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Review on truth of organic farming

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Abstract

In order to mitigate food grain shortage in India, after the independence and make the country self reliant in terms of food grain production, high yielding varieties, chemical fertilizers, irrigation and pesticides were introduced. Intensive farming with these recourses terms as green revolution effectively resolved the problem of India's food shortage. But the indiscriminate and excessive use of chemical fertilizer, high irrigation and pesticides adversely affect the soil health, plant health, environment and ultimately the sustainability of agricultural production as results of toxic effect of chemicals and pesticides. Therefore, scientists are reassessing the agricultural practices which are more relied on biological inputs rather than heavy usage of chemical fertilizers and pesticides. Organic farming could be the alternative to regular conventional farming which provides quality food without affecting adversely the soil health and environment as per some of the reviews. Some of the scientists distress the large scale conversion to organic agriculture which may results in food shortage with the present state of knowledge and technology. But on long run organic farming offer more advantage over conventional agriculture. Some research shows that organic farming is economically feasible and some shows not feasible. But to achieve sustainable food security, ecologically and economically feasible farming, it is concluded to use integrated management approach with organic farming practices.

Keywords: Watermelon, *Citrullus lanatus*, plant spacing, growth, yield

Introduction

Organic farming is a production system which avoid or largely excludes, the use of synthetic fertilizers, pesticides, growth regulators and livestock feed additives etc. and to the maximum extent feasible rely upon crop rotation, crop residues, animal manures, off and on farm organic waste, mineral grade rock additives and biological system, nutrient mobilization and biological plant protection. According to the International Federation of Organic Agriculture Movement the major objectives of organic farming include: (1) production of highquality food in sufficient quantity in harmony with natural systems and cycles, (2) enhancing biological cycles within the farming system involving microorganisms, soil flora and fauna, plants and animals, (3) maintaining long-term soil fertility and genetic diversity of the production system and its surroundings including plant and wildlife, (4) promoting healthy use with proper care of water resources and all life there in, (5) creating harmonious balance between crop production and animal husbandry, and (6) minimizing all forms of pollution. Organic farming was practiced in India since thousands of years. India is blessed with lots of potential to produce all the varieties of organic product due to its various agro climatic regions. In several parts of the country, inherited tradition of organic farming is an added advantage. India's rank in terms of world's organic agricultural land was 9th and in terms of total number of product was 1st as per the 2018 data (FIBL and IFOAM book 2018). The government of India has implemented the national programme for organic production (NPOP). The national programme involves the accreditation programme for certification bodies, standard for organics production, promotion of organic farming etc. India produced around 1.70 million tone (2017-18) of certified organic products which include all varieties of food products namely oil seeds, sugarcane, cereals and millets, cotton, pulses, medicinal plants, tea, fruits, spices, dry fruits, vegetables, coffee etc. The production is not limited to the edible sector but, also produces organic cotton fiber, functional food products etc. Among different states Madhya Pradesh is the largest producer followed by Maharashtra, Karnataka, Uttar Pradesh and Rajasthan. In terms of commodities, oil seeds are the single largest category followed by sugar crops, cereals and millets, fiber crops, pulses, medicinal, herbal and aromatic plants, spices and condiments (APEDA).

However the question is; will organic farming produce enough food for India's increasing population, is organic farming economically feasible? The aim of these review paper is highlighting the truth or reality of organic farming.

Effect of Organic Farming on Soil Health

Soil is major element in increasing crop productivity, maintaining its quality is therefore important for sustainable land development. In general organic farming increase the soil fertility level, this also showed in various studies. At present about 25-30 of nutrient needs can be met through various organic sources (Yadav *et al.*, 2013) [34]. The efficiency of organic sources to meet the nutrient requirement of crops is not as assured as mineral fertilizers, but the joint use of chemical fertilizers along with various organic sources is capable of sustaining higher crop productivity, improving soil quality and productivity on long-term basis (Chhonkar, 2002). Minhas and Sood (1994) [8, 19] reported that organic matter after decomposition release macro and micro nutrients to the soil solution, which become available to plants, resulting in higher uptake. Composting material added plenty of carbon and thus increases the heterotrophic bacteria and fungi and further increases the activity of soil enzymes responsible for conversion of unavailable to available form of nutrients. The application of FYM with *rhizobium* co inoculation with PSB increases the soybean production (Sharma and Namdeo 1999). Chongtham *et al.*, (2018) [26, 17] also reported that application of FYM and vermicompost increase the organic carbon content, available nitrogen, available P₂O₅, available K₂O after the harvest of crop. In the biodegradation process, earthworms work together with microbes and produce vermicompost. Kannan *et al.*, (2005) [14] observed that application of vermicompost with *Azospirillum* influence the soil physical, chemical and biological environment, such as bulk density, water holding capacity, organic carbon and available nitrogen, beneficial bacterial and fungal populations over the inorganic alone applied plots. Vermicompost supply macro elements N, P, K, Ca and Mg and microelements Fe, Mo, Zn and Cu. (Amir and Fouzia, 2011). Manivannan *et al.*, (2009) [2, 18] also observed that application of vermicompost 5 t/ha significantly enhance the pore space, water holding capacity, cation exchange capacity and reduce particle and bulk density, pH, electrical conductivity and increased organic carbon, micro and macro nutrient and microbial activity. Goswami *et al.*, (2010) reported that long term use of organic manures like FYM, vermicompost, neem cake, composted crop residue appreciably increased the organic carbon (7.50 g/kg) over initial value (6.40 g/kg). Integration of the organic and inorganic inputs significantly increased the availability of N, P and K in soil over chemical treatment alone.

