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Effects of organic manures and chemical fertilizers on the yield and quality parameters of Brinjal (Pusa purple long) under the agro-climatic conditions of Kanpur

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Abstract

A field study was conducted during summer season of 2022-23 at horticultural field of Rama University, Kanpur India to evaluate "Effects of organic manures and chemical fertilizers on the yield and quality parameters of Brinjal (Pusa purple long) under the Agro-climatic conditions of Kanpur". The experiment was laid out in RBD considering eight treatments replicated thrice. Three different organic manures viz., cowdung, poultry manure and mustard oil cake were used alone and in different combinations and doses with chemical fertilizers. The variety Pusa Purple Long was selected and the combinations of treatment were T₁ (Cowdung); T₂ (Mustard oil cake); T₃ (Poultry manure); T₄ (Chemical fertilizer); T₅ (50% Poultry manure+50% Cowdung); T₆ (50% Mustard oil cake +50% Poultry manure); T₇ (30% mustard oil cake+40% Cowdung+ 30% Poultry manure); T₈ (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+40% chemical fertilizer). All the organic manures, chemical fertilizers and their combinations were applied at the time of transplanting of brinjal in the plot according to the doses that is to be applied in the plot. Among all the treatments, it is noticed that the growth, yield and yield attributing parameters like plant height, numbers of leaves per plant, number of branches per plant, fruit length, fruit diameter, fruit weight, fruit yield per plant, fruit yield per plot, total yield, and quality parameters like total soluble solids, sugar content, reducing sugar and vitamin C content in fruit were found maximum in treatment T₈ (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) and the minimum being recorded in T₁ (Cowdung). So based on the result it could be concluded that the applications of the organic manures and their combinations with chemical fertilizers (20% cowdung+20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) favourably affect the growth, yield, yield attributing characters and quality parameters of brinjal cv. Pusa purple long.

Keywords: Manure, fertilizer, yield, Brinjal (Pusa purple long), quality parameters

Introduction

Brinjal (*Solanum melongena* L.) popularly known as eggplant having chromosome number of 2n= 24 belongs to nightshade family Solanaceae which is originated native to India. This family includes many crops like tomato, capsicum, potato etc. *Solanum melongena* is grown world wide. The color is normally purple and green. The shape and size differs according to the cultivars i.e. elongated, long, round. The fruit type is berry and the small seeds are present within it. Pusa purple long variety of brinjal is an early maturing and long fruited type variety. Fruits are gloomy, smooth, tender and light purple in color. The size of fruits is 25 – 30 cm long. This variety is suitable to grow in spring and autumn season and is ready for picking in 100 to 110 days.

Eggplant prefers hot weather, and when grown in cold climates or in areas with low humidity, the plants fail to set and produce mature fruit. Brinjal is susceptible to severe frost. A long and warm growing season with temperature range of 21-27 °C is most favourable for its successful production. Climatic conditions especially low temperature during the cool season cause abnormal development of the ovary (Splitting) in flower buds which then differentiate and develop into deformed fruits during that season. The soil should be deep, fertile and well drained. The soil pH should not be more than 5.5 to 6.0 for its better growth and development. In world maximum area and production of brinjal India ranks second position after China (36.55 MT) Brinjal as a vegetable is grown over 7.58 million hectares area in India with the annual production of 13.15 million tonne ha⁻¹ (HSD, 2020/21 West Bengal, Karnataka, Bihar,

India for brinjal Maharashtra, UP, AP are most growing state and West Bengal is the highest producer of brinjal followed by Maharashtra and Bihar.

