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Antioxidant Profile of Ocimum Sanctum Grown On Different Types of Fertilizers

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ABSTRACT

The application of organic and inorganic fertilizer to the soil is considered as good agricultural practice because it improves the fertility of the soil and plant quality. The objective of this study is to compare the effect of organic and inorganic fertilizer on Ocimum sanctum. The experiment was arranged in a randomized design in three replicates. Parameters assess include leaf area, height, leaf length and phytochemicals on leaf of Ocimum sanctum. The application of organic fertilizer gave plants with the greatest plant height, leaf area and surface length than the one grown on inorganic fertilizer and the one without the application of any fertilizer. Organic fertilizer produced higher effect on proteins and amino acids as compared to chemical fertilizers. Effect of organic fertilizer in plant phytochemicals was higher than that of inorganic fertilizer and the control plant. The experimental results of this study have showed that organic fertilizer produced higher effect on Ocimum sanctum leaf when compared with inorganic fertilizer. High amounts of phytochemicals recorded in this study gives preference to the use of organic than inorganic fertilizer.

KEYWORDS : Ocimum sanctum, phytochemicals, Organic and inorganic fertilizer.

Introduction

The growing world economy has improved the clinical diagnosis and treatment of many chronic diseases, but the incidence of diseases like cancer has increased rapidly and is remains the leading cause of mortality worldwide [1]. Therefore, to cope with the increased incidence of chronic diseases, it is necessary to take preventive measures by changing one's lifestyle, including food habits. The diet plays a crucial role in regulating the expression of many genes and therefore it plays a vital role in health and diseases [2, 3]. Hence, intake of the right kind of diet can help avert many chronic diseases. One of the well-known sources of phytochemicals are medicinal plants, which are high in antioxidants and play an important role in averting chronic diseases like cancer and cardiovascular disease.

In the past, the agriculture industry was mainly concerned with increasing the production of crops. Therefore, different kinds of chemical fertilizers and pesticides were utilized [4]. Extensive usage of such chemicals greatly improves the productivity of crops, but with compromised nutritional status. Fertilizer effects on antioxidant activity in medicinal plants have also been reported [5-7].

Health conscious consumers are interested in the nutritional composition of herbs, preferring those with minimal chemical residues and herbs that produced through environmentally friendly agricultural practices. Hence substituting chemicals with organic fertilizers is one of the vital production techniques to meet the demand. Compost has been widely used as a source of nutrients and reported to influence phytochemical content in the products [8, 9]. Compared to mineral fertilizers, organics resulted in higher tannin and pectin content in date fruits [10], and higher total antioxidant capacity in cabbage [11] and herbs [12, 13]. Fruits, vegetables and grains from organic crops were reported to contain significantly more vitamin C, iron, magnesium, and phosphorus and significantly less nitrates than conventional crops [14]

Tulsi, the "Queen of Herbs", is the most sacred herb of India. Ocimum sanctum belongs to the Lamiaceae family, which has close to 252 genera and 6700 species [15]. Leaves have petioles and are ovate up to 5cm long, usually slightly toothily. The flowers are purplish in elongate racemes in close chorals. The two main morph types cultivated in India and Nepal are green-leaved and purple-leaved. Tulsi is cultivated for religious and medicinal purposes and for religious and medicinal purposes, and for its essential oil. Hence, the present study was taken to investigate the effect of organic and inorganic fertiliser on growth and antioxidant status of Ocimum sanctum.

Materials and methods

1-litre pots containing 1kg of red uncultivated soil. Cattle dung and vegetable waste compost applied at a rate of 30g/kg of soil, while Inorganic fertilizer (Nitrogen 6%, water soluble phosphate 12% and water soluble potassium 36%) applied at a rate of 50g/kg 1 week before sowing the seed. 5g seeds of Ocimum sanctum to be potted per pot. Harvesting was done 16 weeks later.

Solvent extraction

Five gram of the plant powder was loaded in the thimble of Soxhlet apparatus fitted with appropriate size round bottom flask with 250 ml absolute ethanol, and upper part fitted with condenser. Constant heat was provided by Mantox heater for recycling of the solvent. After complete extraction, the extract in round bottom flask was transferred into clean and pre-weighed universal tubes. Universal tubes containing extract was weighted and noted down. The extract is diluted with a Sterile distilled water to obtain concentration 100mcg.

