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Review Article

Organic Food production: A Potential Discretion towards Sustainability for Food and Livelihood Security

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Abstract

Pesticides and fertilizers Excess or indiscriminate use of Pesticides and fertilizers has led to the entry of detrimental chemical compounds into food chain leading to serious health implications and deterioration of surrounding ecology. Besides, for sustainable agriculture system productivity and resource quality are also indispensable. In such situations, organic farming can play an important role to get-rid from these snags. Organic farming proliferates natural processes and cycles in harmony with environment. Hence, soil productivity and also pest control are maintained effectively. Organic agriculture contributes to food security by improving household food self-sufficiency and/or by building farmers' self-reliance. Blending of modern science and traditional knowledge, organic agriculture is capable enough to convert low input and subsistent farms to more productive one with increased capacity to manage locally available resources. Thus, enhanced food production, income generation and ecological conservation set the path towards sustainable development.

Keywords: Blending; Organic foods; food standards; GDP.

Introduction

Agriculture is the most imperative segment of Indian economy. The grand part of Indian GDP is directly extracted from agriculture as agriculture is the main source of livelihood of 55% rural dwelling Indians supporting 58% of nation's livelihood.[2] In the past history, green revolution had made Indian agriculture a milestone. This in turn transformed the country from food deficiency to self-sufficiency using high yielding varieties and higher quality fertilizers and pesticides. But the twist came with the indiscriminate/ profuse utilization of field chemicals. Health and environmental issues comprising biomagnifications and bioaccumulation compelled the situation to

shift towards its alternative forms. Henceforth, demands of toxin-free agriculture within a limited arable land became bold. Thus, emphasis on organic farming came forward. In the organic farming system animal well-being is an imperative concern. This can be beneficial to both animals and even environment contradicting traditional production.[14] For many regulars this is an important consideration for buying organic livestock products. However, various consumers believe that organic food products are much healthier. More than 130 countries consuming about 0.65% of total agricultural land are now practicing organic methodology with leading countries including Australia, China, Argentina, USA, Italy.[27]

Organic Approach

Organic Farming

The divergence that sets organic farmers apart from conventional farmers is a holistic approach to the land and animals that is established, primarily on long-term and natural processes. This approach avoids the use of synthetic chemicals is more environment-friendly, protects animals from inhumane treatment, promotes biodiversity and is sustainable. Hence this has now moved into the mainstream farming and one of the fastest growing food sectors. Efforts are made on efficient use of natural resources and renewable resources recycling for sustaining a healthy environment. Therefore, for agricultural and fodder farms, at least for three years (36 months) without application of prohibited materials (i.e. synthetic fertilizers, pesticide or GMOs), sewage, sludge or irradiation be strictly followed. Configuration of buffer zone for deterrence of contamination commencing adjoining land area. Usage of only organic seed manure and compost. Fertility management programme must not contaminate crop, soil or water with plant nutrients, pathogen, heavy metals or prohibited substances. Additionally, the burning of remnants of crop residues in the farmer's field. Thus, subsequently it will be helpful to reduce the detrimental effects of conventional farming and increase production, paving the path of alternative system.[24]

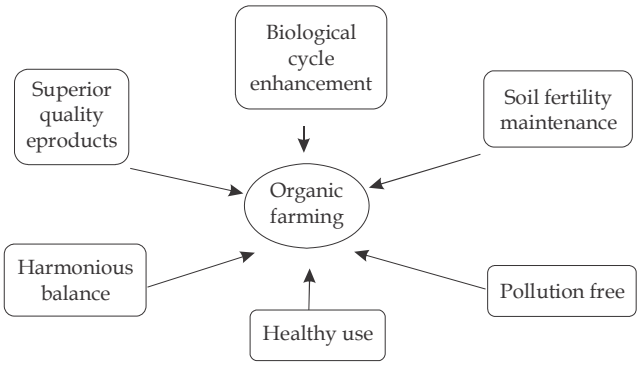

Fig. 1: Objectives of organic farming.

