



Impact of Organic Fertilizers on Growth and Yield of Tomato Plant Under Semi-Arid Climatic Condition of Quetta

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Abstract

Tomato is a vital vegetable crop which is cultivated globally and has second number after than potato but first in rank as a processing crop. The pots experiment was conducted in Agricultural Research Institute of Quetta, Balochistan. The different organic manures were used to assess the vegetative growth and yield of tomatoes. A Randomized Complete Block Design (RCBD) with 3 replications was used for the experiment. The results revealed that the adding of organic manure at quantity of 20 tons ha⁻¹ significantly at P (chicken manure > sheep manure > cow manure > compost > no manure). Chicken as well as sheep manures had a synergistically impact on both fresh and dry weight of tomato shoots and roots as compared to the other treatments. The results indicated that the chicken manures had the best effect on overall studied parameters of tomato variety while soil with no fertilizer, as control group showed the least effect on overall studied parameters of tomato variety. As a general result using of organic fertilizers particularly in compost form had good influence on soil consistency and productivity, which consequents increase yields in long terms can be expected.

Keywords: Organic Manures; Tomato; Analysis of Growth; Yield of Fruits

1. Introduction:

Tomato is a vital vegetable crop which is cultivated globally and has second number after than potato but first in rank as a processing crop (Shamsullah *et al.*, 2019). The present world condition strongly stresses the need to adopt eco-friendly agricultural methods for ecological nutrition products. Many people depend on Balochistan province for tomato production. In Pakistan, Balochistan province is the largest tomato producer, which is about 205.6 thousand tons per year trailed by Khyber Pakhtunkhwa (KPK) province, which is about 153.1

and then by Sindh province, which is about 80.4 thousand tons per year.

In the last two years, the Balochistan become the important producers of tomato fruits by 42% shares in national productivity, then by Khyber Pakhtunkhwa (KPK), 34.5%, Punjab, 14.5% and Sindh, 9% shares (Ahmad *et al.*, 2018). In Balochistan, as well as in Pakistan, Killa Saifullah district is the main manufacturer of tomatoes (Pakistan horticulture development and export board, Islamabad). In Balochistan, tomatoes are commonly cultivated mostly in the whole year in Killa Saifullah, Quetta, Mastung and Khanazai districts. The total area for tomato

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cultivation is about 47, 2420 hectares by estimated production of 479.140 metric tons during 2017-2018.

Organic fertilizer methods are used as an alternate to chemical fertilizers. These organic fertilizers involve the use of organic wastes which promote the soil fertility and vegetables yield. In Pakistan, particularly in Balochistan, the use of organic fertilizer is a best choice for the farmers because it saves time and money. Organic fertilizers make use of local waste materials and raise crop yield by increasing the soil fertility. Compost, which is organic manure, can increase biochemical, physical and biological properties of soil. It also increases soil fertility for various years and results in a continuous quantitative improvement in crop yield and products value (Allievi *et al.*, 1993). Minerals structure of tomato fruits rely upon the number and types of nutrients get from the soil or other growth medium. Insufficient supply of nutrients can exhibit deficiency symptoms and cause less production of tomato fruits (Sainju *et al.*, 2003). Therefore, being an important crop, a suitable nutrient management system of soil is necessary for production of quality tomatoes. Nevertheless, in continuous cropping soils, it is essential to maintain the soil texture (Reeves, 1997). The use of organic manures to enhance the biochemical, physical and biological properties of the soil has been well studied and documented (Tejada *et al.*, 2008; Whalen *et al.*, 2000). Adding compost to the soil usually improves soil texture, water holding capacity of the soil, tilts, permeation and drainage (Cook *et al.*, 1994). Various research on compost and vermin compost from different bases have shown that they promote roots development (Arancon *et al.*, 2005) rise crops yield and fruits yield (Arancon *et al.*, 2004; Atiyeh *et al.*, 2002) and also increases plants dry mass (Edwards, 1995; Subler *et al.*, 1998). Certain authors have reported that fruits and agricultural crops, grown in organic medium, contain more minerals and vitamins than usual crops (Bourn & Prescott, 2002; Magkos *et al.*, 2003). Moreover, high levels of iron, magnesium, phosphorus, vitamin C, and less nitrate and low quantity of certain heavy metals were present in crops grown in organic medium (Worthington, 2001).

