CSIBER INTERNATIONAL JOURNAL OF ENVIRONMENT (CIJE)

Vol. 1, Issue No. 1, March 2024

Published By :
CSIBER Press, Central Library Building,
CSIBER Campus, University Road,
Kolhapur, (MS), INDIA, 416004

Find the Journal online at
https://www.siberindia.edu.in/journals
E-mail :editorcije@siberindia.edu.in

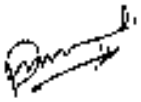
Published By:
CSIBER Press, Central Library Building
Chhatrapati Shahu Institute of Business Education & Research (CSIBER)
University Road, Kolhapur – 416004, Maharashtra, India

Editorial Note

CSIBER International Journal of Environment (CIJE) offers a venue where relevant interdisciplinary research, practice and case studies are recognized and evaluated. Increasingly, environmental sciences and management integrate many different scientific and professional disciplines. Thus the journal seeks to set a rigorous, credible standard for specifically interdisciplinary environmental research. CIJE is a multidisciplinary journal, publishing research on the pollution taking place in the world due to anthropogenic activities. CIJE welcomes submissions that explore environmental changes and their cause across the following disciplines like atmosphere and climate, biogeochemical dynamics, ecosystem restoration, environmental science, environmental economics & management, environmental informatics, remote sensing, environmental policy & governance, environmental systems engineering, freshwater science, interdisciplinary climate studies, land use dynamics, social-ecological urban systems, soil processes, toxicology, pollution and the environment, water and wastewater management, etc.

We invite authors to contribute original high-quality research on recent advancements and practices in Environment Management. We encourage theoretical, experimental (in the field or in the lab), and empirical contributions. The journal will continue to promote knowledge and publish outstanding quality of research so that everyone can benefit from it.

Er. D. S. Mali
Editor, CIJE



CSIBER International Journal of Environment (CIJE)

CONTENTS

Comparative study on Effects of Chemical Fertiliser, Vermicompost and FarmYard Manure on Tomato Plant Growth and Soil Fertility.

Pooja S. Sarolkar
Asst. Prof. Dept. of Envt. Sc., CNCVCW, CSIBER Truste, Kolhapur, India

Abstract
A healthy soil environment is required for desired crop production, which means it should have all the essential nutrients. Nutrients are used in significant amounts by growing plants and hence, they must be replaced periodically to sustain productivity and for this purpose, fertilizers are used in the fields. Chemical fertilizers are essential to enhance proper growth and crop yield and they act as catalysts in providing nutrients to the plants for their better growth and yield. On the other hand, fertilizers may endanger our ecosystems, soil, plants, and human and animal lives. Despite the past gains in crop production through chemical fertilizers, recent observations of stagnant or declining yields have raised concerns about the long-term sustainability of crop production. They also damage the natural makeup of the soil in the long term, which results in unsustainable crop production. Of course, chemical fertilizers add nutrients to the soil, but they don't add anything else. Plants need more than just nutrients to survive. They also need organic matter and living organisms. Therefore, integrated use of organic and inorganic sources of nutrients will not only supply essential nutrients to the soil but may also have some synergistic interaction to increase their efficiency and thereby, reduce environmental hazards. Nutrients from chemical fertilizers enhance the initial establishment of crops while those from mineralization of organic manure promote the yield later. In present experiments, seeds of radish (Raphanus sativus) were sown in soil affected by long-term use of chemical fertilizers and in soil, where organic compost was used as an external nutrient source. A comparative study was made revealing the fact that the germination and survival; were better in the case of soil on application of organic compost while the survival of radish was almost nil in the soil, where inorganic fertilizers were used for a long time.

Key Words: Fertilizers, Nutrients, compost, etc.

Introduction

Chemical Fertilizers

Modern chemical fertilizers include one or more of the three elements that are most important in plant nutrition: nitrogen, phosphorus, and potassium. Trace elements of secondary importance are the elements sulphur, magnesium, and calcium.

