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Response of different organic sources on physical characteristics of ber (*Ziziphus mauritiana* Lam.) cv. apple under sodic soil condition

Shweta Chaturvedi, D Ram, Sanjay Pathak, Atul Yadav, Alok Kumar Pandey and Ajendra Kumar

Abstract
An experiment was conducted to assess th**e** response of different organic sources on physical characteristics of Ber (*Z. mauritiana* Lam.) cv, Apple under sodic soil conditions at Main Experiment Station, Department of Fruit Science, College of Horticulture, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya. During 2021-22 and 2022-23, a well-established 3-year plant of Ber was planted at 8.0 x 8.0 m. The experiment was laid out in Randomized Block Design and replicated thrice. The experiment comprises of ten treatments including control *viz.*T_0 Control (Recommended Dose), T_1 20 Kg FYM+ 20 ml Photosynthetic Bacteria(PSB), T_2 5 Kg Vermicompost + 20 ml PSB, T_3 2.5 litre Jeevamrit + 10 Kg FYM, T_4 5 Kg Vermicompost + 2.5 litre Jeevamrit, T_5 10 Kg FYM + 2.5 litre Amritpani, T_6 5 Kg Vermicompost + 2.5 litre Amritpani, T_7 20 ml PSB+ 2.5 litre Jeevamrit +2.5 litre Amritpani, T_8 10 Kg FYM + 20 ML PSB+2.5 L Jeevamrit+2.5 L Amritpani, T_9 5 Kg Vermicompost+20 ml PSB+2.5 L Jeevamrit+2.5 L Amritpani. The result revealed that maximum Fruit Length (5.16, 5.40 cm), Fruit Width (4.49, 4.80 cm), Average Fruit Weight (63.84, 65.94 g) and Pulp – Stone ratio (5.73, 5.77) were observed in T_9 during both the years respectively. The minimum values of observation were reported in the control.

Keywords: Sodic soil, FYM, jeevamrit, Amritpani, photosynthetic bacteria, vermicompost

Introduction
Ber (*Ziziphus mauritiana* Lam.) is one of the oldest and most popular fruits native to China and India, which belongs to the family Rhamnaceae and genus Zizyphus. It has 2n=48 and is tetraploid. It can thrive on poor soil with a pH as high as 9.0. and up to an altitude of 1500 metres above mean sea level, it can be found growing wild as well as in cultivated varieties across the warmer regions. Central Asia is the region where ber originated and grows there under various weather conditions. It can withstand temperatures as high as 49–50 °C but prefers temperatures between 39–42 °C. Fruits set, however, suffers at temperatures higher than 35 °C. September marks the beginning of flowering, which ends in November. Fruit can be harvested at different times depending on the variety; it is often harvested starting in December and continuing through February depending on the variety and the area. Due to its prolific bearing, high yielder, fruit colour, speedy return, and size of fruits, the recently introduced hybrid ber fruit known as "Thai Apple ber" produced in Thailand is significantly altering the life of farmers. This hybrid jujube and green apple fruit is known as Thailand ber. Its name refers to the size and look of the green apple fruit, which is why it is also known as the "Thai Apple Ber" or "Green Apple." Its farming is currently popular and offers many advantages over conventional ber farming, including a higher rate of return and longer shelf life. Thai Apple Ber fruits are comparable to apples in that they are sweet, crunchy, juicy, and delightful.
Ber is a fruit that is underutilized and semi-arid. Ber have excellent antioxidant properties and are also high in phenolics including caffeic acid, p-hydroxybenzoic acid, ferulic acid, and p-coumaric acid. It also has therapeutic qualities. Additionally useful as medicine are its seeds, roots, and stem. Wild *Z. mauritiana* fruits are used to make an alcoholic beverage in West Africa. Ripe ber fruits are typically eaten fresh in India but can also be cooked. Unripe fruits are frequently consumed with salt. Ber fruit is used to make a variety of products. 81–97% of the fresh, mature ber fruits are pulp, which provides a rich source of nutrients. Fruit is higher in protein, phosphorus, calcium, carotene, and vitamin C than apples and outpace oranges in

these nutrients. The ber fruit contains 0.8 per cent protein, 17.0 per cent carbohydrate, 0.3% fat, 0.02 mg/100 g vitamin B2, 76.0 mg/100 g vitamin C, 4.0 mg/100 g calcium, 9.0 mg/100 g phosphorus, 1.8 mg/100 g iron, and 73.9 Kcal/g energy.