In Pakistan, especially in Balochistan, the soil composition varies, so it is very important to use specific quantity of fertilizers for tomato growth. Tomato can be cultivated in the presence of organic manures both in open fields and plastic tunnels however, in Pakistan, there are few studies done which indicate the growth of tomatoes in the presence of organic fertilizer inside the plastic tunnels.

1.1. Objectives:

- To measure the impact of organic fertilizers on growth, yields and quality of tomato in open field area.
- To explore the different morphological parameters influenced by various biological manures under the semi-arid climatic condition of Quetta valley Balochistan, Pakistan.

2. Materials and Methods:

The pots experiment was performed in an open field area at Agriculture Research Institute (ARI) Quetta. The Rio grande variety of tomato was selected for study purposes. Sample analysis was done in laboratories of Department of Botany, University of Balochistan, Quetta.

2.1. Experimental Study:

The experiment was done by Randomize Complete Block Design (RCBD) method with three replicates. The five treatments including Cow Manure (CM), Sheep Manure (SM), Chicken Manure (CM), Compost (C) and the soil which was used for tomato cultivation without any fertilizer was a control (Mehdizadeh *et al.*, 2013). One of the organic fertilizers, which was used in this research work, is locally available, namely, Compost while the remaining three organic manures (*viz.* cow manures, sheep manures and chicken manures) were prepared by Pit method (Shrestha *et al.*, 2018). The applicable amounts of organic manures were established upon normal usage by local farmer, 20 ton/ha (Mehdizadeh *et al.*, 2013). Seedlings of 52 days were transplanted in rows. The spacing between the rows was 60 cm and plant to plant was 55 cm (Shrestha *et al.*, 2018).

2.2. Evaluation of Growth Parameters of Tomato Plant:

The growth parameters like shoot length, stem diameter or thickness, roots length, fresh and dry weight of shoots and roots of studied tomato was measured. The shoot length of tomato plant was evaluated from earth level to the top of shoot and specified in centimetres. The roots length of tomato plant was assessed from start of node of the shoot to the top of the largest root and also specified in centimetres. The tomato plants after wash-down by tap water, fresh weights of leaves, shoots and roots was calculated by the help of an electric balance and the value was specified in gram. Since taking the fresh

weights, the tomato plant was dry at 60°C in hot air oven for 24 hours. After drying out the plant, the weights were determined and the values were specified in gram (Kalbani *et al.*, 2016).

2.3. Evaluation of Yield Parameters of Tomato Plant:

Fruits of tomato were harvest once in a week at ripe red stage. The harvest fruits were measured weekly. The yields parameters including numbers of flower of each plant, numbers of fruit of each plant, and yields of each plant were measured (Kalbani *et al.*, 2016).

2.4. Statistical Analysis:

Data were analyzed by Statistical Analysis System (SAS Institute 2011). ANOVA, Duncan's Multiple Range Test (DMRT) and Least Significant Difference (LSD) test were determined by Statistical Analysis System (SAS Institute 2011).

3. Results:

The results of the analysis of variance (ANOVA) indicated that the impact of fertilizers type on the growth and yields of tomatoes was significant ($P < 0.01$) as shown in Figure 1 and 2. In the current work, the positive effect of organic fertilizers was observed on the growth and yield of plants.