Organic Foods

For the words organic foods several different words are conversely used as like natural, biological, ecological, unsprayed, free of pesticides, alternative and environment-friendly produced but according to E.C. Regulation 2092/9, organic is the executive term [and this will be used as consistently as possible hereafter]. The word 'natural' applies generally to foods that are minimally processed and free of synthetic preservatives, artificial sweeteners, flavours, colours and other artificial additives, growth hormones, antibiotics, hydrogenated oils, stabilizers and emulsifiers. Most foods labelled natural are not subjected to government controls beyond the regulations and heath codes that apply to all foods excluding meat and poultry. The Department of Agriculture (USDA) and Food Safety and Inspection Service (FSTS) of the U.S. necessitate such food to be free of artificial flavours, colours, sweeteners, preservatives and ingredients that do not occur naturally in the food products. Natural meat and poultry must be minimally processed in a method that does not functionally modify the raw product quality. Additionally, the label should elucidate the use of the term natural, without the addition of synthetic harmful chemicals or ingredients.

Organic Food Standards

Certification of any food items by the concerned authorities or bodies remains mandatory for its proper identification and safe reception by

consumers. As these bodies help regulate the standards of foods by either private or public institutions. The countries which are having their organic legislation, government make approval and supervise the certification bodies. Some are also certified by the International Organic Accreditation Service (IOAS). IOAS is an independent non-governmental organization that authorizes certifiers who follow the voluntary standards of the International Federation of Organic Agriculture Movements (IFOAM). Moreover, Codex too helped in providing organic food guidelines in 1999. It adopted regulations on the production, processing, labelling and marketing of organically produced foods providing a description of the 'organic' system. The 'organic' labelling being determined in order to ensure fair trade and to facilitate the development of the organic sector. Even then, the Codex and IFOAM guidelines for organic agriculture are minimal and can be objectified as 'standards for standards'. These are basically intended to guide governments and private certification bodies in setting concrete standards. The reasons for standard goals are depicted through the following pictorial representation (Fig. 2).

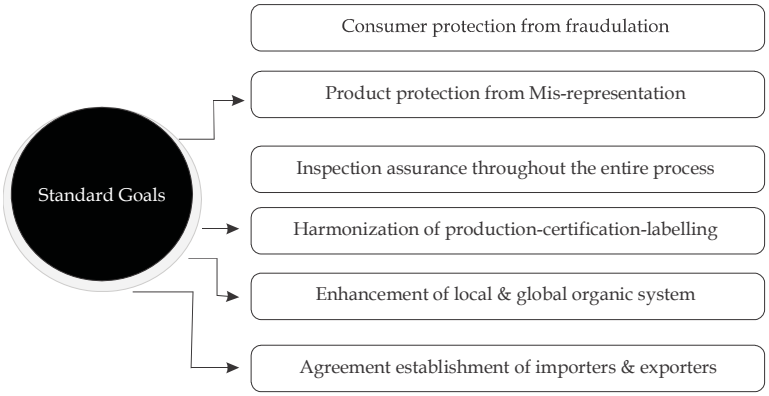

Fig. 2: Reasons for implementation of organic food standards.

The concept does not merely allied with production but the duty lies till its proper dispatch. Since the products need to be endowered with pest management practices to prevent pest infestations, equally these need to be protected from any sort of contamination. Packaging remains yet another important aspect in the final journey of organic production. Materials used for packaging containing fungicides, preservatives or fumigants are not prohibited from being used. Instead approved label claims for "100% organic" (100% organic ingredients including processing aids), "organic" (at least 95% organic ingredients), "made with organic ingredients" (at least 70% of organic ingredients) can be encouraged for use judiciously.