Raw eggplant contains 92% water, 9% dietary fiber, 6% carbohydrates, 2% protein, 2.35- 3.53g sugar, and has negligible fat (0.18 – 0.20g). It provides low amounts of essential nutrients (Ca, Fe, Mg, p, k, Zn) with only manganese having a moderate percentage 11% of the daily value. According to Sowinska and Krygier (2013), eggplants contain low calorie and high nutrient. Gandhi and Sundari (2012) described that eggplant can also be utilized as medicine to reduce cholesterol in blood and it is suitable as diet to regulate hypertension. Owing to high nutrient content of the eggplant, it is presumed that the demand of eggplant will increase, so that the production should be increased as well (Sowinska and Krygier, 2013). As brinjal contains appropriate amounts of nutrients is most helpful in the medicinal point of view too. As brinjal is rich in anthocyanin compounds which has significant role against diabetes, neuronal problem, cardiovascular disorders, and cancer as well. The major phenolic compound chlorogenic acid which is found in the skin of brinjal works as anti-obesity, anti-inflammatory, anti-diabetic agent. For the treatment of stomach bloating, gas, dry brinjal are beneficial whereas when the consumption of fresh fruits helps in strengthening the bones, control diabetes, prevent paralysis and also helpful in the teeth relating. This two cultivar of brinjal (Chinese round and purple dark shade) are grown for ornamental and beautification purpose and are considered as a love of symbol in many parts of India and in USA. It is explained as apples of love. The shady species of brinjal are used for cosmetic purpose by high culture female of China as a fashion and also use to color the teeth.

Nitrogen is an essential part of proteins and nucleic acids, as well as of the chlorophyll molecule (Taiz and Zeiger, 2004). The absence of N in nutrient solution negatively affects stem and new leaves growth in brinjal. Phosphorus plays an important role in energy transfer in cells, respiration, and photosynthesis, besides being a structural component of nucleic acids, as well as of several coenzymes, phosphoproteins, and phospholipids (Grant *et al.*, 2001). Phosphorus deficiency reduces productivity, as it induces flower abscission. Organic nutrition, although used for thousands of years in agricultural soils, has only recently been on the spot due to its positive effects over physical, chemical, and biological soil properties (Santos *et al.*, 2001). The remarkable potential growth of organic production worldwide has also contributed to this momentum.

Among the organic manures used in vegetable production, livestock manures stand out due to their positive effects on soil conditioning and nutrient availability, especially N. The amount of livestock manure recommended for growing brinjal varies usually from 5 to 40 t/ha (Reis *et al.*, 2007). FYM consist of partially rotted straw of plants, urine and faeces. It improves soil physical properties such as water holding capacity, erosion stability and gas exchange (Nyangani, 2010). The cost of commercial fertilizers are higher so that the importance of farm yard manure as organic fertilizer is being realizing nowadays. FYM not only supplies a lot of macro and micro nutrients to the soil, but also plays important role in the improvement of the physical, chemical and biological properties of the soil. Conventional FYM contains about 0.73% N₂, 0.18% P₂O₅ and 0.71% K₂O (Tolessa and Friesen, 2001). In India, farm yard manure is the most

important organic manure. It is made from animal excreta (cow dung and goat droppings). Cattle manure is the good source of nitrogen and organic carbon and goat manure is nitrogen and potash. It is estimated that about 3.88 million tones of nutrients are available from farmyard manure (SOBOAFI, 2019/20).

Both organic manure and chemical fertilizer are most important factor for higher yield. While excessive use of chemical fertilizers negatively affects the quality as well as yield of agricultural crops including Brinjal. The appropriate dose of chemical fertilizers is required for the optimum performance of the crop. Thus, this study will help to determine the appropriate dose of Nitrogen, Phosphorus and potassium and other nutrients for brinjal to some extent.

Material and Method

The experiment was carried out in a Randomized Block Design (RBD) from Feb 2022 to June 2022 at the Horticulture Farm of Rama University, Mandhana Kanpur, India. The test crop was brinjal (cv. pusa purple long). The treatments, were T₁ (Cowdung 25t/ha), T₂(mustard oil cake 1600kg/ha), T₃ (poultry manure 9t/ha), T₄ (chemical fertilizers urea, TSP and MoP 150:100:50 kg/ha), T₅ (50% poultry manure + 50% cowdung), T₆ (50% mustard oil cake + 50% poultry manure), T₇ (30% mustard oil cake + 40% cowdung + 30% poultry manure) and T₈ (20% cowdung + 20% mustard oilcake + 20% poultry manure+ 40% NPK fertilizers). The experimental field of 130 m². The total length of the field is 15.5m and width is 5.0m. The experiment was laid out in factorial RBD considering organic matter and chemical fertilizers as factors. They were evaluated under RBD design with 3 replications and 8 treatments. There were 24 plots and the size of the plot is 2.40×1.20 m. In each plot, 16 saplings were planted. The space between rows is 60×30 cm and plant to plant is 30×30 cm. the main irrigation channel is 1 m and field border is also 1m.