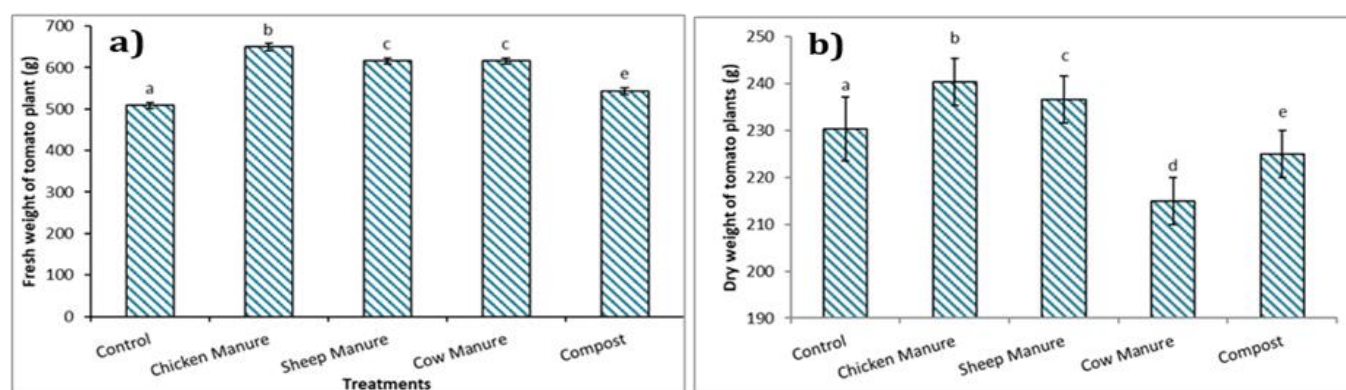
3.1. Growth Parameters:

The outcomes of chicken manure had the maximum effect on all observed parameters of tomato

plants as compared to control and other organic fertilizers groups. Organic fertilizer (chicken, sheep, cow manure and compost) enhanced the fresh weight of plants as given in Figure 1. Maximum and minimum dry weight of plants was observed in chicken and cow manure respectively and shown in Figure 1 (b). Chicken manure enhanced the fresh weights of tomatoes, and dry biomass by 33.37% and 9% respectively. The chicken manure and sheep manure had a synergistic impact on both the fresh weight and dry weight of tomato shoots and roots. Chicken manure increased the shoot length, stem thickness and root diameter by 30%, 7% and 12.28% to control and the graphical presentation is shown in Figure 2 (a, b, d). However, the cow manure improved root length by 64% as compared to the control group as shown in Figure 2 (c).

3.2. Yield Attributes:

The use of organic manures obtained a high yield as compared to the soil in which no addition of fertilizer. The total weight of fruit increased in plants of organic fertilizers as compared to the control and the maximum increase was determined in chicken manure as shown in Figure 1 (c). chicken manure increased the total weight of the fruit of tomatoes by 57% more than the control. The number of flowers on the plants is enhanced by the use of different organic fertilizers. Compost has shown a high impact on the number of flowers as compared to the other fertilizers as illustrated by Figure 1 (fig.1d). Compost and chicken manure increased the number of flowers by 43% and 40% respectively.



