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"Effect of the soil enrichment with organic compost on the yield of tomato (*Solanum lycopersicum* L.)"

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ABSTRACT

In past decades demand of food items has increased which promoted use of chemical fertilizers. Though this input enhanced the yield of crops but it caused environmental quality decay as well as emerging health hazards. This led a revolutionary awareness to find an alternative to meet with the increasing demand as well as maintained quality of environment and food produced which encouraged use of organic based farming using various kinds of raw materials. The present review deals with the various aspects related to the use of organic amendments in the soil for increasing yield of a nutritionally important crop (*Solanum lycopersicum*).

KEYWORDS: *Solanum lycopersicum* , organic farming, green waste, biodegradable

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INTRODUCTION:

Tomato (*Solanum lycopersicum* L., formerly *Lycopersicon esculentum* Mill.) is an important member of Solanaceae family which holds an extraordinary status and value among other vegetables as it is a rich nutritional source of various vitamins and minerals. It is one of the majorly grown vegetable crops worldwide (Antonious, 2016). Fresh tomatoes are rich in several nutritional compounds specially vitamin C (ascorbic acid) and many minerals. It has been shown to possess property to reduce risk of having cardiovascular diseases as well as some type of cancers (Petro-Turza, 1986). .

Therefore, requirement to enhance the nutritional parameters and growth of tomatoes needs to evaluate the differential agricultural practices, such as the use of chemical and bio-fertilizers, organic manure, and development of suitable environmental conditions to increase yield and quality of the crop. On the other hand, recycling of organic waste obtained from various sources such as plants, animal dung, poultry residue, farm residues etc. have attracted the interest of recent era investigators. These cost effective and environment friendly resources put a positive impact on the growth and yield of a wide variety of crops and promote restoration of economic and ecological properties of soil. The proper and safe disposal with management of municipal solid wastes is a challenging issue for almost every country as rapidly growing population with enhanced economic activity, leading urbanization and industrialization has fast-tracked generation of wastes (Srivastava *et al*., 2015; Kumar *et al*., 2017). Therefore, an appropriate and adequate waste management is required.

Incineration is the most effective strategy to minimize biodegradable solid wastes (Agarwal *et al*., 2005; Taylan *et al*., 2008) or sometimes dumping in open and useless land is the only way to get rid of it which finally causes health and environmental issues. In addition, release of highly toxic and stubborn pollutants during incineration of is the main issue of this concern related to human health and the environmental safety (Paritosh *et al*., 2017). Another important reason behind use of waste as manure for crops such as tomatoes is that it has been realised in experimental observations that increased use of chemical based fertilizers negatively affect the nutrient quality and content of the fruit of the crop like tomato and potato (Kaniszewski and Rumpel , 1987 and Weston and Barth, 1997).

WASTES AS MANURE FOR TOMATO GROWTH AND SOIL IMPROVEMENT:

Waste composting is the most popular practice to upgrade soil functions, enhance plant growth and protection from diseases. As composts can be prepared from different source materials,

therefore, its function as source of nutrient, suppressive effect on pathogens may be different according to the starting material used (Termorshuizen *et al.* 2006; Bahramisharif *et al.*, 2013; Tewoldemedhin *et al.*, 2015). It has been known since decades that addition of organic supplement in soil improves its all attributes such increased nutrient availability, water holding capacity, total pore space, aggregate stability, erosion resistance, and temperature insulation. On composting, the organic matter of animal manure becomes rich in nutrients and its addition to soil has been proved to improve all aspects of soil viz. physical, chemical, and biological properties (Antonious, 2016). Rajaie and Tavakoly, 2016 observed that collective mixture of municipal waste compost and nitrogen fertilizer has been proved to give better growth results for tomato instead of sole use of any use of these. Ferreira *et al.*, 2017 observed in their study that fertilization of soil with this organic compost made from household food waste was found to be positively affecting the growth and nutrient integration in tissues of cherry tomato. This study indicated that composting of biodegradable organic waste can be an alternative strategy for recycling and transforming it into organic fertilizer that can be used as agricultural nutrients leading its better management.

The importance and role of inorganic fertilizers in addition with organic manures alongwith bio-fertilizers in sustainable management of plant growth of crops like broccoli (Bahadur *et al.,* 2003), potato (Baishya *et al.*, 2013), tomato and cabbage (Goswami *et al.,* 2017) and tomato (Shao and Huang, 2010). Kalbani *et al.,* 2016 and Kumar *et al.,* 2018 also reviewed the effect of organic manures on the production of crop, quality of fruit and soil health.