Farmers in India used chemical fertilizers to boost the production and productivity of various crops when the country's green-evolution began. The fertility of the soil, biodiversity, produce quality, and human health have all been negatively impacted by the overuse of chemical fertilizers. Additionally, it worsened the physical condition of the soil, depleted organic matter, and produced vitamin deficiencies. It also made the soil more acidic. The future of agriculture should be shifted to organic farming to address these issues. Because organic manure not only supplies essential nutrients (including micronutrients), but also enhances the biological and physical conditions of soils, increases soil aeration, and enhances opportunities for root growth and production. Excessive use of chemical fertilizers deteriorates the physical attributes of ber. Therefore, the objective of the current investigations was to evaluate the physical characteristics of Thai Apple Ber cultivated under sodic soil conditions when different organic sources are applied to it.

Material and Methods

The present study entitled "Response of different organic sources on vegetative growth, yield and quality of ber (*Ziziphus mauritiana* Lam.) cv. Apple under sodic soil condition'' was carried out at the Main Experiment Station**,** Department of Fruit Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (Uttar Pradesh) during two consecutive years 2020-21 and 2021-22. The experiment was laid out in Randomized Block Design. There were 10 treatment combinations with 3 replications *viz*.T_0 Control (Recommended Dose), T_1 20 Kg FYM+ 20 ml Photosynthetic Bacteria(PSB), T_2 5 Kg Vermicompost + 20 ml PSB, T_3 2.5 litre Jeevamrit + 10 Kg FYM, T_4 5 Kg Vermicompost + 2.5 litre Jeevamrit, T_5 10 Kg FYM + 2.5 litre Amritpani, T_6 5 Kg Vermicompost + 2.5 litre Amritpani, T_7 20 ml PSB+ 2.5 litre Jeevamrit +2.5 litre Amritpani, T_8 10 Kg FYM + 20 ML PSB+2.5 L Jeevamrit+2.5 L Amritpani, T_9 5 Kg Vermicompost+20 ml PSB+2.5 L Jeevamrit+2.5 L Amritpani and in each replication one tree served as a treatment unit. Thus 30 trees were selected for the experiment. Ten Fruits were randomly selected from each treatment. Fruit length and width were measured with vernier callipers and expressed in centimeters. Average weight of fruit is measured with the help of electronic balance and average weight is expressed in grams. For Pulp stone ratio the pulp of ber fruit was separated from the stone and weighed by electronic balance. The weight of the pulp was divided by the weight of the stone to obtain the pulp-stone ratio.

Result and Discussion

1. Physical Characteristics of ber

Application of different organic sources has significantly influenced the physical characteristics of ber cv. Apple under sodic soil condition.

Fruit Length (cm)

The data has been evaluated for the year 2021-22 and 2022-23 found that the maximum value for the Fruit Length (5.16 and 5.10 cm) was found in T_9 (5 Kg Vermicompost+20 ml PSB+2.5 L Jeevamrit+2.5 L Amritpani) followed by T_8 (10 Kg FYM + 20 ML PSB+2.5 L Jeevamrit+2.5 L Amritpani) was reported to be 5.10, 5.28 cm in both the years. T_9 was at par with T_8 and other treatments. All the treatments were significantly superior over T_0 (Control). The minimum value for fruit length (3.75, 3.90 cm) was reported in T_0 (Control) in both the years i.e. 2021-22 and 2022-23. The data is presented in Table 1.1 and graphically presented in Fig1.1.

Table 1: Effect of different organic sources on Length of Fruit

Notation	Treatment combination	Fruit Length (cm)	
		2021-22	2022-23
T_0	Control (Recommended Dose)	3.75	3.90
T_1	20 Kg FYM+ 20 ml Photosynthetic Bacteria (PSB)	4.93	5.11
T_2	5 Kg Vermicompost + 20 ml PSB	4.72	4.90
T_3	2.5 litre Jeevamrit + 10 Kg FYM	4.12	4.26
T_4	5 Kg Vermicompost + 2.5 litre Jeevamrit	4.24	4.39
T_5	10 Kg FYM + 2.5 litre Amritpani	4.47	4.60
T_6	5 Kg Vermicompost + 2.5 litre Amritpani	4.38	4.56
T_7	20 ml PSB+ 2.5 litre Jeevamrit +2.5 litre Amritpani	3.91	4.06
T_8	10 Kg FYM + 20 ML PSB+2.5 L Jeevamrit+2.5 L Amritpani	5.10	5.28
T_9	5 Kg Vermicompost+20 ml PSB+2.5 L Jeevamrit+2.5 L Amritpani	5.16	5.40
S.E(m) ±		0.094	0.099
C.D. at 5%		0.282	0.297

