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Research Article

Management Practices Influence the Yield and Quality of Hog plum (*Spondias mombin* L.)

M. M. Rahman[1], M. A. Rahman[1] and M. A. Ali[2] and A.K.Hasan[3]✉

[1]Bangladesh Agricultural Research Institute, RARS, Rahmatpur, Barishal-8211, Bangladesh.
[2]Crops and Natural Resources, Krishi Gobeshona Foundation, Dhaka, Bangladesh.
[3]Department of Agronomy, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

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Correspondence
A.K.Hasan
✉: akhasan@bau.edu.bd

ABSTRACT

A research study was experimented at Gava village in Banaripara Upazila, Barishal district to identify the optimal management approach for cultivating hog plum on *sorjan* beds with the objective of increasing the yield and quality of hog plum. The experiment was carried out for two consecutive years 2021-2022 and 2022-2023. BARI Amra-2, a well-known hog plum variety, released by the Bangladesh Agricultural Research Institute in 2007 used for the study. The experiment was conducted with a randomized complete block design (RCBD) having three replications. The treatments used in the study: T_1 = Control (Earthing up), T_2 = Earthing up + Spraying (Against insect-pest), T_3 = Earthing up + RDF (Recommended dose of fertilizer), T_4 = Spraying + RDF, T_5 = Earthing up + Spraying + RDF. The plot size was 16 m^2. Each plot except control one received 15 kg of cowdung annually, alongside 150 g nitrogen, 70 g phosphorous, 150 g potassium, 30 g sulphur, and 2.5 g boron. These nutrient elements were converted and applied in the form of urea, triple super phosphate, muriate of potash, gypsum and boric acid, respectively. The treatments incorporated during the cropping years of 2021-2022 and 2022-2023 had a significant impact on various parameters such as tree height, single fruit weight, fruit length and diameter, number of bunches per tree, fruit yield per tree, yield per hectare, marketable yield per tree and per hectare, yield increase over control, shelf life, TSS%, and vitamin C content. The treatment T_5, which included earthing up, spraying against insect-pests, and RDF, resulted the highest values. In two consecutive years, treatment T_5 which incorporated earthing up with recommended dose of fertilizer and spraying against pest and diseases resulted the highest marketable yield, with an magnificent quantity of 34.88 and 36.13 t/ha.

Introduction

Hog plum, botanically known as *Spondias mombin* L., belonging to the Anacardiaceae family commonly referred to as "Amra" in Bangladesh, a deciduous tree induces large panicles of small white flowers. Nowadays, it has gained remarkable recognition in the field of modern medicine (Bhuiyan, *et. al.,* 2012; Siddiqu, *et. al.,* 2015). It grows mostly in the Indian subcontinent e.g. in Bangladesh, India and Nepal (Akter *et. al.,* 2012). It is generally cultivated during the rainy season, which falls between June and August (Adepoju and Oyewole, 2008). The fruits are ovoid, yellow, fleshy drupes that grow in clusters of 10-15 fruits and sometimes more. The unripe fruits are sour when tested, while the ripe ones have a sweet-sour flavor. Detailed study of the nutritional constitution of hog plums was found Adepoju and Oyewole (2008). Hog plums constitute of a notable amount of vitamin C, a natural antioxidant that increases the immune system, safeguards against heart disease and assist the synthesis of collagen to sustain overall health (Nwidu *et. al.,* 2017). In a 100 g portion of hog plums, there is a magnificent 46 mg of vitamin C, while a 100 g platter also offers 2.8 mg of iron, contributing to 15-35% of the daily recommended iron intake (Patathananone *et al.,* 2019). In the year of 2019-2020, the hog plum occupied an area in Bangladesh spread over approximately 18,970 acres, with a total production of 46,069 metric tons (MT) (BBS, 2020). Approximately 40% of the hog plums produced in the country annually come from Barishal, making it the largest hog plum producing region. Khulna, on the other hand, is the second highest growing region for hog plums (The Daily Star, 2022). Specifically, the Barishal region provided 16,491 MT from a land area of 7,581 acres (BBS, 2020). Traditionally, farmers of this area cultivate hog plum orchards using *sorjan* systems, particularly *sorjan* beds. The local name of the *Sorjan* beds is "*Kandi*", it has been employed by farmers in the country for more than a hundred years to grow crops on lifted up land. The *sorjan* system,

