STANDARDIZATION OF ORGANIC PRACTICES FOR INCREASING VEGETABLE YIELD AND QUALITY

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Abstract

The research for this article was done at a farm in the small town of Sendarapatti, Standardization of Organic Practices for Yield and Quality Enhancement in Vegetables. at the first experiment, conducted at the nursery, we looked at how solarization affected the development of tomato seedlings when combined with a variety of nutrients. In a randomized block design, each of the 11 treatments was administered three times. The treatments comprised a non-solarized control group, solarization with no amendments, and four weeks of solarization with four different amendments (Vermicompost, chicken manure, neem cake, and castor cake). Azospirillum inoculation was performed at the conclusion of the therapy period.

Keywords: *Standardization, Organic, Practices, Increasing Vegetable, Quality.*

1. Introduction

Vegetables are a boon to farmers since they provide a high profit with little time invested. They guarantee the provision of key elements like minerals and vitamins, in addition to the energy-dense food they provide; hence they play a crucial role in human nutrition. Recent years have seen a global awakening to the need of cultivating and eating vegetables for the upkeep of normal health, and with this awakening has come awareness for bettering both the quality and quantity of these crops. [1]

Careless use of chemical fertilizers, pesticides, and herbicides has led to a reduction in soil health, ground water quality, soil microbial population, air components, quality of agricultural goods, and therefore animal and human health. The physical, chemical, and biological properties of soil are all heavily influenced by the amount of organic matter present in the soil. Because protecting soil and the environment is crucial to growing nutritious food, there has been a movement in recent years towards the use of organic materials and chemical-free farming methods. [2-3]

There is a growing awareness among the general public about the usage of high-quality food materials that are free of chemical toxicants, which is in line with the present global situation which drives scientists to manufacture residue-free agricultural produce. Since then, organic farming has flourished. Organic farming seeks to work in tandem with nature in order to maximize yield with little environmental impact. It's a way of doing things that encourages the growth of healthy plants and animals, which in turn benefits people and the planet. By redefining chemo-synthetic fertilizer and pesticides, organic agriculture drastically decreases the amount of external inputs required for crop production. As consumer demand for organic goods rises around the globe, several nations are investing in organic farming as a way to stand out in the competitive global economy. There are less harmful substances (pesticides, heavy metals, etc.) and more beneficial substances (vitamins, minerals) in organic food. More than one study has shown that organically produced crops had greater levels of minerals like vitamin-C and iron, as well as secondary metabolites (such phenolic compounds) that are thought to have anticancer characteristics.[4-5]

Crop rotation is the practice of rotating the species of annual crops cultivated on a single field in a scheduled pattern of sequence to maximize profit, boost soil fertility, and decrease the likelihood of pests and diseases. As more people learn about the benefits of crop rotation, farmers in various regions begin to use new planting schedules. Increased microbial biomass, better soil structure, and more water-holding capacity are only some of the benefits of rotating legume-based crops. When it comes to preventing pests and maintaining soil fertility, crop rotation with a non-host legume is the way to go.[6-7]

2. Literature review

Beura. (2020) A substantial increase in garden bean output was seen after inoculation with Rhizobium and Vesicular Arbuscular Mycorrhizae (VAM), using vermicompost made from vegetable waste, and using vermiwash as a foliar supplement. The use of humic acid as a foliar spray greatly improved radish growth and production. Radish root tuber production was dramatically increased when humic acid content was raised from 0.1 to 0.3%. The optimum value for growth characteristics and yield (6.80 t ha-1) of vegetable cowpea was recorded when vermicompost and vermiwash made from vegetable waste were applied with VAM and Rhizobium.[8]

Chandrasekaran. (2019) Attempts to harness the sun's rays for the purpose of combating soil and plant pathogens date back to India's ancient civilization. There have been several

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efforts to use improved techniques to collect solar energy. The soil may absorb more solar energy and lose less moisture to evaporation if you cover it with a layer of transparent polyethylene film. Darker soils absorb more sunlight than lighter soils, allowing for a warmer growing environment. Solarization's primary advantage is that it decreases soil-borne pathogens via soil-heating effects, but it also has a wide variety of secondary advantages that may lead to an augmented plant growth response (IGR). Examples of such unintended consequences include the reduction of weeds and insect pests and the release of nutrients for plant growth.[9]

Delapierre. (2018) Sunflower oil solarization using clear polyethylene sheets for 40 days and manual weeding at 45 DAS was shown to be beneficial for reducing weed growth and increasing harvest output. Experiments at UAS, Bangalore found that soil solarization significantly reduced weed count and weed dry weight up to the harvest of groundnut and tomato, in comparison to the control. The overall weed population and dry weight of weeds in a soybean field were dramatically decreased by solarization for 4 and 5 weeks compared to summer ploughing and non-solarized control. In Egypt, an experiment using solarization of seed beds was undertaken on cabbage and lettuce in the cities of Ismailia and Kalubia, in a field that was already plagued with weeds and fungus. Solarizing seed beds drastically decreased Fusarium sp.[10]