Livestock

Besides field and soil, livestock also plays a major role in market disruptions of total agricultural produce. Livestock facilitate the fertility of the soil, organization of flora through grazing, ornamenting biodiversity and facilitating complementary interactions on the farm and escalating the diversity of the farming system. Therefore, for the sake of organicity, the livestock need also to be of 'chemical-free' origin. This can be attained from critical common managemental practices. Feedstuffs of plant origin, mineral origin, trace elements, vitamins or pro-vitamins can only be used if they are of natural origin with no supplementation of synthetic nitrogen or non-protein nitrogen compounds. Feedstuffs of animal origin are provided as prescribed by national legislation. Only natural sources binders, anticaking agents, emulsifiers, stabilizers, thickeners, surfactants, coagulants, antioxidants, preservatives, colouring agents (including pigments), flavours and appetite stimulants, probiotics, enzymes and micro-organisms are allowed. Medicinal substances, antibiotics, coccidiostats, growth promoters or any other substance intended to stimulate growth or production shall not be used in animal feeding. The fodder additives and processing aids be devoid of genetically engineered/modified organisms or products and comprised of only sea salt, coarse rock salt, yeasts, enzymes, whey, sugar or sugar products *viz.*, molasses, honey, lactic, acetic, formic and propionic bacteria or their natural acid products may be used when the weather conditions

for adequate fermentation remain unfavourable.

Health of animals should also be taken -in consideration to prevent disease. Therefore, the best way is selection of appropriate breeds or strains of animals having traits of disease resistance and implementation of animal husbandry practices encouraging strong resistance to disease and the prevention of infections. Provision of balanced organic diet with regular exercise which boosts animal's natural immunological defence system and avoidance of overstocking. In disease and incompatibility conditions, phyto-therapeutic (excluding antibiotics), homeopathic or ayurvedic products and trace elements may be preferred over chemical allopathic veterinary drugs. If the use of these above products is unlikely to be effective in combating illness or injury, allopathic drugs or antibiotics may be used with withholding periods should be the double of that required by legislation, in any case, a minimum of 48 hours. Where no alternative permitted treatment or management practice can assist, or, in cases required by law, vaccination of livestock, use of parasiticides or therapeutic use of veterinary drugs are permitted. But for preventative measures this line of treatment is prohibited. Growth stimulants or substances used for the purpose of stimulating growth or production are not permitted. Hormonal treatment may only be used for therapeutic reasons and under veterinary supervision.

Advantages

Accent on local resources and local ecological knowledge, organic agriculture has the potential to multiply the hands of farmers in their own communities. The budding organic market demand and opportunity to foster agric-tourism for city dwellers have opened new income opportunities for organic farmers. Therefore, alliance of both producers and consumers supports markets to raise manifolds, cut out monopolies and consequently increases farm incomes. Organic certifications endorse economically viable and environmentally friendly use of natural resources. Besides, this promotes people to live in harmony with nature with economic benefits from their lands.

The foremost success of organic farming is the soil fertility as no synthetic nutrients in order to restore degraded soil is followed instead only the basic farming practices. Primarily which includes multi-cropping systems and crop rotations, cover crops, organic fertilizers and minimum tillage to maintain and improve soil quality. The organic soils also have the potential to reduce the cost of purifying drinking water, cause substantially less erosion and better moisture holding capacity. Also, are more buoyant to water stress as well as nutrient loss. Reports in Europe state that 30 to 40 percent more biomass and 30 to 100 percent more microbial activity have been recognized in organically managed soils compared to that of conventional soils. For any kind of soil, soil microbes are the most important components which synchronise soil organic matter decomposition and nutrient cycling. Normally, microbial biomass (C_{mic}) in natural soils ranges between 90 to 2300 µg per gram of dry soil whereas active microbial biomass in agricultural soils range between 75 to 272 µg per gram of dry soil which may be present in dormant state.[3] A few evidences of such organic observations are listed in the following Table 1.

Table 1: Observations showing advantages on application of organic farming

Annotations	References
Improvement in growth and yield when rice seedlings are dipped in Panchagavya before transplanting.	4
Improvement in soil structure, porosity and organic matter content can be possible with organic management	17
Cow products viz., Panchagavya, Beejamruth and Jeevamruth possess abundant beneficial microflora like *Azospirillum, Azotobacter*, phosphobacteria, *Pseudomonas*, lactic acid bacteria and Methylotrophs with useful fungi and *Actinomyctes spps.*	23
Panchagavya helps in nitrogen fixation, growth hormone production and phytopathogens (of many plantation crops) control, proliferating plant growth	1
Panchagavya is nutritious to rhizosphere microorganisms as it contains macronutrients like N, P and K, essential micronutrients, many vitamins, essential amino acids, growth promoting factors like IAA, GA.	13
With massive microbial load Jeevamruth acts as tonic to enhance microbial activity in soil	16
Organic fertilizer provides nutrient to the standing as well as the succeeding crop	8
Cow urine being anti-fungal is a good source of plant nutrients	6
Substituent of synthetic fertilizers can be Kunapajala (bio-fertilizer, a fermented product)	11

