

CORRELATION STUDIES ON EFFECT OF MOISTURE CONSERVATION THROUGH MULCHING IN SAPOTA

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ABSTRACT

A field experiment was conducted from 2011 to 2016 to evaluate the impact of different moisture conservation practices on the growth, physiology, soil moisture status, and yield of rainfed sapota, and to identify the most effective practice for enhancing productivity under rainfed conditions in sapota. The experiment was laid out in a Randomized Block Design along with eight treatments and four replications at a spacing of 8 × 4 m. The treatment viz., Insitu water harvesting in sunken basin with 5 % shape towards centre + organic mulch (T₁); Insitu water harvesting in sunken basin with 5 % shape towards centre + organic mulch (T₂); Insitu water harvesting in sunken basin with 5 % shape + halfmoon shaped organic mulch (T₃); Insitu water harvesting in sunken basin with 5 % shape + halfmoon shaped organic mulch (T₄); Insitu water harvesting in sunken basin with 5 % shape + No mulch (T₅); Water harvesting without shape + organic mulch (T₆); Water harvesting without shape + inorganic mulch (T₇); Water harvesting without shape + No mulch (T₈). The results indicated that moisture conservation practices significantly influenced soil moisture retention, plant morphological characters, physiological attributes, and fruit yield. Treatments involving in situ water harvesting with a 5% sloped sunken basin and organic mulch consistently maintained higher soil moisture at both 30 and 60 cm depths compared to T₈ (water harvesting without slope + no mulch). These treatments also maintained its superiority in physiological performance, including higher Chlorophyll Stability Index, Relative Water Content, proline accumulation, and nitrate reductase activity which leads to improved plant water status and metabolic activity under rainfed conditions. Higher soil moisture availability was closely associated with better vegetative growth, as evidenced by greater plant height, canopy spread, stem girth, and branching. The highest fruit yield was recorded in the treatment comprising in situ water harvesting in a sunken basin with 5% slope and organic mulch (5.20 kg tree⁻¹), which was followed by the corresponding sloped basin with organic mulch (4.80 kg tree⁻¹), while the treatment without basin shaping and without mulch recorded the lowest yield (3.10 kg tree⁻¹). The study concluded that integrating in situ water harvesting with organic mulching effectively conserves soil moisture, improves physiological efficiency, enhances vegetative growth, and increases fruit yield of sapota under rainfed conditions. Therefore, 5% sloped sunken basin combined with organic mulch is recommended for adoption as an efficient moisture conservation practice for sustainable sapota production under rainfed conditions.

KEYWORDS: Sapota, Mulching, moisture conservation, plant morphology, physiology, yield

INTRODUCTION

In india, sapota is an important tropical fruit crop cultivated by the farmers. It is valued for its sweet taste, high nutritional value, and consistent market demand. Sapota is cultivated as a perennial fruit crop it grown well under rainfed conditions. Sapota grown under moderate to high rainfall conditions. However, the availability of adequate soil moisture during dry period play a major role in the the productivity and fruit quality. Water deficit stress can adversely affect vegetative growth, reproductive organ development and yield in sapota. In many orchards, the major constraints are water scarcity and changing rainfall patterns have become major constraints to sustainable sapota fruit production. To maintain the optimum soil moisture conventional irrigation practices alone may not be sufficient particularly in the regions of prolonged dry spells or minimum water resources. Consequently, the adoption of suitable moisture conservation practices has become increasingly important to enhance water-use efficiency and maintain orchard productivity. Mulching is one of the most effective and economical soil moisture conservation techniques used in horticultural crops. It involves covering the soil surface around the plant with organic or inorganic materials to reduce evaporation losses, soil temperature regulation, curtail the population of weed growth, soil structure improvement, and enhance microbial activity. The application of mulch in fruit orchards has been reported to improve soil physical, chemical, and biological properties while promoting better root growth and nutrient uptake. By maintaining favorable soil moisture conditions, mulching can reduce irrigation frequency, increase the efficiency of water use, plant growth improvement and fruit yield. In sapota orchards, where continuous moisture availability is essential for optimal fruit development. Mitigating the adverse effects of water stress and enhancing fruit quality through mulching can play a important role in. With increasing concerns over water scarcity, climate variability, and the need for

sustainable orchard management, evaluating different mulching materials for their effectiveness in conserving soil moisture has gained considerable importance. Understanding the influence of mulching on soil moisture dynamics and plant performance can help develop efficient water management strategies for sapota cultivation. Therefore, the present study entitled "Effect of Moisture Conservation through Mulching in Sapota" was undertaken with the objectives of to evaluate the effectiveness of different mulching materials in conserving soil moisture and to assess their impact on the growth, yield, and quality of sapota and To identify the best moisture conservation practice for higher yield under rainfed condition. The findings of this study are expected to contribute to the development of sustainable moisture management practices that improve water-use efficiency, orchard productivity, and profitability in sapota cultivation.

