SYNERGISTIC EFFECTS OF DIFFERENT ORGANIC MANURES SOURCES ON QUALITY ATTRIBUTES OF BER (*ZIZYPHUS MAURITIANA* LAM.) CV. APPLE UNDER SODIC SOIL CONDITIONS

**ABSTRACT**

The experiment was conducted at Acharya Narendra Deva University of Agriculture and Technology, Ayodhya in 2021-23 using a Randomized Block Design with nine treatments and three replications . The study aimed to evaluate the synergistic impact of different organic manure sources on and quality of ber (*Zizyphus mauritiana* Lam.) cv. Apple under sodic soil conditions. Various organic amendments, including farmyard manure (FYM), vermicompost, photosynthetic bacteria (PNSB), Jeevamrit, and Amritpani, were applied in different combinations. Observations were recorded on fruit quality parameters such as fruit length, width, weight, pulp/stone ratio, total soluble solids, acidity, ascorbic acid content, and sugar composition. The findings contribute to understanding the role of organic amendments in improving ber production under sodic soil conditions.

**Keywords: -** Ber (*Zizyphus mauritiana* Lam.), Organic amendments, Sodic soil, Fruit quality

**INTRODUCTION**

Ber (*Zizyphus mauritiana* Lamk.), the poor man’s apple, is an important drought hardy fruit crop, which can be grown under hostile agro-climatic conditions of the arid region. Since it is hardy and salt tolerant, the tree can be grown even in marginal lands. Its fruit contains 14-16 % sugars, 150 mg vitamin-C per 100 g of pulp, besides other minerals. Ber grows in wild and cultivated forms in India (Bohane & Tiwari 2016). Ber commonly known as Indian jujube, is an important tropical and subtropical fruit crop widely cultivated in arid and semi-arid regions. It is highly valued for its nutritional composition, being rich in vitamin C, carbohydrates, and bioactive compounds that contribute to human health . The fruit is also recognized for its adaptability to drought conditions and poor soils, making it a valuable crop for sustainable agriculture in regions with limited water availability . Despite its resilience, ber production faces several challenges, particularly in sodic soil conditions, which significantly affect plant growth, fruit yield, and quality.

Sodic soils are characterized by excessive sodium content, poor soil structure, reduced water infiltration, and low nutrient availability, which hinder root development and limit crop productivity. The high pH and poor microbial activity in sodic soils further exacerbate nutrient imbalances, leading to deficiencies in essential elements required for optimal plant growth . Addressing these soil-related constraints requires the adoption of sustainable soil management practices that enhance fertility and improve plant growth parameters. The use of organic amendments has emerged as a promising approach for mitigating the adverse effects of sodic soils. Organic inputs such as farmyard manure (FYM), vermicompost, photosynthetic bacteria (PSB), Jeevamrit, and Amritpani play a crucial role in improving soil structure, increasing microbial diversity, and enhancing nutrient availability (Patel *et al*., 2021). These organic sources not only improve soil health but also influence fruit quality attributes such as size, weight, pulp-to-stone ratio, total soluble solids, acidity, and sugar composition (Verma & Yadav, 2020). Additionally, organic amendments promote enzymatic activity in the soil, leading to better nutrient uptake and improved biochemical composition of fruits .

Previous research has demonstrated that the integration of organic manures significantly enhances fruit quality by improving biochemical properties such as ascorbic acid content, sugar accumulation, and total soluble solids, which are key determinants of market value and consumer preference However, limited studies have explored the combined effects of multiple organic amendments on the quality of ber fruits under sodic soil conditions. Given the increasing demand for high-quality organic fruits, there is a need to identify the most effective organic treatment combinations that enhance both soil health and fruit quality.

This study aims to evaluate the response of different organic sources on the quality of ber cv. Apple under sodic soil conditions. By assessing key fruit quality parameters such as fruit length, width, weight, pulp-to-stone ratio, total soluble solids, acidity, ascorbic acid content, and sugar composition, this research seeks to provide insights into sustainable management practices for improving ber production in degraded soils. The findings of this study will be beneficial for farmers, researchers, and policymakers seeking to promote organic farming practices and enhance the productivity of ber orchards in challenging soil conditions.

