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INFLUENCE OF FARMYARD MANURE TYPE AND RATE ON TOMATO FRUIT YIELD AND ITS ATTRIBUTES UNDER DRIP IRRIGATION CONDITIONS

Ahmed, S.Y.[1*] and Noraldeen, A. I.[2]

[1]Soil and water Dep. Agric. Fac. Sebha Univ. **Libya.**
[2]Agricultural Economic Dep. Agric. Fac. Sebha Univ. **Libya.**

[*]**Corresponding author:** syahmed62@hotmail.com **Received:** 19 July 2021 **; Accepted:** 20 Aug. 2021

ABSTRACT: A field experiment was conducted at the Agriculture faculty farm of Sebha University, Sebha, Libya, during the winter season of 2017 to assess the impact of different rates of two farmyard manure (FYM) on the yield under drip irrigation. The two types of FYM were poultry and sheep manures at rates of 0, 20, and 30 tons h^{-1} were mixed with the soil before transplant versus the control. The results indicated that the fresh and dry weights, plant height, number and weight of fruits were significantly affected by different types and levels of FMY. The maximum values of the above mentioned traits were obtained using 30 tons ha^{-1} of sheep manure compared to the other treatments.

Key words: Tomato, farmyard manure, yield, yield components, drip irrigation.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill) is one of the most important vegetables worldwide. As it is a relatively short duration crop and produces a high yield. Accordingly, it is economically attractive and its cultivated area is increasing yearly **(Geboloğlu *et al.*, 2011)**. Tomato fruits are consumed fresh in salads or cooked in sauces, soup, and meat or fish dishes. It contributes to a healthy, well-balanced diet and having rich in minerals, vitamins, essential amino acids, sugars, and dietary fibers.

Using animal manure as fertilizer has become an important approach to increase and sustain soil fertility especially in the south part of Libya (Fezzan region) where desert soils are dominant. Most sandy soils in the south of Libya are low organic matter content, low plant nutrient content means need nutrients supply by adding fertilizers. Fertilization is used not only to give greater yield but also to improve the quality of crops. In the last few decades, the vertical expansion in agriculture necessitated the use of fertilizers to compensate for the deficient soil nutrients, unless efficient varieties are widely employed to meet crop requirements from soil micronutrients reserves **(Heeb *et al.*, 2005a)**. The application of organic fertilizers, which are made from animal excreta or other agricultural wastes is usually used to improve the structure and stability of the soil and in addition to enhancing the yield and quality of the crop

plants **(Bulluck and Ristaino, 2002; Chang *et al*., 2010; Tejada *et al*., 2003; Marzouk and Kassem, 2011)**. Likewise, Organic fertilizers increase the yield and quality of crops in ways similar to inorganic fertilizers **(Bulluck *et al*., 2002; Arancon *et al*., 2003; Heeb *et al*., 2005b; Heeb *et al*., 2006; Ullah *et al*., 2008)**.

The previous studies on the sandy soils showed low and cost their productivity **(Henao and Baanante, 2006)**. This is attributed mainly to their low fertility as well as to the loss of water and applied nutrients, especially nitrogen (N) by leaching. Therefore, applying slow N-release materials such as animal manure is a necessary practice for this kind of soil **(Rezig *et al*., 2012)**. The animal manures contain a considerable amount of macro and micronutrients that are bound to the organic molecules hence not immediately available to the plant unless the mineralization process occurred **(Eghball *et al*., 2002)**. Therefore, the objective of this study was to evaluate the response of tomato yield and its attributes to two diverse organic fertilizers (poultry and sheep manures) at different rates under a drip irrigation system.