MATERIALS AND METHODS

A field experiment was conducted from October 2010 to 2016 in Field No. B3 at Regional Research Station, Aruppukottai, Virudhunagar district, Tamil Nadu, India to evaluate the impact of various in situ water harvesting methods and mulching practices on soil moisture conservation, plant growth, physiological attributes, and yield of sapota under rainfed conditions. The experiment was laid out in a Randomized Block Design along with eight treatments and four replications. The spacing of 8 m × 4 m were maintained in this experiment orchard.

Treatment details

The eight treatments comprised of with basin shaping and without basin shaping for in situ water harvesting and different mulching materials were used as follows:

- **T₁:** In situ water harvesting in sunken basin with 5% slope towards the centre + organic mulch.
- **T₂:** In situ water harvesting in sunken basin with 5% slope towards the centre + organic mulch.
- **T₃:** In situ water harvesting in sunken basin with 5% slope + half-moon shaped organic mulch.
- **T₄:** In situ water harvesting in sunken basin with 5% slope + half-moon shaped organic mulch.
- **T₅:** In situ water harvesting in sunken basin with 5% slope without mulch.
- **T₆:** Water harvesting without basin shaping + organic mulch.
- **T₇:** Water harvesting without basin shaping + inorganic mulch.
- **T₈:** Water harvesting without basin shaping and without mulch (control).

Observations recorded

The following growth and morphological parameters were measured viz., Plant height, Stem girth, Number of primary branches, Number of secondary branches, Plant spread (East–West) and (North–South).

Measurement of soil moisture

The soil moisture content was measured from 2010 to 2012 at 30 cm and 60 cm soil depths to assess the effectiveness of the water harvesting and mulching treatments in conserving soil moisture. Soil moisture was expressed as percentage (%) on a gravimetric basis.

Physiological parameters

Chlorophyll Stability Index

The CSI was estimated following the standard electrolyte leakage method given by [3] and expressed as percentage.

Procedure

Two clean test tubes are taken. Take 250 mg of physiologically active leaf sample and cut into small pieces. Then transfer the cutted leaf sample in to test tube and add 50 ml of distilled water for immersion. Keep the test tube 1 to hot water bath at 55° C for 30 minutes. Then keep the second test tube under room temperature as control. After 30 minutes, collect the leaf sample from the test tube and macerated with 10ml of 80% acetone. Centrifuge the contents at 3000 rpm for 10 minutes. Collect the supernatant and made up the volume to 25 ml by using 80% acetone. Take the Optical Density value at 650 nm by using Spectrophotometer.

Relative Water Content (RWC)

The RWC was estimated using leaf fresh weight, leaf turgid weight and leaf dry weight according to the standard protocol by [1] and expressed as percentage:

Procedure:

Take physiologically active leaf sample. Punch the leaf by using punching machine. Then, take 50 numbers of leaf disc and measure the fresh weight of the leaf disc. The transfer the 50 number of leaf disc in to 100ml beaker and add 50 ml of distilled water and allow it for 2hours for floating. Then collect the leaf disc from the beaker then wipe gently by using filter paper. Then measure the turgid weight by using weighing balance. Then kept the leaf disc in hot air oven at at 80°C for 48 hours and measure the dry weight of the leaf disc. Then calculate the relative water content by using the following formula.

$$\text{Relative Water Content} = \frac{\text{FW} - \text{DW}}{\text{TW} - \text{DW}} \times 100$$

(FW - Fresh Weight; DW-Dry Weight; TW- Turgid Weight)

Proline content

The proline content was estimated following the acid ninhydrin method of [2] and expressed as mg g⁻¹ fresh weight.

