Ecological and Economic security through Organic Vegetable Cultivation in the Raised Bed Model: A case study of Akshayakalpa organics in Tiptur, India

Abstract

This paper explores the potential role of organic vegetable production technologies in ensuring ecological and economical security to farmers. In current scenario, survival of farmers, especially small and marginal farmers is challenged by number of problems such as low land holding, decreased soil fertility, high labour cost, high input cost, less market rate, ecological harshness, increased cost of living and increased awareness about health benefits of organic vegetable consumption among economically middle and high starta of society leads to more demand for organic vegetables. Under this conditions, diversification of cropping system with high value crops like vegetables can be a best option for the distress farmers. In connection with this, new technologies and practices are needed for higher and sustainable production and productivity of vegetablesand to maintain the good ecology in the farm.

Raisedbed is one of the technologies in which beds are raised with the stone border (70*4*1 ft). The vegetables are grown in mixed cropping system. Root crops, leavy vegetables, climbers, Cole crops, Guards etc are all grown with spatial and temporal arrangements (companion cropping). The technology has been followed since from 5 years in one acre of land at Kodihalli, Tiptur.No chemical inputs are using for the management of crops. Manure, cow dung slurry, compost and vermicompost are the source of nutrients for crops. Buffer zone has been established around the farm. Bee boxes are also maintained on the farm for pollination.

It was found that the gross revenue generated by this one-acrefarm per month is found to be Rs.53,928and total expenditure per month is found to be Rs. 21,584.

The Average Air temperature for three months inside thevegetable farm is 27.49℃, in open area it is 29.22℃ and in tree cover area it is 28.54℃. The average soil temperature for three months inside the vegetable farm is 23.48℃, in open area it is 25.54℃ and in tree cover area it is 24.20℃. Th average RH of three months inside the vegetable farm is 60.42 %, in the open area it is 52.38 % and in tree cover area it is 54.15%. These difference in temperature is due to the buffer zone which is maintained around the farm. Due to buffer zonemicroclimate has been created inside the farm. The temperature and RH difference can be noticedwithin and outside of the farm.This system requires a smalleramount of labour and less water when compared to conventionalfarming. With all its advantages the farmer can be assured with economic and ecological security

Key words: Organic farming, Raised bed, Buffer Zone, Ecological and Economic security

Introduction:

Vegetable production in India is an economically very important activity which provides an income and employment for millions of smallholder farmers. Because of arelatively very high return, and added value, commercial vegetable production activity is often characterized

by a very intensive use of agricultural inputs (agrochemicals). On the other hand, little scientifically based schemes of fertilization and crop protection practices exist, which often leads farmers to over-apply the agricultural inputs. This has lead to a problem of food safety in general, and in particular, reduction in soil quality, excessive losses of nutrients to the environment, leading to eutrophication of natural waters (Sutanto 1999).

Over application of pesticides on vegetables, and on high value vegetables in general, has had direct impacts on farmers and affects consumers' health(Kishi et al. 1995; Pawukir and Mariyono 2002), and also leads decline in soil and water quality (Pretty and Hine 2005).

Therefore, there is an urgent need for more environmentally benign strategies of intensive vegetable production. Hence Akshayakalpa organics started to work on organic vegetable cultivation. Raised bed was the new practice adopted by Akshayakalpa. Without chemical inputs vegetables are growing since from 2017.This production model also includes buffer zone, according to the USDA organic regulations, a buffer zone is "an area located between a certified production operation or portion of a production operation and an adjacent land area that is not maintained under organic management. A buffer zone must be sufficient in size orother features (e.g., windbreaks or a diversion ditch) to prevent contact by prohibited substances applied to adjacent land areas." In Akshayakalpa banana, curry leaves, papaya, drumstick, citrus etc has been grown in buffer zone which gives the additional revenue.

Consuming vegetables supports food safety issues, as vegetables contain various vitamins and micro-nutrient. In relation to food security, high valued vegetables are expected to indirectly support household food security, since the sale of such vegetables could be traded for food. Other vegetables are obviously expected to directly support household food security through substitution or supplementation of staple foods. Smallholding farmers do not grow high valued vegetable alone.

In this paper, we explore the potential roles of vegetable production and improved production technologies in ensuring ecological and economic security to farmers. We analyze potential impacts of raised bed model on productivity and ecological benefits.