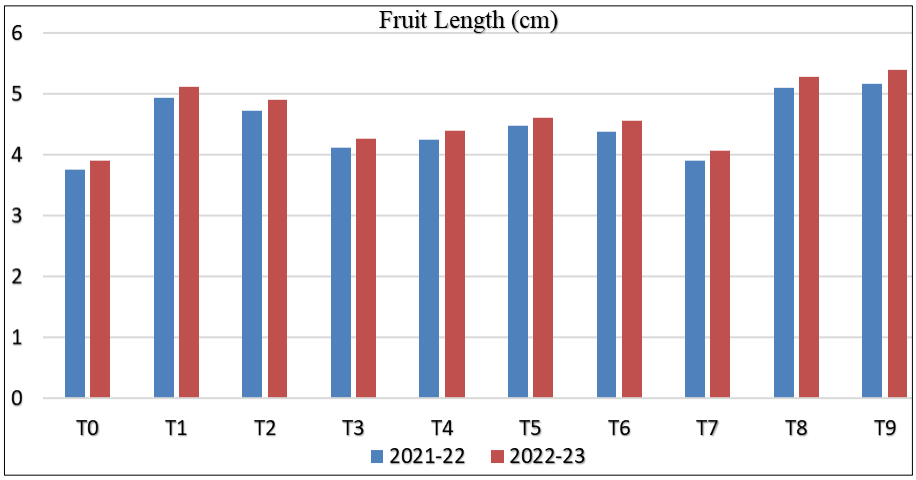

Fig 1: Effect of different organic sources on Fruit length in centimeters

Fruit Width (cm)

The data has been evaluated for the year 2021-22 and 2022-23 found that the maximum value for the Fruit Width (4.49 and 4.80 cm) was found in T_9 (5 Kg Vermicompost+20 ml PSB+2.5 L Jeevamrit+2.5 L Amritpani) followed by T_8 (10 Kg FYM + 20 ML PSB+2.5 L Jeevamrit+2.5 L Amritpani) was reported to be 4.45 and 4.65 cm in both the years. T_9 was at par with T_8 and other treatments. All the treatments were significantly superior over T_0 (Control). The minimum value for fruit length (4.05, 4.17 cm) was reported in T_0 (Control) in both the years i.e. 2021-22 and 2022-23. The data is presented in Table 1.2 and graphically presented in Fig.1.2.

Table 2: Effect of different organic sources on fruit width

Notation	Treatment combination	Fruit Width (cm)	
		2021-22	2022-23
T_0	Control (Recommended Dose)	4.05	4.17
T_1	20 Kg FYM+ 20 ml Photosynthetic Bacteria (PSB)	4.41	4.59
T_2	5 Kg Vermicompost + 20 ml PSB	4.38	4.57
T_3	2.5 litre Jeevamrit + 10 Kg FYM	4.15	4.33
T_4	5 Kg Vermicompost + 2.5 litre Jeevamrit	4.18	4.32
T_5	10 Kg FYM + 2.5 litre Amritpani	4.32	4.50
T_6	5 Kg Vermicompost + 2.5 litre Amritpani	4.27	4.44
T_7	20 ml PSB+ 2.5 litre Jeevamrit +2.5 litre Amritpani	4.09	4.26
T_8	10 Kg FYM + 20 ML PSB+2.5 L Jeevamrit+2.5 L Amritpani	4.45	4.65
T_9	5 Kg Vermicompost+20 ml PSB+2.5 L Jeevamrit+2.5 L Amritpani	4.49	4.80
S.E(m) ±		0.079	0.095
C.D. at 5%		0.237	0.284

