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# Organic Vegetable Production

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**Abstract**

Organic farming is one of the broad spectrum methods of production that ensures environmental safety and restricts the synthetic input use. They are the key component for sustainable agriculture. Vegetables are the vital source in Indian Diet for nutrition. But, in recent decades the use of chemicals had created problem to both human and environment. Thus a need arises to go back for organic farming. The primary goal of the organic vegetable production is to optimize health and productivity of the interdependent communities of plant, soil, people and animals. Organic vegetable production for its quality generates a higher income to the farmers. Varied climatic conditions in India and wide soil types had created a huge scope for organic vegetable production to a greater extend. This article details the organic vegetable production.

## 1. Introduction

India is the second most populated country with a constant increase in the population. But day-by-day the cultivated lands are getting shrunken. Agriculture is the backbone of India. To meet the demand for food, fodder, fuel, fibre and other needs for increasing population the agriculture productivity and soil health are required to be improved. In ancient times farming has been done organically through the fertilizers derived from animals and plants. From the middle of 19$^{th}$ century, farmers started using inorganic fertilizers or synthetic biocides. However, in past two decades nearly, people become conscious regarding the ill effect of chemical fertilizer towards human health and started to move towards the organic cultivation. Organic cultivation is found to be one among the key to attain sustainable agriculture. It refers to the farming without pesticides and fertilizers use. It is a remarkable form of the diversified agriculture that aims in producing nutritious high quality food with higher employment and income generation. They are based upon several laws and certification programs that forbid the use of most of the synthetic inputs and soil health is the central theme recognized in this method. Organic agriculture employs the use of some new varieties, precision and higher efficient technology, cover crops, mulching, crop rotations and other natural based techniques for enhancing and maintaining soil fertility. It emphasizes conservation of water, soil and energy, use of some renewable energy sources, environment enhancement and maintenance along with the optimum quality produce without synthetic or artificial fertilizers uses. Organic vegetable growing could be more productive and rewarding than growing with fertilizers or chemicals (Pimpini *et al.,* 2005). Vegetable crops aids for food and nutritional security. They are found to be rich in vitamins, fibre, minerals and contain a good quantity of carbohydrates and proteins. Demands for vegetables are found not only in local markets but also found in domestic and international markets. Before Independence, the vegetable production was around only 15 MT and now it is found to be 184.39 MT during 2018-2019 (NHB, 2018). Though India is the second largest vegetable producing country in the world next to China, it is found that productivity of some vegetable crops are less than the world's average productivity. It is recommended by Indian Council of Medical Research (ICMR) that 300 g/head/day of vegetable should be consumed in routine diet. The demand for vegetables keeps on increasing. Therefore, to feed the increasing population, productivity or vertical expansion should be increased. Strategy should be planned such that vegetable production must be higher with less use of land, water, energy and resources. Organic vegetable cultivation imparts long lasting stability for production by enhancing soil health. It fetches 10 to 50% premium price over conventional production and also has faster marketing rate (Ashley *et al.,* 2007; Smukler *et al.,* 2008).

### *1.1. Principles Involved in Organic Cultivation*

The principles should be used as a whole (Figure 1). They are composed as the ethical principles to inspire action (Kashyap *et al.,* 2017). They include:

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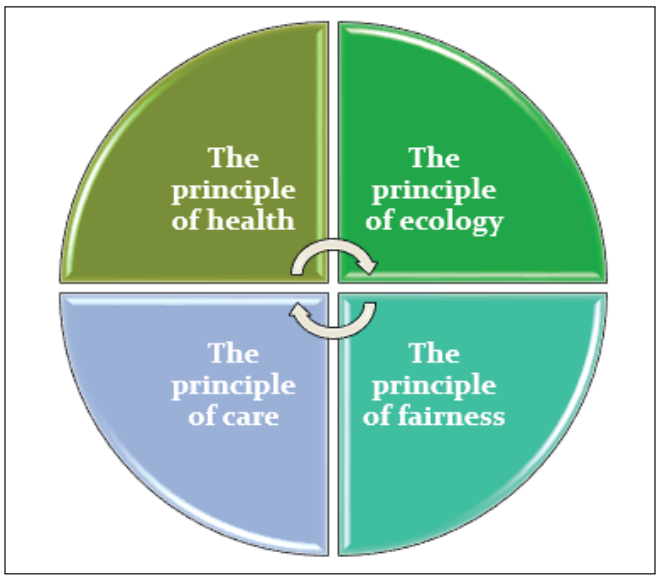


Figure 1: Principles involved in organic cultivation

• **Principle of Health:** Organic agriculture must enhance and sustain the health of soil, plant, human, animal and planet as one and should be indivisible.