**MATERIAL AND METHODS**

The present study entitled “Synergistic effects of different organic manures sources on quality attributes of ber (*Zizyphus Mauritiana* Lam.) cv. Apple under sodic soil conditions.’’ was carried out at the Main Experiment Station, Post-Harvest Technology Laboratory of the Department of Fruit Science and Laboratory of Department of Soil Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (Uttar Pradesh). The experiment was carried out in Randomized Block Design having 9 treatment with three replications in two growing period of 2021-23 The treatment combination was T0-Control (Recommended Dose), T1-20 kg FYM+ 20 ml Photosynthetic Bacteria (PSB), T2-5 kg Vermicompost + 20 ml PSB, T3-2.5 litre Jeevamrit + 10 kg FYM, T4-5 kg Vermicompost + 2.5 litre Jeevamrit, T5-10 kg FYM + 2.5 litre Amritpani, T6-5 kg Vermicompost + 2.5 litre Amritpani, T7-20 ml PSB+ 2.5-litre Jeevamrit +2.5 litre Amritpani, T8-10 kg FYM + 20 ML PSB+2.5 L Jeevamrit+2.5 L Amritpani and T9-5 kg Vermicompost+20 ml PSB+2.5 L Jeevamrit+2.5 L Amritpani. Observation was recorded on quality attributes of fruit Length (cm), Width (cm), Average fruit weight (g), Pulp/stone ratio, Total soluble solids (%), Acidity (%), Ascorbic acid (mg/100 g), Reducing sugar (%), Non–reducing sugar (%) and Total sugar (%).

**STATISTICAL ANALYSIS**

Statistical analysis of the data obtained in the different set of experiments was calculated as suggested by Panse and Sukhatme .

**RESULTS AND DISCUSSION**

**Synergistic effects of different organic manures sources on quality attributes of ber fruits**

The data derived on length of fruit was analysed statistically. It shows that the application of different organic sources has significantly influenced fruit length in ber fruits. All treatments were found significantly superior over T0 (control). The maximum length of fruit (5.16 , 5.40 and 5.28 cm , 5.10 , 5.28 and 5.19 cm) in both years i.e. 2021-22 and 2022-23 and pooled data respectively was recorded in treatment T9 followed by T8. The minimum length of fruit (3.75, 3.90 and 3.83 cm ) was recorded in T0(control) in both the years of investigation and in pooled data respectively. The treatment T9 is at par with T8 and other treatments. The increase in fruit length might be due to correlation with dry matter content and balance level of hormones. Superior physical fruit quality may be due to fact that, organic manures and microbial fertilizers enhances the nutrient availability by enhancing the capability of plants to better solute uptake from rhizosphere, also these nitrogen fixers are known for accumulation of dry matter and their translocation as well as favour synthesis of different growth regulators. The above findings are in accordance with Gawande *et al*. (1998) and Patel *et al*. (2010) in sapota. Dey *et al.* reported an increase in the physical characteristics of guava with the application of biofertilizer and organic manure alone. The results revealed that width of fruit was significantly influenced by application of different organic manures. All treatments were found significantly superior over T0 (control).The maximum width of fruit (4.49, 4.80 and 4.65 cm) was observed in T9 followed by T8 (4.45 , 4.65 and 4.55 cm) in both years and in pooled data respectively. The minimum fruit width (4.05, 4.17 and 4.11 cm) is reported in T0 (control) in both the years i.e. 2021-22 and 2022-23 and in pooled data respectively. The treatment T9 is at par with T8 and other treatments. Fruit width is highly correlated with dry matter content and balance level of hormone and nitrogen fixers are known for accumulation of dry matter and their translocation Kachot *et al*. (2001) as well as synthesis of different growth regulators due to application of different organic manures and liquid fertilizer to the plant. Results also got the support with the findings of Shivakumar *et al*. (2012) in papaya and Kumar *et al*. (2018) in litchi. In terms of average fruit weight was significantly influenced with the application of different organic sources. All the treatments in both the years and in pooled data were significantly superior over T0 (control).The treatment T9 is at par with T8 and other treatments. The maximum average fruit weight (63.84, 65.94 and 64.89 )in 2021-22 and 2022- 23 as well as in pooled data respectively was recorded in plants treated with T9 followed by T8 (62.75, 64.85 and 63.8 g) during both years and in pooled data respectively. Minimum average fruit weight (43.51, 45.12 and 44.32 g) was observed in T0(control) in both years of investigation and in pooled data respectively. Significant increase in average fruit weight in ber fruit might be due to availability of small quantities of macronutrients, micronutrients and growth promoting substances in addition to huge beneficial microbial population in jeevamrit and amritpani, thus when applied to plants as basal dose through soil they increase the fruit weight of ber. Moreover , liquid bio-enhancer avail favourable influence of nitrogen to produce larger cells with thinner cell walls and its contribution in cll division and elongation which promoted vegetative growth and ultimately improved the metabolic and photosynthetic activity for enhancing biological efficiency of plants so that it can uptake more nutrients from soil cause there by accumulation of more carbohydrates and higher dry matter These findings are in line with Tripathi *et al*. (2010) in strawberry.