Most nitrogen fertilizers are obtained from synthetic ammonia, this chemical compound (NH_3) is used either as a gas or in a water solution, or it 1s converted into salts such as ammonium sulphate, ammonium nitrate, and ammonium phosphate, but packinghouse wastes, treated garbage, sewage, and manure are also common sources of it. Because its nitrogen content is

high and is readily converted to ammonia in the soil, urea is one of the most concentrated nitrogenous fertilizers. An inexpensive compound, it is incorporated in mixed fertilizers as well as applied alone to the soil or sprayed on foliage.

With formaldehyde it gives methylene-urea fertilizers, which release nitrogen slowly, continuously, and uniformly, a full year's supply being applied at one time. Phosphorus fertilizers include calcium phosphate derived from phosphate rock or bones. The more soluble superphosphate and triple superphosphate preparations are obtained by the treatment of calcium phosphate with sulfuric and phosphoric acid, respectively. Potassium fertilizers, namely potassium chloride and potassium sulfate, are mined from potash deposits. Of commercially produced potassium compounds, almost 95 percent of them are used in agriculture as fertilizer.Mixed fertilizers contain more than one of the three major nutrients - nitrogen, phosphorus, and potassium. Fertilizer grade is a conventional expression that indicates the percentage of plant nutrients in a fertilizer, thus, a 10-20-10 grade contains 10 percent nitrogen, 20 percent phosphoric oxide, and 10 percent potash. Mixed fertilizers can be formulated in hundreds of ways.

Farm Yard Manure

Among sources of organic matter and plant nutrients, farm manure has been of major importance. Manure is understood to mean the refuse from stables and barnyards, including both excreta and straw or other bedding material. Large amounts of manure are produced by livestock, such manure has value in maintaining and improving soil because of the plant nutrients, humus, and organic substances contained in it.

Manure is a fertilizer graded as approximately 0.5--0.25-0.5 (percentages of nitrogen, phosphoric oxide, and potash), with at least two-thirds of the nitrogen in slow-acting forms. Given that these nutrients are mostly in an unmineralized form that cannot be taken up by plants, soil microbes are needed to break down organic matter and transform nutrients into a bioavailable "mineralized" state. In comparison, synthetic fertilizers are already in mineralized form and can be taken up by plants directly. On properly tilled soils, the returns from synthetic fertilizer usually will be greater than from an equivalent amount of manure.

However, manure provides many indirect benefits. It supplies humus, which improves the soil's physical character by increasing its capacity to absorb and store water, by enhancement of aeration, and by favoring the activities of lower organisms. Manure incorporated into the topsoil will help prevent erosion from heavy rain and slow down the evaporation of water from the surface. In effect, the value of manure as a mulching material may be greater than its value as a source of essential plant nutrients.

Vermicompost

Vermicomposting is a type of composting in which certain species of earthworms are used to enhance the process of organic waste conversion and produce a better end-product. It is a

mesophilic process utilizing microorganisms and earthworms. Earthworms feed the organic waste materials, pass it through their digestive system and give it out in a granular form (cocoons) which is known as vermicompost.
Vermicompost is earthworm excrement, called castings, which can improve the biological, chemical, and physical properties of the soil. The chemical secretions in the earthworm's digestive tract help break down soil and organic matter, so the castings contain more nutrients that are immediately available to plants.

Objectives

- Comparative study of chemical fertilizers, farm yard manure, and vermicomposting on tomato plant growth.
- Comparative study of chemical fertilizers, farm yard manure, and vermicomposting on Soil fertility

Review of literature

Khan et.al (2018), studied the impact of various media combinations on the growth, the qualitative and quantitative yield of tomatoes as well as on the chemical and physical properties of soil. The study comprised seven different media treatments including T0 soil (control), T1 farm yard manure + soil (1:1), 12 coconut coir + soil (1:2), T3 leaf compost + soil (1:), T4 coconut coir +poultry manure to soil (2:1:2), T5 peat moss t spent mushroom waste + soil (1:1:) and T6 farmyard manure + poultry manure + soil (2:1:2). It was concluded that farmyard manure poultry manure +soil at proportion (2:1:2) turned out to be the better medium and perform best for plant growth due to its highest nutritional value as compared to all other treatments. Thus, by using natural fertilizers, the quality of tomatoes can be enhanced while soil fertility will also be maintained.

