



ORGANIC FARMING OF VEGETABLES: PROSPECTS AND SCENARIO

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ABSTRACT

The relatively high success of organic farming in some countries are due to the high awareness of the health problems caused by the consumption of contaminated food products, the ill effects of environment degradation, appropriate supports by the government and organizations like the European Union and International Federation of Organic Agriculture Movements (IFOAM). The conventional farming had helped India not only to produce enough food for own consumption but also generated surpluses for exports. However, the increasing population and income will lead to further increases in demand for food and also for raw materials for industry. The modern system of farming, it is increasingly felt, is becoming unsustainable as evidenced by declining crop productivities, damage to environment, chemical contaminations *etc.* The necessity of having an alternative agriculture method which can function in a friendly eco-system while sustaining and increasing the crop productivity is realized now. Organic farming is recognized as the best known alternative to the conventional agriculture. The major weaknesses of organic agriculture in the country are absence of linkages between the farmers and markets and absence of financial support from the governments. India has the potential to become a major organic producing country given the international demand for our farm products, different agro-climatic regions for the cultivation of a number of crops, the size of the domestic market and above all the long tradition of environment friendly farming and living.

KEYWORDS: Health problems, food particles, farming, environment.

INTRODUCTION

India is the second most populous country in the world with increasing population, the cultivable land resource is shrinking day to day. To meet the food, fibre, fuel, fodder and other needs of the growing population, the productivity of agricultural land and soil health needs to be improved. Green Revolution in the post independence era has shown path to developing countries for self-sufficiency in food but sustaining agricultural production against the finite natural resource base demands has shifted from the "resource degrading" chemical agriculture to a "resource protective" biological or organic agriculture. Sustainable agriculture is necessary to attain the goal of sustainable development. According to the Food and Agriculture Organization (FAO), sustainable agriculture "is the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of environment and conserving natural resources". Organic farming is one of the several approaches found to meet the objectives of sustainable agriculture. Many techniques used in organic farming like inter-cropping, mulching and integration of crops and livestock are not alien to various agriculture systems including the traditional agriculture practiced in old countries like India. However, organic farming is based on

various laws and certification programmes, which prohibit the use of almost all synthetic inputs, and health of the soil is recognised as the central theme of the method. Adverse effects of modern agricultural practices not only on the farm but also on the health of all living things and thus on the environment have been well documented all over the world. Application of technology, particularly in terms of the use of chemical fertilizers and pesticides all around us has persuaded people to think aloud. Their negative effects on the environment are manifested through soil erosion, water shortages, salination, soil contamination, genetic erosion, *etc.* The origin of organic farming goes back, in its recent history, to 1940s. During this period, the path breaking literature on the subject published by J.I. Rodale in the United States, Lady Balfour in England and Sir Albert Howard in India contributed to the cause of organic farming. The farming being practiced for the last three decades in India has increasingly been found non-sustainable. The vegetable crops have been well advocated in solving the problem of food security. They are rich source of minerals, vitamins, fibre and contain a fair amount of protein as well as carbohydrates. In addition to local market demand vegetables have the potential for both domestic and export market. The vegetable production of our country before

independence was merely 15 million tonnes (mt) and now it is about 162.18 million tonnes during 2012-13 (NHB, 2013). Although India is the second largest producer of vegetables next only to China in World, the productivity of different vegetables in our country is comparatively lower than the World's average productivity. Again the per capita availability of vegetable (210g/head/day) is still behind the recommended quantity (300g /head /day). Organic vegetable cultivation offers one of the most sustainable farming systems with recurring benefits to only long-term soil health but provides a lasting stability in production by importing better resistance against various biotic and abiotic stresses. Organic vegetables fetch a premium price of 10% - 50% over conventional products.

Needs of Organic Farming of Vegetable crops in India

- Most of the vegetable crops are eaten fresh or used for health care; hence an contamination (chemical residue) may lead to various kinds of health hazards
- In India majority of the vegetable growers are poor, small and marginal farmers.
- Decrease in land productivity due to ever increasing use of chemical fertilizers.
- There are not many scientific breakthroughs in improving quality and production of vegetable crops.
- The ever-increasing cost of production in chemical farming including investments in manufacturing fertilizers, pesticides, irrigation *etc* despite massive government subsidies is a major cause of concern, which is very low in organic farming.
- High environment pollution.

Strategies of Organic Vegetable Farming

The future success of organic vegetable production would largely depend upon size of the farm and supplies of non-chemical inputs, which have to be thoroughly backed up by well proven package of practices addressing to the objectives of producing vegetable organically. These organic farming practices have to be turn to change in traditional concept of farming. The following issues and their viable strategies are suggested to make organic vegetable production more vibrant, dynamic, and responsive to changing consumer demand both locally and globally as well.