• **Principle of Ecology:** Organic agriculture must be based upon the living ecological systems and cycles, work with them, emulate them and help them to sustain.

• **Principle of Fairness:** Organic agriculture must build on the relationships that ensure fairness with regard to common environment and life opportunities. Fairness is characterized by respect, equity, stewardship and justice of shared world, both among people and in their relations with other living beings.

• **Principle of Care:** Organic agriculture must be managed in precautionary and responsible manner to protect health and well-being of the current and future generations and environment.

*The above principles encourages upon:*

• To maintain soil fertility for long term.

• To work within closed system as much as possible.

• To use the available local resources.

• To decrease in the use of fossil energy.

• To produce the foods in sufficient quantity with good quality.

• To make farmer earn for their living and to meet up their needs.

Organic agriculture is a dynamic system that responds for the internal and external demands and the conditions. Practitioners of the organic agriculture could increase efficiency and enhance productivity, but this should not be at the risk of jeopardizing the health and well-being. Consequently, the new technologies required to be assewssed and the existing methods must be reviewed (Bhattacharaya and Chakraborty, 2005).

### *1.2. Need for Organic Farming in Vegetables*

• The enhancing production cost of the chemical farming such as investments in the manufacturing pesticides, fertilizers, irrigation etc.

• Due to heavier environmental pollution.

• In India, most of the vegetable farmers are poor, small or marginal.

• Land productivity gets decline because of increased chemical fertilizers.

• As most of the vegetable are eaten raw there is a need to reduce the contamination that causes health hazards.

• Organic vegetable fetches more income through saving the cost of production or through international exports.

• Helps in the restoration of soil characters.

## 2. Requirements for Organic Farming

For organic vegetable cultivation to be successful the following factors are to be considered:

### *2.1. Selection of Site*

The best quality of the produce can be obtained through planting the vegetable at correct location. The field or the garden must be located at the open field or southern exposure if possible. Location selected must receive at least 6 to 8 h of sunlight directly every day. The water resource should be nearby the production area. More than 1.5% slope should be avoided to minimize the soil erosion and run off. Proper drainage facilities must be ensured.

### *2.2. Conversion Period*

The interim period required for the establishment of organic management system and soil fertility are termed as conversion period. For vegetable crops the minimum conversion period of 12 months are required before to the start of production cycle. Based upon past use of ecological and land situations, the certification agency might reduce or extend the minimum period for conversion.

### *2.3. Choice of the Crops and Varieties*

The planting materials used must be certified organic, resistance to various stresses and climate resilient. If certified planting materials are not available then care should be taken that it should be chemically untreated one. The use of genetically engineered pollens, seeds and transgenic plants are restricted. The most needed criteria to select the vegetables are based on the market demand. The vegetables are classified into two categories *viz.,* the warm and the cool season vegetable crops. Each of the vegetable crops requires some specific requirement in climate and the season selected for the cultivation (Singh *et al.*, 2016). Following are the schedule generally followed.

**Kharif:** Chilli, Brinjal, okra, onion, drumstick.

**Rabi:** Cabbage, carrot, cauliflower, capsicum, onion, french beans, peas.

**Summer:** Cumber, bottle gourd, water melon, Ridge gourd.

*2.4. Soil Preparation*

The production of organic vegetables requires some long-term outlook for soil preparation. Soil must be friable, porous and well drained with good organic matter content as the soil organic matter releases the nutrient and have a good water holding capacity. For weed control soil solarization is preferred.

*2.5. Planting*

Location size and the problems in size mainly determine the methods used for planting. Raised beds are laid in smaller sites to minimize the compaction, to hold organic matter and for ease of harvest. For larger sites tractors and other equipment's are used in one or other way. Vegetable production mainly relies on the clean cultivation where old crops residues have been turned into the soil. This is done to avoid the allelopathic effect of the previous crop residues.

*2.6. Irrigation*

The successful vegetable cultivars are determined by water application at the correct time and at correct growth stage. Drip and sprinkler method of irrigation are most commonly used in vegetables.

*2.7. Cultural Methods*

The organic sources of nutrients that augment with various cultural methods are efficient. These methods were actually been as a part of agriculture since ancient times. They contribute for increased nutrient content. Some of the cultural methods are:

- Ideal inter-cropping with the complementary interactions.
- Effective rotation of crops.
- Homestead farming practices.
- Alley cropping with Nitrogen fixing trees.
- Fallowing.
- Water and soil conservation practices.
- Through establishing vegetable bunds.

