COLLEGE OF AGRICULTURE AND NATURAL RESOURSE

DEPARTMENT OF HORTICLTURE

Effect of Cattle manure on growth and yield performance of tomato (*Lycopersicon esculentum* Mill) at Wolkite University, Gurage Zone

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EFFECT OF CATTLE MANURE ON GROWTH AND YEILD PERFORMANCE OF TOMATO (*Lycopersicon esculentum Mill*) AT WOLKITE UNIVERSITY GURAGE ZONE

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LIST OF ABBREVIATIONS

IFOAM International Federation Organic Agricultural Movement

FAO Food Association Organization

LSD Least Significant Difference

ANOVA Analysis of Variance

RCBD Randomize Complete Block Design

FAOSTA Food Agricultural Organization State of the Association

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ABSTRACT

Tomato is one of the most important vegetables in Ethiopia. Its production and productivity are mainly affected by biotic and abiotic factors. Among the abiotic factors, the lack of soil fertility is a critical issue. This study aimed to evaluate the effect of cattle manure rate on tomato growth performance in the study area. A field experiment was conducted at Wolkite University, Department of Horticulture field site during 2024. This research conduct to the experiment was be laid out in RCBD with three replication and seven treatments seven different level of manure (0, 5, 10, 15, 20, 25 and 30 ton/ha) was applied to each set as plot treatments. The data were collected and analyzed using SAS 9.4 software. The growth performance of tomato was highly affected (P < 0.05) by the cattle manure. The applications of cattle manure at 30t/ha gave the highest growth performance of tomato in the study area. The highest plant height (33.73cm), leaf number (46.4cm), number of branch (18.93cm), and number of flower (28.4cm) were obtained from the application of 30t/ha, whereas lowest plant height (17.46cm), leaf number (6.53cm), number of branch (1.4cm) and number of flower (2.2cm) were recorded from control treatments. The results showed that higher application of cattle manure increased the growth performance of tomato. Therefore, based on the results obtained, growers use cattle manure at the levels of 30t/ha for tomato production and could be *recommended to gate maximum growth performance of tomato.*

Keywords: *Tomato, Cattle manure, Plant height, Number of branch, Number of flower, leaf number*

1. INTRODUCTION

1.1 Background

Tomato is believed to have originated in western South America, in the region that is now Peru, Ecuador and northern Chile. It was first domesticated by the indigenous people of this area around 500 BC. (WWF and IUCN, 1997). Tomatoes (*Lycopersicon esculentum* Mill) are widely cultivated and highly valued for their nutritional composition and culinary versatility. It is produced in temperate, subtropical and tropical areas around the world (Blanca *et al.*, 2012) and it is the second horticultural crop produced in terms of yield in the world (FAO, 2016). The cultivated tomato is the world's most highly consumed vegetable due to its status as a basic ingredient in a large variety of raw, cooked or processed foods. It belongs to the family *Solanaceae,* which includes several others commercially important species. Tomato is grown worldwide for local use or as an export crop. In 2014, the global area cultivated with tomato was 5 million hectares with a production of 171 million tones, the major tomato-producing countries being the People's Republic of China (hereafter "China") and India (FAOSTAT, 2017). Currently tomato is one of the regional export crops of the country (Wiersinga *et al.,* 2011).

The introduction of cultivated tomato into Ethiopian agriculture dates back to the period between 1935 and 1940 (Samuel *et al.*, 2009). The Ethiopian Institute of Agricultural Research (EIAR) was established in 1966 (Setotaw, 2006; Roseboom *et al.,* 1994) during which tomato was recognized as a commodity crop. Since 1969, 300 varieties were tested (Shushay, 2011).Tomato is being cultivated widely and planted in Ethiopia with about 700 to over 1400 mm annual rainfall indifferent place ,season ,soil weather condition technology (rain feed or irrigation) and output level (Tilahun, 2010). Which is ranking fourth (0.35 million quintal in terms of annual total national vegetable production after Ethiopian cabbage, red pepper and green pepper are third in area coverage and 2.5% of land allotted to it from the vegetable production land (Desalegn, 2016). In Ethiopia tomato served as an ingredient in many dishes (local sauce), fresh produce is sliced and used as salad and processed product such as tomato paste, tomato juice , soup ,stews and tomato catch up are consumed in large quantity when compared to other vegetables (Gemchu and

Beyene, 2019).