Phytochemical analysis

Determination of total phenolics

The concentration of total phenolics was examined spectrophotometrically employing the Folin–Ciocalteu reagent protocol. In this assay 1ml of the extract was mingled first with 0.5ml of Folin-Ciocalteu reagent and then with 7.5ml of deionized water. The whole mixture was placed at room temperature for about 10min. After this, 1.5ml of 20% sodium carbonate was also added. The mixture was then heated in a water bath at 40°C for 20min and then it was cooled in an ice bath. At the end, the absorbance was read at 755nm with a spectrophotometer. Amount of total phenolics was calculated by means of designing a calibration curve of gallic acid [16].

Determination of total flavonoids

Total flavonoid can be conducted using aluminium chloride colorimetric method. 1ml of extracts was added with 4ml of distilled water in a flask. Then, 0.3ml of 5% $NaNO_2$ was added. After 5min, 0.3ml of 10% $AlCl_3$ was added and after 6min, 2ml of 1M NaOH is added. The mixture was diluted to 10ml with distilled water. The absorbance of the solution was measured at 510nm using a spectrophotometer [17].

Determination of total tannins

Tannin content of the extract was estimated by following the standard procedure. The sample extract (1 ml) was mixed with Folin-Ciocalteau's reagent (0.5 ml), followed by the addition of saturated Na_2CO_3 solution (1 ml) and distilled water (8 ml). The reaction mixture was allowed to stand for 30 min at room temperature. The supernatant was obtained by centrifugation and absorbance was recorded at 725 nm using UV-Visible Spectrophotometer. Increasing concentrations of standard tannic acid

was prepared and the absorbance of various tannic acid concentrations was plotted for a standard graph [18].

Determination of total alkaloid content

The total alkaloid content was determined according to UV Spectrophotometer method. This method is based on the reaction between alkaloid and bromocresol green. The part of the plant extract was dissolved in 2N HCl and then filtered. 1ml of this solution was transferred to separatory funnel and washed with 10ml chloroform; the pH of phosphate buffer solution was adjusted to neutral with 0.1N NaOH. One ml of this solution was transferred to a separating funnel and then 5ml of bromocresol solution along with 5ml of phosphate buffer was added. The mixture was shaken and the complex formed was fractioned with chloroform by vigorous shaking. The fractions was collected in a 10ml volumetric flask and diluted to volume with chloroform. The absorbance of the complex in chloroform is measured at 470nm [19].

Results and Discussion

Morphological traits

Table-1 shows the effect of organic and inorganic fertilizer on the performance of Ocimum sanctum.

The results obtained for plant height and weight contradicts with previous reports, [20] reported that plant height of Okra was greater in poultry dropping treated soil. They attributed it to the ready availability of nutrients for the easy absorption by plant root, thus resulting in an increase in plant growth. [21]. the plants treated with organic fertilizer grew fastest in the first three weeks. The plants treated with inorganic fertilizer grew higher from the sixth week up to the end of the experiment in week 10.

The greatest leaf area was observed in the organic fertilizer treatment and lowest in the control plant. Increased leaf area and leaf length implies higher light interception and dry matter product which invariably promotes plant growth. This results is in agreements with previous reports, [22] reported that plant height of Okra was greater in poultry dropping treated soil. Increased leaf area and leaf length implies higher light interception and dry matter product which invariably promotes plant growth. [23]

Table 1: Effect of organic and inorganic fertilizer on morphological traits of Ocimum sanctum

Morphological Trait	Organic	Inorganic	Control
Plant Height cm	20.6	21.8	17.2
Plant Weight g	4.756	7.279	3.687
Leaf area sq.cm	3.57	2.854	2.14

