co-operation with other organic farms in the region.

The following products shall not be included nor added to the feed given to farm animals:

- Synthetic growth promoters or stimulants
- Synthetic appetizers
- Preservatives, except when used as a processing aid
- Artificial coloring agents
- Urea
- Farm animal by-products (e.g. abattoir waste) to ruminants
- Droppings, dung or other manure (all types of excreta) even if technologically processed
- Feed subjected to solvent (e.g. hexane), extraction (soya and rape seed meal) or the addition of other chemical agents
- Pure amino acids
- Genetically engineered organisms (NPOP, 2005)

Use of synthetic growth promoters, synthetic appetizers, preservatives, artificial coloring agents, synthetic amino acids, emulsifiers, urea etc. is prohibited.

Average net farm revenue of organic farm was higher than conventional farm. A critical reason for this is that feeding and other cost in conventional farm is greater than organic farm (Hara and Parson, 2013) [28].

Housing and Management

An organic livestock producer must create and maintain living conditions that promote the health and accommodate the natural behaviour of the animal (Chander, 2011) [17]. These living conditions must include access to the outdoors, shade, shelter, fresh air, direct sunlight suitable for the particular species and access to pastures for ruminants (Greene, 2002) [27].

Table 1: EEC regulations on organic livestock farming in relation to selected minimal standards

Characteristics	EEC regulations	
	Dairy cow	Calves
Locomotion area per animal	6.0 m² indoors + 4.5 m² outdoors	1.5 m² indoors + 1.1 m² outdoors
Floor characteristics	Lying space with litter (bedding)	Dry litter bedding
Husbandry practices	Keeping tethered is forbidden	Generally, group penning

Health care

Organic livestock production requires producers to establish preventive health care practices. These practices include: Selecting the appropriate type and species of livestock, providing adequate feed, creating an appropriate environment that minimizes stress, disease and parasites. Use of natural medicines and methods including Homeopathy and Ayurvedic should be emphasized. If antibiotics or chemotherapeutics are used in organic livestock, the withdrawal time for products is double the official conventional withdrawal time (Oruganti, 2011) [42]. Where conventional veterinary medicines are used, the withholding period shall be at least double the legal period.

Use of the following substances is prohibited:

- Synthetic growth promoters
- Substances of synthetic origin for production, stimulation or suppression of natural growth
- Hormones for heat induction and heat synchronization unless used for an individual animal against reproductive disorders, justified by veterinary indications
- Vaccinations shall be used only when diseases are known or expected to be a problem in the region of the farm and where these diseases cannot be controlled by other management techniques. The certification programme shall define conditions for such cases.
- Genetically engineered vaccines are prohibited
- (NPOP, 2005)

Mutilations

Species shall be chosen which do not require mutilation. Mutilations shall be allowed only in exceptional cases and shall be kept to the minimum. Mutilations are not allowed. The certification programme shall allow the following exceptions:

- Castrations
- Tail docking of lambs
- Dehorning
- Ringing
- Mulesing

Health benefits of Organic Milk

Organic milk has more beneficial Omega-3, less damaging Omega-6 (Benbrook *et al*. 2013) [8]. Omega-3 is an essential fatty acid which is required for healthy growth and its deficiency leads to various health problems that have seemed to increase in recent years. Regular intake of omega 3 fatty acids protects from various diseases and helps to reduce the incidence of heart disease, inflammation (in skin diseases like eczema), cancer, and arthritis (Annon, 2014) [1]. Omega-6 fatty acid in higher concentration in human body may cause increase in blood pressure with diabetes. The organic milk also contains greater amounts of conjugated linoleic acid (CLA).

Conjugated linoleic acid (CLA) increases the body's metabolic rate, immunity to disease, and muscle growth. It also reduces abdominal fat, cholesterol, and allergic reactions (Annon, 2014) [1]. Milk contains Conjugated Linoleic Acid (CLA). Function of CLA in human body is to boost immune system and reduce the growth of tumors. CLA levels in organic milk are higher because these cows eat greater amounts of grass, hay and silage (McBride and Greene, 2009) [37]. Organic cows are grazed on pastures that are grown through organic means. Therefore, their milk is not contaminated with harmful chemicals such as the residues of pesticides, fertilizers and hormones (Singh *et al*. 2011) [49]. Furthermore, this nutrient-rich organic milk does not contain traces of antibiotics, GM feed, urea, or fertility hormones, as these are not fed to the cows to increase their milk production. Organic milk has a two to three time higher concentration of antioxidants like lutein and zeaxanthin than non-organic milk (Mercola, 2014). Lutein is extremely important for eye health and is effective in preventing numerous eye diseases such as macular degeneration and cataracts. Zeaxanthin is also important for good eye health. It protects the eye from UV damage and the impact of free radicals. It is very helpful in preventing cataracts, diabetic retinopathy, glaucoma and macular degeneration. Organic milk has a higher concentration of vitamins such as Vitamin A and Vitamin E than conventional milk. Since organic cows graze on fresh grass and clover, the milk they produce has about 50% higher Vitamin E and 75% higher beta carotene. Animals managed in conventional system in confinement contribute to manure with a high methane producing capacity. In contrast cattle raised in pasture, eating a more natural, low -energy diet composed of grasses and other forages, produce manure with about half of the potential to generate methane (Singh *et al*. 2011) [49].

