

## Performance of Mulching to the Stimulation on the Growth of Cucumber (*Cucumis Sativus*) Production

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### Abstract

A field experiment was conducted at Noakhali, Chittagong during the season in 2019, to determine the effect of mulching on cucumber (*Cucumis sativus*) production where Alavy Green variety was used. The study was laid out in RCBD (Randomized complete block design) method having three replications. The treatment used in this study consists of T<sub>1</sub>=Black plastic mulching, T<sub>2</sub>=Water hyacinth mulching, T<sub>3</sub>=Rice straw mulching, Control= no mulching. The plant showed significant differences after application of various treatments. The maximum average length of vine (113 cm), number of branch per plant (8.33), number of leaves per plant (28.44), number of tendrils per plant (11.52), number of flowers per plant (16.33), number of fruits per plant (9), length of fruit (18 cm), weight of individual fruit (239.67 g) were obtained from T<sub>1</sub> treatment (Black plastic mulching). On the other hand, minimum average length of vine (103.91 cm), number of branch per plant (4.33), number of leaves per plant (22.67), number of tendrils per plant (7.33), number of flowers per plant (12.33), number of fruits per plant (4.33), length of fruit (9 cm), weight of individual fruit (173.67 g) were obtained from T<sub>0</sub> control (No mulching). Among organic (Water hyacinth and Rice straw) and inorganic mulches (Black plastic), inorganic mulches gave better performance over organic mulches.

**Keywords:** Cucumber, Mulching, Growth, Development, Yield.



## I. Introduction

In Bangladesh, to meet the vegetable deficiency during the scarce period Cucumber plays a great role which ultimately diminishes the malnutrition problem. Total cultivable land of cucumber is about 22286 acres and total production is approximately 54854 metric tons (Bangladesh Bureau of Statistics, 2014) gained in Bangladesh. It was found effective against human constipation and improvement in digestion. It is eaten as a cooling food in summer and a fresh Cucumber provides vitamin C, niacin, iron, calcium, thiamine, fibre and phosphorus (Maurya, Pal, Singh, & Meena, 2015). In general, Cucumber (*Cucumis sativus L.*) is one of the most popular vegetable of the Cucurbitaceae family (Lower & Edwards, 1986; Thoa, 1998). After tomato, cabbage and onion in Asia (Tatlioglu, 1997) this crop is the fourth vegetable crop. It is an annual crop which leaves are alternate, simple and triangular-ovate with 3-7 lobed leaf blades, deeply cordate at the base. Besides the vines that are sparingly branched are produced from stem that are certainly creeping type which roots in the ground grows up trellises or other supporting frames, wrapping around supports with thin, spiralling tendrils (Mariod, Mirghani, & Hussein, 2017). The Cucumber plant can also root in a soilless medium and sprawl along the ground if it does not have supports around it. The farmers of Cumilla, Bogra, Rangpur, Noakhali, Faridpur, Chittagong and Mymensingh districts in Bangladesh are grow cucumber commercially. It is enlisted as a profitable business due to its relatively higher net return per hectare cost. Since the soil and climatic condition of Bangladesh are compatible to cultivate cucumber exponentially, it is expected the selection of high yielding varieties will augment the yield considerably. Indeed there is a vast scope to increment production with the introduction of high yielding varieties. Mulching is a technique that has been applied by vegetable growers for many years and prescribed to use either organic or inorganic materials. To help farmers to obtain their production goals such as earliness, soil moisture retention, improved quality, weed control and increased yields several kinds of soil and plant mulching materials are available (Mutetwa & Mtaita, 2014). Besides, mulches, as a natural or synthetic substances cover the soil surface to protect and flourish its quality in landscapes (Cregg & Schutzki, 2009). However, the bare soil revealed to heat and the wind loses water through evaporation while using mulches increases the soils water retention capacity, reduces evaporation and number of weeds as well (Plekhanova & Petrova, 2000) even it moderates soil moisture and temperature (Skroch, Powell, Bilderback, & Henry, 1992) also. Usage of different kinds of mulches such as black polythene, rice straw, water hyacinth, saw dust, leaves, hay, shredded bark, shells, woodchips, newspaper, cardboard etc. has been reported to have developed fruit quality (Brown & Channell-Butcher, 2001), increased growth and subsequent yield. Among all of the mulching materials black polythene and rice straw water hyacinth are profitable and available in our country, Bangladesh. Black plastic mulch is the most popular one because it suppresses weed growth and warms up the soil during the spring. Moreover the black plastic mulch helps in the harvesting earlier in addition to reduce soil water losses. Thus the study was conducted to found out the effects of these several mulching on cucumber production mainly on its growth, development and yield performances.