Tomato is the most vital vegetable in Ethiopia and it is the most important source of a healthy diet and home to micro nutrients like- vitamin C, biotin, molybdenum, vitamin K, vitamin A (in the form of beta-carotene), vitamin B, vitamin E, folate, niacin (Kassa, 2015).

Tomato is a high cash crop production and it has to be the source of income for small-scale farmers and provides employment opportunities in the production, distribution, and processing in the industries (Lemma, 2002). Tomatoes play an important role in Ethiopia's poverty and food insecurity programs because they have a short harvesting season, relatively high production per hectare (example 9.4 tons per hectare in 2016), and one of the strategic commodities prioritized by the Ethiopian government for agro-industry development (Brasesco, 2019). It also strengthens the national economy as a source of raw materials for value-added agro -processing industries and foreign currency for an exportable tomato to international markets (Brasesco, 2019).

Organic manure cow dung, compost and vermin compost improve texture, structure, color, water holding capacity, microbial activity, anion and cation exchange capacity, organic matter and carbon-content of soil and, it also promotes the vegetative growth, flowering, fruit set, yield and quality of tomato in ways similar to inorganic fertilizers (Arancon *et al.*, 2004; Bulluck *et al.*, 2002; Heeb *et al.*, 2006; Liu *et al.*, 2007; Tonfack *et al.*, 2009). Cattle manure is rich in organic matter, macro and micro nutrients, and beneficial microorganisms. When applied to the soil, cattle manure releases nutrients gradually, thereby promoting balanced nutrient availability throughout the growing season. This slow-release property can contribute to improved nutrient uptake and utilization by tomato plants, leading to enhanced growth performance (Smith *et al.,* 2018)

In addition to nutrient supply, cattle manure also enhances soil structure and water-holding capacity. The incorporation of organic matter into the soil improves soil aggregation and porosity, thereby facilitating root penetration and nutrient absorption (Kumar et al., 2019). Moreover, the presence of beneficial microorganisms, such as mycorrhizal fungi and nitrogen-fixing bacteria, in cattle manure can establish symbiotic relationships with tomato roots, promoting nutrient uptake and disease resistance (Bai *et al.,* 2020).

Cattle manure was a source of nitrogen, potassium and phosphorus, which were essential in Ethiopia soil. The use of cattle manure was a well-established crop production practice under small scale farming Ethiopia (Materechera *et al.,* 2000). Cattle manure was easily accessible and was a cheap source of fertilization to enable additional income for emerging farmers. Use of cattle manures to meet the nutrient requirements of a crop was be a valuable practice for sustainable agriculture. Cattle manure improves the soil physical, chemical and biological properties along with conserving the moisture holding capacity and thus resulting in enhanced crop productivity and quality (Premsekhar and Rajashree, 2009). The amount of nitrogen that was available to plants was influenced by nitrogen mineralization immobilization processes (Sorensen and Jensen, 2002*)*, soil type and properties (Van Veen and Kuikman, 2004).

Thus, successful application of manure to soil requires an understanding of the impact of manure addition on microbial characteristics of the soil (Pell, 2003).Organically produced food have larger market acceptance since organic farming uses little or no artificial chemicals for production Nitrogen, P and K, among others were known to affect yield .Deficiency in K affects fruit size and quality rather than numbers. Organic manure has been identified as a potential source of nutrients in vegetable production. Many workers in Ethiopia was be researched extensively on the effects of fertile crop growth and yield. Organic manure fertilizer application sustains soil fertility and crop production (Lemma, 2009). However, the yield was not as such high. Some of the reasons for low yield were due to several factors such as deficiency of soil nutrients, cultural practices, disease, and pest’s factor considered as the major constraints to successful upland crop production. In addition the application of cattle manure were rarely reported and farmer’s knowledge in application of organic manure (cattle manure) seems in inadequate in the study area.