MATERIALS AND METHODS

Experimental sites and agronomic practices

A field experiment was implemented during the winter season of 2017 in the southern part of Libya (22° 30′ N and 30° 00′ E). This region is characterized by a hot and dry climate in summer and cold in winter. The rainfall in this region is about 10 mm per year and in some parts, there is no rain **(Wheida and Verhoeven, 2007)**. Some physical and chemical properties of soil were analyzed using hydrometer methods described by **Bouyoucos (1962)**. The analysis revealed that the soil was sandy throughout the profile (97% sand, 1.3% silt, and 1.7% clay) with pH 8 and electrical conductivity 2.99 dS m^{-1}. The pH was determined at a soil deionized water ratio of 1;2 using a pH meter 3030 (Jenway, Ltd., UK) and electrical conductivity was determined by the conductivity meter (model 4070, ELE, England) using a 1;1 (V/v) water to soil suspension. The experiment included 7 treatments comprised of sheep and poultry manures in three levels versus control (Table 1). The used tomato variety was Arnown.

Farmyard manure

Two types of farmyard manures were used; sheep (SM) and poultry (PM) manures. SM was collected from the farm of Faculty of Agriculture where the animals are mainly fed with clover and barley straw. Whereas PM was collected from poultry farm where using wood shavings as bedding and feeding with grained grain consist of wheat, barley, corn, and soybeans.

Table 1. The organic fertilizer treatments

Treatments	Ton ha^{-1} FYM treatments
T1	0 ton ha^{-1} FYM (control)
T2	10 tons ha^{-1} FYM of poultry
T3	20 tons ha^{-1} FYM of poultry
T4	30 tons ha^{-1} FYM of poultry
T5	10 tons ha^{-1} FYM of sheep
T6	20 tons ha^{-1} FYM of sheep
T7	30 tons ha^{-1} FYM of sheep

Planting and harvesting

The experimental unit area consisted of one row, 3-m long containing 12 plants with a spacing of 25 cm between plants. Tomato seedlings were transplanted when the plant had four to five true leaves on 15 December. 100 units of N ha^{-1} were applied as urea form (46%) after 30 days of planting. All other agricultural practices were carried out as recommended for ideal tomato cultivation. The drip irrigation system was used in this trial. The experimental design was a randomized block design with three replicates.

A random sample of plants for each replicate was taken to measure plant height (cm), number of flowers $plant^{-1}$, number of branches $plant^{-1}$, number of leaves $plant^{-1}$, fresh and dry weight (g), then the tomato fruits were collected from each plot every 7 days then were weight and the yield ha^{-1} was determined per each plot and transferred to fruits yield (Kg ha^{-1}).

Statistical analysis

The analysis of variance (ANOVA) was performed for all collected data using the Genstat 12th Edition. The differences between means were separated by the LSD test at the $p \leq 0.05$ significance level.

RESULT AND DISCUSSION

Yield attributes

The data illustrated in Table 2 displayed a significant influence of organic fertilizer treatments on plant height, number of branches, number of leaves, number of flowers per plant, fresh and dry weights. The maximum values were assigned for 30 tons of sheep manure. This may be due to sufficient available nutrients in the root zoon. The application of 30 tons of sheep manure significantly increased all the above-mentioned traits followed by 30 tons of poultry manure. Besides, the applications of 20 and 30 ton ha^{-1} of both manures significantly increased all the evaluated yield attributes compared to the low level and the control. This is due to the effect of organic manure of fertilizers on plant growth and development. These findings concur with those reported by **Makinde *et al*. (2007); Uko *et al*. (2009) and Geboloğlu *et al*. (2011)**, who depicted that the application of organic manure significantly increased yield attributes as well as the quality of tomato.

