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Effect of vermicompost on the growth of Indian orange, *Citrus reticulatus* with reference to its quality and quantity

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ABSTRACT

Nagpur Oranges (*Citrus reticulata*) are predominantly grown on black soils, rich in minerals. It was observed that due to consistent depletion of organic matter and higher availability of potassium in soil induced high acidity in the fruits, which take comparatively longer time for ripening that result in poor fruit yield and quality. Increased realization of ill effects due to exclusive use of chemical fertilizers, unsustainable productivity of orange and growing demand from consumers for fruit quality have fostered experimentation with some alternative cultural practices. Organic culture is claimed to be the most benign alternative. Use of organic materials such as farmyard manure, cakes of plant origin and vermicomposts, are important components of the bio-organic concept of orange cultivation. The vermicompost application is one of the effective methods to rejuvenate the depleted soil fertility and enrich the available pool of nutrients and conserve more water, maintain soil quality and conserve more biological resources. Application of vermicompost significantly improved the weight, quantity and quality of the oranges, as compared to non vermicompost applied plants. Nagpur oranges favor more requirement of organic matter to maintain and regulate the supply of nutrients to plants. Application of 10 kg vermicomposts in the month of June (during basin preparation) significantly increased the fruit number, fruit weight and fruit yield of orange, as found in the present study.

KEY WORDS: NAGPUR ORANGES, HIGH PRODUCTIVITY, QUALITY ENHANCEMENT

INTRODUCTION

Citrus reticulata (Nagpur Orange) is one of the most promising fruit crops of Vidarbha. It is claimed to be one of the most remunerative and potential foreign exchange earning fruit crop of Vidarbha but recently drying of orange trees, irregular flowering due to varied abiotic and biotic factors resulted in significant decrease in productivity of orange. Oranges are predominantly grown on black soils, rich in minerals. It was observed that due to consistent depletion of organic matter and higher availability of potassium in soil induced high

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acidity in the fruits, which take comparatively longer time for ripening that result in poor fruit yield and quality. Increased realization of ill effects due to exclusive use of chemical fertilizers, unsustainable productivity of orange and growing demand from consumers for fruit quality have fostered experimentation with some alternative cultural practices. Organic culture is claimed to be the most benign alternative. Use of organic materials such as farmyard manure, cakes of plant origin and Vermicomposts, are important components of the bio-organic concept of orange cultivation, (Chellachamy and Dinakaran 2015).

The Vermicomposts application is one of the effective methods to rejuvenate the depleted soil fertility and enrich the available pool of nutrients and conserve more water, maintain soil quality and conserve more biological resources. As reported by some of the researchers vermicomposting is an appropriate technology for residue and wate management (Jambhekar, 1992). Vermicomposting is an easy and effective way to recycle agricultural waste, city garbage and kitchen waste along with bioconversion of organic waste materials into nutritious compost by earthworm activity (Hemalatha , 2012).

Vermicompost is potential organic manure rich in plant nutrients compared to farmyard manure or other organic manures in respect to supply of N, P, and K fertilizers The activities of dehydrogenase, nitrogenase, phosphatase, arylsultatase and urease were found higher in process of vermicomposting. It is fast growing in popularity as a tool of reclamation of waste and is used for reclamation of waste land, (Bhawalkar, 1993, Arunkumar , 2000, Roy *et. al.* 2000 and Sinha *et. al.* 2005).

Fertilizers have almost replaced use of farmyard manures and resulted in severe depletion of soil quality by erosion and loss of organic content (Lavelle *et., al.* 1998). Vermicomposts have a much finer structure than compost and contain nutrients informs that are readily taken up by the plants such as nitrates, exchangeable phosphorous and soluble potassium, calcium and magnesium (Edwards *et.al.*1998). Their growth productivity and ability to transform organic waste as animal dung, agricultural residues, urban washes and sludge have been widely reviewed. The work were carried out in my own field at Sambhora Orange Garden to study the effect of vermicompost application on productivity and quality of orange in typical expansive clay soils in the field of 04 hectares with 1000 trees. The soil had pH 7.9, $CaCO_3$ 82 g /kg, organic carbon 6.5 g/ kg and. The culture bed of 15ft X 15ft for experimental sets was prepared by putting a layer of garden soil up at the base. Over this softened wastes mixed with cow dung in equal proportion was added on the surface of the soil. The entire culture trough was left for 15 day prior to experimentation for composting of the bedding materials. These stock foods were stabilized by moistening with water to maintain 75 - 80% moisture content. The heat produced due to decomposition process was reduced by sprinkling water over the bed. In 10 –15 days, the predigested compost was ready for the preparation of vermicompost. After 15 days 200 worms were introduced in bed. Surface of the composting setups were covered with polythene to prevent the entry of predators and to keep away flies. This setup was left without disturbing the beds and worms until the vermicast were produced (Chellachamy and Dinakaran 2015). Water was sprinkled over the surface once a day and sometimes alternate days if the bed was wet and covered by net during the time of vermicomposting.