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characterized by alternating deep sinks and raised beds, is especially convenient for regions that experience both flooding and drought (Domingo and Hagerman, 1982). The cultivation of these crops was carried out without any form of management here for many years. Nowadays, a few farmers executing various management techniques without gathering any scientific understanding (Chen *et al*., 2021). They were unable to reach a sufficient yield, resulting in economic losses in terms of yield and quality fruits. Systematized nutrient management is necessary for accelerating fruit crop productivity and yield. (Tanou *et al.,* 2017). Supply of optimal quantity of nutrients from the soil to the plant system also assists pathogenic resistance, and the longevity of vegetation (Kader et al., 2022) and increases the stability and quality of plants (Dzanagov, *et. al.,* 2021). Improper application of chemical fertilizers can lead to environmental risks when the surface runoff water enters the *sorjan* canal. This ultimately leads to remarkable health hazards and economic losses. Hence, the study aims to identify the optimal management approach for cultivating hog plum on *sorjan* beds with the objective of increasing the yield and quality of hog plum.

Materials and methods

Characteristics of the Experimental location

A study was experimented at Gava village in Banaripara upazila, Barishal district to assess the impact of agronomical management on the yield and quality of hog plum. The experiment was carried out for two consecutive years 2021-2022 and 2022-2023. The site is located at a latitude of 22°45ˈ55.59397ˈˈN, a longitude of 90°10ˈ46.57429ˈˈE and an elevation of 6 meters above the sea level in the coastal south region. The location represents the Ganges Tidal Floodplain (AEZ-13), characterized with a subtropical monsoon climate and a humid environment. The soil type in the experimental land is clayey loam. The land of the experiment is a medium low land that has been raised up as the *sorjan* system. The soil shows a neutral reaction in nature, low organic matter content and overall low fertility level.

Experimental materials, design and treatments

The experiment associated with the employment of BARI Amra-2, a well-known hog plum variety, was released by the Bangladesh Agricultural Research Institute in 2007. The experiment was conducted in a randomized complete block design (RCBD) with three replications. The experiment focused on perceiving the impact of the treatments used in the study: T_1 = Control (Earthing up), T_2 = Earthing up + Spraying (Against insect-pest), T_3 = Earthing up + RDF (Recommended dose of fertilizer), T_4 = Spraying + RDF, T_5 = Earthing up + Spraying + RDF.

Experimental techniques

The study was carried out in an established orchard that had been standing for eleven years. The plantation was segmented into three blocks, each containing five plots, and the treatments were randomly assigned to these plots. Thus, the orchard was made fifteen plots. Two trees consisted a single plot, and the size of each plot was 16 m^2. To supply the necessary nutrients, each tree in each plot except control one received 15 kg of cow dung annually, alongside 150 g of nitrogen, 70 g phosphorous, 150 g potassium, 30 g sulphur, and 2.5 g boron. These nutrient elements were converted and applied in the forms of urea, triple super phosphate, muriate of potash, gypsum and boric acid, respectively. The fertilizers were given in two equal splits, one in November after harvesting and the other in April just before flowering started. The fertilizers were applied 1.0-1.5 meters away from the tree base and mixed into the soil by gently ploughing with a hand spade. The soil was irrigated thoroughly in accordance to the treatments. During the dry season, irrigation was performed frequently as needed. The tree base was regularly kept weed free, and the soil was often broken down to a fine tilth. The study was focused on the occurrence of major diseases and insect pests throughout the research period, insect pest infestation was not seen during this period. However, incidence of anthracnose disease was noticed in the research plots which was handed by spraying Score 250 EC (Difenoconazole) at a rate of 0.5 ml per liter of water and done twice with a seven-day interval. No other disease incidence was recorded in the experimental area. The experimental area was kept free from the attack of Hog plum beetle, cleaning the orchard regularly and spraying the orchard with Rogor 40 EC (Dimethoate) @ 2 ml per liter of water. The fruits were harvested when they reached full physical maturity and had a green skin color. After harvesting, the fruits were washed and dried under shade.