Material and methods:

The study has been conducted at a place called Kodihalli, which is located near Tiptur, Tumkur district of Karnataka. One acre of land was selected, and beds was constructed. Total of 52 beds can be found. The beds are with the dimension of 70*4*1 feet. Out of 4000 sq.mt area only 1200 sq. mt of area is used for crop production, rest of the area is used for walking path and creating buffer zone.The virgin soil was used to create the beds. Planting materials was initially burrowed fromprogressive farmers and local nurseries.

The data of expenditure incurred for inputs, management and labour has been documented for each month. Soil test reports,microclimate parametersi.e, Air temperature, Soil temperature and RH andproduction (yield) data of each crop has been recorded for each month.Using descriptive statistics, the data has beenanalyzed with statistical tools such as frequency and percentage. The results have been summarized below.

Results and discussion:

The data revealed that 903.69 kg of vegetable production can be seen every month. This model is generating total revenue of Rs. 53,783.25 per month and with the expenditure of Rs. 21,584.35.

Table 1: Table representing the production, productivity, and profit of Raised bed model.

Month/Year	Crop Production per Ac (in KG)	Gross Revenue in Rs (per Month)	Total Expenses in Rs (Per month)	Diff in Rs. Per Month
Jan-19	773.70	50,000.00	22733	27,267.00
Feb-19	953.95	56,479.00	23400	33,079.00
Mar-19	779.50	44,881.00	22800	22,081.00
Apr-19	559.70	32,761.00	22767	9,994.00
May-19	678.64	32,506.00	20966	11,540.00
Jun-19	782.90	36,699.00	22053	14,646.00
Jul-19	672.23	35,734.00	23753	11,981.00
Aug-19	520.78	34,121.00	22163	11,958.00
Sep-19	744.03	29,344.00	22863	6,481.00
Oct-19	739.70	39,217.00	22053	17,164.00
Nov-19	746.58	48,899.00	17764	31,135.00
Dec-19	845.35	38,152.00	21936	16,216.00
Jan-20	928.12	40,933.00	22134	18,799.00
Feb-20	821.95	48,572.00	22134	26,438.00
Mar-20	929.80	37,990.00	22163	15,827.00
Apr-20	996.80	59,253.00	22832	36,421.00
May-20	977.95	56,590.00	22163	34,427.00
Jun-20	928.12	54,334.00	17932	36,402.00
Jul-20	865.02	48,430.00	22744	25,686.00
Aug-20	774.50	69,706.00	22733	46,973.00
Sep-20	991.50	43,933.00	17933	26,000.00
Oct-20	940.83	78,857.00	22600	56,257.00
Nov-20	770.79	65,399.00	17402	47,997.00
Dec-20	559.79	36,536.00	17966	18,570.00
Jan-21	1,480.60	28,737.00	17933	10,804.00
Feb-21	981.90	65,067.00	17942	47,125.00
Mar-21	1,260.22	53,928.00	20811	33,117.00
Apr-21	1,495.96	66,387.00	22823	43,564.00
May-21	1,497.00	81,672.00	19701	61,971.00
Jun-21	593.58	63,088.00	17400	45,688.00
Jul-21	901.06	42,711.00	20482	22,229.00
Aug-21	907.36	51,639.00	17400	34,239.00
Sep-21	1202.75	65,997.00	19702	46,295.00
Oct-21	726.45	75,388.00	21920	53,468.00
Nov-21	542.84	60,072.00	25014	35,058.00
Dec-21	726.35	40,279.00	25348	14,931.00
Jan-22	964	60,669.00	17650	43,019.00

Feb-22	1006	72,523.78	19954	52,569.78
Mar-22	1085.5	69,797.00	21120	48,677.00
Apr-22	1184.7	75,884.00	33618	42,266.00
May-22	1151.2	85,215.60	22656	62,559.60
Jun-22	965.3	72,952.00	22667	50,285.00
Jul-22	773.70	61,347.50	27999	33,348.50
Average	*903.69*	*53,783.25*	*21,584.35*	*32,198.90*

Initially the production will be less because the land will be in conversion process. As the year passes the yield also increases. In general, 10 per cent of grading loss can be observed in vegetable cultivation. After deducting all the grading losses an average of 903.69 kg of yield and Rs. 53,783.25 of total revenue can be seen per month. This model incurs the monthly expenditures of Rs. 21,584.35/- per month. the expenditure includes all the total input cost, management cost and two labour cost. Hence the farmers are economically secured with this model.