Organic milk is produced without the use of synthetic hormones, so their residue is not present in milk. Organic milk is free from the presence of antibiotic residues which reduces the chance of development of microbial resistance. The price of organic milk is higher and more stable than the conventional milk price. Organic milk is known to have a lower presence of pesticide residues than conventional milk, although not completely free of these residues. Organic milk has lesser amount of Aflatoxin M1 levels (Woese *et al*. 1997) [55]. There are no major differences in terms of milk composition from conventional and organic production (Kouba, 2003) [34]. The organic milk price has been on gradual upward trend while conventional price has bounced up and down.

Determination of organic milk authenticity

Natural stable isotopes of carbon and nitrogen (12C, 13C, 14N, 15N) have abundances unique to each living creature. Therefore, measurement of the stable isotope ratio of carbon and nitrogen (δ13C = 13C/12C, δ15N = 15N/14N) in milk provides a reliable method to determine organic milk (OM) authenticity. Chung *et al* (2014) [20] determined the authenticity of organic milk by using δ13C and δ15N and concluded that mean carbon isotope ratio (δ13C) was higher in organic milk (OM) than in conventional milk (CM); mean nitrogen isotope ratio (δ15N) was lower in the OM than in the CM, and the combination of δ13C and δ15N was more effectively distinguished between OM and CM (Chung *et al*. 2014) [20].

Energy use and greenhouse gas emissions

Organic milk production inherently increases methane emission and, therefore, can reduce global warming potential only by reducing emission of carbon dioxide and nitrous oxide considerably (Boer, 2003) [10]. Energy use and greenhouse gas emissions in Dutch organic and conventional farming systems and reported that energy use and greenhouse gas emissions per unit milk in organic dairy are approximately 25% and 5-10% lower than in conventional dairy (Bos *et al*. 2014) [12]. Organic milk producers can become self-sufficient in energy and reduce total GHG emissions from milk production by 46% in the biogas system.

Organic certification

It is a certification process for producers of organic food and other organic agriculture products. In general, any business directly involved in food production can be certified, including seed suppliers, dairy farm, farmers, food processors and retailers. Certification is essentially aimed at regulating and facilitating the sale of organic products to consumers and also prevents fraud (Yadav, 2009) [39]. Five natural principles are imperative and have an overall acknowledgment, viz. European Union Regulation (1804/1999), Organic Food Products Act (OFPA) of USA, Draft Guidelines of Codex/WHO/FAO, United Kingdom Register of Organic Food Standards (UKROFS) of UK and the International Federation of Organic Agricultural Movements (IFOAM) fundamental norms. It has been accounted for that there are 468 associations overall which offer natural confirmation administrations (Yadav, 2009) [39]. National Standards for Organic Production (NSOP) in India are largely based on the IFOAM Basic Standards. These standards need to be discussed by the stakeholders at different levels for periodic changes and modifications as per the local situations. The academician and researchers may play a vital role in raising the awareness among the farmers, who may have to venture into organic production sooner or later due to growing demand.

Certification bodies in India

In India, Agricultural Processed Foods Export Development Authority (APEDA) under Ministry of Commerce is the controlling body for organic certification. Currently 33 certification/accredited agencies have been authorized to undertake certification process in India under National Programme for Organic Production (NPOP).