Data collection

Data were collected from every tree in each treatment over all replications.

First Branch position (m): The measurement was evaluated from the bottom of the tree to the highest point of the tree and unit expressed in meters.

Tree height (cm): The estimation of the height of trees was managed for all treatments and later on, the average value was figure out for each individual tree.

Fruit length (mm): Slide calipers were used to quantify the length of twenty fruits randomly selected from each treatment. Summation of the values then divided by 20 to acquire the average fruit length.

Fruit diameter (mm): Twenty fruits were picked randomly from each treatment and their diameter was recorded with the help of a slide calipers. The sum of the estimation was then divided by 20 to get the average fruit diameter.

Number of bunches per tree: All of the bunch or cluster of fruits of every tree was counted from each treatment and then averaged.

Number of fruits per plant: The mature fruits were harvested and thereafter tallied each time as they reached maturity at different intervals within the same plant. Eventually, the total count of fruits from all the trees related to a specific treatment was divided by the number of trees and subsequently calculated.

Single fruit weight (g): Twenty harvested fruits in accordance with the treatments were weighed and subsequently divided by the number of fruits weighed to decide the weight of a single fruit.

Fruit Yield/tree (kg): After harvesting the fruits from each tree in every treatment, they were weighed and recorded. The yield per tree was then calculated by dividing the total weight of fruits by the number of trees.

Yield (t/ha): This was calculated by multiplying the tree density per hectare of land with the average yield of the representative trees.

Marketable yield per tree (kg): The fruits harvested from each tree were graded, sorted, terminating any spoiled or diseased ones and afterwards weighed and averaged to determine the marketable yield per tree.

Marketable yield (t/ha): The calculation was obtained by multiplying the marketable yield per tree with the total number of trees per hectare of land.

Yield increase over control (%): To calculate the increase in yield (t/ha) with respect to the control trees when assessing the treatment's impact, the percentage increase in yield (%) was computed using the equation provided in the following manner (Farag, 2022):

$$\text{Yield increase over control (\%)} = \frac{\text{Yield (treatment)} - \text{yield (control)}}{\text{yield (control)}} \times 100$$

Total soluble solids TSS (%): The determination of the percentage of total soluble solids was estimated by extracting the juice from the flesh and putting a few drops onto the Atago pocket refractometer PAL-1. Eventually, the data concerning the total soluble solids was automatically displayed.

Shelf life (days): The shelf life of 20 fruits was evaluated by put away them in a well-ventilated room with an ambient temperature of 32^{o} C and an average relative humidity of 60-70%. The fruits were regularly observed for decay, and the days required for 70% decaying was recorded.

Vitamin C content (mg/100g): The hog plum fruit sample of 100 g was sliced into small pieces and pulverized with a mortar and pestle. Distilled water was put on in 10 ml increments during grinding the sample, and the resulting liquid extract was poured off into a 100 ml volumetric flask each time. The fruit pulp was then strained through cheesecloth, with the pulp being rinsed with several 10 ml portions of water and all filtrate and washings being collected in the volumetric flask. Finally, the extracted solution was made up to 100 mL with distilled water. Titration was then performed repeatedly on this sample solution, and the number of moles of ascorbic acid reacting was calculated using the formula provided below (redox titration method):

Ascorbic acid + I2 → 2 I− + dehydroascorbic acid

After that, the concentration in mol L−1 of ascorbic acid in the solution was calculated gained from fruit. Then it was converted to mg/100g of ascorbic acid, in the sample of fruit.

Statistical analysis: The analysis of variance (ANOVA) was used to estimate the data using R statistical analysis systems 4.2.0. The average value of various yield and yield contributing factors in relation to the applied treatments was compared through LSD tests at a significance level of $P < 0.05$.