Effect of Organic Farming on Productivity and Yield

The first question arises in our mind when one think about organic farming is that will organic farming produce enough food for our increasing populations? In the long run, organic farming offers more advantages compared to conventional farming, because it ensures higher yield security and reduces dependence on external inputs, thus making poor households less crisis-prone (Julia *et al.*, 2008) [13]. However an analysis done by FAO showed that intensification of organic farming in most subsistence systems yields 40% more; while transition losses with organic farming can be overcome in 4-7 years' time. The lower crop yield during initial years of organic farming is mainly due to less supply of nutrients to crop plant due to slow release of nutrients from the sources (Bhardwaj and Omanwar, 1994). Das *et al.*, (2010) [6, 10] reported that maximum residual effect on yield was reported on mustard in terms of yield and yield attribute when whole nutrient was applied using organic manure (*Azolla* compost + FYM).

Surekha (2007) [28] observed that organics with moderate C:N ratio and lignin content released N slowly and gradually for longer periods and led to higher productivity in rice-rice system. Surekha *et al.*, (2010) [29] also observed that during *kharif*, rice grain yields in the inorganic fertilizer applied plots were near stable ranging from 5.2-5.5 t/ha and superior to organics during the first two years (2004-06) by 15-20% which improved with organics (4.8-5.4 t/ha) in the later years to parity with inorganic. However, during *rabi*, inorganic were superior to organics for the first four years and both were at par in the fifth year. This could be due to mismatch of nutrient release from organic sources and crop demand as influenced by seasonal conditions in the initial years and once the soil fertility was built up sufficiently, organic system also produced equal yields as conventional system. Thus, slow and gradual release of nutrients from organics during the initial years of conversion to organic farming could not result in increased yields (Surekha *et al.*, 2010) [29]. But, repeated application of organics over the years built up sufficient soil fertility by improving soil biological activity. Goswami *et al.*, (2019) [12] also reported that organic treatment followed a steady increase and registered 20 to 50 % more yield at the end of the five years of experiment, however the effect of different organic input packages on potato tuber yield was not stable over the years. Maximum seed yield, straw yield and biological yield in soybean crop was produced by application of 45 kg P₂O₅/ha through SSP + PSB + *Rhizobium* + VAM (Pawar *et al.*, 2018) [23]. The organic farming practice and integrated farming practice recorded higher yield of soybean than chemical farming practice (Aher *et al.*, 2015) [1].

Effect of Organic Farming on Quality Parameters of Crops

The answer to the question whether organic produce has better quality than the conventional produce can be both 'Yes' and 'No'; the yes when conventional produce is grown on soils deficient in essential minerals and this is likely to be expressed in the produce of that soils. If both the soils of conventional and organic farms are healthy soils then the chances of differences in quality are negligible. The information available on comparison of quality of organic foods and conventional foods is not consistent and expert opinions also differ (C S Aulakh and Ravisankar, 2017) [4]. Myths of better taste, improved quality and higher nutritive value, generally attached with organically produced foods, have been argued and found to lack a scientific basis (Chhonkar and Dwivedi, 2004; Woese *et al.*, 1997) [7, 31]. However there are many studies that reported better quality of organic product than the conventionally produced product. Moderate improvement in nutritional quality parameters such as protein, phosphorus and potassium contents was recorded higher with organics compared to inorganic. This improvement in nutritional quality parameters were recorded higher in brown rice (by 5-16%) than polished rice (by 1-6%) (Surekha *et al.*, (2010) [29]. Yadav and Vijayakumari (2004) [33] carried out an experiment to assess the effect of vermicomposted vegetable waste on the biochemical characters of chilli and found that the protein was higher at 60 (113 mg/g) and 90 DAS (79 mg/g). The carbohydrate content was higher in vermicomposted treatment at 60DAS (15.34 mg/g). Das *et al.*, (2017) [9] also found that most of the quality parameters of tomato (lycopene content, total sugar, total soluble solids) and carrot (total soluble solid, ascorbic acid and beta carotene) were superior under organic farming. In India studies conducted by various certification agencies