The data regarding pulp- stone ratio revealed that the basal application of different organic sources significantly influence pulp-stone ratio. All the treatments in both the years and in pooled data were significantly superior over T0 (control). The treatment T9 is at par with T8 and other treatments. The maximum pulp stone ratio (5.73, 5.77 and 5.75) was reported in T9 followed by T8 (5.71, 5.75 and 5.73) during both years and in pooled data respectively. Minimum pulp – stone ratio (5.17, 5.20 and 5.19) was observed in T0 (control) in both years of investigation and in pooled data respectively. The increase in pulp weight to stone weight of fruits might be on account of incorporation of organic manures and biofertilizers which supplies essential micro and macro nutrients .Organic manures and biofertilizers have direct role in nitrogen fixation, production of phytohormones like substances and increased uptake of nutrients hence quality improvement reflected in fruit character. These observations are in agreement with the findings of Madhavi *et al.* (2008) in mango and Patel *et al.* (2010) in sapota. Fruit weight and fruit size are highly correlated with dry matter content and balance level of hormones. Superior physical fruit quality may be due to fact that, organic manures and microbial fertilizers enhances the nutrient availability by enhancing the capability of plants to better solute uptake from rhizosphere, also these nitrogen fixers are known for accumulation of dry matter and their translocation as well as favour synthesis of different growth regulators.

The data regarding to total soluble solids revealed that the basal application of different organic sources significantly influenced total soluble solids. All the treatments in both the years and in pooled data were significantly superior over T0 (control). The treatment T9 is at par with T8 and other treatments. The maximum total soluble solids (9.72, 9.92 and 9.82) was recorded in plants treated with treatment T9 followed by T8 (9.54 , 9.78 and 9.66) during both years and in pooled data respectively whereas the minimum total soluble solids(6.42,6.62 and 6.52 ) was reported in T0 (control) in both years of experiment and in pooled data respectively. Application of organic sources such as vermicompost, jeevamrit, amritpani and photosynthetic bacteria might have exhibited regulatory role on the absorption and translocation of various metabolites, in which carbohydrates are most important which affects the quality of fruits. During ripening of fruits the carbohydrates reserves of the root and stem are drawn upon heavily and hydrolyzed into sugars hence results in better fruit quality. The results are in accordance in with Parsana *et al*. (2023) in custard apple, and Maurya *et al.* (2020) in mango. )

The data derived on acidity was analysed statistically. It indicates that the application of different organic sources has significantly influenced acidity in ber fruits. The maximum acidity (0.42, 0.43 and 0.42) was reported in T0 (control) .The minimum acidity (0.31, 0.30 and 0.30) was reported in T9 followed by T8 in both years of investigation and in pooled data respectively. The fact that organic manures and biofertilizers considerably increases the rate of repiration which involves three steps: glycolysis, Kreb cycle and electron transport might elucidate the reduction in acidity caused by application of treatment. The Krebs cycle relies heavily on citric acid. The removal of acids from the vacuole and imported into the mitochondria and converted to oxaloacetate or pyruvate as the respiration rate increases. As a result, the kreb cycle consumes organic acids to synthesize oxaloacetate or pyruvate as an alternate carbon route. As a result, it is possible that the combination of vermicompost, jeevamrit, amritpani and photosynthetic bacteria enhanced respiration rate and decreased acidity of fruit in the treatment. Similar findings were reported by Deepak *et al.(*2016) Acidity content of fruit decreased with increase in the concentration of nitrogen which might be due to increased total soluble solids as a result of NPK. Increased nitrogen from organic sources also decreased the acid content, which might be due to the increase in total soluble solids and ultimately reduced the acidity of fruits. The results regarding ascorbic ascorbic acid revealed that ascorbic acid was statistically non significantly influenced by application of different organic manures during both experimental years. Maximum ascorbic acid (78.55, 78.40 and 78.31) was recorded with treatment T9 followed by T8 ((78.22, 78.40 and 78.31) during both years and in pooled data respectively whereas the minimum ascorbic acid (72.71,72.89 and 72.80 ) was observed in T0 (control) in both years of experiment and in pooled data respectively.

