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Research Article

Scraps to Greens: Urban Leafy Vegetable Cultivation through Kitchen waste Recycling in Penamaluru

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Abstract

Growing food from parts of plants that are usually discarded during cooking is an excellent way to reduce waste and save money. Rather than throwing away the tops or bottoms of vegetables, such as beets, celery, scallions, leeks and romaine lettuce, these parts can be regrown into leafy greens or other produce. This can easily be done right in your own home by placing the vegetable scraps in water and allowing them to grow. In a recent study focused on cultivating leafy vegetables such as Amaranthus gangeticus (Red), Amaranthus gangeticus (Green), Hibiscus sabdariffa (roselle), Spinacia oleracea and coriander, kitchen waste was used as a growth medium. Various growth parameters, including root length, shoot length, number of leaves per plant and fresh weight of the plants, were analyzed from 20 Days After Sowing (DAS) to 60 DAS. The results showed that red Amaranthus and coriander had the maximum growth. The tested plants grew healthy and effectively, as compared to the control group. Kitchen waste is a common occurrence in households, both in urban and rural areas and can be an excellent supplement in vegetable gardens. This project prevented a significant amount of waste from being collected, transported and disposed of or incinerated. This approach is economically sustainable since decentralized composting costs were lower than the average cost of municipal solid waste treatment in the region. In Andhra Pradesh, urban gardening is a new phenomenon. This research work will help people to understand the benefits of kitchen gardening in urban areas of Andhra Pradesh.

Keywords: Kitchen waste; Solid waste; Amaranthus; Red Amaranthus; Spinach; Coriander; Kanaf

Introduction

Vijayawada is a city on the banks of Krishna River in the Indian state of Andhra Pradesh. It is a municipal corporation and the headquarters of the Vijayawada (urban) Mandal in Krishna district of the state. It is also a part of the Andhra Pradesh Capital Region and the headquarters of the Andhra Pradesh Capital Region Development Authority (APCRDA). The present study area is penamaluru and total area of Penamaluru is 80.21sq.km with population density of 2095per sq.km. Out of total population, 11.25% of population lives in Urban areas and 88.75% lives in Rural area. From the last few years Vijayawada city facing the problem of disposal and handling of municipal solid waste including kitchen waste. To overcome the disposal and treatment of solid waste many innovations are being done in recent days. There are so many techniques and methods to reduce waste and were reported by Pinupolu et al. [1]. Soil fertility refers to the soil's ability to provide the necessary nutrients for optimal crop production and fertilization involves adding nutrients to the soil [2]. Chemical fertilizers containing nitrogen, phosphorus and potassium may be used to supply the necessary nutrients. Soil contains a variety of microorganisms and act as iron chelators, was reported earlier in our previous paper [3]. Chemical tests of the soil or plants can help determine the fertilizer requirements, and the rate of application is typically based on various factors, including soil fertility, cropping system, type of crop and expected financial return.

To address these issues, urban agriculture or rooftop farming is recommended as a potential solution [4]. By enhancing local food production, urban agriculture can help meet the nutritional demands of the population by providing access to nutritious food. Additionally, it can reduce air pollution, increase stormwater retention capacity, improve public health, enhance the aesthetic value of the urban environment and amplify community functions [5]. Various methods can be used to apply fertilizers, including scattering and mixing with the soil before planting, drilling below the soil surface at the time of planting, row application before or at planting time, and row application during plant growth, also known as side-dressing. Recently, plowed-down broadcast fertilizers have been combined with high-analysis liquid fertilizers applied at planting or as a side-dressed band. Several types of backyard static composters as well as small size in vessel (both dynamic and static) are being employed for composting at campus and other local programs [6-8]. Planting devices with fertilizer attachments can also be used to apply fertilizers in the form of bands near the seed. For most vegetables, the bands are typically placed two to three inches (five to 7.5 centimeters) away from the seed at the same depth or slightly below the seed. Agricultural production involves the use of various fertilizers, insecticides and pesticides.

However, excessive use of these chemicals can have adverse effects on human health, harm the environment and increase crop production costs. So that they make use of urban organic waste in an innovative and sustainable way Anastasiou et al. [9]. Limited literature available for the production of leafy vegetables from kitchen waste. To address these concerns, agriculture universities and research Institutes are shifting their focus towards integrated pest and nutrient management [10]. This approach involves utilizing various natural microbial resources, such as bio-fertilizers and modifying traditional agricultural practices in Andhra Pradesh. In this study cultivation practices were recorded by using kitchen waste in penamaluru.