Srinivasan. (2017) Nurseries of brinjal, tomato, and chilli crops benefited most from soil solarization using white polythene sheet for 30 days during the peak summer time to reduce damping off disease. Solarizing nursery beds with a 300 gauge polyethylene sheet for 15 days boosted germination rates and resulted in transplantable chilli seedlings ten days faster than usual. Solarization boosted brinjal seedlings' root length, shoot length, number of leaves, vigour index, chlorophyll, and dry matter content. Nematode populations in tomato nursery were shown to be well managed after two weeks of solarization therapy. tomato seed germination was observed to increase by 42.0% after solarization, compared to germination rates of 0% and 5%, respectively.[11]

Puttaiah (2016) Traditional methods of pest management have often included the preventative use of pesticides because of the unexpected and cryptic character of many soil pests and their ability to inflict harm even when present in low quantities. This entailed using methyl bromide, a broad-spectrum soil fumigant, in the more intensive production methods. Methyl bromide's role in ozone depletion has recently come under scrutiny. This has led several nations to take steps towards phasing out the use of methyl bromide in agricultural settings by limiting its usage and production. Therefore, it is believed that the usage of methyl bromide for managing the soil-borne pathogen may be reduced by the use of alternate approaches. [12]

3. Methodology

From 2018 to 2020, researchers in Sendarapatti Village studied the effects of standardising organic farming methods on vegetable yields and quality.

3.1. Location of the experimental site

Sendarapatti, a small village in Tamil Nadu's Salem District, is at an elevation of +5.79 m above mean sea level (11° 34′ N, 70° 41′ E), and is where the tests are being conducted.

3.2 Experiment I: Effect of solarization with amendments on the performance of tomato seedlings

3.2.1 Experiment details

To determine how solarization with amendments will affect the growth of tomato seedlings, a nursery experiment was carried out in May of 2018. The soil was ploughed thoroughly to remove clods and plant debris that might prevent uniform heat and biogas conductivity and allow certain disease-causing organisms to escape. The selected alterations were drawn from a pool of options in the Salem district. The modification was applied at a rate of 1 kg m-2. In each treatment group, the organic additions were worked deeply into the soil. After mixing in the organic ingredients, 3m x 1m elevated nursery beds were built. After that, we flooded the beds with water to promote an exothermic fermentation process. The beds were irrigated, then covered with a 300-gauge high-density polyethylene sheet, with the edges tucked into the soil. After this was finished, the beds were solarized for four weeks while being closely watched. The polyethylene sheets were taken down after the solarization process was complete. After 2 days, the sheet was removed from each treatment and azospirillum was applied to the seeds and the bands. Tomato cv.KashiSarath seedlings were planted in the greenhouse.

3.3 Crop and Variety

The IIVR Varanasi-released cv.KashiSarath tomato was selected for the study. The MTH-6 x Kalani Eunish hybrid is a pedigreed offspring. These plants lack a defined end stage. In 130 days, it may produce between 40 and 50 t/ha. Red, somewhat oval, and with a thick pericarp, the fruits are very appealing.

3.4 Source of manures and bio-fertilizers used

The Salem district's market was scoured for bulk supplies of organic manures including Vermicompost and poultry manure, as well as oil cakes like Neem cake and Castor cake. The azospirillum culture utilised in the research was obtained from the Department of Microbiology at the Faculty of Agriculture at Annamalai University.

3.5 Experiment II: The impact of organic manures, both in bulk and concentrated forms, on tomato production and quality

This study was conducted to provide a benchmark for the volume and concentration of organic manures required to successfully replace inorganic fertilizers in tomato cultivation. In April and May of 2019, translucent polythene sheets of 300 gauge thickness were used for a solarization process that lasted for six weeks. Basal dosage manures were applied after solarization, as per the treatment plan. On the third day, when the polythene covering had been removed, the solarized tomato seedlings were transplanted. Based on nitrogen equivalent calculations, the necessary quantity of organic manures was determined. Both bulk and concentrated organic manures, each containing either 25% or 75% nitrogen, were used to provide the recommended dosage of nitrogen (150 kg ha-1).

3.6 Methods and treatments in experiments

The experiment used a Randomized Block Design with three sets of data (replicates) and fourteen treatments.

3.7 Statistical analysis

All experimental observation data were analyzed statistically. Wherever there was a statistically significant result, the crucial difference was calculated at the 5% level.

4. Results

The results of many trials with the working title "Standardization of organic practices for yield and quality enhancement of vegetables" were analyzed statistically.