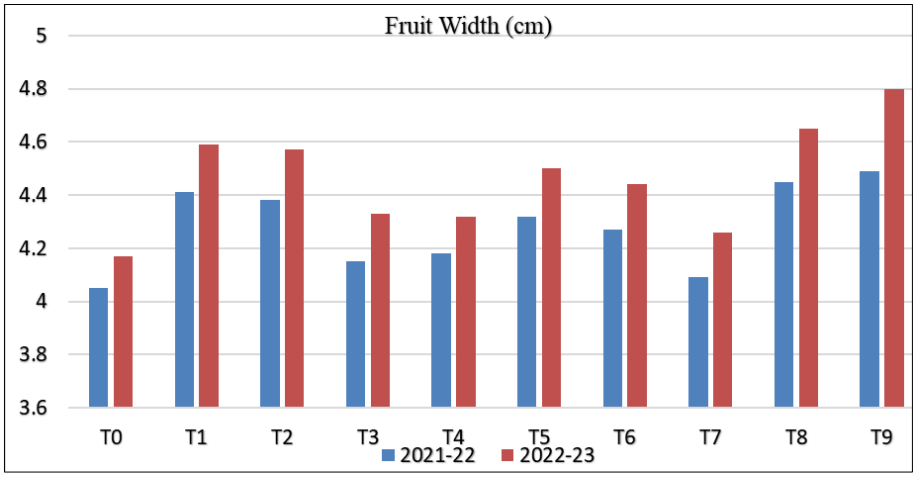

Fig 2: Effect of different organic sources on Fruit width in centimeters

1.3 Average Fruit Weight (g)

The data has been evaluated for the year 2021-22 and 2022-23 found that the maximum value for the Average Fruit Weight (63.84 and 65.94 g) was found in T_9 (5 Kg Vermicompost+20 ml PSB+2.5 L Jeevamrit+2.5 L Amritpani) followed by T_8 (10 Kg FYM + 20 ML PSB+2.5 L Jeevamrit+2.5 L Amritpani) was reported to be 62.75 and 64.85 g in both the years. T_9 was at par with T_8 and other treatments. All the treatments were significantly superior over T_0 (Control). The minimum value for average fruit weight (43.51, 45.12 g) was reported in T_0

(Control) in both the years i.e. 2021-22 and 2022-23.The data is presented in Table 1.3 and graphically presented in Fig.1.3.

Table 3: Effect of different organics sources on Average Fruit Weight

Notation	Treatment combination	Average Fruit Weight (g)	
		2021-22	2022-23
T_0	Control (Recommended Dose)	43.51	45.12
T_1	20 Kg FYM+ 20 ml Photosynthetic Bacteria (PSB)	60.35	62.45
T_2	5 Kg Vermicompost + 20 ml PSB	57.62	60.05
T_3	2.5 litre Jeevamrit + 10 Kg FYM	48.82	51.32
T_4	5 Kg Vermicompost + 2.5 litre Jeevamrit	50.21	52.70
T_5	10 Kg FYM + 2.5 litre Amritpani	54.95	57.40
T_6	5 Kg Vermicompost + 2.5 litre Amritpani	53.19	55.65
T_7	20 ml PSB+ 2.5 litre Jeevamrit +2.5 litre Amritpani	46.11	48.62
T_8	10 Kg FYM + 20 ML PSB+2.5 L Jeevamrit+2.5 L Amritpani	62.75	64.85
T_9	5 Kg Vermicompost+20 ml PSB+2.5 L Jeevamrit+2.5 L Amritpani	63.84	65.94
S.E(m) ±		1.267	1.242
C.D. at 5%		3.794	3.720