Materials

Seeds of Amaranthus, Spinach, Coriander, Kanaf

Methodology

Physicochemical analysis

The physicochemical attributes of the material are analyzed using various methods suggested by other researchers, including pH, organic carbon, total nitrogen, available phosphorus, exchangeable potassium, C:N ratio and organic matter. The earthworm number, biomass, cocoon production and weight loss of organic substrate during the composting process are also assessed. Throughout the investigation, samples are examined at regular intervals of 15, 45 and 75 days of vermicomposting [11].

Types of Composting

Composting can be divided into the following types based on the nature of the decomposition process.

Aerobic composting

Aerobic composting takes place in the presence of oxygen. During this process, aerobic microorganisms break down organic matter, producing Carbon Dioxide (CO_2), water, heat, humus and ammonia as relatively stable organic end products. Any intermediate compounds such as organic acids are further decomposed by aerobic microorganisms. The resulting compost has a relatively unstable structure of organic matter, which poses little risk of phytotoxicity. The heat generated during the process helps break down proteins, fats and complex carbohydrates like cellulose and hemi-cellulose, reducing processing time. Additionally, the high temperatures involved in aerobic composting destroy many human or plant pathogens and weed seeds. Although more nutrients may be lost during aerobic composting than during anaerobic composting, it is considered more efficient, fruitful and useful for agricultural production. This publication focuses primarily on aerobic composting [12].

Anaerobic composting

Anaerobic composting is commonly used for the treatment of high-moisture organic waste such as food waste and animal manure. The process produces biogas, which is a mixture of methane and carbon dioxide that can be used as a renewable energy source. Biogas production can help offset the cost of waste management and reduce greenhouse gas emissions. While anaerobic composting has some benefits, such as biogas production and the ability to handle high-moisture waste, it is generally considered less efficient and effective for producing compost suitable for agricultural use compared to aerobic composting.

Data Analysis

Data collected from 10 DAS (Days after Sowing) to 60 DAS. Each data is an average of three replicates. The observed plant growth variables were some vegetative and generative growing parameters, namely high and crop yields. Observation data were analyzed descriptively.

Results and Discussion

For the present study organic vegetable production, the selected area is penamaluru, an urban area, located in Vijayawada, Krishna district, Andhra Pradesh, India. The area is very near to our campus, Maris Stella College. A group of students collected data from the home makers of penamaluru area for solid waste in the area. To overcome the problem in that area we suggested kitchen gardening like organic vegetable productions. Some of the home makers cultivated leafy and fruit vegetables in their own lands. The students group created an awareness on solid and liquid waste and collected data. According to our view the areas were divided into two categories. 1. Small area 2. Large area (Table 1,2). The knowledge of vermicompost and kitchen gardening also recorded from the home makers i.e., 1. Low level. 2. Moderate level 3. High level. The data is collected from October to December 2022.

Table 1: Level of knowledge towards organic vegetable production.

Sl.No	Name	Cultivated Area	Description
1	Home maker-1	Small area	Low level
2	Home maker-2	Large area	Moderate level
3	Home maker-3	Small area	Low level
4	Home maker-4	Large area	Moderate level
5	Home maker-5	Small area	Low level
6	Home maker-6	Large area	Low level
7	Home maker-7	Large area	Low level
8	Home maker-8	Small area	Low level
9	Home maker-9	Large area	High level
10	Home maker-10	Small area	Low level

Table 2: Practices of organic vegetable production by home makers.