- Bureau Veritas (India) Pvt. Limited, Mumbai
- ECOCERT India Pvt. Ltd., Gurgaon
- IMO Control Pvt. Ltd., Bangalore
- Indian Organic Certification Agency (INDOCERT), Kerala
- Lacon Quality Certification Pvt. Ltd., Kerala
- OneCert International Private Limited., Jaipur

- SGS India Pvt. Ltd., Gurgaon
- CU Inspections India Pvt. Ltd., Mumbai
- Uttarakhand State Organic Certification Agency (USOCA), Dehradun
- APOF Organic Certification Agency (AOCA), Pune
- Rajasthan State Organic Certification Agency (RSOCA), Jaipur
- Vedic Organic Certification Agency, Hyderabad
- ISCOP (Indian Society for Certification of Organic Products), Coimbatore
- TQ Cert Services Private Limited, Telangana
- Aditi Organic Certifications Pvt. Ltd., Bengaluru
- Chhattisgarh Certification Society, India (CGCERT), Chhattisgarh
- Reliable Organic Certification Organization, Bengaluru
- Bhumaatha Organic Certification Bureau (BOCB), Bengaluru
- Tamil Nadu Organic Certification Department (TNOCD), Coimbatore
- Intertek India Pvt. Ltd., New Delhi
- Madhya Pradesh State Organic Certification Agency, Bhopal
- Odisha State Organic Certification Agency (OSOCA), Orrisa
- Natural Organic Certification Agro Pvt. Ltd., Pune
- Fair Cert Certification Services Pvt. Ltd., MP
- Gujarat Organic Products Certification Agency (GOPCA), Ahmedabad
- Uttar Pradesh State Organic Certification Agency, Lucknow
- Karnataka State Organic Certification Agency, Bangalore
- Sikkim State Organic Certification Agency (SSOCA), Gangtok
- Global Certification Society, Palampur
- GreenCert Bio solutions Pvt. Ltd., Pune
- Telangana State Organic Certification Authority, Hyderabad
- Bihar State Seed and Organic Certification Agency (BSSOCA), Patna
- Baltic Testing India Pvt. Ltd., Mumbai
- India is having 44,926 certified organic farms and 528,171 hectares (0.3% of total agricultural land) are under organic farming, and India is largest organic producer (Pandey and Singh, 2012) [48].

Steps taken by government of India to promote Organic Livestock Farming:

- Launching of National Programme of Organic Production (NPOP) in 2000.
- Indian National Standard for Organic Production (NSOP) developed and published in 2001 and revised in 2002.
- National Centre for Organic Farming established in 2003.
- Allotment of ` 100 crores in 10th plan outlay for organic development.
- A network project on organic farming sanctioned by I.C.A.R. (2004-07) involving four ICAR institutes and nine SAUs.
- A pilot study on organic milk production system undergoing at National Dairy Research Institute, Karnal.

Organic Livestock Farming in India

After the independence, the first five year plan was agriculture oriented. India was facing scarcity of food grains in the initial decades of post-independence era. There were no enough food grains to feed the growing population. So green revolution was started in 1960s under the guidance of M. S. Swaminathan. It was based on use of High Yielding Variety (HYV) seeds, chemical fertilizers, pesticides, insecticides and weedicides etc. for crop production. It resulted in surplus production of food grains. India not only became a self-sufficient nation in the production of food grains to feed its growing population but also exported food grains to other countries. But excessive use of chemical fertilizers and pesticides degraded the soil composition, soil fertility and the environment. These chemicals also became the part of food chain and deteriorated the health of consumers. In such conditions, organic farming became popular as it attracted health conscious people and environmentalists. The Organic Farming Association of India (OFAI) was set up in 2002 in Bangalore.

As per the available statistics, India's rank 6th in terms of world's organic agricultural land and 1st in terms of total number of producers as per 2021 data (FiBL and IFOAM, 2023). The APEDA, Ministry of Commerce and Industries, Government of India is implementing the National Programme for Organic Production (NPOP). The programme involves accreditation of certification bodies, standards for organic production, promotion of organic farming and marketing etc. As on 31st March, 2023 total area under organic certification process (registered under National Programme for Organic Production) is 10.17 million hectares (2022-23). This includes 53,91,792.97 hectares cultivable area and another 47,80,130.56 hectares for wild harvest collection. Among all states Madhya Pradesh has covered largest area under organic certification followed by Maharashtra, Gujarat, Rajasthan and Odisha etc. Uttarakhand is the pioneering state in organic agriculture, since it is the first tate declared as organic because it follows all organic practices although by default (Subrahmanyeswari, 2008) [52]. India produced around 2.9 million MT (2022-23) of certified organic products including organic livestock products (APEDA, 2023). The total volume of export during 2022-23 was 3,12,800.51 MT (APEDA, 2023). The organic food export realization was around INR 5,525.18 Crore (708.33 million USD). Organic products are exported to USA, EU, Canada, Britain, Switzerland and Turkey etc. (APEDA, 2023). India has emerged as the largest producer of milk with 22.76% share in total milk production in the world in 2021. India accounts for about 7.25% of the global egg production in 2021. India has the largest population of milch animals in the world. India's exports of animal products in 2022-23 was Rs. 32,597.39 Crores/ 4,062.15 million USD (APEDA, 2023). In India there are excellent breeds of livestock that are well suited to changing climatic conditions, resistant to most of diseases and thrive well on crop residues. Apart from livestock food products, non-food livestock products like hides, leather & wool also offer hope for organic livestock production in India (Chander *et al*., 2011) [17].