## 2. Methodology

### 2.1 Experimental Site

On the basis of the potentiality, the experiment had been done at Navogram Farm in Mannan Nagar union which is situated at sadar upazila in, Noakhali 2019 that is fall under the Agroecological Zone (AEZ) 18 i.e. Young Meghna Estuarine Floodplain, annually inundated and fertilized by silt deposit from the Meghna estuary (Figure 1). As it was located in the tropical climatic zone where the average annual temperature is 25.6°C and about 2980 mm precipitation falls annually. The average maximum temperature during September to December is 28.1°C which was suitable for cucumber production at that region in Bangladesh. (Table 1). The soil of the experimental plots was sandy loam in texture, medium high land and it was moderately alkaline with pH value 7.3 - 8.3 with salinity >2 dS/m, Organic matter 0.64%, Nitrogen 0.04%, Phosphorus 27.27%, Potassium 0.18% individually. Physical and Chemical characteristics of soil in research plots were noted from Soil Resource and Development Institute (SRDI)



Figure 1. Map Showing the Research Site

Table I. Monthly Average Climatic Condition of the Experimental Site during the Research

Month	Temperature (OC)			Relative humidity %	Total Rain fall (mm)
	Maximum	Minimum	Average		
September	32	26	29	89.25	60.5
October	34	25	28	83.75	100.25
November	32	17.9	28	80	3.25
December	26.1	15.5	20.8	56.5	00

Source: Weather Station of Noakhali District, Bangladesh

## 2.2 Experimental Materials

The material used in the research was Alavy Green variety of cucumber which was collected from Bangladesh Agricultural Research Institute (BARI). For mulching certainly three types such as black plastic, water hyacinth, rice straw were used. Organic and inorganic fertilizer, pesticide and other materials were collected from Dotterhat Seed Ghor in Noakhali.

## 2.3 Experimental Design and Treatment

The experiment was arranged in Randomized Complete Block Design (RCBD) with three replications. In this experiment, four treatments were considered as following-

- T<sub>0</sub>(Control): No mulching
- T<sub>1</sub>: Black plastic mulching.
- T<sub>2</sub>: Water hyacinth mulching.
- T<sub>3</sub>: Rice straw mulching.

## 2.4 Land Preparation

The selected land for the experiment was ploughed at first day of September in 2019 than it was kept open to sun for 4 days prior to further ploughing. Eventually, the land was prepared well by ploughing and cross ploughing followed by well laddering. The unit plots were prepared by keeping 1 m spacing in between two plots and 50 cm draining channel was dug around the

land. There were three pits in every plot. The length and breadth of each pit was 30 cm and 30 cm respectively. Pits were 20 cm depth and 45 cm distance from the border of the plots.

### 2.5 Seed Sowing and Fertilizers Application

The seeds were sown directly in the pit where three seeds were sown in each pit at 2 to 3 cm depth. Different mulching materials were applied after 10 days of seed emergence. Manures and fertilizers applied uniformly in the experimental plots and pits as per following doses (Table 2) in accordance with the recommended dose.

Table 2. Fertilizers Doses Applied on the Research Field

Fertilizers	Recommended Dose	
	Dose per Plot	Dose per Pit
Cowdung	6 kg	1 kg
Urea	90 g	15 g
Triple Super Phosphate	75 g	12.5 g
Murate of Potash	60 g	10

### 2.6 Intercultural Operations

Weeding was done whenever necessary to keep the crop free from weeds. When the seedlings were established, staking was given to each plant. For proper growth and development of the plants the vines were managed upward by hand and with the help of iron rope and nylon net. Light over-head watered were provided with a watering can to the plots immediately after germination of seedlings. The un-mulched plot had to be watered more frequently than the mulch plots.