Vermicomposting has been recently universally accepted as eco friendly technology for sustainable development and abatement of pollution caused by municipal; garbage, sewage, sludge, agricultural wastes. The results at the present experiment revealed that the Vermicomposts prepared from cow dung and wastage fruits in the field processed by earthworm. Is used as a best organic fertilizer in terms of nutritional quality and the impact on the growth of the fruit and plant. The earthworm activity accelerated the process of waste products decomposition and stabilization and promoted biochemical characteristics of the Vermicastings that were favorable for plants growth. The reduced C: N ratio of the substrate material reflects the organic waste mineralization and stabilization during the process of composting or vermicomposting. The loss of carbon as carbon dioxide through microbial respiration and simultaneous addition of nitrogen by worms in the form of mucus and nitrogenous excretory material lowered the C: N ratio of the substrate, (Suthat, 2007).

The enhanced phosphorous level in vermicompost suggests phosphorous mineralization during vermicomposting process. The passage of organic matter through the gut of earthworm's results in phosphorus is converted to forms, which are more available to plants (Lee, 1992). Some previous studies also indicate enhanced potassium content in vermicompost by the end of the experiment, (Manna *et.al.* 2003 and Suthat 2007). The higher potassium concentration in the end product prepared from sewage sludge (Delgado *et. al.* 1995). The calcium level was more in experimental than control. This is due to microbes in gut of earthworms and their metabolic process. Calcium, Potassium are higher in Vermicompost, (Atiyeh *et.al.*2002).

It was found that pots containing soil amended with vermicompost at the time of plant growth achieving significantly better height and large number of leaves than control *Punica grantum balasta* showed the richest contents of organic carbon, Nitrogen Phosphorus, Potassium and Calcium.There were two treatments namely in

Photos of Sambhora Orange Garden in month of June 2015 before use of vermicompost

Photos of Sambhora Orange Garden in month of December 2015 showing productivity of oranges after use of vermicompost

year namely in June and January before flowering *i.e.* application of 10 kg per average above12 years age of orange tree. Vermicompost had relatively higher concentration of different nutrients which might have met the nutrient requirement of crop reasonably better and suitably modified the physical and biological properties of soil (Srivastava *et. al.*2004).

Table showing nutrient content of vermicompost and its effects on growth and yield of *Citrus reticulata*

Application of 10 kg vermicompost per plant in the month of June (during basin preparation), recorded significantly higher number of fruits, fruit weight and yield. The per cent increase in fruit number per tree, fruit weight and yield due to vermicompost application Vermicompost application improves the porosity and internal drainage of soils, nutrient content of soil and conservation of water led to low fruit drop and higher fruit number and fruit weight and yield of orange. Applica-

Nutrients of	N	P	K	Ca	Mg	Fe	Mn	Cu	Zn
	Percentage mg /hectare								
Vermicompost	1.2	0.69	0.76	0.49	0.18	168	92	4.90	23

Treatment	Without Vermicompost		With Vermicompost 10 kg/ tree	
Year	2014	2015	2014	2015
No of Trees Treated	500	500	500	500
Avg Weight of fruits (gm +-)	115.8	125.7	150.6	165.4
Fruit Production (tons /ha)	25	23	35	40

tion of vermi compost significantly improved the weight, quantity and quality of the oranges, as compared to non vermin compost applied plants. Nagpur oranges favor more requirement of organic matter to maintain and regulate the supply of nutrients to plants. Application of 10 kg vermi composts in the month of June (during basin preparation) significantly increased the fruit number, fruit weight and fruit yield of orange, as found in the present study with reference to the juice contents.

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