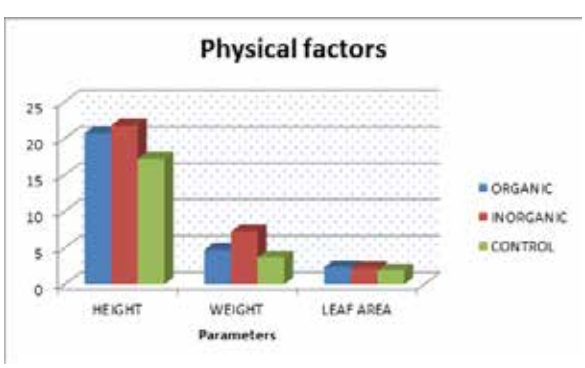

Fig 1: Effect of organic and inorganic fertilizer morphological traits of Ocimum sanctum.

The response of Ocimum sanctum to organic manure application may also be attributed to the increasing total organic matter, macro and micronutrients rendered after the application of manure.

Phytochemical analysis

The result of comparative effect of organic and inorganic fertilizer on phytochemicals of Ocimum sanctum was given in Table-2. Effect of organic fertilizer in plant phytochemical was higher than that of inorganic fertilizer.

Table 2: Effect of organic and inorganic fertilizer on phytochemical profile of Ocimum sanctum

Phytochemicals	Organic	Inorganic	Control
Total phenolics mcg/ml	68	41	31
Flavonoids mcg/ml	28	20	12
Tannins mcg/ml	32	21	14
Alkaloids mcg/ml	8.3	17	11.9

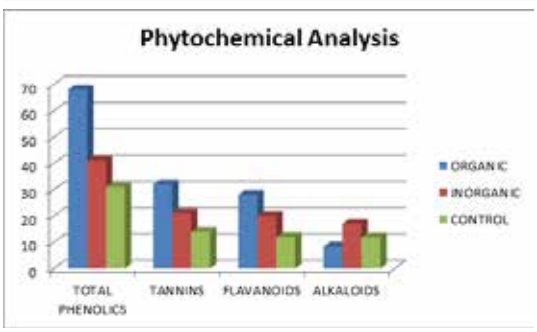

Fig 2: Effect of organic and inorganic fertilizer on Phytochemical of Ocimum sanctum

This study on effect of organic and inorganic fertilizers on phytochemicals level of *Ocimum sanctum* revealed that organic fertilizer produced higher effects on all the parameters investigated when compared with inorganic fertilizer. The results of this study are in agreement with [24] who have reported increases with organic fertilizers on phytochemical, nutritional and in vitro antioxidant. These increases could be due to the ease with which nutrients such as N, P and K in inorganic fertilizers are lost by leaching. Nutrients in organic material are less easily available since the materials have to be decomposed and organic nutrients mineralized phytohormones and may stimulate the plant growth[25] .The positive correlation between total phenolic and flavonoid compounds indicates that an increase in phenolic was followed by an increase in total flavonoid. Both were found to be highly correlated with antioxidant activity. Results of this study are also in consonance with results of the biggest and most extensive scientific study and research into the benefits of organic food by,[26] who reported that organic food is more nutritious than non-organic (ordinary produce) food and may in fact lengthen people's lives. She also found that they contain higher levels of antioxidants and flavonoids which help ward off heart disease and cancer as well as iron and zinc. Research that was carried out in the Newcastle University also showed that organic food contain more antioxidants and less unhealthy fatty acid .This could be attributed to the fact that the nutrients in the organic manure are released gradually through the process of mineralization maintaining optimal soil levels over prolonged periods of time.

Conclusion

Fertilisation is the most important and controllable factor affecting photochemical value of plants. The result indicate that application of cattle dung manure and vegetable waste compost can enhance the growth parameter, nutritional content, phytochemicals and antioxidant activity of *Ocimum sanctum*. The effects of composts on plants are not solely attributed to the quality of mineral nutrition is provided but also to its other growth regulating components. Furthermore, the application of compost in the field enhances the quality of soils by increasing microbial activity and microbial biomass which is key components in nutrients cyclings, production of plant growth regulators. Therefore, it could be concluded that, the chemical fertilizers could be replaced by the compost for improving the quality of the produced yield under safe agriculture conditions, in addition to decreasing the production costs and environmental pollution.

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