1.2 Objectives

1.2.1 General Objective

- ✓ To determine the effect of cattle manure on growth and yield performance of tomato.

1.2.2 Specific objectives

- ✓ To evaluate the economic benefit of applying cattle manure on growth and yield of Tomato production.
- ✓ To determine the rate of application of cattle manure on growth and yield of tomato at the study area.

2. LITRATURE REVIEWS

2.1 The Tomato Crop

Tomato plants are herbaceous perennials in their native tropical and subtropical regions, but they are often grown as annuals in temperate climates. They belong to the Solanaceae family, which includes other well-known species such as potatoes, peppers, and eggplants. The tomato plant is characterized by a sprawling growth habit, with long, branching stems that can reach several feet in length. The leaves of the tomato plant are pinnately compound, consisting of multiple leaflets arranged along a central midrib. The flowers are small, yellow, and star-shaped, and they typically occur in clusters. Tomato flowers are self-fertile, meaning they possess both male and female reproductive structures, allowing for successful pollination and fruit development (Peet *et al.*, 2008).

The classification of the tomato species has undergone revisions over time due to advancements in genetic analysis. Historically, tomatoes were classified as members of the Solanum genus along with other nightshade plants. However, modern genetic research has led to the reclassification of tomatoes into the *Solanum lycopersicum* species (Peralta and spooner, 2001).

2.2 Climatic requirement of Tomato

High temperature, high humidity and diseases at fruit setting lead to low yield in tomatoes. For optimum fruit setting, tomato requires night temperatures of 15-20oC. However, in lowlands, heat tolerant cultivars were needed especially in summer. These cultivars with heat tolerance often need to be moisture tolerant, Samaratunga, *et al.*, (2001). At present there were modern tomato cultivars which can be grown to produce fruit in climates far different from the site of origin (Abubakar and Majeed, 2000).

2.3 Types of organic manure

Organic manures can be applied to soils as compost or in their fresh state. According to Gambardella *et al.* (2003), fresh organic materials contain higher inorganic N concentrations and have higher net N mineralization rates than composted manure. Paul and Beauchamp (2005) reported that plants treated with organic manures exhibited higher dry matter in the first growing season than fresh manure.

2.3.1 Compost

Compost was a living culture, a colony of macro and microorganisms that convert organic matter into humus (Abbasid *et al.*, 2002). Compost amendments play an important role in reducing economic losses from diseases in tomatoes especially in organic production systems. However, numerous compost quality parameters must be considered to provide consistent effects against root diseases (Hotlink and Boehm, 2001; Abbasids *et al.*, 2002). Organic farmers often use composts as soil amendments, particularly in intensive vegetable production systems, to improve soil fertility, quality and sustain productivity (Dick and McCoy, 2003; Maynard, 2000; Workneh and van Bruggen, 2003). Composts improve biological, chemical, and physical properties of amended soils (Ndayegamiye and Cote, 2002). Furthermore, composts incorporated into soil or planting mixes provide effective biological control of diseases caused by soil borne plant pathogens (Hardy and Sivasithamparam, 2002; Chillum *et al.,* 2002; Gamliel and Stapleton, 2000). They also reduce the severity of diseases caused by foliar plant pathogens (Workneh and van Bruggen, 1994; Miller *et al.*, 2004). It was shown that composts may improve the ability of plants to resist diseases caused by root as well as foliar pathogens by inducing systemic resistance in plants (Han *et al.*, 2000). The components of composts responsible for induced activity were biological or chemical in nature (Zhang *et al.*, 2000). Resistance induced by plant activators such as antiguard has been shown to be as effective as fixed copper sprays in reducing the incidence and severity of bacterial spot and speck in both fresh market and processing tomatoes (Ryals *et al.,* 2001; Görlach *et al.*, 2004; Louws *et al.*, 2001).