The collected data were entered in Excel and analyzed statistically by F-test to examine the treatment effects and the mean differences were judged by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

Result and Discussion

The result of present work experiment entitled "Effects of organic manures and chemical fertilizers on the yield and quality parameters of Brinjal under the Agro-Climatic Conditions of Kanpur" was conducted at Horticultural Field of Rama University, Kanpur, India during Feb to June 2022 to evaluate the effect of organic and inorganic fertilizers on the yield of brinjal cv. PPL. were presented below.

1. Effect of organic manures and their combinations with chemical fertilizers on vegetative growth of Brinjal

The plant height is measured maximum in T₈ (89.92 cm) (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) followed by T₆ (50% Mustard oil cake +50% Poultry manure) whereas the minimum height of plant is recorded in T₁ (82.23 cm) (100% cowdung). The number of branches per plant was (3.97) which was recorded from the treatment T₈ containing 20% cowdung + 20% mustard oil cake + 20% poultry manure + 40% fertilizers followed by T₆ (3.36). Whereas, the lowest branching (1.49) were found with T₁ (cowdung). Similarly the maximum number of leaves per plant is recorded in T₈

(61.31) (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) followed by T₆ (59.33) and minimum in T₁ (55.74).

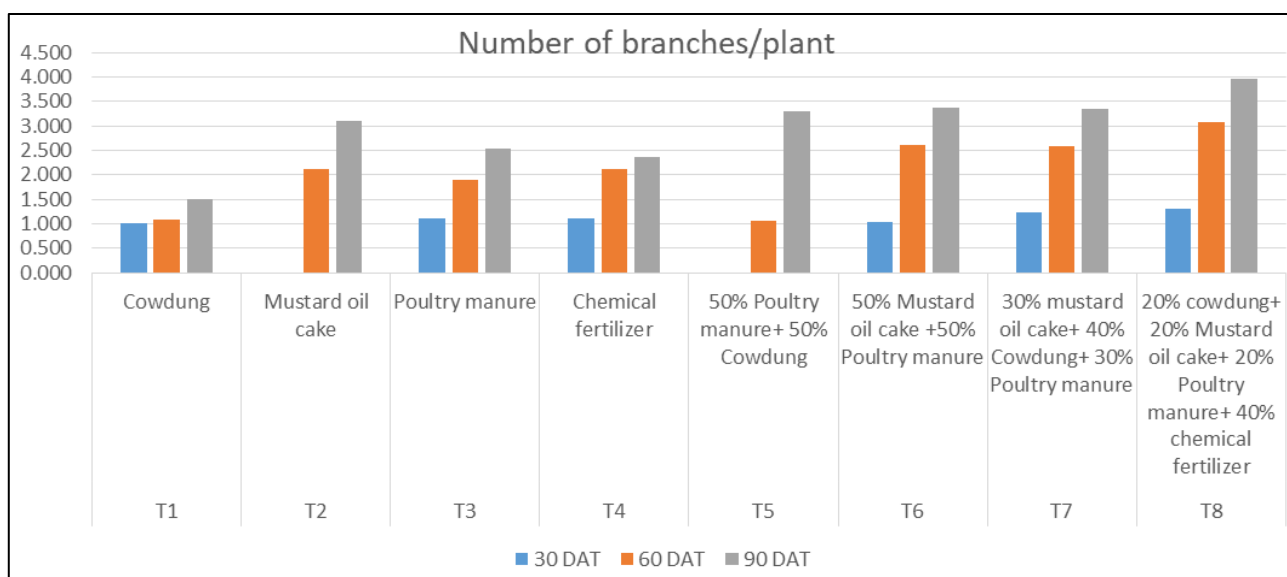
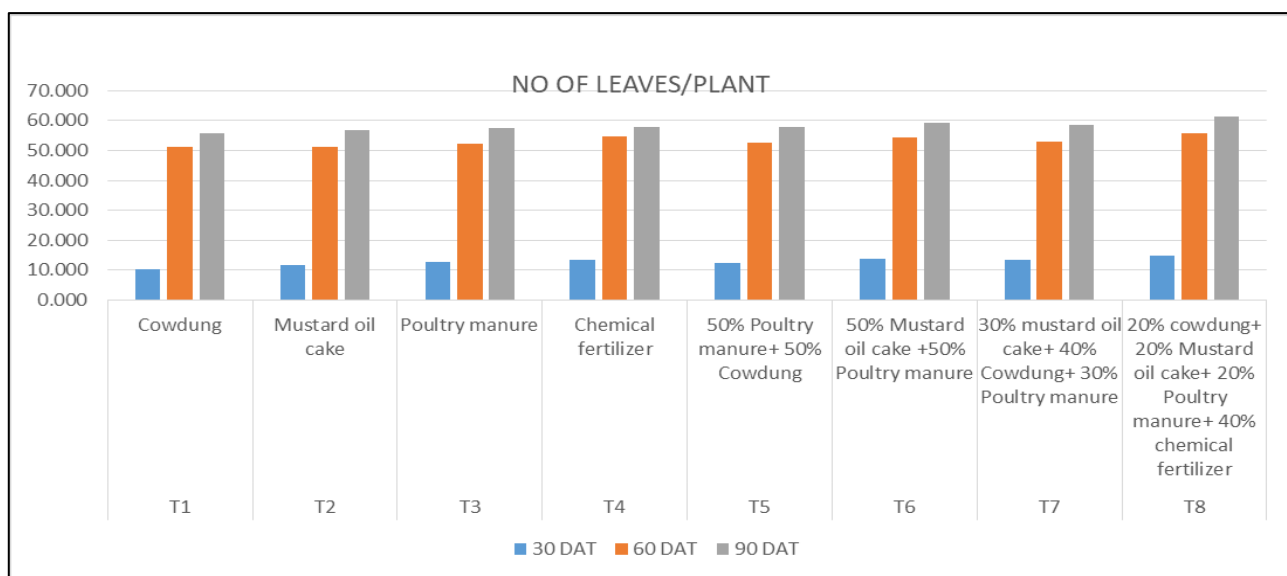
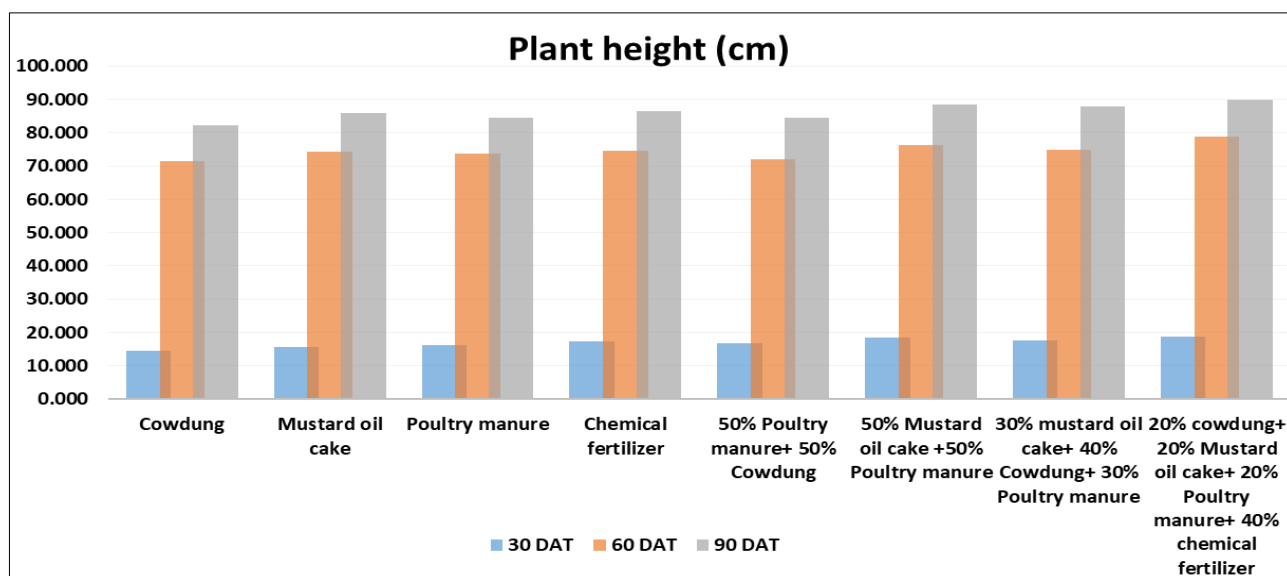