Table 2: Soil test reports

Test.no.	**Year**	**pH (6.3-8.3)**	**EC (<1)**	**OC (0.5-0.75)**	**Cu (0.2-2.0 ppm)**	**Zn (0.6-1.2 ppm)**	**Fe (4.5-9.0 ppm)**	**Mn (2.0-4.0 ppm)**	**N (280-560 KG/Ha**	**P_2O_5 (22.5-55 kg/ha**	**K (144-336 Kg/ha)**
1	2022	6.07	0.370	**0.53**	1.371	0.382	2.976	3.494	273.4	20.84	289.49
2	2021	7.62	0.285	**0.5**	0.835	0.344	5.612	5.278	294.78	21.76	327.4
3	2020	7.92	0.31	**0.56**	1.148	0.562	3.66	3.601	323.01	23.5	367.72
4	2019	7.90	0.330	**0.59**	1.12	1.04	13.20	11.92	269.7	34.12	371.6
5	2018	7.00	0.25	**0.49**	0.41	1.00	3.18	0.46	231.4	12.06	202.80

Soil test will be conducted every year. The table illustrate that all the soil parameters are found to be within the range. Mainly Organic Carbon (OC) is maintained above 0.5. The neutral soil pH (6.5-7.5) is maintained. Electric conductivity (EC) is found to be within the limits (<1) all this is due to the use of Cow dung slurry, Manure, Compost, Vermicompost, Jeevamruta etc. even for pest control Dashaprani is used instead of pesticides. The status of major and micronutrients in soil help us to manage the nutrient requirements of the soil.

Organic farming is believed to improve soil fertility by enhancing soil organic matter (SOM) contents. An important co-benefit would be the sequestration of carbon from atmospheric CO2.

Farming practices are known to exert strong control oversoil organic carbon (SOC) content because they affect bothinput and turnover rates of soil organic matter (SOM).Whether practices lead to either an increase or adecrease in SOM content has implications for environmental policy, with respect to soil carbon sequestration. Measures that offset some of the anthropogenicCO2 emissions could mitigate global warming (Lal 2004).Soil carbon sequestration is a key measure in agricultureand may counterbalance large proportions of agriculturallyinduced emissions of methane and nitrous oxide (UNFCCC2008).

Table 3: Climatic data

Area	Soil Temp℃	Air Temp ℃	RH (%)	Light
Raised bed model	23.48	27.49	60.42	High
Open Area	25.54	29.22	52.38	High
Shadow Area (tree cover)	24.20	28.54	54.15	High

The temperature and RH difference was recorded with in the farm, open area and tree cover area.

The soil temperature in the farm is 23.48 whereas, in open area it is 25.54 and in tree cover area it is 24.20 respectively. the air temperature in the farm is 27.49 whereas, in open area is 29.22 and in tree cover area 28.54 respectively. The relative humidity inside the farm is 60.42 % whereas, in open area it is 52.38% and in shade area it is 54.15%.

In real sense it refers to a comprehensive approach towards improvementof both health of underlying productivity of the soil and plant leading to the enrichment of thesurroundingecology,whichisapre-requisitecriterionforsustainableagriculture(Barik and Narayan, 2017).AccordingtoIFOAM,"Organicagricultureisaproductionsystemthatsustainsthehealth ofsoils,ecosystemsand people". It relies on ecological processes, biodiversity and cycles adapted to local conditions,ratherthantheuseofinputswithadverseeffects.Themajorobjectivityoforganicfar mingresidesondevelopmentofaself-sustainablefarmingsysteminharmonywithnaturewhichdeliversecologicallyandeconomicall ysustainablepurefoodwithenrichmentofsurroundingbiodiversityanditsentirecomponents. The temperature difference which we can notify here is due to the organic farming practices and maintenance of buffer zone and tree cover around the farm.

This model always maintains the good ecosystem in the farm and ensures the ecological security to the farmers.

Conclusion:

As this study is focused on ensuring ecological and economic security to small and marginal farmers. The average profit of Rs. 32,198.90per month ensures economic stability and security to the farmers. The soil parameters such as pH, EC and OC have been improved from year to year. The buffer zone has created the microclimate inside the farm. The temperature (Soil & Air) and RH difference can be noticed. This climate and edaphic factors improvement ensures the ecological security to the farmers. Hence from this study it can be concluded that organic vegetable production in raised bed technology ensures both economic and ecological security to the small and marginal farmers.

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