Kang B.S and Sidhu B.S (2005), studied protected farming as an alternative technique for seasonal and off-seasonal vegetable cultivation, particularly in high-altitude regions, and can be successfully employed for niche areas of agriculture. Experimentation on vegetable crops under protected conditions was carried out to see the feasibility of their farming at different altitudes in the central Himalayan region. For evaluating the suitable conditions required for the cultivation of vegetables, three treatments, viz., polyhouse, shade net, and plastic mulch, were selected in comparison to open conditions at both altitudes. Capacity building through organizing a training program was adopted for demonstration and dissemination of this technology to rural farmers of the region.

Adeyeye et al (2018), studied one of the limiting factors to crop production in Sub-Saharan Africa is due to poor soil fertility to increase the crop yield to meet ever increasing population

of this region, fertilizer is required as in the form of organic or inorganic. There seems to be some level of specificity in crop adaptation to the type of fertilizer to increase its growth and yield potential. So, the current field experiments were conducted to study the effect of different organic and inorganic fertilizers on the growth and yield of tomatoes during 2015 and 2016 in the rainy seasons at the Teaching and Research Farm of Federal University Wukari. The results showed a significant effect ($P<0.05$) of the treatments on the growth and yield parameters of tomatoes. The application of poultry manure significantly produced a higher number of leaves, nodes, flowers, and fruits. While organic manure treatment gave significantly higher plant height. Hence poultry manure produced the best result for the production of tomatoes.

Hashemimajd, K. *et.al* (2006), studied vermicomposting and composting are efficient methods for converting solid wastes to useful products. Incorporation of composts and vermicomposts into potting and container media is a potential use for these materials. In a greenhouse trial, the effects of a vermicompost produced from raw dairy manure (RDM) along with some other composts produced from tobacco residue (TR), yard leaf (YL), sewage sludge + rice hull (SS + RH), sewage sludge + yard leaf (SS+ YL), and RDM were studied.

Materials and Methods

The experiment was carried out by using three types of fertilizers which are the farm yard manure, chemical fertilizers, and vermicompost. Each type of fertilizer is applied to the plant with a specific dose. Chemical fertilizers were applied 50 ml on alternative days from the sapling stage. Farmyard manure and vermicomposting are applied every seven days in 100 gm from the sapling stage.

Soil analysis is carried out in 2 stages, before the addition of fertilizers and further addition of fertilizers.

Used material in the experiments

Pasture land of soil, earthen pots, vermicompost, Farm yard manure, chemical fertilizer, tomato plant.

- **Preparation of soil**
- Collecting soil from the pasture land, then drying, pulverizing, and sieving. 1 kg of soil is used for the pre-analysis. After that 4 earthen pots fill with 4 kg soil/pot.

- **Study site:**
- The Pot experimental research was carried out in CSIBER, Kolhapur.

- **Tomato variety:**
- TO-1057 was selected based on availability in the markets of the Kolhapur district.

Experimental Design-

Treatment of Different fertilizers on the same 4 tomato plants was taken for the experiment --
1st plant was grown with vermicompost at the rate of 100g per week
2nd plant was grown with an FYM rate of 100g per week
3rd plant was grown with an inorganic fertilizer rate of 100g per week
4th plant was grown without any fertilizers
Soil analysis is carried out in 2 stages, Pre-analysis of soil before the addition of fertilizers and further addition of fertilizers i.e., post-analysis of soil

Table 1: Pre-analysis of soil sample

Sr. No.	Soil Parameters	Result
1.	OCOM (mg/L)	1.95
2.	pH	7.45
3.	Water holding Capacity (%)	91.049
4.	Nitrogen Kg/ha	2144.51
5.	Potassium Kg/ha	11.76
6.	Phosphorous Kg/ha	492.441

Table 2: For soil fertility

Sr. No.	Parameters	Chemical Fertilizer	Farm Yard Manure	Vermicompost
1.	OCOM (mg/L)	3.799	2.19	15.128
2.	pH	6.90	7.52	7.29
3.	Water holding Capacity (%)	37.327	42.311	45.355
4.	Nitrogen Kg/ha	15115.52	3060.73	3010.56
5.	Potassium Kg/ha	165.312	83.328	55.104
6.	Phosphorous Kg/ha	5283.48	1056.69776	4411.456

Measurement of plant growth parameters

Vegetative growth of the studied tomato plants (viz., plant height, stem diameter, number of branches, and leaves per plant was evaluated. The plant height was measured from the soil level to the tip of the shoot and expressed in the foot.