Fig 1: Effect of organic manure and their combinations with chemical fertilizers on vegetative parameter

Table 1: Effect of organic manure and their combinations with chemical fertilizers on vegetative parameter

| Effect of organic manure and their combinations with chemical fertilizers on vegetative parameter | | | | | | | | | | |
|---|--|-------------------|--------|--------|--------------------------|--------|--------|------------------------|--------|--------|
| | Treatment Combinations | Plant Height (cm) | | | Number of branches/plant | | | Number of leaves/plant | | |
| | | 30 DAT | 60 DAT | 90 DAT | 30 DAT | 60 DAT | 90 DAT | 30 DAT | 60 DAT | 90 DAT |
| T ₁ | Cowdung | 14.52 | 71.56 | 82.23 | 1.00 | 1.09 | 1.49 | 10.38 | 51.23 | 55.74 |
| T ₂ | Mustard oil cake | 15.66 | 74.36 | 85.93 | 1.20 | 2.11 | 3.11 | 11.63 | 51.24 | 56.84 |
| T ₃ | Poultry manure | 16.27 | 73.69 | 84.41 | 1.10 | 1.90 | 2.54 | 12.60 | 52.41 | 57.46 |
| T ₄ | Chemical fertilizer | 17.34 | 74.43 | 86.46 | 1.12 | 2.11 | 2.37 | 13.45 | 54.66 | 57.80 |
| T ₅ | 50% Poultry manure+ 50% Cowdung | 16.61 | 72.13 | 84.49 | 1.01 | 1.06 | 3.30 | 12.58 | 52.59 | 57.83 |
| T ₆ | 50% Mustard oil cake +50% Poultry manure | 18.37 | 76.20 | 88.46 | 1.03 | 2.61 | 3.36 | 13.71 | 54.22 | 59.33 |
| T ₇ | 30% mustard oil cake+ 40% Cowdung+ 30% Poultry manure | 17.52 | 74.97 | 87.93 | 1.23 | 2.59 | 3.34 | 13.45 | 52.88 | 58.47 |
| T ₈ | 20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer | 18.82 | 78.73 | 89.93 | 1.31 | 3.07 | 3.97 | 14.69 | 55.90 | 61.31 |
| | CD | 1.43 | 1.20 | 1.60 | 0.05 | 0.09 | 0.80 | 1.40 | 1.88 | 1.54 |
| | SE (m) | 0.38 | 0.32 | 0.43 | 0.01 | 0.02 | 0.21 | 0.38 | 0.50 | 0.41 |

2. Effect of organic manures and their combinations with chemical fertilizers on reproductive parameter of Brinjal

The maximum number of flowers per plant observed at 60 DAT was produced by T₈ (35.23) (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) followed by T₆ treatment (34.97). The maximum length of fruits (28.98) was found in T₈ (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) and minimum in T₁ (22.31). The fruit diameter diameter (5.62 cm) was reported maximum in T₈ (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) while minimum fruit diameter (4.17 cm) was recorded in T₁. The maximum weight of fruit (80.26

g) was found in T₈ (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) and minimum in T₁ (70.05 g). The fruit weight per plant 1.087 kg was obtained from T₈ (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) treatment and minimum in T₁ (0.603 kg). The fruit weight per plot 17.35 kg was obtained from T₈ (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) treatment and minimum in T₁ (9.61 kg). The total yield 25.85 t/ha was obtained from T₈ (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) treatment and minimum in T₁ (18.60 t/ha).

Table 2: Effect of organic manures and their combinations with chemical fertilizers on reproductive parameter of Brinjal