Results and Discussion

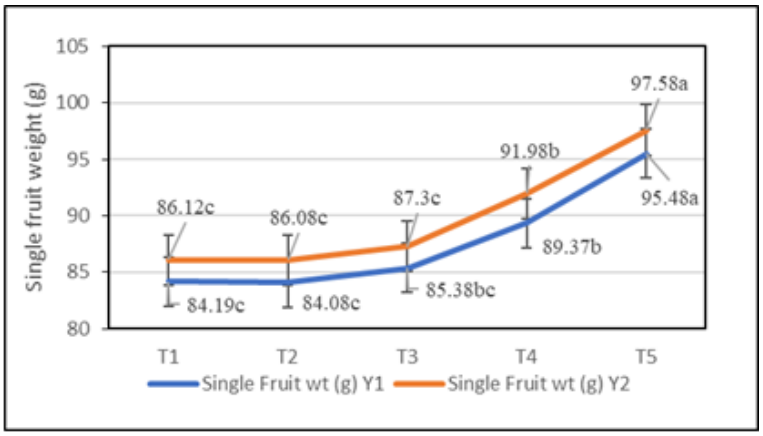
First branch position (m): The first branch position on the tree was significant in accordance with treatments during 2021-2022. It was observed that the highest distance of the first branch from the base of the trees was found in treatment T_1, which involved only earthing up (4.38 m). On the other hand, treatment T_2, which included both earthing up and spraying, resulted in a lower distance of 3.49 m from the base presented in Table 2. In the second year, no significant variation was found. The first branch position was recorded at 4.58 m from the base in treatment T_1 and it was highest distance, while the lowest distance of first branch position from the base was observed in treatment T_2 at 3.69 m. First branch position, stoutness and vigor of plant depends on the space, fertility of land, availability of nutrients, irrigation, climate and weather condition prevailing on the experimental area. To the best of my comprehension, there has been no study directed on the impact of agronomic and cultural management on the positioning of hog plum branches. Ramírez and Davenport (2010) conducted research with another anacardiaceous tree mango and evaluated that, the type of the bud, whether it was vegetative, reproductive, or mixed, was determined by various factors and conditions that contributed to its induction.

Table 1. Monthly average temperature and rainfall data obtained from the experimental area during the observation period (October 2021 - September, 2022 and October 2022- September 2023)

Month and year	Temperature (°C)	Precipitation (mm)	Month and year	Temperature (°C)	Precipitation (mm)
October 2021	28.43	298	October 2022	27.50	298
November 2021	24.28	0.00	November 2022	24.30	0.00
December 2021	21.45	10.11	December 2022	21.45	0.00
January 2022	18.26	0.00	January 2023	19.10	0.00
February2022	18.2	0.00	February 2023	22.92	0.00
March 2022	26.64	62	March 2023	17.80	62
April 2022	29.89	66	April 2023	29.60	66
May 2022	29.52	192.6	May 2023	28.72	192.6
June 2022	29.97	223.50	June 2023	28.51	223.50
July 2022	31.58	295.2	July 2023	29.25	227.40
August 2022	30.83	520.2	August 2023	28.33	635.70
September 2022	30.25	323.0	September 2023	28.71	306.80

* Source: Bangladesh Rice Research Institute, Regional Station, Barishal.

Tree height (m): The treatments employed in both 2021-2022 and 2022-2023 significantly changed the height of the trees. During the first year, treatment T_1 resulted in the tallest trees (11.58 m), which was statistically similar to treatments T_3, T_4 and T_5. The shortest trees were observed in treatment T_2, which involved earthing up and spraying against insects and pests, as shown in Table 2. A similar trend was observed in the following year, where treatment T_1 producing the tallest trees (12.09 m) and treatment T_2 recorded as the shortest trees (9.67 m). It may be due to the balanced fertilization effect; nitrogen is directly related to the vegetative growth of plant and trees. Proper management and healthiness also play a great role in vigorous growth of tree. Nehete and Jadav (2019) also found comparable outcomes, as they discovered that the highest tree height in Amrapali mango cultivar was achieved through the utilization of 100% dose of chemical fertilizer.