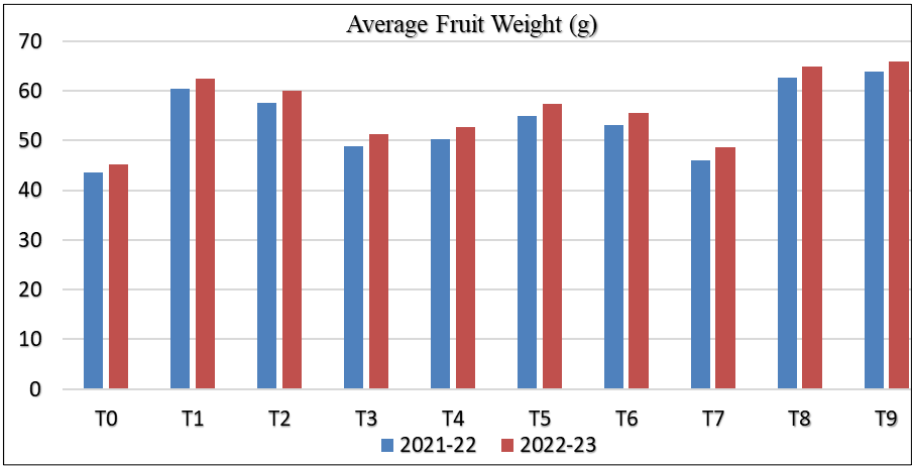

Fig 3: Effect of organic sources on Average Fruit Weight in grams

1.4 Pulp-Stone Ratio

The data has been evaluated for the year 2021-22 and 2022-23 found that the maximum value for the Pulp – Stone Ratio (5.73 and 5.77) was found in T_9 (5 Kg Vermicompost+20 ml PSB+2.5 L Jeevamrit+2.5 L Amritpani) followed by T_8 (10 Kg FYM + 20 ML PSB+2.5 L Jeevamrit+2.5 L Amritpani) was reported to be 5.71 and 5.75 in both the years. T_9 was at par with T_8 and other treatments. All the treatments were significantly superior over T_0 (Control). The minimum value for average fruit weight (5.17, 5.20) was reported in T_0 (Control) in both the years i.e. 2021-22 and 2022-23.The data is presented in Table 1.4 and graphically presented in Fig.1.4.

Table 4: Effect of different organics sources on Pulp- Stone Ratio

Notation	Treatment combination	Pulp – Stone Ratio	
		2021-22	2022-23
T_0	Control (Recommended Dose)	5.17	5.20
T_1	20 Kg FYM+ 20 ml Photosynthetic Bacteria (PSB)	5.72	5.76
T_2	5 Kg Vermicompost + 20 ml PSB	5.59	5.62
T_3	2.5 litre Jeevamrit + 10 Kg FYM	5.21	5.25
T_4	5 Kg Vermicompost + 2.5 litre Jeevamrit	5.17	5.20
T_5	10 Kg FYM + 2.5 litre Amritpani	5.47	5.51
T_6	5 Kg Vermicompost + 2.5 litre Amritpani	5.36	5.38
T_7	20 ml PSB+ 2.5 litre Jeevamrit +2.5 litre Amritpani	5.29	5.32
T_8	10 Kg FYM + 20 ML PSB+2.5 L Jeevamrit+2.5 L Amritpani	5.71	5.75
T_9	5 Kg Vermicompost+20 ml PSB+2.5 L Jeevamrit+2.5 L Amritpani	5.73	5.77
S.E(m) ±		0.137	0.140
C.D. at 5%		0.410	0.419

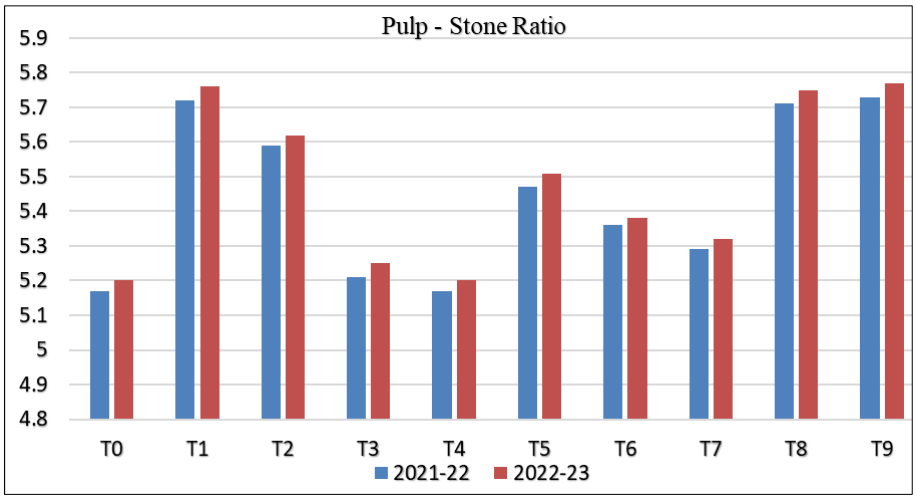

Fig 4: Effect of organic sources on Pulp- Stone Ratio

Conclusion

As per the findings of investigation twice application of T_9 (5 Kg Vermicompost+20 ml PSB+2.5 L Jeevamrit+2.5 L Amritpani) followed by T_8 (10 Kg FYM + 20 ML PSB+2.5 L Jeevamrit+2.5 L Amritpani) is good for improving physical characteristics of ber cv. Apple in sodic soil condition and can be recommended to farmers in order to get good quality fruits.

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