In addition, sequestration of carbon in soil is another essential phenomenon. It perhaps is in the forms of soil organic carbon (SOC) and soil inorganic carbon (SIC). Comparatively the rate of SIC sequestration as secondary carbonates is low (5 to 150 kg C/ha/yr). Basically, it is emphasised by biogenic processes and carbonates leaching in groundwater, particularly in low carbonate irrigation water.[15] Normally the soil carbon pool balances the input and output. In case of low carbon flux relative to storage, it leads sequestration in soil whereas a higher flux causes carbon loss. A loss of 30– 70% of predecessor SOC pool of soil has already been reported in the most agricultural soils.[10] However, soil carbon sequestration is cost effective and even subsidize up to about 89% of total carbon mitigation.[22] In organic farming, permanent soil cover is an intrinsic part of the agriculture system. The successive quality improvements of soil enables reduce cost of future fertilizer needs.[7]

The restricted use of mineral fertilizers reduces the use of non-renewable energy (fossil fuels) which in turn condenses the emissions of greenhouse gases. The positive impact of organic agriculture practices on atmosphere, lithosphere, hydrosphere and biodiversity helps instigating convention to combat desertification by implementing international environmental agreements viz., the Kyoto Protocol, Convention on Biological Diversity (Decision III/11 on the conservation and use of agricultural biological diversity) and national strategies. Below are listed a few field reports which show the advantageous characters of the chemical-free agriculture.

Table 2: Field reports showing successful trials of different organic applications

Target	Organics	Inference	References
Secondary and micronutrients (Ca, S and Fe), macronutrients (NPK) contents of leaves and pods of annual moringa	Poultry manure + neem cake + Panchagavya treatments	Superior	5
Abelmoschus esculentus yield parameters	3% panchagavya spray	Increased	19
Photosynthetic pigments content viz., chl. A, chl. B and carotenoid	3% panchagavya spray	Increased	25
Root yield	4% panchagavya spray	Superior	9
Nutrient management in soybean-wheat cropping system	Organic manures + fermented organics	Significant improvement of soil microbial population and enzymatic activity	20
Aswagandha farming	Poultry manure + 3% Panchgavya	Highest root yield of 1354.50 kg ha^{-1}	12
Chilli farming	3% panchagavya	Highest plant height, early 50% flowering, highest number of flowers, highest yield/ha	26
Rice yield level	Biodigester liquid manures	Increased	21

Organic farming creates job opportunities (generally rural), as it requires over 15% more labour than traditional farming.[18] Because organic farming techniques involve strip farming, non-chemical weeding and production, collection and transportation of organic supplements, all of which requires significant numbers of manpower. Objectives of crop rotations, natural inputs, local breeds and species and family activities aid organic to be a natural link between agricultural practices and biodiversity for every species of life often flourish in organic settings. Absence of synthetic pesticides, presence of hedges and higher crop density on organic farms, assist safe access to food and even shelter for wildlife species.

Human Profits

Mothers consuming mostly organic milk and meat products were found to have about 50% higher level of rumenic acid in their breast milk. Conjugated lenoleic acid (CLA) is responsible for most of the health benefits through milk and meat. The better reliance of organic beef and dairy farmers on pasture and forage grasses increase the level of CLAs in milk and beef and return in the breast milk of women eating such organic animal produce. Multiple studies show that organic verities do provide significantly greater levels of iron, magnesium and phosphorus than non-organic verities of same foods. In addition, organic

