International Journal of Agriculture and Food Science Technology.
ISSN 2249-3050, Volume 4, Number 10 (2013), pp. 1037-1044
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http://www.ripublication.com/ ijafst.htm

Organic Gardening: A Case Study for Sustainability

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Abstract

Today, the concentration of modern agriculture is on the use of genetically modified seeds, chemical fertilizer, irrigation water, pesticides etc. to secure the goals of meeting the ever-growing demand for food grains for consumption and for earning foreign exchange. These ambitions come at the cost of compromise on environmental quality as the methods used are unsustainable in the long-run due to the adverse effect on the environment and ecosystem. Thus an imminent environmental degradation, the increase in poverty around the world and the need for achieving and maintaining good quality of life formed the fundamental factor for our interest in intergenerational equity, related to the access to natural resources. As most good agricultural lands in India have exceeded the safe limit, the availability of natural resources for further farming expansion is practically exhausted. So, this called for an alternative agriculture method which can be functioned in a friendly ecosystem while sustaining and increasing the productivity without the use of energy intensive techniques and the best recognized alternative was Organic Farming. It is economically feasible in practice and farmers are able to obtain premium prices for their end-products. While low productivity in the transition stage needs research activities in the national and international level, it is assured that organic farming will yield a high cost-to-benefit ratio. Organic farming paves way for a healthy lifestyle in addition to meeting our food security goals. So, a paradigm shift to organic farming is the need of the hour in order to enhance the quality of our lives.

Keywords: Organic agriculture; sustainable farming; vermicompost; mulching; grey water.

1. Introduction

Organic farming can be described as a method of farming system which primarily aimed at cultivating the land and raising crops in such a way, so as to keep the soil alive, healthy and in good health by use of organic wastes (crop, animal and farm wastes, aquatic wastes) and other biological materials along with beneficial microbes (bio-fertilizers) to release nutrients to crops for increased sustainable production in an eco-friendly pollution free environment. Organic farming "Organic farming is a system which avoids or largely excludes the use of synthetic inputs and to the maximum extent feasible rely upon crop rotations and residues, natural manures such as animal manures, organic waste which are off-farm, additives such as grade rock minerals and biological system of nutrient mobilization and plant protection".

2. Background Study and Literature Survey

The Indian subcontinent supports 50% of the world's hungry. About 1 in 12 children world over (170 million), are malnourished. Asia has only 0.14 hectare (14,000sq.ft) arable land (or) person. There is an expectation if massive food crisis in the near future due to the combined effect of the overpopulation which is about to explode, increase of water scarcity, rising land degradation every day and economic upheavals and the disruption in the distribution systems. In this context it is inferred that there is utmost importance to utilize every square inch of available vacant land for food production. Organic food gardens provide a local and assured food supply that utilizes vacant land for fulfilling local food needs.

Irrigation constitutes 80% of India's freshwater consumption. By 2025, some 50 countries will have a massive hit by water stress or scarcity. Every product produced or foodstuff has large quantities of 'embodied water'—freshwater which is most scarce and precious is used in production, distribution and disposal of the product wastes. Re-using your own grey water (shower and washing water) for irrigation displaces some of the demand on the precious and scarce freshwater that would otherwise be used to cultivate crops for feeding you. India's solid waste management infrastructure is overburdened and in many places they are simply non-existent and inefficient. Over 70% of the Indian cities lack adequate capacity to transport the waste and there are no sanitary landfills to dispose of the waste collected. Hence the wastes that are collected are often disposed of irresponsibly. More than 25% of the municipal solid waste is not collected at all and is left to rot on the streets or collected by scavengers. Approximately 48% of solid waste in Indian cities is biodegradable (i.e. potential manure). The best use of such waste is to compost it locally and apply it to food gardens. This eliminates the need for transporting almost half of the nation's wastes. Hence by applying this compost to gardens and plants it is possible to convert the waste to the greatest wealth—FOOD.

In India, land degradation affects 105 mi. ha (32.07% of arable land), out of which 81.45 mi. ha (24.78%) are desertified. Hence loss of soil organic matter and moisture are among the most common characteristics of such degraded soils. Remedial actions are taken by addition of organic manures or carbonaceous biomass to the soil. Addition

of biomass to degraded soil can substantially increase crop yields (e.g. Adding the equivalent of 1 ton carbon /ha can increase yields by 20-40 kg/ha for wheat, 11-20 kg/ha for maize, and 0.55-1 kg/ha for peas). Thus the humus from the decomposed biomass also helps the soil hold more water, therefore reducing the need for irrigation. Hence organic waste composting and applying it to food gardens achieves a dual purpose of reducing the solid waste problem and improving soil fertility.