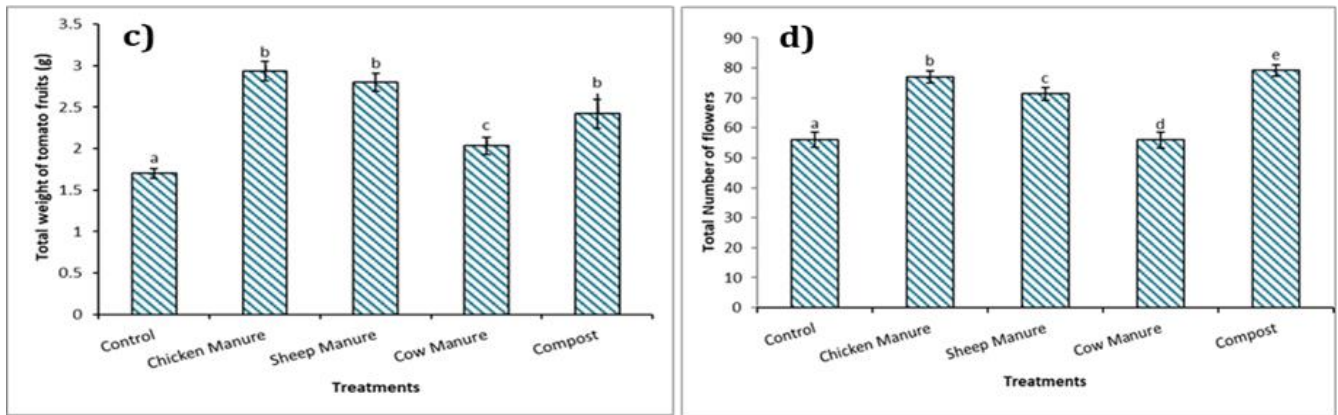


Figure 1: Effect of organic fertilizers on fresh, dry weight, the weight of fruit and the total number of flowers of tomato plants. **a, b, c and d** illustrate the fresh weight of tomato plants, the dry weight of tomato plants, the total weight of tomato fruits and the total number of flowers, respectively.

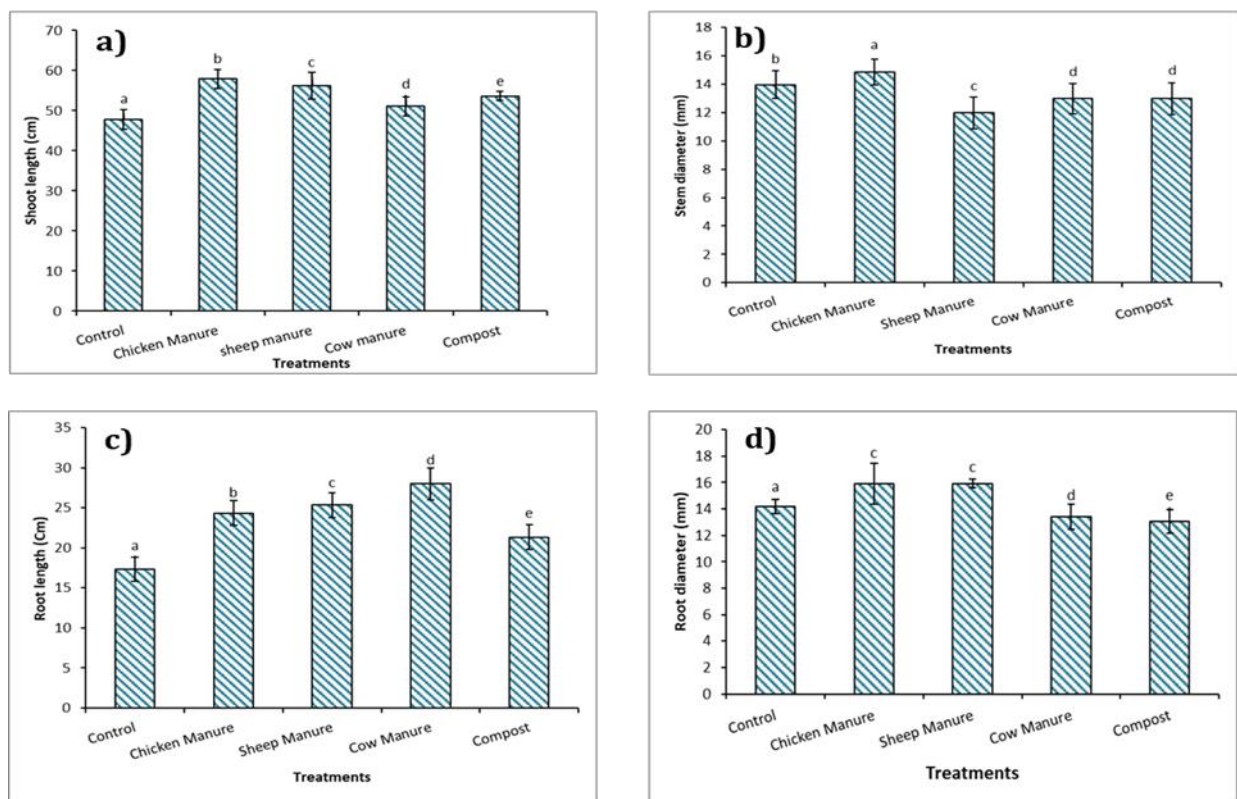


Figure 2: Effect of organic fertilizers on shoot length, stem diameter, root length, and root diameter. **a, b, c and d** demonstrate the shoot length, stem diameter, root length and root diameter, respectively.