T_1= Control (Earthing up), T_2= Earthing up + Spraying, T_3= Earthing up + RDF, T_4= Spraying + RDF, T_5= Earthing up + Spraying + RDF; Y_1= 2021-2022 and Y_2= 2022-2023

Figure 1. Single fruit weight (g) as stimulated by the applied treatments

Fruit length (mm): The length of the fruits exhibited significant dissimilarities depended on the treatments applied. The treatment that employed Earthing up + Spraying + RDF in the first year (T_5) expressed the highest fruit length of 72.42 mm, while in the second year, the length increased to 73.26 mm as showed in Table 2. Then again, the lowest fruit length was recorded in the control treatment (T_1) with 68.68 and 69.29 mm in the first and second year, respectively. This may be due to proper nutrition during fruit set and developmental stage.

Fruit diameter (mm): The diameter of fruits showed significant variations based on the treatments applied. In case of first year, the treatment that used Earthing up + Spraying + RDF (T_5) resulted in the highest fruit length of 55.54 mm. The diameter increased to 56.53 mm in the second year, as specified in table 2, where T_5, T_4, and T_3 were statistically identical in both years. The control treatment (T_1) exposed the lowest fruit diameter, measuring 52.64 and 53.06 mm in the first and second year, respectively.

Single fruit weight (g): The treatments regulated to the fruits had a significant effect on their development, as verified by the statistical analysis. The highest single fruit weights were observed in treatment T_5, with recorded values of 97.58 g and 95.48 g in two consecutive years. Conversely, the lowest fruit weights were seen in treatment T_1, with documented values of 86.12 g in the first year and 84.19 g in the second year, as presented in Figure 1. This result could be assigned to the effects of well-balanced fertilization, alongside the careful maintenance of the tree to prevent infestation by insects and diseases.

Table 2. Different growth and yield characters of hog plum tree as influenced by management practices

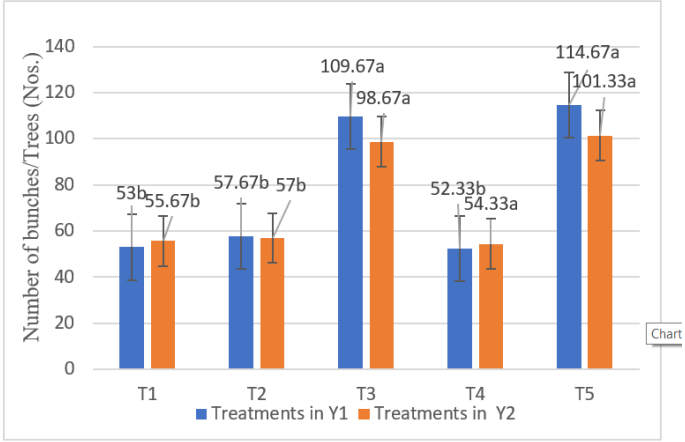
Treatments	1st Branch position (m)		Tree height (m)		Fruit length (mm)		Fruit diameter (mm)	
	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2
T_1	4.38 a	4.58	11.58 a	12.09 a	68.68 c	69.29 c	52.64 b	53.06 b
T_2	3.49 b	3.69	9.67 b	10.13 b	70.50 b	71.21 b	56.69 b	55.15 a
T_3	4.07 a	4.27	11.53 a	12.04 a	70.84 b	71.44 b	53.13 a	55.72 a
T_4	3.95 ab	4.13	10.32 ab	10.79 ab	71.54 ab	72.13 ab	54.54 a	55.99 a
T_5	4.28 a	4.46	11.72 a	12.27 a	72.42 a	73.26 a	55.54 a	56.53 a
CV (%)	7.18	9.83	6.96	11.46	1.17	1.10	1.54	1.61
LSD	0.55	NS	1.44	1.51	1.56	1.52	1.60	1.68

T_1= Control (Earthing up), T_2= Earthing up + Spraying, T_3= Earthing up + RDF, T_4= Spraying + RDF, T_5= Earthing up + Spraying + RDF; Y_1= 2021-2022 and Y_2= 2022-2023

The research conducted by Youting, *et al.* (2021) demonstrated that the application of nitrogen had a great effect on the yield of plum. As the amount of nitrogen applied increased, there was a remarkable increase in the weight of individual fruits and the results is homogenous with our findings the weight of single fruit was found to be maximum in the well fertilized treatment. Dwivedi *et al*. (2018) also found same result with guava cultivation.