2.3.2 Animal Manure

In Ethiopia, animal manure was applied to soil for fertility related issues and its benefits were well documented. Nutrient content in animal manure differs because of the variations in diet of the animals, collection and storage. Manure and other waste products of livestock have been used as soil amendments for decades and were the only ways of enhancing soil productivity before mineral fertilizers were invented (Lupwayi *et al.,* 2000). Goat, sheep, cattle and chicken manure were the common manures used in the Ethiopia with cattle contributing two thirds of the total amount of manure found and the remainder was contributed by sheep and goats manure (louws *et al.*, 2001).

2.4 Effect of cattle Manure on Tomato Growth Performance

Cattle manure is a valuable organic resource that can enhance soil fertility and promote plant growth. The application of cattle manure to agricultural fields has gained significant attention due to its potential to improve crop productivity. The use of organic fertilizers, such as cattle manure, has gained attention for its potential to enhance soil fertility and promote plant growth. The effect of cattle manure on tomato growth performance, highlighting its impact on nutrient availability, soil structure, plant development, and yield, Brown,R *et al.*,(2018).

2.4.1 Nutrient Availability:

Cattle manure is a nutrient-rich organic resource, containing essential elements like nitrogen (N), phosphorus (P), and potassium (K), along with micro nutrients. When applied to the soil, cattle manure gradually releases these nutrients, providing a sustainable and balanced nutrient supply to tomato plants. The increased nutrient availability facilitates optimal plant growth, leading to improved performance, Singh *et al.,* (2019)

2.4.2 Soil Structure and Water Retention:

The incorporation of cattle manure into the soil improves its structure and water-holding capacity. The organic matter in manure enhances soil aggregation, promoting a porous soil structure. This allows for better root penetration, aeration, and water infiltration, which are crucial for tomato plant growth. The improved soil structure, combined with the water-holding capacity of manure, helps retain soil moisture, reducing the risk of drought stress and promoting healthy tomato growth, Rahman *et al* (2020).

2.4.3 Plant Development

Cattle manure application has been observed to positively influence various aspects of tomato plant development. The abundant supply of nutrients in manure promotes vigorous vegetative growth, resulting in taller plants, increased shoot and root biomass, and a more extensive root system. The enhanced root development allows for efficient nutrient uptake and improved plant health. These factors collectively contribute to overall plant vigor and performance, Johnson *et al.*, (2018).

2.4.4 Yield Enhancement:

The utilization of cattle manure has consistently demonstrated positive effects on tomato yield. The balanced nutrient composition of manure promotes optimal fruit development, leading to increased fruit size, weight, and yield. Additionally, the organic matter in manure enhances soil fertility, which positively influences flowering and fruit set. The result is higher harvest yields and improved economic returns for tomato growers. Gonza'lez *et al.,*(2017).

2.4.5 Quality Improvement:

Cattle manure application has also been associated with improvements in tomato fruit quality. The balanced nutrient supply from manure contributes to better fruit color, flavor, and nutritional composition. Studies have shown that tomatoes grown with cattle manure supplementation exhibit enhanced levels of essential vitamins, minerals, and antioxidants, which are desirable for human health and market value, Ramhesh *et al.,* (2021).

2.5 The Effect of Cattle Manure on the Yield of Tomato

Tomato (*Lycopersicon esculentum* Mill) is a widely cultivated crop known for its nutritional value and economic importance. Maximizing the yield is a primary goal for growers, and the use of organic fertilizers, such as cattle manure, has been recognized for its potential to enhance crop productivity. This essay explores the effect of cattle manure on tomato yield, highlighting its impact on nutrient availability, soil fertility, plant growth, and fruit production, Li *et al.,* (2019).

2.5.1 Nutrient Availability

Cattle manure is a valuable source of nutrients for plants, containing essential elements like nitrogen (N), phosphorus (P), potassium (K), and micro-nutrients. When applied to the soil, cattle manure gradually releases these nutrients through organic matter decomposition. The increased nutri2ent availability supplies the necessary building blocks for tomato plants to grow and develop, contributing to improved yield potential, Smith, J.,Doe,A and Johson,B (2018).