4. Discussion:

The occurrence of organic substances in both organic manures and compost increases soil physical properties like mass, improved aeration of soil and lower bulk density, maintaining surface layer, improved water holding capacity and provide essential elements to the plants (Yafan & Barker, 2004). The increase in plants growth and fruit production in the

presence of organic alterations may also owe partly to great increase in microbial biomass of soil after the uses of organic fertilizer which leads to the production of hormones in the compost which act as growth regulators in plants independent of the nutrients supply (Tu *et al.*, 2006). Nevertheless, as (Barker & Bryson, 2006) proposed, fertilization with compost may be more helpful for plant growth to increase when the compost is enriched with nutrients. Cook *et al.*

(1994) show up that by adding compost to the soils usually improve soil's texture, water holding capacity of the soil, tilts, permeation and drainage. Generally, it can be said that a proper supply of nutrients either in organic or mineral form is essential to get large yield in tomato plants.

Our outcomes are similar to Amer, (2007) investigated that Farmyard manure considerably improved both fresh weight and dry weight of tomatoes shoots and roots. Our findings are also correlated to Abdel-El-Moez *et al.* (2001) demonstrated that chicken manures improved the growth of pepper plant both fresh and dry weights in vegetative and yields stages as compared to control by 19 percent and 27.3 percent correspondingly. Our results are aligned with Kazqkov, (1995) that revealed the yields of grain in maize and winter wheat were improved by 33 percent and 27 percent during the three years with both chicken manure and farmyard manure correspondingly, under sandy soil conditions. In corn plants, chicken manure and farmyard manure indicated the maximum causing impact on dry matter yields (Gaskell *et al.*, 2007). These outcomes are same as that of (Gianquinto & Borin, 1990), who showed that the participation of manures is well favourable to the large production of industrial tomatoes. These useful effects of animal manures have been proved by different authors (Cavero *et al.*, 1996; Oikeh & Asiegbu, 1993). In recent times, Kandil & Gad, (2009) indicated that the use of organic fertilizers increases plant growth, yields, chemical structures and chemical elements in broccoli plants. Generally, organic fertilizers should be used in culture systems because it promotes the fertility of soil, structure of soil and minerals availability to the soil. Actually, in any organic system, increase in soil organic substances to optimal levels is an important stage (Gaskell, 2000).

The microbial activity of the soil increases by adding organic fertilizers, their capacity to preserve water for irrigation purpose increases and accordingly their productiveness and yield also increases (Wanderley & Mitton, 2004). In recent times, Kandil and Gad, (2009) investigated that the use of organic fertilizers increases nutrient absorption of roots and translocation of nutrients to higher parts of broccoli plants. The beneficial impact of organic manures in the soil might be associated with the stimulation of bacteria activities which increases the release of Nitrogen, Phosphorus and other minerals in soils and increases the absorption of nutrient by roots of tomatoes (Bertand & Cleyetmarel, 2008). Normally, the use of organic materials in culture systems should be enhanced. Animal manures are available locally in large amounts for all community groups and they are economically more beneficial and profitable than costly minerals manures. Probably, some maximum

yields can be achieved by using organic fertilizers at the limit, practiced in our work.

5. Conclusion:

This study shows that the adding of organic manures at quantity of 20tons.ha⁻¹ to the soil enhanced the nutrient balance of soil and increased the yields of tomato. This study also reveals that it could be possible to improve tomato yield in Balochistan province of Pakistan by improving the fertilization policy. Particularly the use of chicken manure and animal manures are proved to be very helpful for nutritional requirements of the soil and culture. The outcomes generally revealed that organic fertilizers, especially chicken manures, are proper source of important elements which enhance the efficacy and productivity of the soil and fruit yields of tomato plants.

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