The municipal wastewater treatment capacity developed so far is sufficient for only 27% of wastewater generation in Class I cities and Class II towns. Over 73% of sewage water in these Indian cities and towns is not treated at all. All the untreated effluent finds its way into surface waters and groundwater that are sources of drinking water leading to a massive loss of life and illness. Reusing grey water for food gardens considerably reduces the volume of wastewater going to the overburdened municipal effluent treatment plants. Locally grown food greatly reduces green house gas emissions from the transportation fuel burnt in the process. Agriculture is a big consumer of energy (for farm machinery, pump sets, making the petroleum-based agrochemicals, storage, transportation, food processing etc.). Hence every kilogram of the foodstuffs has some 'embodied energy'—the energy used in producing and distributing that foodstuff. Since more than 85% of our energy comes from fossil fuels, proportionately there is emission of greenhouse gases. Hence, the food we consume in some way or the other causes global warming and environmental damage. Also India unfortunately does not have much of oil reserves and we depend on expensive foreign oil. Organic gardens greatly reduce the energy consumption and the organic produce has very low embodied energy. Thus they also reduce our food supply's dependence foreign oil. Human nitrogen inputs to the land (through synthetic fertilizers) have risen so rapidly in the past few decades that they now equal biological fixation. Untreated sewage and effluent water can also add nitrogen and phosphorous to water causing eutrophication. This causes a great loss to aquatic life and even lead to a loss of biodiversity in terrestrial ecosystems. About 30% of the value of Indian fruits and vegetables ends up destroyed or spoiled on the way to market, mostly because of bad infrastructure; esp. bad roads. Sourcing your food locally (food gardens) reduces food miles and food spoilage at various stages of transportation and storage. Organic farming is a form of agriculture that relies on techniques such as crop rotation, biological control and green manure compost of pests. Organic farming excludes or strictly limits the use of manufactured (synthetic) fertilizers, pesticides, plant regulators on growth such as hormones, livestock antibiotics, human sewage and sludge, genetically modified organisms, food additives, and nanomaterials.

Organic agricultural methods are internationally regulated and legally enforced by many nations, based in large part on the standards set by the International Federation of Organic Agriculture Movements (IFOAM), an international umbrella organization for organic farming organizations established in 1972.

3. Planning

The region of implementation Ettimadai, Coimbatore is a rain shadow region adjoining the Western Ghats. The soil is of red loamy type and is generally suitable for all vegetable and legume types. The climate in Ettimadai is tropical and the average annual temperature is 27 degree Celsius. The average annual rainfall is 809mm. Provision for grey water is available in the cultivation region at low energy intensity. The grey water treatment does not involve addition of chemicals and is hence compatible with sustainable agriculture. Soil lacks moisture retention and has to be provided with suitable layering such as mulching and soil embankment. Heavy downpours can also be expected, because of which facilities to drain away excess water is required. Based on this soil and climate analysis, the crops chosen for the organic farm were ladies finger, tomato, beans, chilly and coriander. Beans are leguminous plant which fixes nitrogen in the soil which acts as a natural fertilizer for other plants and help the soil retain its fertility. Tomato and chilly are pest repellent varieties. Ladies finger and beans grow well in any kind of soil and they do not require special care. The vegetables were choosing keeping in mind these facts. Good quality organic seeds were used.

4. Implementation

An area of 10x10 was chosen. The plot was dug and the weeds were removed and the area was completely cleared. Clearing the land took about three days. The plot was divided into four in order to accommodate diverse crops. The plot was tilled and smoothened and the surface was cleared. A trench was created around the edges to outline the soil bed and provide for an effective draining system.