### 2.7 Data Collection

Length of main vine, no. of lateral branches/ plant, no. leaves/ plant, no. tendrils/plant, no. of flowers/plant, no. of fruits/plant, individual fruit weight, fruit length parameters data were recorded from the experimental plot (from the plant with: Black plastic mulching, Water hyacinth mulching, Rice straw mulching, No mulching and pruning)

### 2.8 Experimental Design

The experiment was laid in the Randomized Complete Block Design (RCBD) with one variety and 4 treatments and the experiment was replicated 3 times.

### 2.9 Statistical Analysis

The recorded data on the different parameters of the study were analyzed statistically using Analysis of Variance (ANOVA) procedure by F test (Gomez & Gomez, 1984)  $P < 0.05$  was considered statistically significant.

## 3. Result and Discussion

### 3.1 Length of Main Vine (cm)

Length of main vine varied significantly due to the application of treatments on cucumber plant. Average lengths of main vine were 113 cm, 107.97cm, 105.98cm and 103.91cm respectively for  $T_1$ ,  $T_2$ ,  $T_3$  and  $T_0$ . The highest value recorded at  $T_1$  treatment which was 113cm whereas the lowest value observed in  $T_0$  treatment (Figure 2). Similar results were found where Ajibola and Amujoyegbe (2019) recorded highest length of cucumber (113.21 cm) after application of black plastic mulch in their works.

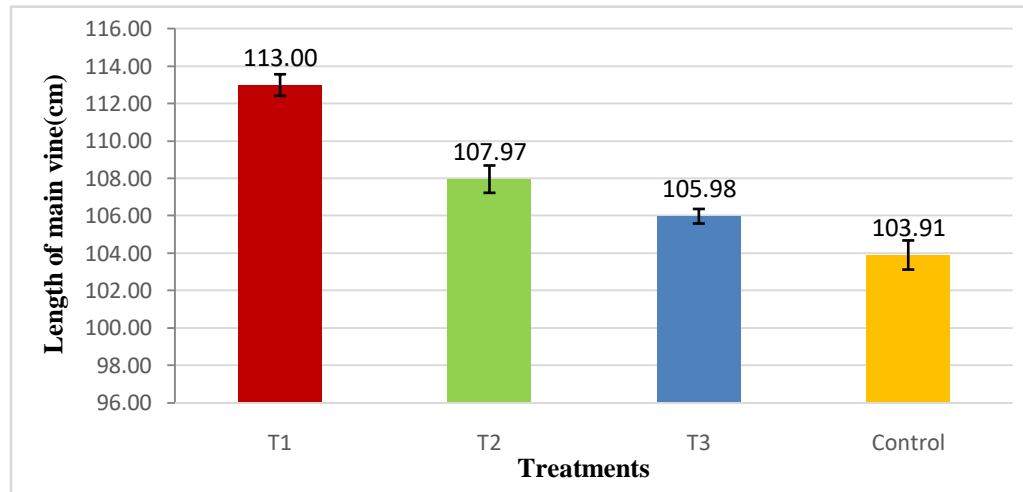


Figure 2. Effects of Different Treatments on the Length of Main Vine (cm)

### 3.2 No. of Branches per Plant

Application of different treatments (black plastic mulching, water hyacinth mulching, rice straw mulching and no mulching) show significant ( $P < 0.05$ ) variation on the number of branches produced in each plant. From Figure.3, the average no. of branches was 8.33, 6.83, 5.50 and 4.33 respectively for the treatment of T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>. The topmost value was observed for T<sub>1</sub> i.e. 8.33 and minimum value obtained for T<sub>0</sub> that was 4.33. This agreement is similar to the experiment of [Ajibola and Amujoyegbe \(2019\)](#) where they got highest number of lateral branches (5.68) after application of black plastic mulch.