Table 2. Effect of organic fertilizer treatments on yield attributes of tomato

Treat.	Plant height (cm)	No. of leaves/plant	No. of branches/plant	No. of flowers/plant	Fresh weight (gm)	Dry weight (gm)
T1	33.17 ^{c}	21.0 ^{c}	3.83 ^{b}	8.67 ^{b}	27.2 ^{d}	4.50 ^{c}
T2	43.67 ^{b}	31.8 ^{ab}	5.67 ^{ab}	9.50 ^{b}	65.5 ^{bc}	10.17 ^{ab}
T3	44.83 ^{ab}	36.3 ^{ab}	6.33 ^{a}	16.33 ^{a}	70.2 ^{abc}	11.50 ^{ab}
T4	45.33 ^{ab}	39.3 ^{a}	7.33 ^{a}	12.17 ^{ab}	83.8 ^{ab}	12.67 ^{a}
T5	43.33 ^{b}	30.8 ^{b}	5.50 ^{ab}	11.17 ^{ab}	57.8 ^{c}	8.17 ^{bc}
T6	46.67 ^{ab}	36.3 ^{ab}	6.33 ^{a}	14.17 ^{ab}	73.5 ^{abc}	11.67 ^{ab}
T7	49.50 ^{a}	37.5 ^{ab}	7.50 ^{a}	16.00 ^{a}	93.2 ^{a}	13.67 ^{a}

Means in each column which have the same letter(s) are not significantly different.

Fruits number and weight

The application of 30 tons ha^{-1} of sheep manure significantly increased the total number of fruits compared with the other treatments. This is due to the slow release of nutrients. Likewise, the study of **Patel *et al.* (2015)** disclosed that the application of organic matter enhanced root growth and nutrient uptake, resulting in higher yields. The crop response to organic fertilizer application is affected by the nutrient reserve in the soil **(Dauda *et al.* 2008)**. Also, the crops respond more to fertilizer application in soils with very low nutrient content than soils with high nutrient reserve **(Makinde *et al.*, 2007** and **Uko *et al.*, 2009)**. All organic fertilizer treatments significantly increased tomato yield compared to control. The highest fruit weight was assigned for the application of 30 tons ha^{-1} of poultry manure. These results are in consonance with those obtained by **Bulluck and Ristaino (2002)** and **Ullah *et al.* (2008)** as they manifested that organic fertilizer increased the yield and quality of agriculture crops similar to inorganic fertilizer.

Table 3. Effect of organic fertilizer treatments on yield of tomato

Treat.	No. of fruits 1	No. of fruits 2	No. of fruits 3	Total No. of fruits	Yield 1 (gm)	Yield 2 (gm)	Yield 3 (gm)	Total Yield (gm)
T1	46.7 ^{c}	59.7 ^{c}	10.00 ^{c}	116.4 ^{c}	29.0 ^{b}	843.0 ^{b}	746.0 ^{c}	1618 ^{e}
T2	72.5 ^{ab}	94.3 ^{ab}	21.17 ^{ab}	187.97 ^{a}	25.0 ^{b}	2050 ^{a}	1602 ^{a}	3677 ^{b}
T3	79.8 ^{a}	92.0 ^{ab}	18.83 ^{ab}	190.63 ^{a}	172.0 ^{a}	2212 ^{a}	1392 ^{ab}	3776 ^{b}
T4	73.5 ^{ab}	94.7 ^{ab}	26.33 ^{a}	194.53 ^{a}	21.0 ^{b}	2565 ^{a}	1570 ^{a}	4156 ^{a}
T5	63.7 ^{b}	88.5 ^{ab}	18.67 ^{b}	170.87 ^{b}	46.0 ^{b}	1981 ^{a}	1450 ^{ab}	3477 ^{bc}
T6	66.2 ^{b}	85.8 ^{b}	16.00 ^{bc}	168.0 ^{b}	88.0 ^{ab}	1952 ^{a}	1018 ^{bc}	3058 ^{d}
T7	81.2 ^{a}	101.2 ^{a}	17.33 ^{bc}	199.73 ^{a}	18.0 ^{a}	2118 ^{a}	1162 ^{abc}	3298 ^{cd}

Means in each column which have thesame letter(s) are not significantly different.

Conclusion

The results displayed a significant increase in tomato yield using 30 tons ha^{-1} of poultry or sheep manures compared with control. Accordingly, using poultry or sheep residuals could be recommended for increasing organic tomato production particularly under sandy soils.

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