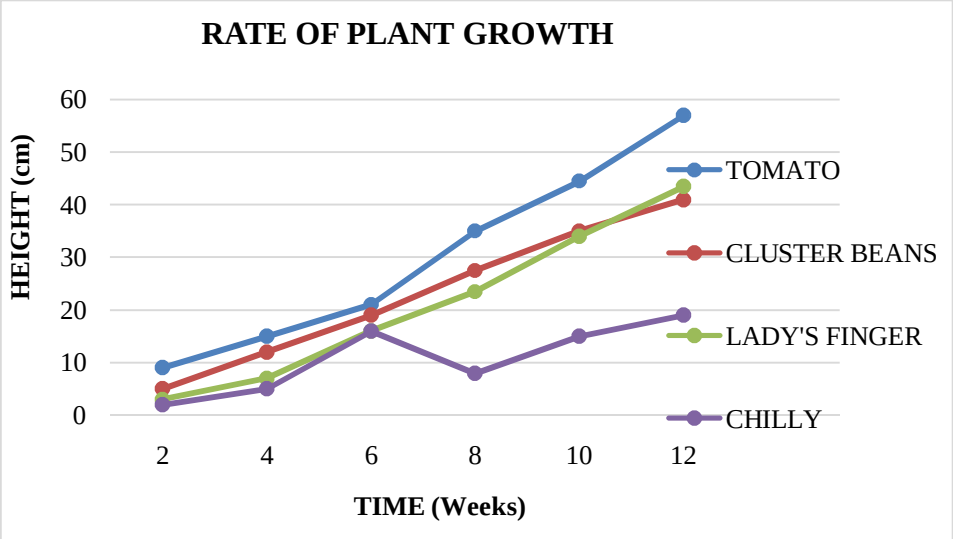

Fig. 1: Growth rate of crops.

Organic seeds obtained from Tamil Nadu Agricultural University were sown. The beds were watered daily using bio remediated grey water (grey water with EM: Effective Microorganisms). Essentially it is a combination of aerobic and anaerobic species commonly found in ecosystem. When EM is introduced into the natural environment, the individual microorganism effects are greatly magnified in a synergistic fashion. Following this, the beds were covered with mulch (dried leaves and weeds) which helped to retain the moisture of the soil.

Fig. 2: Sowing of Seeds

Fig. 3: Lady's Finger.

5. Result

Sustainable organic gardening practices were implemented. Vegetables like cluster beans, lady's finger; chilly, tomato and coriander were grown. They were found to be healthier, fresher and tastier than the conventionally grown counterparts. Chemical-free, minimal inputs including bio-remediated recycled grey water ensured that the yield was marginally better than the yield obtained from conventionally grown vegetables for some crops. Cost benefit analysis, from figure shows that organic farming produces almost similar results for lesser cost without intensive strain on natural resources thereby making it sustainable in the long run.

Table 1: Time Vs Yield.

Crop Name	Time for Full Growth (Weeks)	1st Yield (g)	2nd Yield (g)	3rd Yield (g)
CLUSTER BEANS	6	1200	2500	1550
LADY'S FINGER	7	1500	1300	1500
TOMATO	9	NA	NA	NA
CORIANDER	3	1 bunch	NA	NA
CHILLY	6	250	NA	NA

The tables Table.1 and Table.2 have been tabulated with TIME (weeks) taken by the crops to grow, taken along the X-axis and the growth of the crops (cm) along Y-

axis which represent organic farming. Fig.2 and Fig.3 shows desliting of plot and lady's finger

Fig 1.Shows the graph which depicts TIME Vs YIELD.

Table.3 depicts the cost to benefit results observed and Fig.4 shows the final yield obtained.

Table 2: Growth of crops week by week (in cm).

Time(Weeks) / Crops	**3rdweek (cm)**	**4thweek (cm)**	**5thweek (cm)**	**6thWeek (cm)**	**7thweek (cm)**	**8thweek (cm)**	**9thweek (cm)**
Tomato	9	15	21	35	44.5	57	62.5
Cluster Beans	5	12	19	27.5	35	41	51.5
Lady's Finger	3	7	16	23.5	34	43.5	55
Chilly	2	5	8	15	19	24.5	27
Coriander	NA	NA	2	5	6.5	8	15

Table 3: Cost to Benefit Ratio.

Crops	**Input Cost (Seed) (Rs)**	**Output cost (Yield) (Rs)**	**% Profit (Output-Input) /(Input)*100**
Tomato	20	NA	NA
Cluster Beans	20	115.5	477.5
Lady's Finger	20	77.4	287
Chilly	5	15	50
Coriander	5	10	25

Figure 3: Final Yield.

6. Conclusions

Despite better performance with inorganic sources for some crops, the use of organic by-products not only improves soil health but also the productivity of crop yield.

Consumers demand for high quality and safe food products that are produced with minimal environmental pollution. The number of studies about safety of organic foods is limited. In order to provide application of organic sources in the field, which could be the satisfactorily alternate solution for inorganic fertilizers in the future need further assessment of nutrient analysis in these sources and their consumption rate with any antagonistic effect.

7. Acknowledgements

We would like to express our gratitude to Mr. Krishna Prakash and Mrs. Radhamani Pillay for their help and support. We would like to thank them for their constant support and guidance throughout the project.

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