Number of bunches per tree (Nos.): The number of bunches per tree expressed considerable variation depended on the treatments applied each year. The highest number of bunches (114.67) was revealed in the initial year under the high management treatment (Earthing up + Spraying + RDF), while in the second year, it was observed 101.33 nos. Correspondingly, the lowest number of bunches (52.33 in the first year and 54.33 in the second year) was noted under the low management treatment (control only earthing up) showed in Figure 2. The proper growth and development of the tree could be associated with this.

Number of fruits per tree: The number of fruits produced in each tree is subject to significant variation based on the treatments involved each year. The highest number of fruits amounting to 378.33 in the first year and 387.00 in the next year was found in the trees received high management treatment T_5 (which included earthing up, spraying against insect-pests and RDF). On the other hand, the trees that received low management treatment (control with only earthing up) gave a lower number of fruits, with 304.33 and 305.67 in the two consecutive years presented in Table 3. The quantity of fruits per tree was depended upon the fruit set and the preharvest fruit drop. The maximum number of fruit setting and retention of fruits are subjected to the healthy tree and proper nutrition, especially boron availability. The results presented here corresponds with the findings reported by Swietlik (1992) in their study on grapefruit trees of the "Ray Ruby" variety and also with the research conducted by Hikal (2000) on Washington navel orange trees.



T_1= Control (Earthing up), T_2= Earthing up + Spraying, T_3= Earthing up + RDF, T_4= Spraying + RDF, T_5= Earthing up + Spraying + RDF; Y_1= 2021-2022 and Y_2= 2022-2023

Figure 2. Changes in number of bunches in accordance with employment of treatments

Fruit yield/tree (kg): The treatment combinations had a significant effect on the total weight of fruits per tree i. e., fruit yield/tree. Treatment T_5, which included earthing up, spraying against insect-pests, and RDF, procced with the highest yield per tree. In the years 2021-2022 and 2022-2023, the yield amounted 36.12 kg and 37.78 kg, respectively. In other ways the lowest yield was seen in treatment T_1, with 25.69 and 26.36 kg in the first and second year, respectively, as manifested in Table 3. The complementary end product observed was a combination of the appropriate application of nitrogen-based fertilizer and the accurate maintenance of the tree's health by preventing the outbreak of diseases and pests. Nehete and Jadav (2019) as well as Usha *et al.* (2019) revealed that application of full doses of nitrogenous fertilizer gave highest yield per plant in mango. The impact of nitrogen on different characters of fruit can be attributed to the increased efficiency of metabolic processes, which in turn regulates the growth of the plant and its various components, including fruits. Accomplishment of appropriate intercultural activity and stabilized fertilizer application had been observed to increase the accumulation of carbohydrates. The inclusion of carbohydrates has been proven to have a positive effect on the expansion of fruit dimensions, leading to a subsequent increase in their overall weight, reported by Rubee Lata *et al*. (2011).

Table 3. Yield and yield attributes of hog plum as influenced by different management techniques