The results revealed that the application of different organic sources significantly influenced the reducing sugars percentage of ber fruit during both years of investigation. All the treatments were found significantly superior over the control. The maximum reducing sugar (2.56, 2.80 and 2.68 %) was observed in treatment T9 followed by T8 (2.51, 2.75 and 2.63 %) during both years and in pooled data respectively. The treatment T9 is at par with T8 and other treatments. The minimum reducing sugar percentage of ber fruits (2.19, 2.43 and 2.31 %) was reported in treatment T0 (control) in both years (2021-22 and 2022-23) and in pooled data respectively. It is obvious from the data that application of different organic sources has significantly influenced the non- reducing sugar percentage in ber fruits. All the treatments were significantly superior over T0(control) during both years (2021-22 and 2022-23) of investigation. The maximum non-reducing sugars percentage (4.86, 5.11 and 4.99%) was recorded in T9 followed by T8 (4.84, 5.05 and 4.95 %) during both years and in pooled data respectively. The treatment T9 is at par with T8 and other treatments. The minimum non – reducing percentage (4.32, 4.52 and 4.42 %) was observed in T0 (control) during both years and in pooled data respectively. The data regarding total sugars percentage is showed that application of different organic sources has significantly influenced the total sugars percentage in ber fruits. All the treatments were significantly superior over T0(control) during both years (2021-22 and 2022-23) of experiment. The maximum non-reducing sugars percentage (7.42, 7.91 and 7.67%) was encoded in T9 followed by T8 (7.35, 7.80 and 7.58 %) during both years and in pooled data respectively. The treatment T9 is at par with T8 and other treatments. The minimum non – reducing percentage (6.51,6.95 and 6.73 %) was recorded in T0 (control) during both years and in pooled data respectively. Application of organic sources influenced on sugar content in the fruits. Potassium improves sugars in the fruits and improves quality. During ripening of fruits the carbohydrates reserves of the root and stem are drawn upon heavily and hydrolyzed into sugars hence results in better fruit quality. The results are in accordance in with Hema *et al.* (2016) in banana.

**Table-1. Synergistic effects of different organic manures sources on Length of Fruit, width and average fruit weight in ber**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Notation** | **Treatment Combination** | **Length of Fruit (cm)** | | | **Width of Fruit (cm)** | | | **Average fruit weight (g)** | | |
| **2021-22** | **2022-23** | **Pooled** | **2021-22** | **2022-23** | **Pooled** | **2021-22** | **2022-23** | **Pooled** |
| **T0** | Control (Recommended Dose) | 3.75 | 3.90 | 3.83 | 4.05 | 4.17 | 4.11 | 43.51 | 45.12 | 44.32 |
| **T1** | 20 kg FYM+ 20ml Photosynthetic  Bacteria (PSB) | 4.93 | 5.11 | 5.02 | 4.41 | 4.59 | 4.50 | 60.35 | 62.45 | 61.40 |
| **T2** | 5 kg Vermicompost + 20 ml PSB | 4.72 | 4.90 | 4.81 | 4.38 | 4.57 | 4.48 | 57.62 | 60.05 | 58.84 |
| **T3** | 2.5 litre Jeevamrit + 10 kg FYM | 4.12 | 4.26 | 4.19 | 4.15 | 4.33 | 4.24 | 48.82 | 51.32 | 50.07 |
| **T4** | 5 kg Vermicompost + 2.5 litre Jeevamrit | 4.24 | 4.39 | 4.32 | 4.18 | 4.32 | 4.25 | 50.21 | 52.70 | 51.46 |
| **T5** | 10 kg FYM + 2.5 litre Amritpani | 4.47 | 4.60 | 4.54 | 4.32 | 4.50 | 4.41 | 54.95 | 57.40 | 56.18 |
| **T6** | 5 kg Vermicompost + 2.5 litre Amritpani | 4.38 | 4.56 | 4.47 | 4.27 | 4.44 | 4.36 | 53.19 | 55.65 | 54.42 |
| **T7** | 20 ml PSB+ 2.5 litre Jeevamrit +2.5 litre Amritpani | 3.91 | 4.06 | 3.99 | 4.09 | 4.26 | 4.18 | 46.11 | 48.62 | 47.37 |
| **T8** | 10 kg FYM + 20 ML PSB+2.5 Jeevamrit+2.5 L Amritpani | 5.10 | 5.28 | 5.19 | 4.45 | 4.65 | 4.55 | 62.75 | 64.85 | 63.80 |
| **T9** | 5 kg Vermicompost+20 ml PSB+2.5L Jeevamrit+2.5 L Amritpani | 5.16 | 5.40 | 5.28 | 4.49 | 4.80 | 4.65 | 63.84 | 65.94 | 64.89 |
| **SE(m) ±** |  | 0.09 | 0.09 | 0.08 | 0.079 | 0.095 | 0.092 | 1.26 | 1.24 | 1.43 |
| **C.D. at 5%** |  | 0.28 | 0.29 | 0.24 | 0.237 | 0.284 | 0.274 | 3.79 | 3.72 | 4.30 |