Sl.No	Name	Vegetable Crop Selected	Knowledge about the Cultivation
1	Home maker-1	Red Amaranthus, Amaranthus, Coriander, Spinach, Kanaf	Low level
2	Home maker-2	Red Amaranthus, Amaranthus, Coriander, Spinach, Kanaf	Low level
3	Home maker-3	Red Amaranthus, Amaranthus, Coriander, Spinach, Kanaf	Low level
4	Home maker-4	Red Amaranthus, Amaranthus, Coriander, Spinach, Kanaf	Low level
5	Home maker-5	Red Amaranthus, Amaranthus, Coriander, Spinach, Kanaf	Moderate level
6	Home maker-6	Red Amaranthus, Amaranthus, Coriander, Spinach, Kanaf	Moderate level
7	Home maker-7	Red Amaranthus, Amaranthus, Coriander, Spinach, Kanaf	Low level
8	Home maker-8	Red Amaranthus, Amaranthus, Coriander, Spinach, Kanaf	Low level
9	Home maker-9	Red Amaranthus, Amaranthus, Coriander, Spinach, Kanaf	Low level
10	Home maker-10	Red Amaranthus, Amaranthus, Coriander, Spinach, Kanaf	Low level

From the results growth parameters were studied and recorded the results. The maximum no of leaves (16) was observed at 60 DAS compared to control. Total weight and dry weight were also calculated from the results. Maximum dry weight 0.55mg was observed. Growth parameters were studied by 20 DAS to 60 DAS for red Amaranthus by using vermin compost prepared from kitchen waste [13]. Root and shoot length initiated and there was observed with 7cm and 10cm respectively. Results related to the other studies reviewed by Sastro et al. [14]. The studies were conducted from 20 DAS to 60 DAS in the fields of penamaluru. In this study the home makers cultivated 5 varieties of leafy vegetables like red Amaranthus, Amaranthus, Spinach, Coriander and kanaf. The results were compared with control like shoot length, root length, no of leave and fresh and dry weight was recorded (Table 3-5) [15]. Maximum differences were observed by all the parameters we studied. The results also compared to other references a slight difference and maximum growth observed (Table 6,7). The results related to Karthikeyan et al. [16] reported that the organic compost gives the maximum results [17].

Table 3: Growth parameters of red Amaranthus by using vermi compost.

Sl.No	DAS	Control	Root Length (Cm)	Control	Shoot Length (Cm)	Control	No of Leaves	Control	Total Weight (FW- DW)
1	20	3	4	7	10	4	4	0.15	0.21
2	30	5	6	10	15	8	10	0.23	0.38
3	40	7	10	14	22	12	16	0.34	0.45
4	50	10	12	22	30	12	16	0.39	0.55
5	60	10	12	22	30	12	16	0.39	0.55

Table 4: Growth parameters of Amaranthus by using vermi compost.

Sl.No	DAS	Control	Root Length (Cm)	Control	Shoot Length (Cm)	Control	No of Leaves	Control	Total Weight (FW- DW)
1	20	3	4	7	10	4	4	0.15	0.21
2	30	5	6	10	15	8	10	0.23	0.38
3	40	7	10	14	22	12	16	0.34	0.45
4	50	10	13	22	35	12	20	0.45	0.6
5	60	10	13	22	35	12	20	0.45	0.6

Table 5: Growth parameters of kanaf by using vermi compost.

Sl.No	DAS	Control	Root Length (Cm)	Control	Shoot Length (Cm)	Control	No of Leaves	Control	Total Weight (FW- DW)
1	20	3	4	6	8	4	8	0.23	0.35
2	30	5	6	15	18	8	14	0.44	0.52
3	40	4	8	20	32	12	20	0.56	0.61
4	50	6	10	30	46	16	26	0.58	0.72
5	60	6	10	40	46	16	26	0.65	0.72

Table 6: Growth parameters of Spinach by using vermi compost.

Sl.No	DAS	Control	Root Length (Cm)	Control	Shoot Length (Cm)	Control	No of Leaves	Control	Total Weight (FW- DW)
1	20	2	2	4	5	3	4	0.36	0.45
2	30	4	5	8	10	5	6	0.56	0.59
3	40	6	7	10	12	6	8	0.76	0.79
4	50	6	7	12	15	8	10	0.82	0.88
5	60	6	7	12	15	8	10	0.82	0.88

Table 7: Growth parameters of Coriander by using vermi compost.