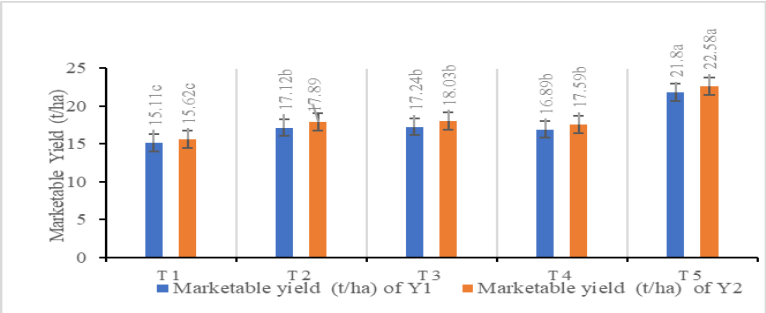
Treatments	Fruits /tree (nos.)		Fruit yield/tree (kg)		Yield (t/ha)		Marketable yield /tree (kg)	
	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2
T_1	304.33 c	305.67 d	25.69 c	26.36 c	16.05 c	16.47 c	24.18 c	24.90 c
T_2	346.00 b	357.33 ab	29.18 b	30.78 b	18.20 b	19.24 b	27.39 b	28.62 b
T_3	345.00 b	350.33 bc	29.42 b	30.53 b	18.38 b	19.08 b	27.58 b	28.85 b
T_4	312.33 c	321.00 cd	28.00 bc	29.57 bc	17.49 bc	18.48 bc	27.02 b	28.14 b
T_5	378.33 a	387.00 a	36.12 a	37.78 a	22.57 a	23.61 a	34.88 a	36.13 a
CV (%)	4.82	4.73	6.14	5.79	6.12	5.79	5.00	5.01
LSD	30.58	30.65	3.43	3.38	2.13	2.11	2.66	2.77

T_1= Control (Earthing up), T_2 = Earthing up + Spraying, T_3 = Earthing up + RDF, T_4 = Spraying + RDF, T_5 = Earthing up + Spraying + RDF; Y_1 = 2021-2022 and Y_2 = 2022-2023

Yield (t/ha): The involved treatments exhibited in a significant increase in yield, with a notable order observed. Remarkably, trees associated with the treatment five resulted the highest weight of fruits, with 22.57 t/ha in the first year and 23.61 t/ha in the following year. In contrast, the control treatment (T_1) produced the lowest yield of fruits, with 16.05 and 16.47 t/ha in the two years, as visible in Table 3. The fruit yield increase might be associated with the rising level of nutrient adjacent to the assimilating area of plant which enhanced the rate of dry matter production and its coherent partitioning to economic part i.e., fruits, improved the yield as Dalal *et al*. (2004) previously explained.

Marketable yield per tree (kg): The marketable yield showed notable variations in return to the different treatments implemented during the two consecutive growing seasons. During the initial year, treatment five gained the highest amount of marketable produce, resulting 34.88 kg per tree. Subsequently, in the next year, further improved was observed in this treatment, its production, resulting in a yield of 36.13 kg per tree. Conversely, the treatment one consistently resulted the lowest weight of graded fruits per tree, with 24.18 kg in the 2021-2022 season and 24.90 kg in the 2022-2023 season, as indicated in Table 3. This increase on marketable fruit yield may be due to the combined effect of management practices and mixing up of organic and balanced fertilizer and less disease and pest occurrence in the growing period. Mishra *et al.* (2004) observed similar findings, enhanced productivity in the tomato crop that can be assigned with the increased levels of nitrogen and phosphorus, which result in improved fertilizer efficiency. Similar result was found by Hasan *et al*. (2004).

Marketable yield (t/ha): Remarkable differences observed between the treatments applied and treatment T_5 expressed the highest marketable yield per hectare in both seasons, measuring 21.80 and 22.58 t/ha. Alternately, the control treatment yielded the lowest value (15.11 t/ha in the first year and 15.62 t/ha in the second year), as shown in Figure 3. This variance could be attributed to the yield per individual tree.



T_1 = Control (Earthing up), T_2 = Earthing up + Spraying, T_3= Earthing up + RDF, T_4 = Spraying + RDF, T_5 = Earthing up + Spraying + RDF; Y_1 = 2021-2022 and Y_2 = 2022-2023

Figure 3. Variation in marketable yield per hectare in relation to the treatments

Yield increase over control (%): An increase in yield compared to the control was distinguished in both consecutive years. Treatment five (Earthing up + Spraying + RDF) showed the highest increase in the first year, surpassing the other treatments with a 45.5% increase in yield over control. Consequently, in the following season, this treatment observed with a similar effect and noted the highest yield increase over the control, amounting to 46.68% displayed in Table 4.