Global Scenario of Organic Livestock Production

According to FAO, livestock contributes to nearly 40% of total agricultural output in developed countries and 20% in developing ones, supporting the livelihoods of at least 1.3 billion people worldwide. Thirty-four per cent of global food protein supply comes from livestock. Organic livestock farming has a greater demand due to more focus on sustainability. According to FiBL, 3.7 million organic producers were reported in 2021, an increase of 4.9%

compared to 2020. India remained the country with the most organic producers (1.6 million). In 2021, 1.6% farmland around the world was organic. In 2021, the organic market reached almost 125 billion euros, an increase of 4 billion euros or approximately 3% (FiBL, 2023). The global organic meat products market will grow from $ 16.67 billion in 2022 to $ 17.99 billion in 2023 at a compound annual growth rate (CAGR) of 7.9% (The Business Research Company report, 2023). Organic dairy products make up 22.3% of overall organic farm products in the world. The global organic dairy market size reached US $ 23.9 billion in 2022, it is expected that the market to reach US $ 36.0 billion by 2028, exhibiting a growth rate (CAGR) of 6.5% during 2023-28 (IMARC Group report, 2023). According to FiBL and IFOAM, Australia has most organic agricultural land (35.7 million hectares) in the world in 2021. About 74 countries in the world had fully implemented regulations on organic farming (IFOAM- Organics International, 2023).

Opportunities

- **Consumer awareness and demand for healthy food:** There has been a trend over the last decade for products associated with lifestyle choices and process quality which ultimately justify premium price of organic products (Nardone *et al*. 2004) [40]. The consumer's interest in organic farming seems mainly to be related to care of their own health and the environmental impact of agriculture, better test but also to considerations of animal welfare (IFST, 2001). With increasing per capita income, change in lifestyle and food habits demand for organic dairy products is growing in domestic market as well as in foreign market, especially in the USA, EU, Japan, Argentina and Brazil. Literacy is on the rise and the media are making consumers more aware of and concerned about animal welfare issues and healthy foods. This may well boost the domestic consumption of organic foods.
- **Grass or crop residue-based feeding:** Most of the livestock in India is kept by the small and marginal farmers that do not have enough resources. As a result, the animals are fed mostly grasses and agricultural by-products mostly straw. In India, there is very limited practice of fodder production in rural areas and animals generally consume naturally grown grasses and shrubs which are of low quality in terms of protein and available energy, they are thus heavily dependent on seasonal variations and this results in fluctuation in fodder supply round the year affecting supply of milk round the year (Meena and Singh, 2014) [50]. It is estimated that crop residues contribute on an average 40-60% of the total dry matter intake per livestock unit in rural India (Singh *et al*. 2014) [50]. But given the predominance of integrated and well diversified crop livestock integrated farming more cultivation of legumes will improve the quality of feed along with other beneficial effects. Availability of home-produced protein rich concentrates such as beans, peas contribute to reduce the necessity of commercial concentrates. The use of self-reseeding annual legumes (*Trifolium* sp. and *Medicago* sp.) can be beneficial to low input and organic farming systems (Caporali and Campiglia, 2001) [13].
- **Protecting and enhancing biodiversity and positive social impact:** Organic farming is environmentally friendly also provide energy for microbial activity. Chemicals have destroyed many beneficial insect species and have caused environmental degradation (Bello, 2008). Organic livestock producers are mandated to manage manure so that it does not contribute to the contamination of crops, soil or water and optimizes the recycling of nutrients (Chander *et al*. 2011) [17]. This will be particularly beneficial for improving already degraded biodiversity in green revolution areas as well as will help to maintain and enhance natural resource base in other traditional farming dominated area. Organic dairy production also has significant social impact on rural communities. The main benefit according by some organic farmers in developing countries (e.g., China and India) is that they now have better standards of living. Good product prices, low unemployment, dropped rural emigration and reduced health risks (from chemicals) are the results of farming organic (Wolde and Tamir, 2016).