| Effect of organic manure and their combinations with chemical fertilizers on reproductive parameters | | | | | | | |
|--|--|-------------------|---------------------|-----------------|-------------------------|------------------------|-----------------------------|
| Symbol | Treatments combinations | Fruit length (cm) | Fruit diameter (cm) | Fruit yield (g) | Fruit yield/ plant (kg) | Fruit yield/ plot (kg) | Fruit yield/ hectare (t/ha) |
| T ₁ | Cowdung | 22.31 | 4.17 | 70.1 | 0.6 | 9.61 | 18.6 |
| T ₂ | Mustard oil cake | 22.47 | 4.32 | 71.5 | 0.78 | 12.6 | 19.2 |
| T ₃ | Poultry manure | 23.15 | 4.47 | 74.6 | 0.81 | 13.1 | 21.1 |
| T ₄ | Chemical fertilizer | 24.67 | 5.01 | 75.9 | 0.98 | 15.6 | 24.9 |
| T ₅ | 50% Poultry manure+ 50% Cowdung | 25.24 | 5.11 | 77.7 | 0.86 | 13.7 | 20.6 |
| T ₆ | 50% Mustard oil cake +50% Poultry manure | 26.42 | 5.3 | 78.4 | 0.92 | 14.6 | 23.9 |
| T ₇ | 30% mustard oil cake+ 40% Cowdung+ 30% Poultry manure | 24.86 | 5.38 | 78.6 | 1.02 | 16.4 | 23.5 |
| T ₈ | 20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer | 28.98 | 5.62 | 80.3 | 1.09 | 17.4 | 25.9 |
| | CD | 0.283 | 0.81 | 0.51 | 0.02 | 0.4 | 0.34 |
| | SE (m) | 0.076 | 0.29 | 0.14 | 0.01 | 0.02 | 0.02 |

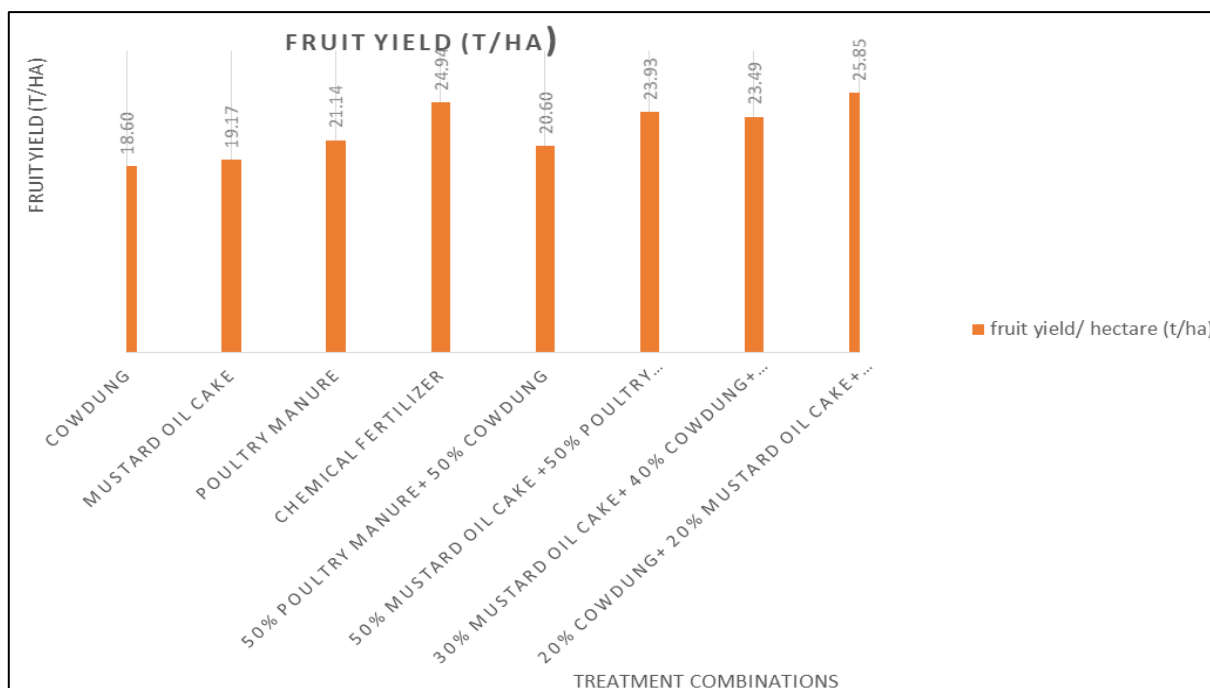
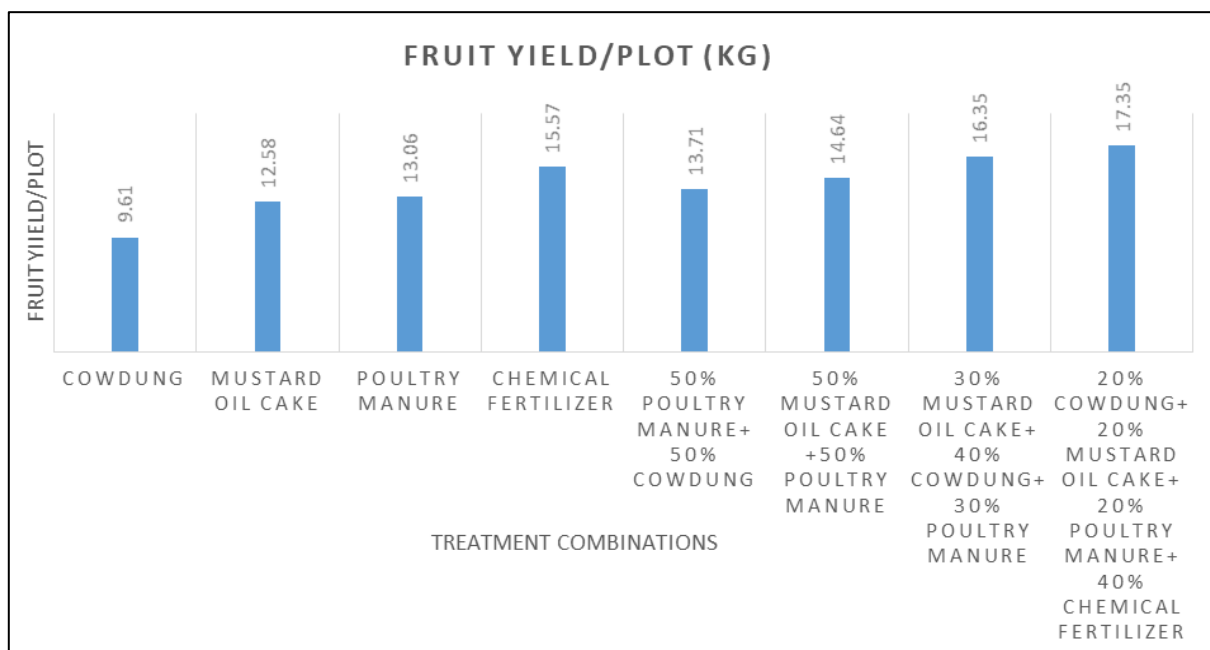