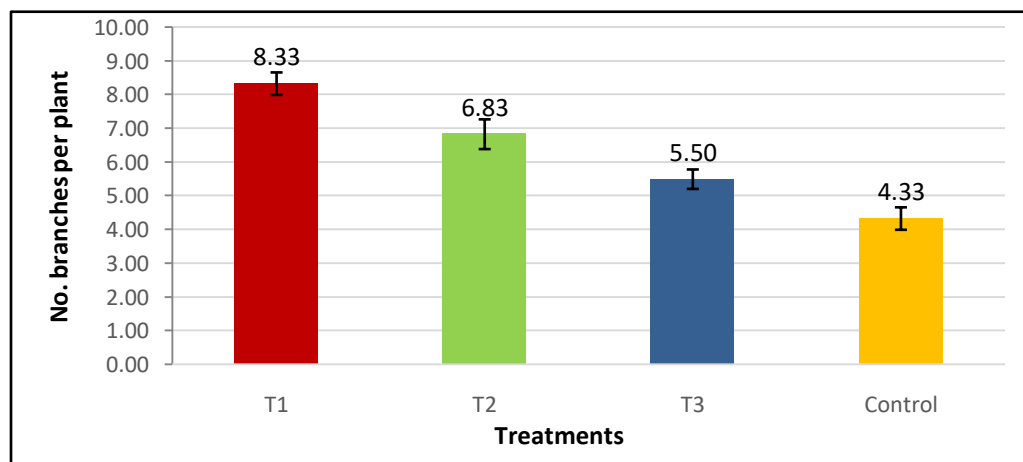


Figure 3. Effects of Different Treatments on the Number of Branches per plant

### 3.3 No. of Leaves per Plant

Figure.4 was illustrated that the maximum value obtained for T<sub>1</sub> (black plastic mulching) was 28.33 while the minimum value found from T<sub>0</sub> (no mulching method) treatments which was 22.67. [Ajibola and Amujoyegbe \(2019\)](#) support the current result as they also found highest number of leaves in each plant after application of black plastic mulch.

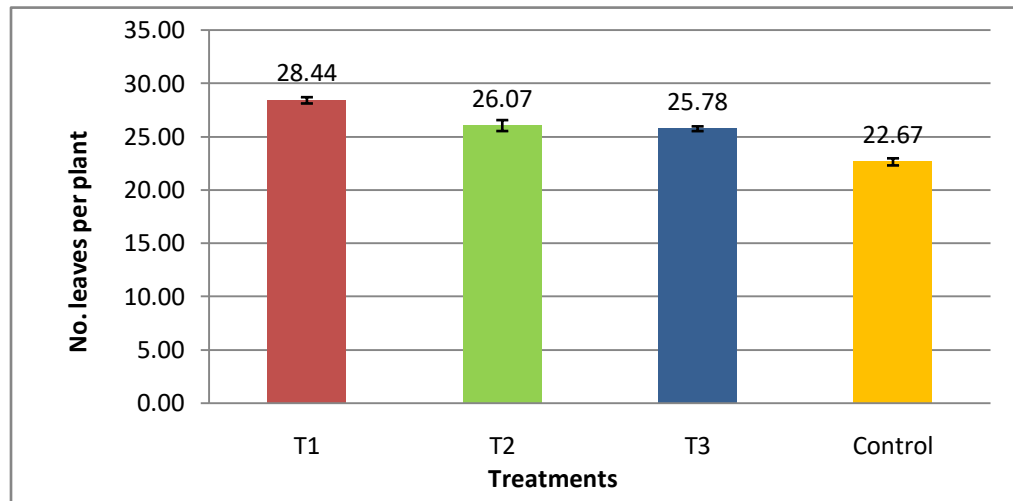


Figure 4. Effects of Different Treatments on Leaves Number per Plant

### 3.4 Number of Tendrils per Plant

In case of tendrils number different mulching materials exhibited significant ( $p < 0.05$ ) variation. Figure 5 showed that the highest number of tendril observed for T<sub>1</sub> i.e. 11.52 whereas lowest obtained for T<sub>0</sub> treatment that was 7.33. Similar result revealed in [Ajibola and Amujoyegbe \(2019\)](#) studies.