*2.8. Crop Diversification and Crop Rotation*

Growing of legumes as the main or companion or inter crops with vegetable crops enhances the organic soil load. Changing multiple crops and crop rotation ensures the better utilization of the resources. The legume crops like peas, beans, cluster bean, cowpea etc are to be included in crop rotation for improving soil fertility through atmospheric fixing of nitrogen. The inoculation of the legume crops with some specific rhizobium strain could further improves nitrogen fixing ability. The quantities of nitrogen fixed are given in Table 1.

Table 1: Quantity of nitrogen fixed by vegetable crops (Palaniappan and Annaduari, 1999)

| Crop | Nitrogen Fixed (kg/ha) |
|---|---|
| Cluster bean | 37-196 |
| Cowpea | 80-85 |
| Pea | 52-57 |
| Fenugreek | 44 |

*2.9. Weed Control*

The major constraint in the organic vegetable production is the weed control as herbicide spray is not used. Weed management is expensive, time consuming and also cause severe yield losses when they aren't controlled. Internationally the researches on the organic weed management in vegetable and herbs have increased considerably (Kristiansen, 2003). The weeds in organic vegetable production can be controlled by both physical and chemical method (Figure 2). In Directed seeded vegetable crops, the application of corn gulten meal is found to control the weed in squash (Webber *et al.,* 2010). A study on lettuce on summer cover crop before planting showed a positive effect on weed management (Ngouajio *et al.,* 2003).

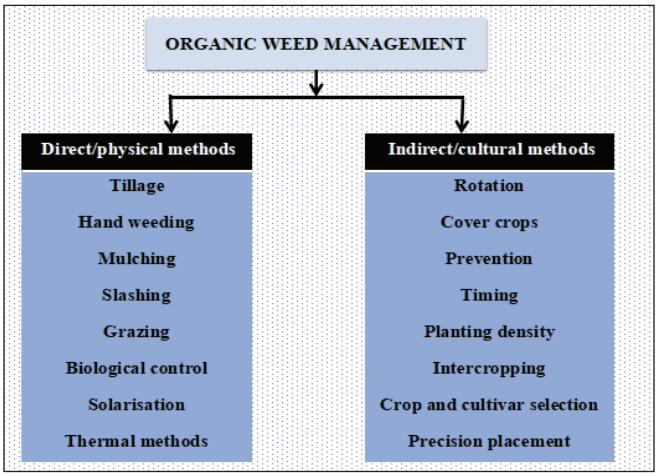


Figure 2: Organic weed management methods used in vegetable crops (Modified from Olle and Williams, 2012)

*2.10. Nutrient Management*

The nutrient management in the organic farming mainly depends upon the nutrients that are been derived biologically as the use of the synthetic fertilizers/ chemicals are abandoned. The uses of organics have been practiced. Following are the source of nutrients.

- **Green Manure:** Green manuring is the incorporation of the living biomass into the soil to supply nutrients. The crops used in the methods are turned as green manure crop. The nature of green manuring crop should be non-woody, fast growing and short duration in nature. Nitrogen fixing fast growing crops like sunhemp, dhaincha and cowpea are capable of fixing about 60-100 kg/ha of nitrogen and are used as green manure crops

commonly. They improve the soil health and yield.

• **Farm Yard Manure:** The manure prepared using cow urine, dung and farm waste in the backyard space is termed as farm yard manure. This method has been followed from old times. The preparation of FYM can be by the use of any one of the method including sealed pit method, open pit method and Japanese method. The soil physical property, microbial activity and yield have been increased considerably using FYM.

• **Enriched Compost:** One of the traditional sources for the crop nutrient is through composting the organic residues. Though nutrient concentration is less, apart from NPK it also provides the required micro-nutrients to the areas cultivated. Micro-nutrient supply satisfies particularly the hidden hunger in the plants and safeguards it against the injury and toxicity. It also improves chemical, physical and biological properties of the soil. In addition, compost are enriched externally through microbial inoculants, bio fertilizers etc. It is found that in cucumber, the application of compost increased the yield (Nair and Ngouajio, 2010).

• **Vermi-Compost:** The technology uses earthworm as a natural bio-rectors for recycling the non-toxic organic waste to soil. Vermi-compost refers to the manure generated through rearing earthworms in large scale either in natural or artificial pit. This method is generally adopted when there is a huge quantity of undecomposed organic matter (Chauhan *et al.,* 2010; Chatterjee *et al.,* 2014).