The management of plant diseases is also an important factor in producing healthy and quality crop. Many of the plant pathogens are soil borne. It is critical to remove these pathogen from the soil to attain a disease free crop. Various chemical based bactericidal formulations, fungicides and pesticides are being used to suppress these soil-borne pathogens. But in past years use of organic manure has been proved to change favourable soil conditions of these pathogens thereby hindering their growth and invasion of host plant. Even organic waste with non-pathogenic microorganisms has been proved a great tool for this purpose. In a study, the effect of oak–bark compost, *Bacillus subtilis* subsp. *subtilis, Trichoderma harzianum* and two commercial products (FZB24 and FZB42) were examined for their effect on tomato growth, production of metabolites and resistance under biotic stress condition (infection with *Phytophthora infestans*). Oak–bark compost, *B. subtilis* subsp. *subtilis*, and *T. harzianum* were found to enhance plant growth and immunity significantly whereas commercial products were not as effective for both the parameters tested. Therefore use of green compost combined with bio-agents is recommended to use as a reliable and consistent strategy for increased tomato production and disease protection (Hu and Barker, 2004; Bahramisharif and Rose, 2018). Hoossain *et al.,* (2012) also reported that use effective bio-fertilizer not only decreases the

burden of chemical fertilizers in soil but also minimizes the hazards caused by excessive uses of the latter. In their experiment, the mixture of *Trichoderma*-enriched bio-fertilizer was evaluated to reveal its effect on growth, yield and nutritional quality of tomato and it was found to be an effective measure. Similar studies have also been reported by another researcher in their investigations on different variety of tomato var. Arka Rakshak (Nagoni, 2015).Similarly higher yield has been obtained in tomato plants on treatment with optimal concentration of vermicompost (Joshi and Vig, 2010; Ahirwar and Hussain, 2015; Vaidyanathandl and Annamalai, 2017).

The investigation of effect of the green teas on tomato plants growth clearly demonstrated that both ACT (Aerated Compost Tea) and AVT (Aerated Vermicompost Tea) can be applied on weekly basis and produce a positive influence on shoot and root growth and dry weight. Simultaneously the chlorophyll content and stem diameter are also improved on this treatment. These results strongly support the use of (ACT) and (AVT) as a potent alternative to the conventional use of synthetic pesticides and fertilizers in agriculture, simultaneously providing sustainable environmental and farming safety (Morales-Corts *et al.*, 2017). A significant increase in growth and yield of tomato plants was recorded on soil treatment with compost of green waste between the ranges of 65.71 to 65.83% (Al- Kahtani *et al.*, 2018). Similarly application of fertilizers obtained from green manure enriched with nitrogen, phosphorus and potassium was found more effective on the yield and providing maximum macronutrients to tomato plant (Khan *et al.*, 2017). In a study results showed that the use of AM (Arbuscular Mycorrhizal), rhizobacteria mixed inoculum with green compost has potential to upgrade quality of tomato fruit, biochemical constituents and other important nutritional compounds in it (Copetta *et al.*, 2011).

In recent years, the potential of biochar has been exploited to improve crop productivity. Study aimed to find effects of three different biochars (wheat straw biochar, poplar biochar and olive residues biochar) determined that only biochar application was sufficient to maintain the growth of tomato fruit specially size and nutritional properties.

Conversely, secondary metabolites showed changes with reference to biochar type used.In tomatoes grown in medium amended with straw biochar and olive residues biochar, total flavonoid, phenol contents and antioxidant activities were found to be higher. Though amount of lycopene, lutein and β carotene in tomato fruits grown on substrates mixed with various biochars were considerably lower than the control (Petruccelli *et al.*, 2015). Use of biochar is an adjustment of soil fertility and water storage capacity for increased crop productivity. Akhtar *et al.*, (2014) showed that adding biochar results in increased soil moisture contents, which subsequently improves physiology, yield, and quality of tomato as compared with the non-biochar treated control. It is advantageous in decreased irrigation conditions as it enhances water content of leaves, membrane stability index and

fruit yield. The study also proposed that integration of biochar under reduced irrigation can be a new methodology to progress water productivity and superiority of tomato fruits.

Vermi composting has been proved to provide a great content of nutritions to the crop but it has also been proved that addition of vermin-compost leachates into an irrigation system during cultivation of tomato (*Solanum lycopersicum* cv. Rafaello) reduces availability of phytotoxic ions to plants by 99%. It thereby improves the soil structure by increasing the availability and amount of organic matter (Juarez *et al.*, 2015).

In another study, tomatoes grownup in nursery trays were supplemented with compost at a combination quantitative relation of compost/soil 1:1(w/w). In the controls (without oil), the highest biomass yield of 492 mg was recorded (Nawanko *et al.*, 2014). Oliveira *et al.*, 2013 observed that tomato fruits from organic farming experienced stressing conditions that resulted in oxidative stress and the accumulation of higher concentrations of soluble solids as sugars and other compounds contributing to fruit nutritional quality such as vitamin C and phenolic compounds. Similar results have been reported by Riahi *et al.* (2009) and Mccollum *et al.* (2005). Firm fruits don't lose an excessive amount of juice once sliced and area unit less vulnerable to physical harm in shipping (Paula *et al.*, 2007). Gutiérrez-Miceli *et al.* (2007) also observed that in greenhouse production of tomatoes, biofertilizers considerably increased plant growth though no big change in number of leaves was observed.

CONCLUSION

From the above discussion, It is clearly observed that composted organic manure and green manure can be a novel replacement of conventional techniques opted for eco-friendly and economic management strategy of the crop the improvement. In this sense, green manure obtained from farm, dairy or household waste can be a good source of biofertilizer which is safer and more economic as well as high performing. Tomato crop production can be enhanced by using such environment friendly strategy which can also be exploited to manage various diseases associated with the crop.

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