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4.1. EXPERIMENT I: Effect of nursery solarization with amendments on the performance of tomato seedlings

Table 4.1: First, second, third, and fourth week soil temperature (in degrees Celsius) during nursery solarization with additives

Treatments	1st week			2nd week			3rd week			4th week		
	5cm	10cm	15cm	5cm	10cm	15cm	5cm	10cm	15cm	5cm	10cm	15cm
T_1	39.57	35.67	31.87	39.64	35.73	31.93	39.67	35.75	31.95	39.60	35.70	31.92
T_2	42.90	38.82	33.62	42.14	37.91	33.48	42.78	38.24	34.16	42.72	38.15	34.11
T_3	46.59	42.67	38.86	47.78	43.66	39.82	48.28	44.30	40.30	48.55	44.34	40.36
T_4	46.98	42.99	39.26	48.20	43.97	40.23	48.71	44.72	40.72	48.77	44.75	40.77
T_5	48.38	44.36	40.55	49.71	45.47	41.63	50.33	42.23	42.23	50.28	46.15	42.26
T_6	47.43	43.56	39.75	48.71	44.57	40.73	49.23	45.23	41.23	49.28	45.25	41.26

Table 4.2: As measured on day 28 following solarization, the impact of nursery solarization with amendments on soil physicochemical properties

Treatments	PH	EC(dsm^{-1})	OC(%)
T_1-nonsolarizedcontrol	7.11	0.66	0.41
T_2-solarizationwithnoamendments	7.06	0.63	0.44
T_3-solarizationwithCastercake	6.90	0.60	0.46
T_4-solarizationwithNeemcake	6.83	0.57	0.48
T_5-solarizationwithVermicompost	6.80	0.39	0.56
T_6-solarizationwithpoultrymanure	6.86	0.45	0.49
SED	0.01	0.01	0.005
CD (P=0.05)	0.02	0.02	0.01

T6 (43.56 °C) followed by T4 (42.99 °C). The temperature at T2 after the therapy was 38.82 degrees. The non-solarized control group had the lowest average temperature (35.67°C).

At 15 cm deep, treatment T5 (40.55 °C) had the highest temperature of the solarized treatments, followed by T6 (39.75 °C) and T4 (39.26 °C). At 33.62 degrees Celsius, T2's treatment was the warmest, with T1's at the lowest, 31.87 degrees Celsius.

Table 4.1 shows that the measured temperature fluctuation followed the same pattern in the second, third, and fourth weeks of observation. Soil temperature was found to rise at a rate that was inversely related to soil depth.

When comparing the pH of the nonsolarized control (T1) and the solarized treatments (T5 and T6), the pH of the latter was 6.80 and that of the former was 6.86 (Table 4.2). When compared to the non-solarized control, the pH after solarization without any additions was 7.06, which was higher than the pH after solarization with additional modifications.

The lowest effective concentration (EC) was recorded for treatment T5 (0.39 dSm-1), followed by T6 (0.45 dSm- '), and then T2 (solarization without amendment; EC 0.63 dSm- '). The non-solarized control group had the greatest EC (66 dSm-1).

Solarization with organic additions significantly altered the soil's nutritional status, as seen in Table 4.3. Compared to treatments T2 (178.48 kg ha-1) and T1 (166.06 kg ha-1), T5 had the highest accessible nitrogen content (260.66 kg ha-1), followed by T6 (245.68 kg ha-1) and T4 (240.99 kg ha-I). This characteristic was similarly affected by treatments T3 and T4.

Table 4.3: Changes in soil nutrient status 28 days following nursery solarization with amendments

Treatments	**Nitrogen(kgha^{-1})**	**Phosphorus(kgha^{-1})**	**Potassium(kgha^{-1})**
T_1-nonsolarizedcontrol	166.06	23.07	193.21
T_2-solarizationwithnoamendments	178.48	26.10	213.91
T_3-solarizationwithCastercake	215.57	36.05	297.04
T_4-solarizationwithNeemcake	240.99	48.10	323.03

T_5-solarizationwithVermicompost	260.66	44.09	333.56
T_6-solarizationwithpoultrymanure	245.68	40.19	363.06
SED	6.17	1.51	12.90
CD(P=0.05)	12.40	3.03	25.80

4.2. Experiment. II: Growth, production, and quality of tomatoes as affected by application of bulk and concentrated organic manures

When each therapy was compared to the control, significant changes emerged. Because to the use of inorganic fertilizer, the value reached a high of 66.82 cm. Treatment T8had achieved the highest plant height (63.91 cm) among the different organic manures tested. The next closest result (61.41 cm) was observed for the T12 therapy. Treatment T7 (58.90 cm) was the second best in terms of height. According to Table, the lowest value (36.01 cm) was found under perfect control.