• **Oil Cakes (Concentrated Organic Manure):** The oil cakes are applied in the granular form before the fertilizer use, so that nutrients that are contained in them are available for the crops. This enriches the soil organic carbon to soil that in turn increases the microbial activity. Castor cake, neem cake and linseed cakes are few examples of non edible cakes. As most of the edible cakes are fed to cattles as concentrates the use of it as nutrient source is limited in Indian scenario.

• **Crop Residues:** Soil fertility, soil organic matter and crop yield increases with the application of crop residues. Vegetable crop generates a huge quantity of crop residues after the harvest of their economic part. The nutrients that are embedded in residues are a potential source of the organic nutrition. They can also be used to produce vermi-compost.

• **Liquid Manures:** Liquid manures applied enrich the microbial activity in the soil. 3-4 liquid manures application are required for most of the crops. Liquid manures include vermiwash, jivamrutha, panchgavya, cow urine, biosel etc. That forms a vital growth promoter when used as the foliar spray.

• **Biofertilizers**: Biofertilizers are the cultures of the appropriate microbial species that can fix the atmospheric nitrogen such as *Azospirillium* and *Azotobacter* in non-leguminous and *Rhizobium* species in the leguminous crops (Anant *et al.,* 2003). The phosphate mobilizing fungi (VAM) and phosphate solubilizing bacteria are found more efficient in making the unavailable soil phosphorous available for the plants. It is found that legume-rhizobium association could fix 40-120 kg/ha of nitrogen under optimum conditions. The crops innoculated with Mycorrhizal fungi are found resistant to *Fusarium oxysporum, Rhizoctonia solani*, *Phythium* and nematode.

• **Agro Industrial Waste:** In recent past the agro waste quantity generated at various agro industries are increasing. A large quantitative of the organic decomposable waste are produced from it. Though the industries regard them as a value less waste, they form a rich source in plant nutrients. Hence they can be efficiently used by converting them into the valuable manure that can be applied to the crop as nutrients.

*2.11 Pest and Disease Management*

The pest control strategies in organic farming are targeted in reducing and preventing the aggregation of the insect population. The risks in pest outbreaks are minimized by enriching the soil with compost, crop rotation, inter-cropping and conservation tillage (Niggli, 2010). Strategy for the pest control in the organic farming limits the use of chemical pesticides and promotes the use of organically derived pesticides. The effective control for pest population are achieved through field scouting, trap crops, insect trapping and application of some biological control methods like introduction of the beneficial insects and by using natural enemies for reducing pest population. Onion thrips incidence was found similar between the mineral fertilized and organic fertilized fields. Simmons *et al.* (2010) suggested that the combination of host plant resistance and the reflective mulch could suppress the white-fly infestation that mainly affects the organic vegetables production. Root knot nematodes in vegetable crops are effectively controlled by spraying the nematophagus fungus (*Pochonia chamydosporia*) (Atkins *et al.,* 2003) Added, solarization that are associated with the organic fertilization have a potential role in controlling nematodes (Silva *et al.,* 2006).

The fungicide application prevents most of the diseases when applied. But the organic farming restricts the use of fungicides. Key techniques used for controlling includes the avoidance strategy, use of genetic resistance and by approved fungicidal products. The physical treatments of seeds like hot air, hot water and electron treatments can moderately control some of the diseases. Biological methods are also used for controlling, where they are found more prominent in the green house condition than in open field conditions.

**3. Issues in Organic Vegetable Farming**

Even though the organic farming is the best approach for the sustainable crop production, but there are some constraints faced in adopting it under Indian conditions (Maity and Tripathy, 2004). These are due to the following reasons:

• Reduction in yield in the initial few years when the farmers convert from chemical farming to organic farming.

• Inputs required are difficult to generate easily in the farm.

• Lack of market facilities of the organic vegetable produce.

• Organic farming is a knowledge intensive farming where one have to keep in pace with nature dynamics to increase the production.

• Shifting from chemical farming to pure organic farming is laborious and time consuming method.

• Actual amount required for soil through organic material is difficult to calculate as the content of nutrient is too low.

• There is a constrain in the availability, transportation and the application of the biological material for meeting the crop nutrient demand.

• There is a lack of the farmers' adoption without getting any financial help from the government.

**4. Conclusion**

Thus in countries like India, the adoption of pure organic farming is possible partially, especially for exporting to International market. On the other hand, adoption of the Integrated Green Revolution Farming is one of the options for adopting Organic Farming in a large scale. The basic of green revolution are increased use of the external inputs, developing high yielding and hybrid varieties, farm mechanization that limits the damage to human health and environment. For this purpose, some of the organic techniques have been developed and combined with some high input technology for creating integrated systems like INM (Integrated Nutrient Management), IPM (Integrated Pest Management) and biological control methods that reduces the chemical needs. Further researches on some proper technology (time saving and less cost) for organic vegetable production are needed in near future.