foods typically supply greater levels of important antioxidant and phytochemicals (anthocyanins, flavonoids and carotenoids). Clear health benefits from consuming organic dairy products have been established in regard to allergic dermatitis. Relative studies represent lower nitrate contents and less pesticide residues contradicting with usually higher levels of Vitamin C and phenolic compounds in organic plant products. Whereas, higher levels of omega-3 fatty acids and conjugated linoleic acid are common in livestock products from organically raised animals. Conversely, the discrepancy in outcomes of comparative studies is very high, depending on plant fertilization, ripening stage and plant age at harvest and weather conditions. Furthermore, there appeared no simple relationship between nutritional value and health effects. It is consequently difficult to draw conclusions from analytical data about the health effects of organic foods. Although some *invitro* studies comparing health-related richness of organic and conventional foods showed higher antioxidative and antimutagenic activity in addition to better inhibition of cancer cell proliferation of organically produced foods. Modern human epidemiological studies associated with consumption of organic foods revealed lower risks of allergies, while findings of human intervention studies were still vague. The assumption might be that organic food increases the capacity of living organisms towards resilience.

Constraints

The most carving disadvantage of organic farming is the requirement of two to three years for converted fields to be certified as organic which indeed requires a long-term planning and careful cost-benefits analysis. Though standards, inspection, certification and accreditation (or the organic guarantee system) ensure credibility. But more harmonized approach is necessary for proper regulation and ensuring the consistent appliance of organic rules and standards so designed taking into account all stakeholders' interests. Side-by-side, even if in arid lands, organic agriculture can be a viable alternative but also there lies a number of constraints including lack of knowledge, scarcity of organic materials, insecure land tenure, 'old fashioned' perception of organic agriculture and the most importantly promotion of chemical inputs in farming through extension services, as to adopt the very agriculture systems even its single technique.

Thus, absence of supportive policy, loss of crop yield, non achievement of expected quality, failure of organic pest management, shortage of biomass and livestock, lack of quality seeds supporting organic agriculture, lack of storage, transport and organized organic marketing systems, vested interests of chemical and pesticide lobby, lack of awareness and guideline for organic farming, inability to meet the export demand, complexity and high cost of organic certification system, scarcity and high cost for quality analysis consist the major hurdles of upliftment of organic agriculture fruitfully. Consequently, to thrive in the organic sector, there needs more than growing markets, governmental and intergovernmental policies to synchronise standards, developmental supports through research and advisory systems, education and consumer information, regulation of synthetic inputs use and implementation of global environmental treaties.

Future of Indian Organic Farming

India is dignified for immense growth as compared with the growing domestic market and organic is the fastest growing food sector in terms of both land use and market size. Hence, key of Indian organic success lies with the growth of its own domestic markets. Moreover, India possesses tremendous potential to cultivate crops organically due to availability of sizable acreage which leads India to emerge as a major supplier of organic products in the world's organic market. Hence, keeping in pace with this growing demand, lots more technological innovation like Inhana Rational Farming (IRF) Technology (Indian organic farming practice) can demonstrate some promising results. Implementation of IFR methodologies in field will ensure economically viable organic agriculture and encourages its adoption without any subsidy scheme or guaranteed premium price. Henceforth, considering the increasing awareness about the safety and quality of foods and long-term sustainability and productivity of the system, the organic farming can be emerged as an alternative system of farming in our country as it safeguards a debt free, profitable livelihood option.

Conclusion

Ecologically and economically sustainable organic farming is the pre-requisite for enabling wider adoptability, secured livelihoods and ensuring

affordability at the consumer's end. India has a rich history of organic farming and the increasing domestic market of organic food can provide the necessary drive to the organic movement. For large scale organic conversion, awareness program at both the consumer and farmers' end is necessary. But most importantly innovative organic farming technologies can popularize the practice even among the resource poor farmers by ensuring ecologically and economically sustainable organic crop production in a time bound manner. Case studies of IRF Organic Practice also testify the corresponding GHG mitigation and adaptation potential as reflected in the high carbon sequestration, soil resource regeneration, high energy use efficiency as well as development of plant resilience; but the highlight remains its cost effectiveness and time bound results. Flexible requirements to establish equivalency among regulatory systems is the main challenge ahead for the organic agriculture community. The endorsement of organic agriculture is not a small task, but can be achieve through effective policies, scientific education, exercising farmer's skill and public rendezvous.

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