### 3.5 Number of Flowers per Plant

A significant ( $p < 0.05$ ) different was observed on the production of flower per plant where the average number of flowers per plant were 16.33, 15.67, 14.00 and 12.33 individually for all treatments (Figure 6). However, the treatment of T<sub>1</sub> produced maximum number (16.33) in comparison with other treatments and the minimum (12.33) was recorded in T<sub>0</sub> treatment (no mulching). It was confirmed by [Wien, Minotti, and Grubinger \(1993\)](#) who reported that mulching increased number of flower cluster on main branches and secondary branches compared with no mulch.

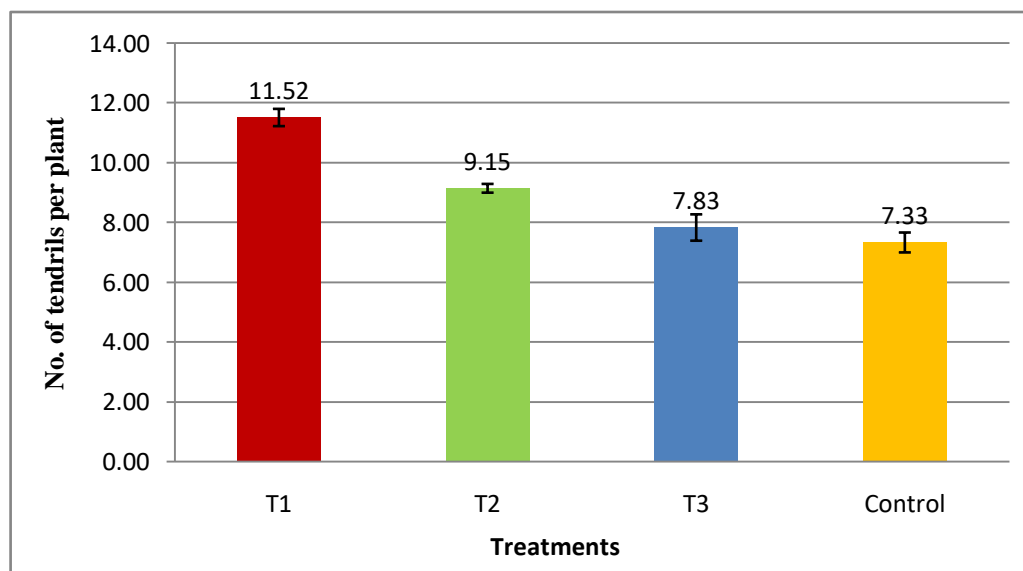


Figure 5. Effects of Different Treatments on Tendril Numbers per Plant

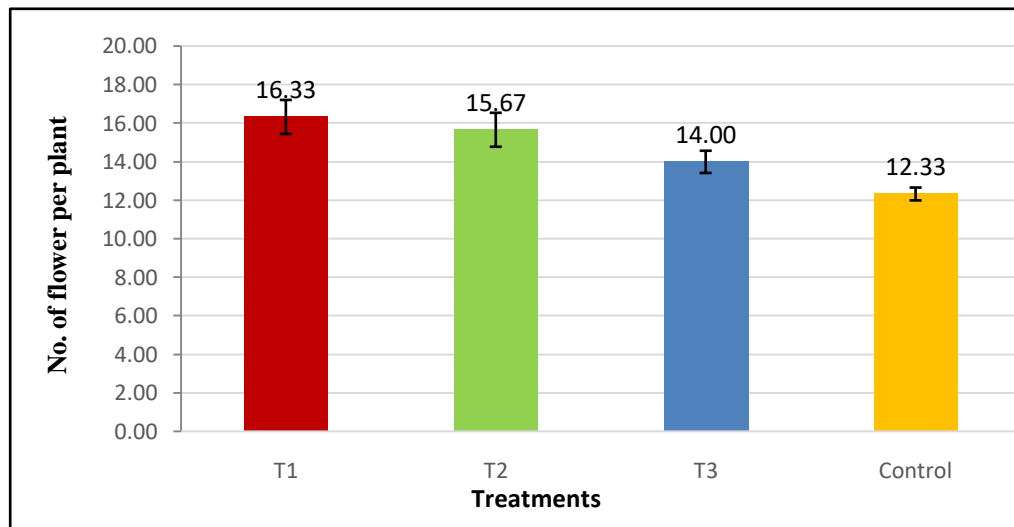


Figure 6. Effects of Different Treatments on Flower Number Per Plant

### 3.6 No. of Fruits per Plant

Significant variation ( $P < 0.05$ ) was seen due to the application of mulching materials in case of fruits number. The maximum fruits obtained for  $T_1$  treatment which was 8.78 and minimum number found from  $T_0$  treatment (no mulching method) that was 4.17 (Figure.7) [Nair, Carpenter, and Weieneth \(2013\)](#) were agreed with the provided result as they also got similar outcome by using black plastic mulch which gave maximum fruits in their research works.

### 3.7 Weight of Individual Fruit (g)

The average weight of individual fruit were 239.67 g, 212.00 g, 192.67 g and 173.67 g respectively for black plastic mulching ( $T_1$ ), water hyacinth mulching ( $T_2$ ), rice straw mulching ( $T_3$ ) and no mulching ( $T_0$ ) treatments used in the experiment. The highest weight obtained 239.67 g for  $T_1$  and on the other hand the lowest weight was found from  $T_0$  treatment which was 173.67 g (Figure 8) which is clarified by [Nair et al. \(2013\)](#) where they claimed that using of black plastic mulch gave highest weight of fruit.