Procedure

250 mg of leaf sample is macerated with 10ml of 3% sulphosalicylic acid and centrifuged at 3000rpm for 10mts. 2ml of supernatant solution is transferred into a test tube and add 2 ml of acid ninhydrin, 2ml of glacial acetic acid and 2ml of 6M orthophosphoric acid. The contents of the test tubes are kept in water bath for one hour and cool under tap water. The solution is transferred into a separating funnel and 4ml of toluene is added. It is shaken well for 5mts and pink color development can be noted. The colorless layer at the bottom is removed and the pink color solution is collected and the OD value is read at 520nm.

Nitrate reductase activity (NRase)

The NRase enzyme activity was estimated by the in vivo nitrate reductase assay given by [4] and expressed as $\mu\text{mol NO}_2 \text{ g}^{-1} \text{ fresh weight h}^{-1}$.

Procedure

Take 250 mg of physiologically active leaf sample and cut into small pieces. Then transferred the cutted leaf sample transferred into a test tube, and add 10 mL of assay medium. The test tubes was kept in a desiccator for 5 minutes and then keep the test tube under dark adopted conditions for 1 hour for incubation. After incubation, take 2 mL of the aliquot in a separate test tube and 1 mL of zinc acetate, then white color precipitation will appear and to wash the precipitation add 2 mL of ethanol. Then filtered through Whatman filter paper. Then add 1 mL of sulphanimide to the filtrate, followed by 1 mL of NEED (N-(1-naphthyl) ethylene diamine dihydrochloride). The resulting solution was mixed thoroughly, and the optical density (OD) was measured at 540 nm using a spectrophotometer.

Yield

The fruit yield was recorded during harvest stage and expressed as kg tree^{-1} .

Statistical analysis

The data on growth and morphological characters, physiological parameters and yield were collected and were analyzed by using ANOVA for a Randomized Block Design (RBD). Treatment means were compared using the Critical Difference (CD) test at the 5% probability level ($P = 0.05$) wherever the F-test indicated significant differences.

RESULT AND DISCUSSION

Soil Moisture

The result on soil moisture content was significantly influenced by different in situ water harvesting and mulching treatments at both 30 cm and 60 cm soil depths (Table 1). The maximum soil moisture were recorded at 60 cm depth over the at 30 cm in all treatments.

At 30 cm depth, the highest soil moisture content of 20.86% was recorded in the T₂ (in situ water harvesting in sunken basin with 5% slope towards the centre + organic mulch) treatment, which was followed by the treatments T₁ (17.14%), T₄ (16.82%), and T₃ (16.62%) respectively. The treatment T₅ (14.21%) recorded intermediate soil moisture content, whereas T₆ (13.12%) and T₇ (13.01%) showed comparatively lower values. The lowest soil moisture content (11.67%) was observed in the T₈ (water harvesting without basin shaping and without mulch, control) treatment.

A similar trend was observed at 60 cm depth, the treatment T₂ (in situ water harvesting in sunken basin with 5% slope towards the centre + organic mulch) recorded the highest soil moisture content of about 28.24%, which was followed by T₁ (23.10%), T₃ (21.46%), and T₄ (21.06%). The treatment T₅ recorded 18.78% of soil moisture content, while T₇ (17.23%) and T₆ (17.05%) exhibited moderate soil moisture levels respectively. The control treatment (T₈) recorded the lowest soil moisture content value (15.81%).

Growth and Morphological Parameters

The result on effect of different moisture conservation practices through mulching on the growth and morphological characteristics of sapota is presented in Table 2. The treatments were differed significantly on all the growth and morphological parameters.

Plant height

Comparing the treatments, T₂ (In situ water harvesting in a sunken basin with 5% slope towards the centre + organic mulch) recorded the tallest plant of about 2.72 m, which was on par with T₁ (2.60 m) and T₄ (2.56 m) respectively. The shortest plant in terms of height was observed in T₆ and T₈ (2.25 m). The enhanced plant height under T₂ treated plants may be attributed to enhanced soil moisture retention and improved availability of water and nutrients due to the combined effect of basin shaping along with organic mulching, which leads to enhancement of vegetative growth.

Stem girth

The data on stem girth was differed significantly among all the treatments. The highest girth was recorded in T₂ (26.4 cm), which was followed by T₁ (24.7 cm) and T₃ (24.6 cm) respectively, whereas the lowest girth was observed in T₅ (21.3 cm). Increased stem girth under mulched treatments stated that improved cambial activity resulting from favourable soil moisture and temperature conditions maintained by organic mulch. Similar findings have been reported in fruit crops where organic mulches enhanced trunk growth through improved soil physical properties and reduced moisture stress.