\* SE(m) : Standard error of mean , C.D. : Critical Difference

**Table-2.** **Synergistic effects of different organic manures sources on Pulp stone ration, TSS (%), and Acidity in ber**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Notation** | **Treatment Combination** | **Pulp – Stone Ratio** | | | **TSS (%)** | | | **Acidity (%)** | | |
| **2021-22** | **2022-23** | **Pooled** | **2021-22** | **2022-23** | **Pooled** | **2021-22** | **2022-23** | **Pooled** |
| **T0** | Control (Recommended Dose) | 5.17 | 5.20 | 0.42 | 0.42 | 0.42 | 6.52 | 0.42 | 0.43 | 0.42 |
| **T1** | 20 kg FYM+ 20ml Photosynthetic  Bacteria (PSB) | 5.72 | 5.76 | 0.34 | 0.34 | 0.34 | 9.47 | 0.34 | 0.33 | 0.33 |
| **T2** | 5 kg Vermicompost + 20 ml PSB | 5.59 | 5.62 | 0.35 | 0.35 | 0.35 | 9.28 | 0.35 | 0.34 | 0.34 |
| **T3** | 2.5 litre Jeevamrit + 10 kg FYM | 5.21 | 5.25 | 0.39 | 0.39 | 0.39 | 9.11 | 0.39 | 0.38 | 0.38 |
| **T4** | 5 kg Vermicompost + 2.5 litre Jeevamrit | 5.17 | 5.20 | 0.38 | 0.38 | 0.38 | 8.58 | 0.38 | 0.37 | 0.37 |
| **T5** | 10 kg FYM + 2.5 litre Amritpani | 5.47 | 5.51 | 0.36 | 0.36 | 0.36 | 8.93 | 0.36 | 0.34 | 0.35 |
| **T6** | 5 kg Vermicompost + 2.5 litre Amritpani | 5.36 | 5.38 | 0.37 | 0.37 | 0.37 | 8.70 | 0.37 | 0.35 | 0.36 |
| **T7** | 20 ml PSB+ 2.5 litre Jeevamrit +2.5 litre Amritpani | 5.29 | 5.32 | 0.41 | 0.41 | 0.41 | 8.43 | 0.41 | 0.40 | 0.40 |
| **T8** | 10 kg FYM + 20 ML PSB+2.5 Jeevamrit+2.5 L Amritpani | 5.71 | 5.75 | 0.32 | 0.32 | 0.32 | 9.66 | 0.32 | 0.31 | 0.31 |
| **T9** | 5 kg Vermicompost+20 ml PSB+2.5L Jeevamrit+2.5 L Amritpani | 5.73 | 5.77 | 0.31 | 0.31 | 0.31 | 9.82 | 0.31 | 0.30 | 0.30 |
| **SE(m) ±** |  | 0.13 | 0.14 | 0.009 | 0.009 | 0.009 | 0.21 | 0.009 | 0.009 | 0.009 |
| **C.D. at 5%** |  | 0.41 | 0.41 | 0.02 | 0.02 | 0.02 | 0.65 | 0.02 | 0.02 | 0.02 |