Measurement of yield parameters

Tomato fruits were harvested twice weekly at the pink to red-ripe stage. Weekly yields were determined by pooling the two weekly harvests. Measured yield parameters included number of flowers per plant, number of fruits per plant, and yield per plant.

Expected outcome of

1. It gives 25/ more yield.
2. As compared to chemical fertilizers it has a chef cost so farmers can save their money.
3. It is eco-friendly and has no hazards for humans and animals.

Table 3: For plant growth

	Chemical Fertilizer	Farm Yard Manure	Vermicomposting
Flowers count	3	10	14
Fruits	24	4	2
Height (in cm)	67	85	70
Leaf colour	Yellowish	Green	Green

Conclusions:

In the present study, the organic fertilizers had the significant influence on the plant growth, yield and quality.

Table No. 1 & 2 shows the pre and post analysis of soil fertility and table no 3 shows the significant differences between effects of fertilizers on tomato plant height, tomato fruits count and life period of plants. The results revealed that FYM had the best effect as compared to other two fertilizers on plant height and tomato yield. Compared with conventional fertilizers, organic fertilizers, especially with FYM, could be an effective way to reduce the harmful effect of mineral fertilizer on the environment and human health.

References:

Adeyeye A.S, Olalekan, K.K,Lamidi, W.A, Aji, P.O, Othman, H.J, and Ishaku, M.A (2018). 'Comparative effect of organic and inorganic fertilizer sources on the growth and fruits yield of tomato (Lycopersicum esculentum mill).' International Journal of Agricultural Policy and Research Vol.6 (8), pp. 122-126

Fatimah OS, Mhammed AS, Abdul JC Shyam SK Senthilkumar A. (2016). 'Effect of some organic fertilizers on growth yield and quality of tomato (solanum lycopersicum).' International Letters of Natural Sciences. Vol. 53, pp 1-9

Ganesan, M. (1999). 'Effect of poly-greenhouse models on plant growth and yield of tomato (Lycoperisiconesculentum).' Indian J. Agric. Sci. 10: 586-588.

Hashemimajd K, Kalbasi M, Golchin A and Shariatmadari H. (2006) 'Comparison of Vermicompost and Compost as Potting Media for Growth of Tomatoes.' Journal of Plant Nutrition, Vol 27. Pp 1107-1123.

Hazarika, T.K. and Phookan, D.B. (2005). 'Performance of tomato cultivars for polyhouse cultivation during spring summer in Assam.' Indian J. Hortic. 62(3): 268-271.

Khan, W., Khan, M.A., Abbasi, N.A., Hussain, Q. and Mehmood, R. (2018). 'Comparative study of different potting media for tomato production.' Acta Hortic. 1208, 257-264 DOI: 10.17660/ActaHortic.2018.1208.34

Kang, B.S. and Sidhu, B.Ss. (2005). 'Studies on growing an off- season tomato nursery under a polyhouse.' Ann. Agri Bio Res. 10 (1): 53-56.

Kengar, I. (2008). Performance of tomato (Solanum Lycop ersicum L.) Hybrids under shade house condition.' M.Sc. (Ag) Thesis, Univ. Agric. Sci., Dharwad. 62

Leonardi, C., Guichard, S., and Bertin, N., (2000). 'High vapour pressure deficit influences growth, transpiration and quality of tomato fruits' Sci. Hortic. 84: 285-296.

Parvej, M.R., Khan, M.A., and Awal, M.A. (2010). 'Phenological development and production potentials of tomatoes under a polyhouse climate.' J. Agri. Sei. 5: 19-31.