Threats

- **Foreign market dependence:** Domestic market for organic products is not still at developing stage and the international trade in organic dairy products is considered a risky business due to poor sanitary conditions, existence of diseases, traceability problems as also self-sufficiency in importing countries, which might discourage producers in India too. The restriction applied on import of agricultural products from developing countries often due to political reasons is an important limiting factor given the limited demand and less price premium in domestic market.
- **Polluted natural resources:** Intensive use of fertilizers and pesticides throughout the last few decades leaves soil, water and other natural resources contaminated. Problem of pesticide residue is quite high in India despite of the fact that average consumption of pesticide in India is far lower than many other developed countries. Heavy use of pesticides has polluted fodder and animal feed concentrates resulting in contamination of milk and milk products, eggs, meat and meat products consumed by human beings (Prasad and Chhabra, 2001) [46]. The residue of pesticide in milk sample collected from intensive chemical farming practicing region of Punjab, Haryana, UP etc. showed a decline trend over the years but they did not cease to exist in milk. Some of the less popular and fat-soluble organophosphorus pesticides like acephate, diazinone, phorate, chlorpyriphos and malathion have been detected in foods with high fat content including dairy products (Ivey et. al. 1993) [31]. Quinalphos, parathion- methyl and ethion were detected in few samples from river Ganga and Malathion and monocrotophos were also detected from ground water samples from some areas of UP (Bansal and Gupta, 2000) [4]. Along with pesticide heavy metals like mercury, lead, cadmium and arsenic are the common heavy metals detected in milk samples at some locations in India (Dwivedi *et al*. 2001) [23]. But it was also confirmed by many studies that relative low presence of pesticide residue in organic as compared to conventional product, although organic milk may not be completely pesticide free, especially due to environmental contaminants if judicial use is not promoted (Woese *et al*. 1997) [55]. Thus, for organic farming use of these chemical inputs should be stopped not only by the organic farmer but also in surrounding fields also.
- **Organic dairy farming standard:** Organic dairy farming must meet the strict regulations which need to be

monitored by well-developed mechanism which is presently lacking in India. Given the totally different characteristics of Indian Dairy farmers the blind follow-up of organic dairy standard of western developed nation will be totally unacceptable and unfeasible for Indian farmers.

- **Fodder shortage:** It is estimated that India has a demand of 1097 million tons of green fodder and 609 million tons of dry fodder against the supply of400.6 and 466 million tons respectively. Thus, it represents a deficit of 63.50 per cent and 23.56 per cent of green and dry fodder against actual demand which will further grow to 64.21 per cent and 24.81 per cent up to 2020 (Planning Commission, 2001).
- **Nutrition management challenge:** Dairy production systems face unique nutrient management challenges. Most dairy farms run large nutrient (NPK) surpluses as a result of high nutrient imports (mostly as feed) relative to farm nutrient exports (mostly as milk). Studies in western nations suggested that some organic dairy farms may develop phosphorus deficiencies especially decreasing top soil phosphorus concentrations (Loes and Ogaard, 2001) [36]. Thus, milk fever or hypocalcaemia is sometime more in organic farming than conventional farming (Patra, 2007) [44]. Giving the low application of phosphorous by Indian farmers and already deficient nature of Indian soil this issue can become a potential threat of fertility of soil in organic dairy farms.

Constraints

While many tropical countries are making concerted efforts to boost organic production, especially of high value commercial crops, with considerable success, some serious problems are still restricting growth in organic farming. Some of these potential obstacles, especially when exporting livestock products, are as follows.

- Small-sized land holdings
- Low level of literacy
- Lack of information about organic production practices
- High stocking density
- Inadequate production of feeds and fodders
- High cost of certification
- It is difficult to provide a large locomotion area
- Organic milk production may further decrease the availability of milk
- Blank rejection of preservatives may have serious effects on food supply and safety of foods
- Lack of training

Conclusion

Organic livestock farming gives emphasis on preservation of soil fertility, reduce pollution, reducing the use of non-renewable resources and produces optimum nutritional quality food for human consumption. Production of organic milk gives safety and environmental protection to consumer. Organic products is creating a new export opportunity for developing countries to meet the global demand. Organic product production ensures health-conscious consumers, as they need environmentally safe, chemical residue healthy food and high standards of animal welfare. Success of organic livestock farming is challenging because of paper work, certification cost, organic inputs sourcing and preventing as well as treatment cost for maintain animal health

Future Prospects

Keeping in a view of the export demand for livestock products it is necessary to provide inputs to the organic farmers in the form of technical knowledge how to certify which is mandatory in organic production system. There is need to create awareness about organic production practices, animal welfare issues and the requirements of importing countries. Special attention must be paid on the marketing strategies of organic products since this is the main constrains of the sector to improve farm profitability and overall sustainability if the food system.

Conflict of Interest

Not available

Financial Support

Not available

Reference

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