**\*** SE(m) : Standard error of mean **,** C.D. : Critical Difference

**Table-3. Synergistic effects of different organic manures sources on Ascorbic acid, Reducing Sugars, Non-Reducing Sugar and Total sugar in ber**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Notation** | **Treatment Combination** | **Ascorbic acid (mg/100 g)** | | | **Reducing Sugars (%)** | | | **Non-Reducing Sugar (%)** | | | **Total sugar (%)** | | |
| **2021-22** | **2022-23** | **2021-22** | **2021-22** | **2021-22** | **Pooled** | **2021-22** | **2022-23** | **Pooled** | **2021-22** | **2022-23** | **Pooled** |
| **T0** | Control (Recommended Dose) | 72.71 | 72.89 | 72.80 | 2.19 | 2.43 | 2.31 | 4.32 | 4.52 | 4.42 | 6.51 | 6.95 | 6.73 |
| **T1** | 20 kg FYM+ 20 ml Photosynthetic Bacteria (PSB) | 77.87 | 78.02 | 77.95 | 2.48 | 2.72 | 2.60 | 4.76 | 4.96 | 4.86 | 7.24 | 7.68 | 7.46 |
| **T2** | 5 kg Vermicompost + 20 ml PSB | 76.13 | 76.28 | 76.21 | 2.42 | 2.66 | 2.54 | 4.74 | 4.94 | 4.84 | 7.16 | 7.60 | 7.38 |
| **T3** | 2.5 litre Jeevamrit + 10 kg FYM | 73.83 | 74.01 | 73.92 | 2.21 | 2.45 | 2.33 | 4.50 | 4.70 | 4.60 | 6.71 | 7.15 | 6.93 |
| **T4** | 5 kg Vermicompost + 2.5 litre Jeevamrit | 74.33 | 74.47 | 74.40 | 2.23 | 2.47 | 2.35 | 4.61 | 4.81 | 4.71 | 6.84 | 7.28 | 7.06 |
| **T5** | 10 kg FYM + 2.5 litre Amritpani | 76.03 | 76.17 | 76.10 | 2.36 | 2.55 | 2.46 | 4.67 | 4.87 | 4.77 | 6.98 | 7.42 | 7.20 |
| **T6** | 5 kg Vermicompost + 2.5 litre Amritpani | 75.13 | 75.31 | 75.22 | 2.31 | 2.51 | 2.41 | 4.69 | 4.89 | 4.79 | 7.05 | 7.31 | 7.18 |
| **T7** | 20 ml PSB+ 2.5 litre Jeevamrit +2.5 litre Amritpani | 73.43 | 73.61 | 73.52 | 2.21 | 2.42 | 2.32 | 4.38 | 4.58 | 4.48 | 6.59 | 7.03 | 6.81 |
| **T8** | 10 kg FYM + 20 ML PSB+2.5 Jeevamrit+2.5  L Amritpani | 78.22 | 78.40 | 78.31 | 2.51 | 2.75 | 2.63 | 4.84 | 5.05 | 4.95 | 7.35 | 7.80 | 7.58 |
| **T9** | 5 kg Vermicompost+20 ml PSB+2.5L Jeevamrit+2.5 L Amritpani | 78.55 | 78.77 | 78.66 | 2.56 | 2.80 | 2.68 | 4.86 | 5.11 | 4.99 | 7.42 | 7.91 | 7.67 |
| **SE(m) ±** |  | 1.61 | 1.72 | 1.62 | 0.05 | 0.04 | 0.04 | 0.09 | 0.10 | 0.11 | 0.15 | 0.19 | 0.18 |
| **C.D. at 5%** |  | NS | NS | NS | 0.14 | 0.14 | 0.13 | 0.29 | 0.30 | 0.32 | 0.46 | 0.56 | 0.54 |

\* SE(m) : Standard error of mean , C.D. : Critical Difference

**Conclusion**

The study demonstrated that the application of organic amendments significantly improved the vegetative growth, yield, and quality of ber (*Zizyphus mauritiana* Lam.) cv. Apple under sodic soil conditions. Among the treatments, T9 (5 kg Vermicompost + 20 ml PSB + 2.5 L Jeevamrit + 2.5 L Amritpani) exhibited the most positive effects on fruit quality parameters, including size, weight, pulp-to-stone ratio, total soluble solids, acidity, ascorbic acid, and sugar content. T8 (10 kg FYM + 20 ml PSB + 2.5 L Jeevamrit + 2.5 L Amritpani) also showed notable improvements. These findings highlight the potential of organic amendments in enhancing ber production and suggest their beneficial role in mitigating the adverse effects of sodic soil conditions.

Disclaimer (Artificial intelligence)

I hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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