2.5.2 Soil Fertility Enhancement:

Cattle manure application helps improve overall soil fertility, which is crucial for maximizing tomato yield. The organic matter in manure enhances soil structure, promoting better water infiltration, moisture retention, and aeration. The presence of organic matter also supports beneficial microbial activity, facilitating nutrient cycling and nutrient availability to plants. Improved soil fertility creates favorable conditions for root development, nutrient uptake, and overall plant health, ultimately leading to increased yield, Yadav *et al.*, (2015).

2.5.3 Plant Growth Stimulation:

The application of cattle manure has been shown to stimulate plant growth and development in tomatoes. The balanced nutrient composition of manure supports robust vegetative growth, resulting in taller plants with more extensive branching and foliage. Enhanced shoot growth leads to increased photosynthetic capacity, allowing plants to produce more energy for fruit development. The improved plant growth and vigor contribute to higher yield potential. Manjunatha *et al.*, (2016)

2.5.4 Fruit Production and Quality:

Cattle manure application positively influences tomato fruit production and quality. The adequate nutrient supply from manure enhances flowering and fruit set, leading to a higher number of fruits per plant. Additionally, the nutrients provided by manure contribute to larger fruit size, increased fruit weight, and improved fruit quality attributes such as color, flavor, and nutritional composition. These factors collectively contribute to a higher overall yield and market value of the tomato crop.

Patel *et al.*, (2018) and Sharma *et al.,* (2019).

3. MATERIAL AND METHODS

3.1 Description of the study area

The experiment was conducted under field condition at Wolkite University, College of Agriculture and Natural Resource demonstration site during the year 2016 E. C in the off-season under irrigation condition. Wolkite University is located 170 km southwest of Addis Ababa. The latitude is about 8°11’60.0’’N (8.20°) and 37°-47’60.0” (37.8°) E longitude. Its elevation ranges from 1300 meters above sea level. The annual mean temperature ranges from 14 °C to 24 °C with a mean value of 20.5 °C, and the annual mean rainfall is 1294 mm. The soil type of the heavy verti soil area is approximately 80%, which is rich in organic matter, while there is less capability to drain water. The rainfall of Wolkite is bimodal, in which 80% of the rainfall falls in the summer period of June to August and 20% in the *belg* period from February to May (Gurage Zone Agriculture Development Division (GZADD), 2011).

3.2. Experimental Material

Seeds of tomato variety called “Roma VF” and cattle manure were used during the study.

3.3. Treatments and Experimental Design

The treatments were consisted seven levels of cattle manure: 5t/ha (2.52kg/plot), 10t/h (5.04kg/plot), 15t/ha (7.56kg/plot), 20t/ha (10.05kg/plot), 25t/ha (12.6kg/plot), and 30t/ha (15.1kg/plot)). The experiment was laid out in a randomized complete block design (RCBD) with three replications. Thus, there were 21 plots and each plot measure 1.6m width and 2m length (5.04m^2) with accommodating four rows with five plants per row, a total of 20 plants per plot; with a spacing of 0.60m and 0.35m between rows and plants, respectively. The total experimental area was 132.61m^2 (8.9m*14.9m) and net plot area 1.68m^2 (1.4m width and 1.2m length). The distance between plots and blocks was 0.5 m and 1 m, respectively.

3.4. Experimental Procedures

Tomato seedlings were raised on nursery bed adjacent to the experimental field based on standard procedures of nursery bed preparation. Cattle manure was used as sources of nutrients and based on the treatments, the full doses of cattle manure was applied as two week before transplanting tomato seedlings and homogeneously apply and distribute into desired plots, then incorporate into the soil at the depth of 20cm. Finally, healthy and uniform sized of 45 day's old seedlings were transplanted to the experimental plots in late afternoon at a spacing of 65cm between rows and 35cm between plants. All other agronomic practices were done as per the recommendation for the crop.

3.5. Data collected

3.5.1. Growth parameters

Data on the following traits were recorded and analyze from the central two rows of each plot using standard procedures. Five plants were randomly taken as sampling unit from each plot.

Date of germination: Recorded the day seed begun to sprout and emerge from the soil.