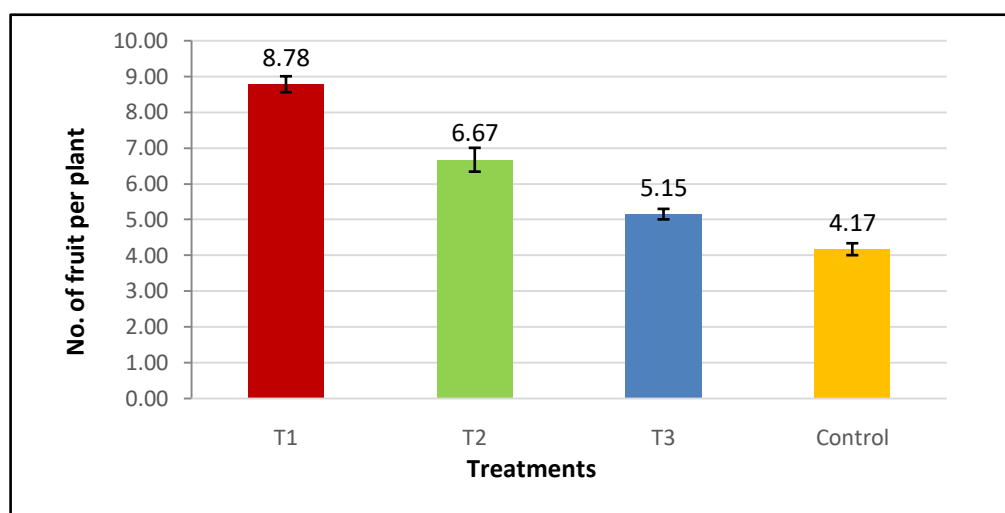


Figure 7. Effects of Different Treatments on the Number of Fruits per Plant

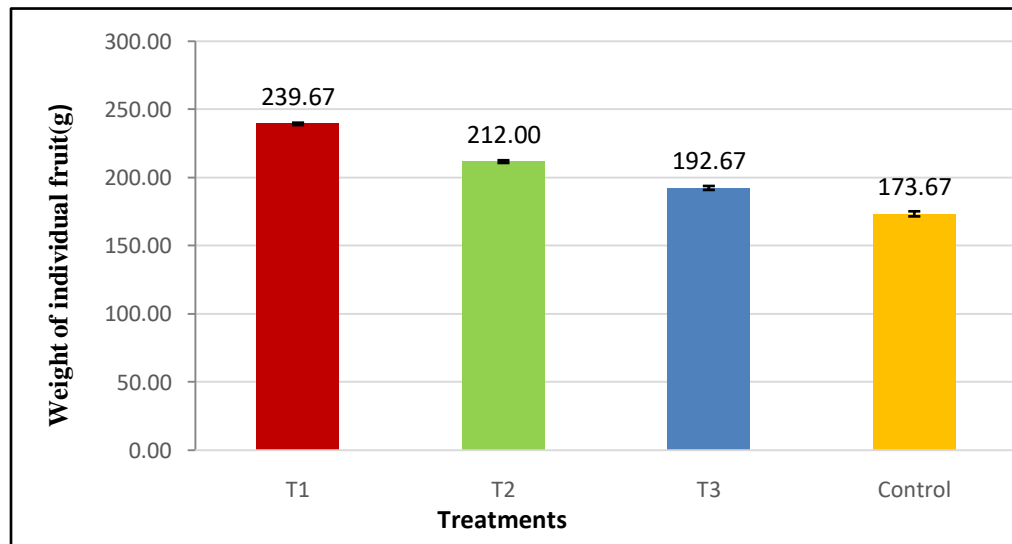


Figure 8. Effects of Different Treatments on Weight of Individual Fruit (g)

### 3.8 Length of Fruit (cm)

Length of each fruit varied significantly due to the application of different mulching materials on cucumber plant where the highest length obtained 18cm for T1 treatment and lowest length recorded 9 cm for T0 (Figure 9). Both [Ajibola and Amujoyegbe \(2019\)](#) and [Nair et al. \(2013\)](#) conducted research were agreed with the results of the current experiment as they also found black plastic mulch was better than other materials to get highest length of fruits in cucumber.

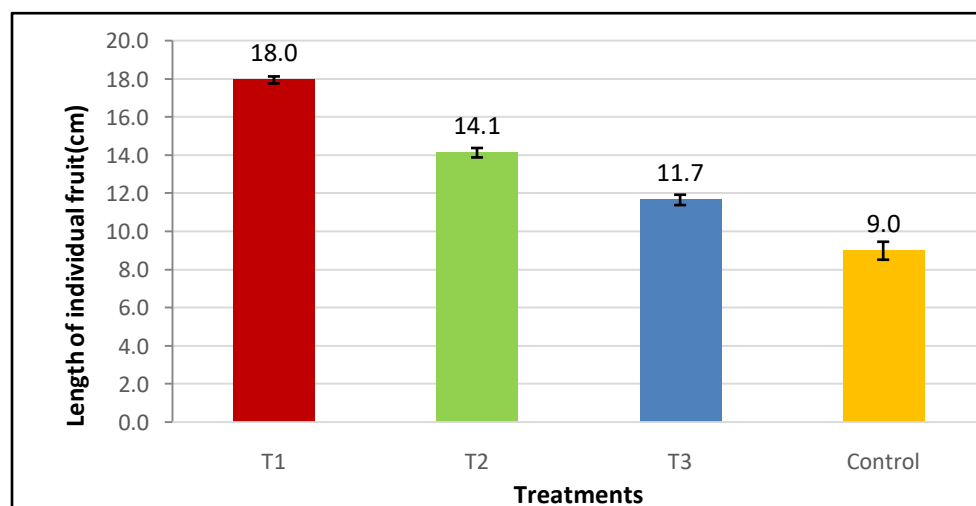


Figure 9. Effects of Different Treatments on the Length of Individual Fruit (cm)

## 4. Conclusion

Some cultural practices such as mulching can be used for cucumber production. It is the practice of covering the soil to make more favourable condition for plant growth, development and efficient crop production. Water hyacinth, straw, saw dust, rice husk and black polythene are available to the farmers and resulted in reduced soil water loss by evaporation and controlling weeds. All treatments used in the experiment showed significant variation on the growth and yield contributing parameters. After the study, it can be said that if farmers used proper mulching, it will give maximum growth and yield per stated area. From the study it can be recommended that application of different mulches in cucumber production will provide economically viable results as compared to no mulch condition.



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