Fig 2: Effect of organic manures and their combinations with chemical fertilizers on fruit yield/plot and total yield (ton/ha)

3. Effect of organic manures and their combinations with chemical fertilizers on quality parameter of Brinjal

Total soluble solid (TSS) was recorded maximum (6.21 0 brix) in T₈ (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) treatment and followed by T₇ (30% mustard oil cake+ 40% Cowdung+ 30% Poultry manure) and minimum (5.48 0 brix) in T₁ (cowdung). The maximum sugar content (1.623%) found in T₈ (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) and minimum Of 2.19% in T₁ (cowdung). The reducing sugar was found maximum (0.31%) in T₈ and minimum in treatment T₁ (0.24%). Likewise the maximum vitamin C content (8.10 mg/100g) was recorded in treatment T₈ (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) followed (7.13 mg/100g) by T₇ (30% mustard oil cake+ 40% Cowdung+ 30% Poultry manure) and minimum (4.66) in T₁ (cowdung).

40% chemical fertilizer) and minimum Of 2.19% in T₁ (cowdung). The reducing sugar was found maximum (0.31%) in T₈ and minimum in treatment T₁ (0.24%). Likewise the maximum vitamin C content (8.10 mg/100g) was recorded in treatment T₈ (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer) followed (7.13 mg/100g) by T₇ (30% mustard oil cake+ 40% Cowdung+ 30% Poultry manure) and minimum (4.66) in T₁ (cowdung).