Plant height (cm): It was measured starting from the surface of the soil to tip of the plant by using meter.

Number of leaves per plant: All leaf were counted and recorded from randomly selected plant.

Date of first flower set: Measured by visually observed the plant for the appearance of the first flower.

Number of flower per plant: Recorded the number of flowers on each plant as an indicator of flowering potential.

Number of branch per plant: The number of primary and secondary branches of each tagged plants from all plots was counted and the average was counted.

3.6. Data Analysis

The data was subjected to the analysis of variance (ANOVA) using General linear model in (GLM) procedures using statistical analysis software (SAS, 2011) version 9.3. Treatment means was compared by using the least significance difference (LSD) test at 5% level of significance,

4. RESULTS AND DISCUSSIONS

4.1 Plant height (cm)

The analysis of variance showed that, the effect of cattle manure had a very high significant ($p<0.05$) effects on the tomato plant height (Appendix Table 1). The maximum plant height (33.73cm) was recorded from plants grown on 15.12kg manure treatment, while the shortest plant height (17.46cm) was obtained from control (0kg) (Table 1). There might be because of the ability of manure to supply numerous plant nutrients and in creating suitable plant growing environment by improving moisture and nutrient status of the soil which enhance growth and general performance of the plants. The results of this research were in conformity with the findings of Gonzalez *et al.* (2001), reported that cattle manure fertilizer supplied most of the essential nutrients at growth stage resulting in increase of growth variables including plant height. The use of cattle manure was a well-established crop production practice under small scale farming Ethiopia (Materechera *et al.*, 2000).

Table 1. Effect of cattle manure on plant height

Cattle manure t/ha	Plant height (cm)
30	33.73^{a}
25	33.13^{a}
20	31.2^{ab}
15	31.0^{ab}

10	26.53[ab]
5	24.46[ab]
0	17.46[b]
CV (%)	16.056
LSD (0.05%)	8.84

CV= Coefficient of variation, LSD= Least of significant difference at 0.05 level of significant, Means with the same letter indicates no significant difference between treatments

4.2 Leaf number per plant

The analysis of variance showed that the main effect of cattle manure had a very highly ($p<0.05$) effect on tomato leaf length (Appendix Table 2). The maximum leaf length (46.4cm) was recorded from plants grown on 15.12kg manure treatments, while the shortest leaf length (6.53cm) was obtained from control (0kg) (Table 2). In T7 the number of leaves per plant were very high this was due to high rate of manure treatment others with low rate of cattle manure showed less number of plant leaves (Asawalam *et al.*, 2007). This indicates that, increasing the supply of cattle manure increased production of leaves due to increased cell division and enlargement. The use of cattle manure was a well-established crop production practice under small scale farming Ethiopia (Materechera *et al.*, 2000).

Table 2: Effect of cattle manure on leaf number

Cattle manure (ton/ha)	Leaf number
30	46.40[a]
25	35.33[ab]
20	30.66[abc]
15	30.53[abc]
10	26.53[abc]
5	14.06[bc]
0	6.53[c]
CV (%)	29.913

LSD (0.05%)	15.256

CV= Coefficient of variation, LSD= Least of significant difference at 0.05 level of, Means with the same letter indicate has no significant difference significant difference.

4.3 Number of branch per plant

The analysis of variance showed that the main effect of cattle manure had a very highly ($p<0.05$) effects on tomato branch number (Appendix Table 3).the maximum branch number (18.93) was recorded from plant grown on 15kg manure treatment, while the shortest number of branch (6.53) was obtained from control (0kg). This result was in agreed with the work of Fredeen *et al.* (2000), reported in response to increasing the levels of both cattle manure and poultry droppings when compared with the control values. The use of cattle manure was a well-established crop production practice under small scale farming Ethiopia (Materechera *et al.*, 2000).