- The research for Organic farming in vegetable crops must be on a system basis. It must be integrated one and must not be looking at in isolation.
- The task of research would be to produce technologies, which can not only increase more food but also more jobs and more incomes.
- The research for organic farming should be focused on developing technologies which may attract the vegetable growers to adopt them, keeping in view of the requirements of small holdings of resource poor small and marginal farmers.
- The research should be in a holistic manner with long-term evaluation of different organic substrates.

- Identification of suitable cover crop and smother crop in a given cropping system.
- There should be strategy for monitoring of changes in groundwater quality with references to heavy metal toxicity, besides nitrate pollution.
- Identification of soil improving crops under major agro-climatic zone.
- Evaluation of soil conservation practices of disease management, change in the habitat for beneficial insects and suitability of trap crops in organic culture and identification of nematode repellent cover crops especially from various vegetable crops should be given due emphasis.
- There is need for marketing research for organically produce for export potential. There should be proper planning for marketing of organically grown fruits, vegetables and food grains that should help farmers to get a better price for their produce. This, in turn, should motivate them to invest more in Organic Farming.
- There should be incentives to the growers who produce organic vegetables.
- Extension scientists must develop strategy to create interest in small and marginal farmers to adopt organic farming technologies for growing vegetable crops.

Multiple cropping and crop rotation

Mix cropping is the outstanding feature of organic farming in which variety of crops are grown simultaneously or at different time on the same land. In every season care should be taken to maintain legume cropping at least 40%. Mix cropping promotes photosynthesis and avoids the competition for nutrients because different plants draw their nutrients from different depth of soil. The legume fixes atmospheric nitrogen and make available for companion or succeeding crops. Deep rooted plants drew nutrient from deeper layer of soil and bring them to the surface of soil through their leaf fall. So the nutrients leached down to lower strata are further brought back to upper layer by these deep rooted plants. Also help in protecting soil from soil erosion. Farmers should select the crops combination according to their needs and season.

Crop rotation

Crop rotation is the back bone of organic farming practices. To keep the soil healthy and to allow the natural microbial systems working, crop rotation is must. Crop rotation is the succession of different crops cultivated on same land. Follow 3-4 years rotation plan. All high nutrient demanding crops should precede and follow legume dominated crop combination. Rotation of pest host and non pest host crops helps in controlling soil borne diseases and pest. It also helps in controlling weeds. It is better for improving productivity and fertility of soil. Crop rotations help in improving soil structure through different types of root system. Legumes should be used frequently in rotation with cereal and vegetable crops. Green manure crops should also find place in planning rotations. High nutrient demanding crops should

always be followed by legume crops and returned back to soil.

Use of Biofertilizers and microbial cultures

Biofertilizers *viz.* Rhizobium, Azotobacter, Azospirillum, PSB and Pseudomonas *etc* have been found to be very effective tools of fertility management and biological

nutrient mobilization. Recently customized consortia of such biofertilizer organisms, better adapted to local climatic conditions have also been developed and are available commercially. Efficiency of such microbial formulations is much higher under no-chemical use situations, therefore application of such inputs need to be ensured under all cropping situations.

Use of Green Manure is highly beneficial for organic production and maintaining soil health

Crop	Productivity (T/ Ha)	Nitrogen %
Subabul	09-12	0.80-0.90
Sunhemp	12-13	0.43-0.45
Dhaincha	20-22	0.43-0.45
Coepea	15-16	0.49-0.49
Clusterbean	20-22	0.34-0.51

Technology packages for Organic Vegetables Production

- Timely preparation of soil to a fine tilth with 2-3 ploughings to remove all debris, stubbles, stones *etc* and to avoid infestation of ants and termites. However, minimum tillage is considered as an important component of organic farming.
- Use of organic manures as basal dose @ 25-38 t/ha through FYM, poultry manures, fish manures, sheep composts *etc*. Use of organic cakes from neem, groundnut, pongamia, and castor becomes imperative.
- Raising of green manure crops like sesbania or dhaincha and incorporating into the soil, besides using biomass of other plant species.
- Studies conducted by Upadhyay and Sharma (2000) reported that application of five group of crop residues

like bharg (*Cannabis sativus*) leaves, parthenium weeds, gulmohar and peepal leaves to the soil @ 15t/ha each before raising cowpea crop in a cowpea-potato cucumber rotation and subsequently the crop residues of cowpea, potato (haulms) and cucumber were added in succession after harvest of each crop and before sowing of succeeding crop resulted a positive effect on the yield of crops and enriched the soil with organic matter.

- Always include legume crop like beans, peas, cowpea *etc*. in the crop rotation not only to improve the soil fertility by fixing atmospheric nitrogen but also to increase the yield upto 30-35%. Inoculation of legume crop specific rhizobial strains can further improve their N- fixing ability.