Number of primary branches

The result on the number of primary branches was highest in T₁ (2.51), which was followed by T₅ (2.40) and T₆ (2.38), however, the lowest number was recorded in T₂ and T₇ (2.18). Besides, T₂ treated plants showed the

tallest plants and T₁ treated plants had more number of primary branch development, portentous that slight differences in microenvironment and resource allocation may have influenced branching behaviour.

Table 1. Effect of moisture conservation through mulching on the soil moisture status of sapota.

Treatments	(30 cm) (%)	(60 cm) (%)
T ₁ : In situ water harvesting in sunken basin with 5% slope towards the centre + organic mulch.	17.14	23.10
T ₂ : In situ water harvesting in sunken basin with 5% slope towards the centre + organic mulch.	20.86	28.24
T ₃ : In situ water harvesting in sunken basin with 5% slope + half-moon shaped organic mulch.	16.62	21.46
T ₄ : In situ water harvesting in sunken basin with 5% slope + half-moon shaped organic mulch.	16.82	21.06
T ₅ : In situ water harvesting in sunken basin with 5% slope without mulch.	14.21	18.78
T ₆ : Water harvesting without basin shaping + organic mulch.	13.12	17.05
T ₇ : Water harvesting without basin shaping + inorganic mulch.	13.01	17.23
T ₈ : Water harvesting without basin shaping and without mulch (control).	11.67	15.81
Mean	15.43	20.34
SEd	0.102	0.138
CD (P=0.05)	0.218	0.296

Number of secondary branches

The data on number of secondary branches reported that, the treatment T₁ recorded the highest value (9.87), which was statistically comparable with T₃ (9.76) treatment. The lowest number of secondary branches was recorded in T₅ (8.47) treatment. The maximum number of secondary branches were observed in mulched treatments can be correlated to maintained soil moisture availability, which favoured continuous shoot emergence and canopy development in sapota.

Canopy spread

The result on canopy spread was measured in two directions viz., East to West and North to South. In the East to West direction, T₂ treated plants recorded the maximum spread of about 2.90 m, which was followed by T₁ (2.87 m) and T₃ (2.72 m) respectively. However, the minimum spread was recorded in the control T₈ (2.28 m) treatment. In the North to South direction, the highest tree spread was recorded in T₃ (2.60 m) treatment, which was followed by T₂ (2.55 m) and T₁ (2.53 m) respectively, whereas the lowest was again recorded in T₈ (2.27 m) treatment. The wider canopy spread under treatments combining basin shaping with organic mulch found that vigorous vegetative growth resulting from efficient soil moisture conservation and utilization.

Overall, treatments involving in situ water harvesting combined with organic mulching (T₁ and T₂) consistently produced superior morphological and growth characters compared with treatments without mulch and basin shaping. The control treatment (T₈) and the treatment without mulch (T₅) generally recorded the lowest values for most growth parameters, highlighting the importance of mulch in reducing evaporative water losses, moderating soil temperature, improving microbial activity, and enhancing essential nutrient availability. Proper maintenance of organic mulch predictable created a favourable root-zone environment which leads to enhancement of better root growth, increased water uptake, and consequently improved above-ground biomass development.

These findings are in agreement with earlier reports in sapota and other perennial fruit crops, where organic mulching and in situ moisture conservation practices significantly improved morphological growth by

maintaining higher soil moisture availability, soil health improvement and reducing moisture stress during critical growth periods in sapota under rainfed conditions.

Physiological and yield parameters

The data on Chlorophyll Stability Index (CSI), Relative Water Content (RWC), proline accumulation, nitrate reductase (NRase) enzyme activity, and yield of sapota are presented in Table 3. Comparing the eight treatments, significant differences among treatments were observed for all the physiological parameters and fruit yield of sapota.