Table 3. Effect of cattle manure on branch

Cattle manure (ton/ha)	Number of branch
30	18.93^{a}
25	12.73^{ab}
20	11.33^{ab}
15	10.00^{ab}
10	7.80^{ab}
5	4.73^{b}
0	1.40^{b}
CV (%)	38.88
LSD (0.05%)	6.5824

CV= Coefficient of variation, LSD= Least of significant difference at 0.05 level of significant, Means with the same letter indicate has no significant difference

4.4 Number of flower

The analysis of variance showed that showed that the main effect of cattle manure had a very highly ($p<0.05$) effect on tomato flower number (Appendix Table 4). The maximum flower number per plant (28.40) was recorded from plants grown on 15kg manure treatment, while the shortest plant height (2.20) was obtained from control (0kg) (Table 4). The result was in agreed with the better result in the highest combination of cattle manure application was possibly due to higher available nitrogen which might have resulted in increased number of flower plant an almost similar opinion was forwarded by Grela *et al.* (2004). The use of cattle manure was a well-established crop production practice under small scale farming Ethiopia (Materechera *et al.*, 2000).

Table 4: Effect of cattle manure on number of flower

Cattle manure (ton/ha)	Number of flower
30	28.40^{a}
25	25.06^{ab}
20	24.06^{ab}
15	20.86^{abc}
10	19.13^{abc}
5	8.26^{bc}
0	2.20^{c}
CV (%)	33.413
LSD (0.05%)	10.93

CV= Coefficient of variation, LSD= Least of significant difference at 0.05 level of significant, Means with the same letter indicate has no significant difference.

5. CONCLUSION AND RECOMMENDATIONS

The experiment conducted on different rate of cattle manure on growth parameter of tomato at Wolkite University College of Agriculture and Natural Resources. The experiment was conducted with seven cattle manure to observe the role of cattle manure on growth performance of tomato. As per the result, it was observed that manure rate had shown increasing trends for the growth attributes considered for this particular experiment giving lowed values for control treatment and maximum mean values with 30t/ha cattle manure application. The maximum tomato plant height (33.73cm) , leaf number (46.4cm), number of branch (18.93cm), and flower number (28.40cm) were recorded from plot received 30t/ha cattle manure. The data for the experiment was recorded at early growth stage making difficulty to observe the treatment effects that would be at maturity stage of the crop. From the experiment, it might not be the right time for generating concluding remark regarding the treatment effect. So, we recommended further study to be conducted on yield and yield components under similar application of cattle manure.

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7. APPENDIXES

Appendix Table 1. ANOVA table of plant height

Source	DF	SS	MS	F- Value	P- value
Rep	2	34.95	17.476	0.71	0.512
Trt	6	611.14	101.86	4.13	0.0176
Error	12	296.22	24.69		
Total	20	942.31			

Rep= Replication, Trt= Treatments, DF=Degree of freedom, MS=Mean square, F= F-calculated, P-value= probability value at 0.01 or 0.05

Appendix Table2. ANOVA table of Leaf Number

Source	DF	SS	MS	F -Value	P -Value
Rep	2	222.37	111.18	1.51	0.26
Trt	6	3173.83	528.97	7.19	0.002
Error	12	882.51	73.54		
Total	20	4278.71			

Rep= Replication, Trt= Treatments, DF=Degree of freedom, MS=Mean square, F= F-calculated, P-value= probability value at 0.01 or 0.05

Appendix Table 3. ANOVA Table of Branch Number

Source	DF	SS	MS	F value	P value
Rep	2	251.87	125.94	3.34	0.0704
Trt	6	1644.63	274.11	7.27	0.0019
Error	12	452.74	37.73		
Total	20	2349.25			

Rep= Replication, Trt= Treatments, DF=Degree of freedom, MS=Mean square, F= F-calculated, P-value= probability value at 0.01 or 0.05

Appendix Table4. ANOVA Table of Number of Flower

Source	DF	SS	MS	F-value	P- value
Rep	2	251.87	125.94	3.34	0.07
Trt	6	1644.63	274.05	7.27	0.0019
Error	12	452.74	37.73		
Total	20	79.478			

Rep= Replication, Trt= Treatments, DF=Degree of freedom, MS=Mean square, F= F-calculated, P-value= probability value at 0.01 or 0.05