Quantity of N fixed by legumes

Crop	N Fixed (Kg/ha)
Cowpea	80-90
Clusterbean	40-200
Fenugreek	45
Pea	50-60
Chickpea	85-100

(Source: Palaniappan and Annaduari, 1999)

- Application of bio-fertilizer is of great significance in organic farming. As they play a nutritional stimulatory and the therapeutic role in improving growth, yield and quality of vegetable crops. Inoculations of vegetable crops with different bio-fertilizers have depicted an encouraging response both in terms of increasing yield, quality and soil fertility. The field response of *rhizobium* is encouraging as reported by a number of research workers. *Azotobacter* and *Azospirillum* depicted a significant influence on vegetable crops, resulting in nitrogen economy of 25-50% and increase in yield from 1- 42 %. Similarly phosphorus solubilizers can also save in general 40% phosphorus fertilizers and can enhance the crop yields from 4.7-51%.
- Use of locally available mulching materials or polythene sheets to reduce moisture loss and minimum weed growth.
- Use bio-pesticides and bio-control methods for control of various pests and diseases.
- Natural products like garlic extract are used as broad-spectrum pesticides. Neem, Sabadilla, and Pyrethrum extracts are also used as pesticides. Besides this, bio-fertilizers like *Azotobacter*, *Azospirillum*, PSM, and phosphorus mobilize have antifungal activities without any residual or toxic effect resulting in the sustainable quality vegetable production. Crop inoculated with *mycorrhizal* fungi exhibits increase resistance to *Rhizoctonia solani* and *Fusarium oxysporum*. Damping off of tomato caused by *Phythium* could be considerably prevented. Mycorrhized tomato plants were found more resistant to nematode infection.

Response of Vegetable crops to Bio-fertilizer inoculations (for nitrogen)

Bio-fertilizer	Crop	Increase in yield (%)	Nitrogen economy (%)	References
Rhizobium	Cowpea	4.09		Mishra & Solanki (1996)
	Pea	13.38		Kanaujia et al (1999)
Azotobacter	Cabbage	24.30	25	Verma <i>et al</i> (1997)
	Garlic	14.23	25	Wange (1995)
	Knol khol	9.60	25	Chatto <i>et al</i> (1997)
	Tomato	13.60	50	Kumaraswamy (1990)

Response of Vegetables to Organic Farming

- Potato: The long-term field experiment for seven years at Jalandhar (Sharma *et al.*, 1988) revealed that FYM was more effective in increasing tuber yield than green manuring with dhaincha. Grewal and Jaiswal (1990) reported that the yield increase due to increased nutrients by increasing organic matter.
- Tomato: Application of oil cakes of margosa, castor, and groundnut (@ 0.2% W/W) is generally is found to reduce the intensity of root gall development. Thamburaj (1994) found that organically grown plants were taller with more number of branches. They yielded 28.18 t/ha, which was at par with the recommended dose of FYM and NPK (120:100:100 kg/ha).
- Brinjal: Highest yield of brinjal was with 50 kg N/ha as poultry manure and 50 kg N/ha in the form of urea (Jose et al, 1988). By application of neem cake higher yield was obtained in brinjal (Som *et al.*, 1992).
- Okra: Okra responded to poultry manure @ 20 kg N/ha (Abusaleha and Shanmugavelu, 1989). There was increased in protein and mineral content of okra crop by application of FYM as compared to commercial manures (Bhadoria *et al.*, 2002). Higher yield was also recorded by application of neem cake (Raj and Geetha Kumari, 2001).
- Cauliflower: Singh and Mishra (1975) obtained highest returns of cauliflower by mulching with mango leaves.
- Cabbage: Application of animal compost (cattle manures and chicken manure) to mineral soil of cabbage crop was effective in reducing the leaching out of mineral nutrients. The total carbon content was increased with the application of compost prepared with cattle manure.

CONCLUSION

The ill effects of the conventional farming system are felt in India in terms of the unsustainability of agricultural production, environmental degradation, health hazards problems *etc.* Organic agriculture is gaining momentum as an alternative method to the modern system. Organic Farming has the twin objective of the system sustainable and environmentally sensitive. In order to achieve these two goals, it has develops some rules and standards which must be strictly adhere to. There is very little scope for change and flexibility. With ever increasing population having huge requirements of vegetables and meager availability of organic resources, pure organic farming is not possible in India; rather some specific area can be diverted to organic farming for export of high quality vegetable crops. Thus, as a whole under Indian condition, only partial switching to Organic Farming of export oriented vegetable crops can be

possible in recent times. In this context, it will relevant to quote Nobel Laureate Dr. Norman Borlaug (2002) who said that, "Switching on food production to organic would lower crop yields. We can use all the organic that are available but we are not going to feed six billion people with organic fertilizers." For Indian Agriculture, use of chemical fertilizers cannot be totally eliminated, rather can be reduced, or minimized. It has been proved by various experiments that by conjoint application of inorganic fertilizers along with various organic sources are capable of sustaining higher crop productivity, improving soil quality and soil productivity, besides supplying N, P and K, these organic sources also helps in alleviating the increasing incidence of deficiencies of secondary and micronutrients. Therefore, these organic resources should be used in integration with chemical fertilizers to narrow down the gap between addition and removal of nutrients by crops as well as sustain the quality of soil and achieve higher crop productivity.

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