Among the eight treatments, T₂ (In situ water harvesting in sunken basin with 5% slope towards the centre + organic mulch) showed the highest values for all the physiological parameters (CSI of 82.2%, RWC of 87.3%, proline content of 70.5 mg g⁻¹ FW, NRase activity of 306.2 µmol NO₂ g⁻¹ h⁻¹), and the highest fruit yield of 5.2 kg tree⁻¹. Which was followed by T₁ treated plants had 80.5% of CSI, 86.4% of RWC, 70.2 mg g⁻¹ FW of proline, 295.3 µmol NO₂ g⁻¹ h⁻¹ of NRase activity, and 4.8 kg tree⁻¹ of yield. The superior performance of the T₁ and T₂ treatments might be attributed to the combined effect of efficient rainwater harvesting through 5% slope basin shaping and the use of organic mulch, which leads to reduced evaporation losses, enhances the soil moisture availability, moderated soil temperature, and enhanced rhizosphere activity [2]. As a result, the sapota plants had higher leaf water status along with maximum membrane integrity, resulting in enhancement of physiological efficiency which leads to enhancing the fruit production.

The treatments T₃ and T₄ had significantly higher values than the treatments without mulching, although the treatments T₃ and T₄ remained inferior to T₁ and T₂. The CSI value ranged from 76.3 to 77.9%, RWC from 83.2%, proline from 68.8 to 69.0 mg g⁻¹ FW, NRase activity from 286.4 to 289.3 µmol NO₂ g⁻¹ h⁻¹, and yield remained at 4.1 kg tree⁻¹. These findings were opined that, the partial mulching improved soil moisture conservation, besides these treatments was less effective than complete basin mulching in maintaining a favorable rhizosphere zone environment.

Physiological performance was reduced in the treatments of without basin shaping or without mulch. The treatment T₅ recorded 73.5% CSI, 82.4% RWC, 68.7 mg g⁻¹ FW proline, 284.3 µmol NO₂ g⁻¹ h⁻¹ NRase activity, and 3.5 kg tree⁻¹ yield. Similarly, T₆ and T₇ registered on par values, showed that although mulching alone provided some benefit, the absence of proper basin configuration reduced rainwater harvesting efficiency and moisture retention [1]. Besides, the treatment control (T₈) recorded the lesser values for all physiological parameters, with 72.1% CSI, 81.0% RWC, 67.1 mg g⁻¹ FW proline, 277.4 µmol NO₂ g⁻¹ h⁻¹ NRase activity, and the lowest yield of 3.1 kg tree⁻¹. The reduced physiological activity in T₈ treatment can be attributed to lesser availability of soil moisture, which leads to greater water stress, reduction of stability of the cell membranes and lowers the metabolic activity, and ultimately reduction in productivity.

However, the mulched treatments maintained its superiority in CSI indicates better maintenance of cell membrane integrity under moisture stress, reflecting enhanced drought tolerance and also increased RWC indicates improved plant water status and availability due to reduced soil evaporation and greater maintenance of soil moisture availability in the root zone. The higher proline accumulation observed in T₁ and T₂ treatments suggests improved osmotic adjustment, enabling plants to tolerate intermittent moisture stress more effectively. The same treatments maintained its superiority in NRase enzyme activity which leads to higher maintenance of photosynthetic efficiency, vegetative growth, and fruit yield.

The observed results are consistent with earlier reports that organic mulching and in situ rainwater harvesting improve soil moisture conservation, enhance plant water relations, maintain the stability of cellular membrane, fastest stimulation of nitrogen metabolism, and increase fruit yield in sapota.

Correlation studies between Physiological attributes and yield of sapota

Chlorophyll stability index (CSI) and Yield

The result on correlation studies between Chlorophyll stability index (CSI) and yield (kg/tree) stated that a very strong positive relationship as the Chlorophyll stability index enhanced from 72.1% to 82.2% and the yield increased from 3.1 to 5.2 kg tree⁻¹ (Fig 1. Scatter plot diagram). The Y regression equation value reported that for every 1% increase in Chlorophyll stability index leads to the yield enhanced by 0.195 kg tree⁻¹ approximately. The R² value (0.982) of coefficient of determination explained that there was a variation of about 98.2% in yield is notified by changes in Chlorophyll stability index. The above said results suggest that a strong positive relationship between Chlorophyll stability index and yield with higher Chlorophyll stability index value is being closely connected with fruit yield enhancement. Therefore, the Chlorophyll stability index is an important reliable physiological predictor of yield enhancement in the current study.