**5. References**


Ashely, R., Bishop, A., Dennis, J., French, J., Gardam, P., Butler, L., Trebilco, V., O'Donnell, D., Heazlewood, G., Simmul, P. and Tuck, G., 2007. Intensive organic vegetable production: integrated development, p. 46.

Atkins SD, Hidalgo-Diaz L, Kalisz H, Mauchline TH, Hirsch PR, Kerry BR, 2003. Development of a new management strategy for the control of root-knot nematodes ( Meloidogyne spp) in organic vegetable production. *Pest Manag Sci* 59, 183–189.

Bhattacharyya, P., Chakraborty, G., 2005. Current status of organic farming in India and other countries. *Indian Journal of Fertilisers* 1(9), 111.

Chatterjee, R., Bandyopadhyay, S., Jana, J.C., 2014. Evaluation of vegetable wastes recycled for vermicomposting and its response on yield and quality of carrot (Daucus carota L.). *International Journal of Recycling of Organic Waste in Agriculture* 3(2), 60.

Chauhan, A., Kumar, S., Singh, A.P., Gupta, M., 2010. Vermicomposting of vegetable wastes with cowdung using three earthworm species Eisenia foetida, Eudrilus eugeniae and Perionyx excavatus. *Nature and Science* 8(1), 34-42.

Gonçalves, P.A.D.S., Silva, C.R.S., 2003. Impact of the organic fertilization on onion thrips incidence. *Horticultura Brasileira* 21(3), 459-463.

Kashyap, P, Mishra, D., Meena, V.H., Kumar, S., Kansal, A., 2017. Organic Vegetables. Towards Organic Agriculture, pp. 257-279.

Kristiansen, P.E., 2003. Sustainable weed management in organic herb and vegetable production (Doctoral dissertation, University of New England), p. 225.

Maity, T.K., Tripathy, P., 2004. Organic farming of vegetables in India: Problems and Prospects. Department of Vegetable Crops, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya. Available at www. share. 4dev. info/kb/ documents/2997. pdf.

Nair, A., Ngouajio, M., 2010. Integrating rowcovers and soil amendments for organic cucumber production: Implications on crop growth, yield, and microclimate. *HortScience* 45(4), 566-574.

Ngouajio, M., McGiffen Jr, M.E., Hutchinson, C.M., 2003. Effect of cover crop and management system on weed populations in lettuce. *Crop Protection* 22(1), 57-64.

NHB, 2018. National Horticulture Board. Ministry of Agriculture and Farmers Welfare, Govt. of India, Gurgaon.

Niggli, U., 2010. Organic agriculture: a productive means of low-carbon and high biodiversity food production. In Trade and Environment Review-Promoting poles of clean growth to foster the transition to a more sustainable economy. United Nations Conference on Trade and Development (UNCTAD), pp. 112-118.

Olle, M., Williams, I.H., 2012. Organic farming of vegetables. *Sustainable Agriculture Reviews*, Springer, Dordrecht, pp. 63-76.

Palaniappan SP, Annadurai K., 1999. Organic Farming- Theory and Practice. Scientific Publishers (India), pp. 1-257.

Pimpini, F., Gianquinto, G., Sambo, P., 2005. Organic vegetable production: evolution, base principles and quality of products. Italus Hortus (Italy).

Silva, M.G., Sharma, R.D., Junqueira, A.M.R., de, O., C.M., 2006. Effect of solarization, chemical and organic fertilization on the control of nematode on greenhouse lettuce. *Horticultura Brasileira* 24(4), 489-494.

Simmons, A.M., Kousik, C.S., Levi, A., 2010. Combining reflective mulch and host plant resistance for sweetpotato whitefly (Hemiptera: Aleyrodidae) management in watermelon. *Crop Protection* 29(8), 898-902.

Singh, S.K., Yadava, R.B., Chaurasia, S.N.S., Prasad, R.N., Singh Raghwendra, C.P., Singh, B., 2016. Producing organic vegetables for better health. *Indian Hort* 61(1), 5-8.

Smukler, S.M., Jackson, L.E., Murphree, L., Yokota, R., Koike, S.T., Smith, R.F., 2008. Transition to large-scale organic vegetable production in the Salinas Valley, California. *Agriculture, Ecosystems & Environment* 126(3-4), 168-188.

Webber, C.L., Shrefler, J.W., Taylor, M.J., 2010. Influence of corn gluten meal on squash plant survival and yields. *HortTechnology* 20(4), 696-699.