When each therapy was compared to the control group, noticeable differences emerged. In the inorganic fertilizer treatment (T2), plants grew to a maximum height of 79.21 centimeters by harvest time. T8 saw the plants grow to a height of 74.00 cm. T7 (67.00 cm) and T12 (70.22 cm) followed suit. According to Table 4.4, the absolute control treatment recorded the shortest final plant height of 40.12 cm.

Table 4.4: Tomato crop yield and plant height change in response to bulk and concentrated organic manures

Treatments	**Plantheight(cm)**	
	atflowering(cm)	**atharvest(cm)**
T_1-Control	36.02	40.11
T_2-Inorganicfertilizers(150:100:50NPKkgha^{-1})	66.81	79.22
T_3-FYM@3.5tha^{-1}+NC@2.18tha^{-1}	44.21	69.32

T_4-FYM@10.5tha^{-1}+NC@0.73tha^{-1}	46.51	51.42
T_5-FYM@3.5tha^{-1}+CC@2tha^{-1}	38.32	43.11
T_6-FYM@10.5tha^{-1}+CC@0.65tha^{-1}	42.31	46.62
T_{7}-VC@3.34tha^{-1}+NC@2.18tha^{-1}	58.91	67.01
T_8-VC@10.03tha^{-1}+NC@0.73tha^{-1}	63.92	74.01
T_9-VC@3.34tha^{-1}+CC@2.0tha^{-1}	52.11	59.01
T_{10}-VC@10.03tha^{-1}+CC@0.65tha^{-1}	53.71	62.62
T_{11}-PM@0.72tha^{-1}+NC2.18tha^{-1}	56.72	64.01
T_{12}-PM@2.16tha^{-1}+NC0.73tha^{-1}	61.42	70.22
T_{13}-PM@0.72tha^{-1}+CC2.0tha^{-1}	48.12	54.32
T_{14}-PM@2.16tha^{-1}+CC0.65tha^{-1}	49.92	57.22
S.ED	**0.87**	**1.11**
CD(P=0.05)	**1.74**	**2.22**

Table 4.5: Time to 50% blooming, total flower count, and fruit yield in tomatoes as affected by bulk and concentrated organic manures

Treatme nts	The time it takes for 50% of flowers to open	Total number of blossoms on a plant	Produced by the plant as a whole
T_1-Control	83.32	49.38	19.15
T_2-Inorganicfertilizers(150:100:50NPKkgha^{-1})	50.22	87.44	57.44
T_3-FYM@3.5tha^{-1}+NC@2.18tha^{-1}	75.14	60.03	30.03
T_4-FYM@10.5tha^{-1}+NC@0.73tha^{-1}	73.34	63.08	33.08
T_5-FYM@3.5tha^{-1}+CC@2tha^{-1}	80.15	54.61	24.61

T_6-FYM@10.5tha^{-1}+CC@0.65tha^{-1}	77.82	57.52	27.58
T_{7-}VC@3.34tha^{-1}+NC@2.18tha^{-1}	59.21	77.92	37.92
T_8-VC@10.03tha^{-1}+NC@0.73tha^{-1}	53.42	84.94	44.94
T_9-VC@3.34tha^{-1}+CC@2.0tha^{-1}	66.92	74.67	34.67
T_{10}-VC@10.03tha^{-1}+CC@0.65tha^{-1}	64.52	71.43	31.46
T_{11}-PM@0.72tha^{-1}+NC2.18tha^{-1}	61.21	74.72	34.73
T_{12}-PM@2.16tha^{-1}+NC0.73tha^{-1}	57.62	82.12	42.15
T_{13}-PM@0.72tha^{-1}+CC2.0tha^{-1}	71.32	66.05	36.03
T_{14}-PM@2.16tha^{-1}+CC0.65tha^{-1}	68.14	69.13	39.15
S.ED	**0.87**	**1.34**	**1.22**
CD(P=0.05)	**1.74**	**2.70**	**2.44**

T2 (inorganic fertilizer treatment) had the largest average number of fruits per plant (57.45). T8 (44.95) and T12 (42.14) both performed similarly when on an organic diet. The absolute control group had the fewest total fruits per plant (19.16).

5. Conclusion

Vegetable productivity and quality may both benefit from a standardized approach to organic farming procedures. Farmers may maximize their output and get better results from their organic farming practices if they adhere to standardized norms and regulations. The treatments consist of inorganic fertilizers and a control, as well as varied amounts of bulk and concentrated organic manures. Bulk organic manures included vermicompost and chicken manure, while neem cake and castor cake were employed for concentration. In April 2019, October 2019, and February 2020, we ran Experiments V, IV, and VII to see whether we could minimize the amount of organic manures needed by combining them with biofertilizers and foliar organic nutrients. These tests used a randomized block design with 14 treatments and 3 repetitions. For the new N application rates, the biofertilizers Azospirillum and Phosphobacteria were utilized at 5 kg/ha each.

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