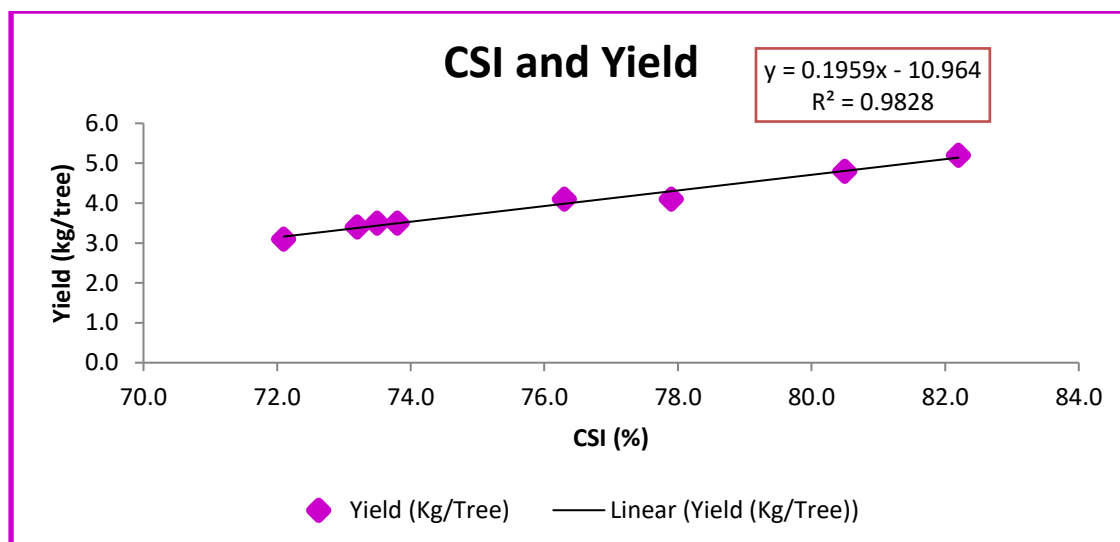


Fig. 1. Scatter plot correlation studies between Crop Stress Index (CSI) and yield (kg/tree)

Relative Water Content (RWC) and Yield

The scatter plot result on correlation studies between relative water content (RWC) and yield (kg/tree) stated that a very strong positive relationship as the relative water content (RWC) enhanced from 81% to 87.3% and the yield increased from 3.1 to 5.2 kg tree⁻¹ (Fig 2. Scatter plot diagram). The Y regression equation value reported that for every 1% increase in relative water content leads to the yield enhanced by 0.329 kg tree⁻¹ approximately. The R^2 value (0.951) of coefficient of determination explained that there was a variation of about 95.1% in yield is notified by changes in relative water content. The above said results suggest that a strong positive relationship between relative water content and yield with maintaining the higher relative water content is being closely linked with increased fruit yield. Therefore, the relative water content is an important dependable physiological forecaster through highlighting the importance of adequate plant water status for maximizing productivity was found in the current study.