Shelf life (days): The shelf life of hog plum fruits differed with changes in the treatments applied each year, with an average temperature of 32°C and a relative humidity of 60-70%. Fruits from unfertilized treatments showed a faster rate of maturing, leading to fruit yellowing, in balancing to those from fertilized treatments. Treatment T_5 showed the longest shelf life of 9.67 and 9.17 days in the two years, which was statistically similar to the fertilized treatment T_4 in the second year. In contrast, the control treatment expressed a shelf life of 7.67 and 8.08 days during the first and second cropping years, respectively. Fertilizer and managemental treatments appeared to be enhanced the food reserves of the fruit, as evidenced by the higher TSS contents compared to the unfertilized treatment. Patil *et al.* (2004) suggested that a balanced combination of organic and inorganic fertilizers enhanced the postharvest longevity of fruits and vegetables.

Total soluble solids (TSS%): The hog plum's total soluble solids demonstrated a significant variation in harmony with the cultural practices applied and documented in Table 4. Treatment T_5 disposed the highest levels of soluble solids, measuring 8.90 and 8.91% in the first and second years, respectively. Contrarily, the lowest levels were observed in treatment T_1 counting 7.33% and 7.36% during the two cropping years. Significance of magnesium and other nutrients that are well-balanced in fertilizers, might be the possible reason of this phenomenon which play a critical role in the process of photosynthesis and the overall metabolism of plants. This outcome is resembled to the realization made by Kassem and El-Sabrout (2002) and Abd El-Migeed *et al*. (2007) in their research on Washington Navel orange trees.

Table 4. Impact of managemental treatments on the yield increase and qualitative characters of hog plum

Treatments	Yield increase over control (%)		Shelf life at average temperature 32 °C with 60-70% RH (days)		TSS %		Vitamin C content (mg/100 g)	
	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2
T_1	0	0	7.67 c	8.08 c	7.33 d	7.36 d	20.57 e	20.87 e
T_2	13.94	15.58	7.67 c	8.17 bc	8.10 c	8.12 c	20.81 d	21.06 d
T_3	14.82	17.11	8.33 bc	8.50 bc	8.33 b	8.35 b	21.1 c	21.43 c
T_4	11.53	13.33	8.67 b	8.75 ab	8.17 c	8.18 c	21.36 b	21.70 b
T_5	45.53	46.68	9.67 a	9.17 a	8.90 a	8.91 a	22.35 a	22.67 a
CV (%)	-	-	6.15	3.86	0.65	0.64	0.12	0.21
LSD	-	-	0.97	0.62	0.1	0.01	0.05	0.09

T_1= Control (Earthing up), T_2= Earthing up + Spraying, T_3= Earthing up + RDF, T_4= Spraying + RDF, T_5= Earthing up + Spraying + RDF; Y_1= 2021-2022 and Y_2= 2022-2023

Vitamin C content (mg/100 g): The vitamin C content evidenced considerable alteration with different treatments. The application of treatment T_5 revel the highest levels, measuring 22.35 and 22.67 mg/100 g in two consecutive years. Conversely, the lowest were observed when treated with treatment T_1, measuring 20.57 and 20.87 mg/100 g in the first and second years, respectively. Experience of this phenomenon could probably be assigned to intercultural operations, the prevailing environmental conditions and genetic variability, as previously documented by Lee and Kader (2000). Balanced fertilization otherwise can be said that adequate quantity of necessary elements can increase the vitamin C content in fruits as in their study, Dios *et al.* (1962) explained that specific inorganic elements, namely manganese and magnesium, have the ability to increase the vitamin C content in plants.

Conclusion

Hog plum has resulted with highest marketable yield on *sorjan* beds, 34.88 and 36.13 t/ha of extraordinary quality in two consecutive years. This outcome can be attributed to the implementation of treatment T_5, which involves earthing up and spraying against pests and diseases, alongside the recommended dosage of fertilizer.

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