Sl.No	DAS	Control	Root Length (Cm)	Control	Shoot Length (Cm)	Control	No of Leaves	Control	Total Weight (FW- DW)
1	20	2	2	4	4	4	4	0.12	0.2
2	30	3	3	5	5	8	8	0.35	0.4
3	40	4	4	6	6	12	12	0.45	0.52
4	50	5	5	10	10	18	20	0.55	0.62
5	60	5	5	10	10	18	20	0.55	0.62

Conclusion and Recommendation

The total studies done on Penamaluru, Vijayawada city of Andhra Pradesh called as the second densely populated area and business capital after Vishakhapatnam. Where municipal solid waste is not dumped properly and disposed of in open areas, many harmful things like air, land and water pollution, foul smell, bacteria formation takes place. Kitchen waste is a rich source of various nutrients and minerals, making it highly beneficial for all types of plants. This study recommends the use of kitchen waste for developing kitchen gardens and cultivating leafy and fruit vegetables in both urban and rural areas. The findings of this study suggest that: (1) vermicomposting technology can produce organic fertilizer faster, even though it may not meet the quality standards of organic fertilizers; and (2) vermicompost has shown positive results in the growth of various leaf vegetables such as Red Amaranthus, Amaranthus, spinach, Coriander and Kanaf.

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References

1. Pinupolu P, Kommineni HR (2020) Best method of municipal solid waste management through public-private partnership for Vijayawada city. Materials Today Proceedings 33: 217-222.
2. Kumar GK, Silpa D, Ram MR (2022) Hydroxymate type of siderophore production by rhizobacterial strains isolated from root nodules of vigna trilobata. Research Journal of Biotechnology 17(9): 107-110.
3. Kumar GK, Silpa D (2022) studies on nodulation diversity and leg haemoglobin content of vigna trilobata (L.) verde. cultivars from Andhra Pradesh and Telangana state. Open Access journal of Microbiology & Biotechnology 8(1): 1-4.
4. Smit J, Nasr J, Ratta A (1996) Urban agriculture: Food, jobs and sustainable cities. New York, USA, pp. 35-37.
5. Localize B (2007) Tapping the potential of urban rooftops: Roof top resources neighborhood assessment: Final Report.
6. Sangamithirai KM, Jayapriya J, Hema J, Manoj R (2015) Evaluation of in-vessel co-composting of yard waste and development of kinetic models for co-composting. Int J Recycl Org Waste Agric 4(3): 157-165.
7. Va´zquez MA, Soto M (2017) The efficiency of home composting programmes and compost quality. Waste Manag 64: 39-50.
8. Waliczek T, McFarland A, Holmes M (2016) The relationship between a campus composting program and environmental attitudes, environmental locus of control, compost knowledge and compost attitudes of college students. Hort Technology 26(5): 592-598.
9. Anastasiou A, Valenca AD, Amare E, Oca GM, Widyaningrum I, et al. (2014) The role of urban agriculture in urban organic waste management in the hague, The Netherlands. Master's Thesis, Wageningen University, Wageningen, The Netherlands.
10. Sinha A, Kumar R, Srivastava S, Srivastava M (2010) Production of organic manure from kitchen waste: Ensuring livelihood of resource poor women, please give web address.
11. Bharadwaj A (2010) Management of kitchen waste material through vermicomposting. Asian Journal of Experimental Biological Sciences 1(1): 175-177.
12. FAO (2002) Biofertilizer production plant, Myanmar (FAO/UNDP Project), by H. Hiraoka. Back to Office Report. FAO-RAP, Bangkok.
13. Sastro Y, Ikrarwati, Amatillah CS, Hakim L, Fadillah Y (2013) Assessment of organic fertilizer production from market waste using worms (vermicompost) and its use as a medium for vegetable nurseries. Annual

Report of AIAT (Jakarta: AIAT), p. 73.

14. Sastro Y, Kusnari T, Hakim L, Ikrarwati (2016) Assessment of organic fertilizer The role of red worms (Eisenia foetida) in improving the quality of market organic waste compost Urban Farming Bulletin 6: 12-23.

15. Chanu LJ, Hazarika S, Choudhury BU, Ramesh T, Balusamy A, et al. (2018) A guide to vermicomposting-production process and socio economic aspects. Extension Bulletin (Meghalay: ICAR Research Complex for NEH Region) 81: 30.

16. Karthikeyan V, Sathyamoorthy GL, Murugesan R (2007) Vermi composting of market waste in Salem, Tamilnadu, India. Proceeding of The International Conference on Sustainble Solid Waste Management, pp. 276-281.

17. Chaulagain A, Gauchan DP, Lamichhane J (2018) Vermicompost and its role in plant growth promotion. Internat Jour of Research Available 4: 849-864.