indicate either no or very low levels (below detectable limits) of pesticides and other contaminants. In other countries also organic products have been found to be having very low levels of residues, which are coming mainly as drift from conventional farms (Yadav 2010). Sihi *et al.*, (2012) [11] also reported that micronutrients (Fe, Mn and Zn) concentration increased in organic practices but there is no difference in aroma of organic and conventionally grown basmati rice. Application of vermicompost to the crop significantly increased in vitro iron availability, total carotenes, crude fibre, vitamin C and zinc contents compared to conventionally grown crop (Shankar *et al.*, 2013) [27].

Plant Protection Measures in Organic Farming

In organic farming systems, pest and disease management strategies are largely preventive rather than curative practices. In general, pest and disease incidence is less severe in organic farms compared to conventional farms. Pest control in organic farming begins by making sensible choices, such as growing crops that are naturally resistant to diseases and pests, or choosing sowing times that prevent pest and disease outbreaks. Careful management in both time and space of planting not only prevents pests, but also increases population of natural predators that can contribute to the control of insects, diseases and weeds. Other methods generally employed for the management of pests and diseases are: improving soil health to resist soil pathogens and promote plant growth; rotating crops; encouraging natural biological agents for control of diseases, insects and weeds; using physical barriers for protection from insects, birds and animals; modifying habitat to encourage pollinators and natural enemies of pests, and using semi-chemicals such as pheromone attractants and trap pests (Ramesh *et al.*, 2005) [24]. Basu, (2009) reported that for managing potato virus epidemics, planting early in the cropping season helps to avoid early incidence and high disease severity. Rao, (2003) [25] observed that the groundnut plants received organic manure recorded low nitrogen content and higher levels of phenols and tannins compared to the plants received straight fertilizer and pest incidence was correlated with nitrogen content and negatively correlated with phenols and tannins. The organic manures induced the phenols and tannins production in groundnut plant and thus the induced resistance plays an important role in groundnut insect pest management. Aqueous extract of leaves of neem (*Azadirachta indica* Juss.), provided control of leaf stripe pathogen (*Drechslera graminea*) on barley that was as effective as the fungicide bavistin (carbendazim) (Paul and Sharma, 2002) [22]. Reduction in Gundhi bug population (*Leptocoryza varicornis*) by foliar application of vermin wash, neem oil, aqueous garlic and annona leaf extract has been reported by Mishra *et al.*, (2015) [20].

Effect of Organic Farming on Economics

Theoretically, replacement of external inputs by farm-derived resources should lead to reduction in variable input costs under organic management. However, in most cases outsourcing of bulky organic inputs, in-effective pest control and huge production loss increase the cost of production. Also higher requirement of labours under organic practice adds up the cultivation cost. Technological advances that can enable sufficient and timely on-farm resource generation and sustain crop productivity can only cut down the production cost (Barik, 2017) [5]. The profitability of organic farming depends upon factors like skill of individual, climate, general price

level, amount of land available and price premiums (Offermann and Nieberg, 2002) [21]. A study, based on 120 farmers of six villages of Shimoga and Bhadravati Talukas of Karnataka State of India, compared the cost-benefit components of organic rice production (Suresh and Kunnal, 2004) [30]. The study indicated that in organic farm, although the average cost of cultivation per acre of paddy was lower only marginally. The net return increased by over 40 % suggesting that a properly planned is beneficial not only from environmental point of view but also from economic point of view. But, Kumari *et al.*, (2010) and Kharub and Chander, (2008) [16, 15] reported higher profit from conventionally grown crops compared to the organically grown crops.

Conclusion

The reviews of various research studies indicate that organic farming could provide quality food without adversely affecting the environment and soil health. Many of them alarms towards large scale conversion to organic agriculture would results in food shortage with the present state of knowledge and technology in our country. But on long run, organic farming offer more advantage over conventional agriculture. In terms of feasibility of organic farming there is not clear stand of scientist as some research review shows organic farming as economically feasible and some shows not feasible. But to achieve sustainable food security, ecologically and economically feasible farming one should use integrated management approaches with organic farming practices.

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