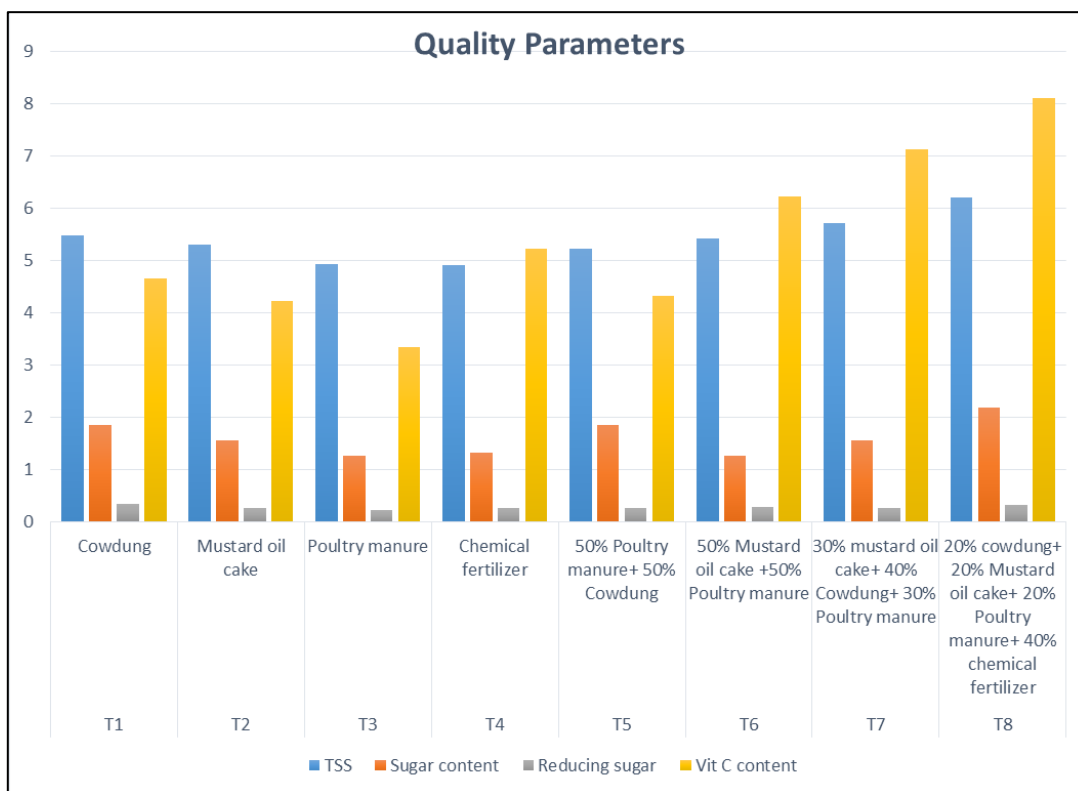


Fig 3: Effect of organic manure and their combinations with chemical fertilizers on quality parameters.

Table 3: Effect of organic manure and their combinations with chemical fertilizers on quality parameters

| Effect of organic manure and their combinations with chemical fertilizers on quality parameters | | | | | |
|---|--|-------|---------------|---------------|---------------|
| Symbol | Treatment combinations | TSS | Sugar content | Reducig sugar | Vit C content |
| T ₁ | Cowdung | 5.48 | 1.86 | 0.34 | 4.66 |
| T ₂ | Mustard oil cake | 5.31 | 1.55 | 0.27 | 4.22 |
| T ₃ | Poultry manure | 4.92 | 1.25 | 0.22 | 3.34 |
| T ₄ | Chemical fertilizer | 4.91 | 1.32 | 0.27 | 5.23 |
| T ₅ | 50% Poultry manure+ 50% Cowdung | 5.23 | 1.84 | 0.26 | 4.33 |
| T ₆ | 50% Mustard oil cake +50% Poultry manure | 5.41 | 1.27 | 0.27 | 6.23 |
| T ₇ | 30% mustard oil cake+ 40% Cowdung+ 30% Poultry manure | 5.71 | 1.55 | 0.25 | 7.13 |
| T ₈ | 20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer | 6.21 | 2.19 | 0.31 | 8.10 |
| | CD | 0.160 | 0.032 | 0.020 | 0.813 |
| | SE (m) | 0.043 | 0.009 | 0.005 | 0.015 |

Conclusion

The study showed that overall yield was maximum in treatment T₈ (20% cowdung+ 20% Mustard oil cake+ 20% Poultry manure+ 40% chemical fertilizer). This result showed that the best combination for growing Pusa Purple Long variety of Brinjal in Kanpur area of India is growing the Brinjal with organic and inorganic fertilizers combinations. Only the organic fertilizers is not responsible for the higher yield but for the organic cultivation of the brinjal it is the best way for growing. For the commercial cultivation of Brinjal, the organic and inorganic fertilizers combination is more suitable for farmers.

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