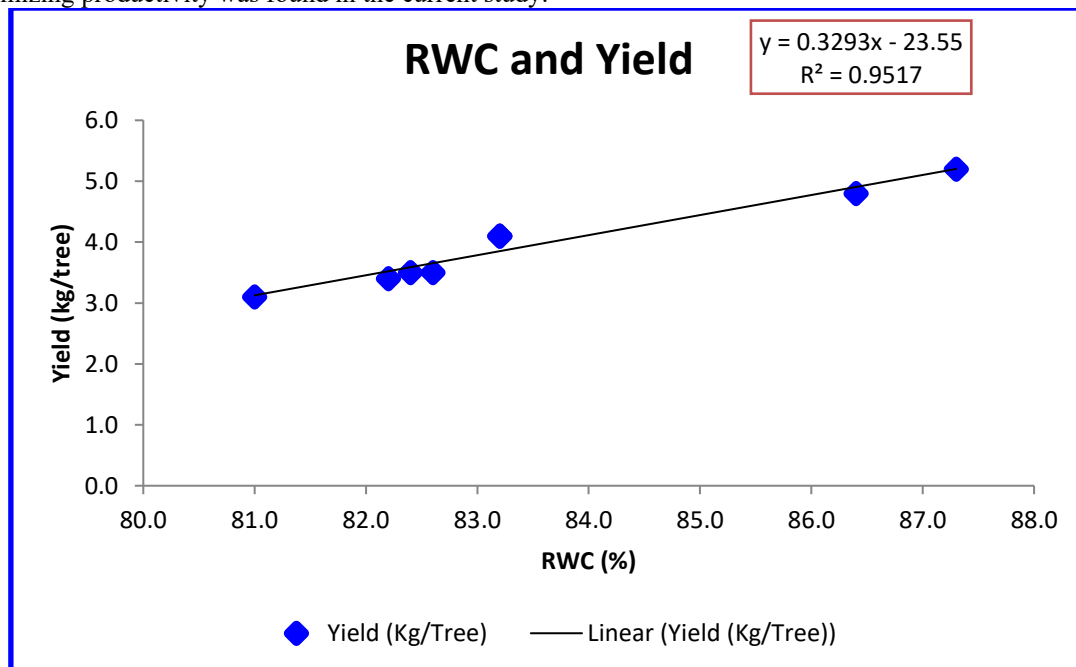


Fig. 2. Scatter plot correlation studies between Relative Water Content (RWC) and yield (kg/tree)

Proline and Yield

The correlation studies on proline content performed a strong positive linear relationship with yield. The regression equation y value explained that, as proline concentration increased, yield also increased. The R^2 value (0.919) of coefficient of determination explained that 91.9% of the variation in yield was explained by proline content, representing a strong connection between the two variables. Therefore, the proline content is an important iminoacid for enhancement of drought tolerance capacity and it is important dependable physiological forecaster through maintenance of osmotic adjustment and it act as a compatible osmolyte (osmoprotectant) that helps maintenance of cells osmotic pressure, retain water, and protect the cell structures during dehydration under rainfed conditions which leads to maximizing productivity was found in the current study.

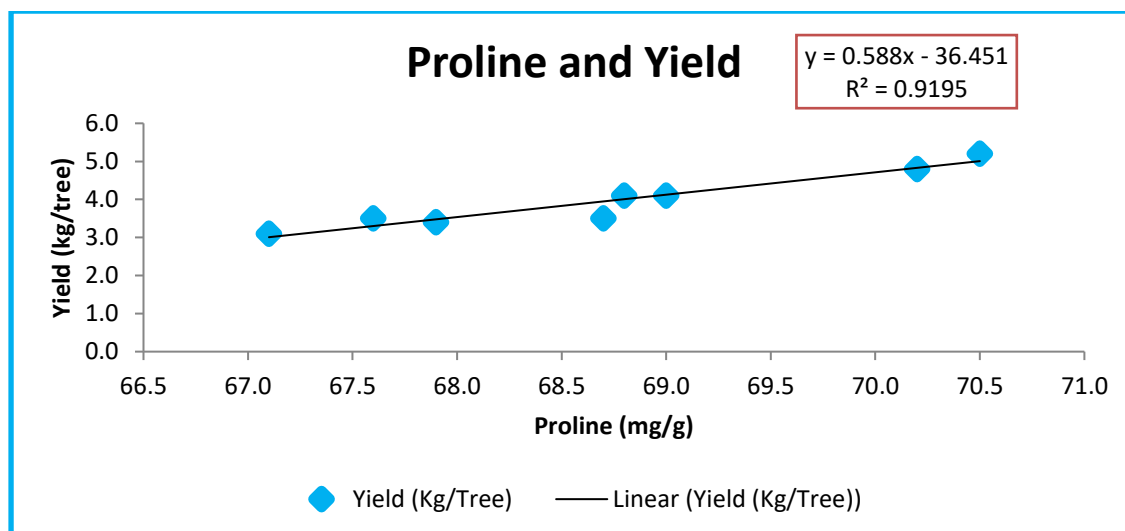


Fig. 3. Scatter plot correlation studies between Proline and yield (kg/tree)

Nitrate Reductase (NRase) enzyme and Yield

The correlation studies on Nitrate Reductase enzyme activity showed a strong positive linear relationship with yield. The regression equation y value explained that, as yield increased with increasing Nitrate Reductase enzyme activity. The R^2 value (0.946) of coefficient of determination explained that 94.6% of the variation in yield was explained by Nitrate Reductase enzyme activity, representing a strong connection between the two variables. Therefore, the Nitrate Reductase enzyme activity is an important physiological parameters for supplying the essential nitrogen needed for growth and also for protein synthesis.

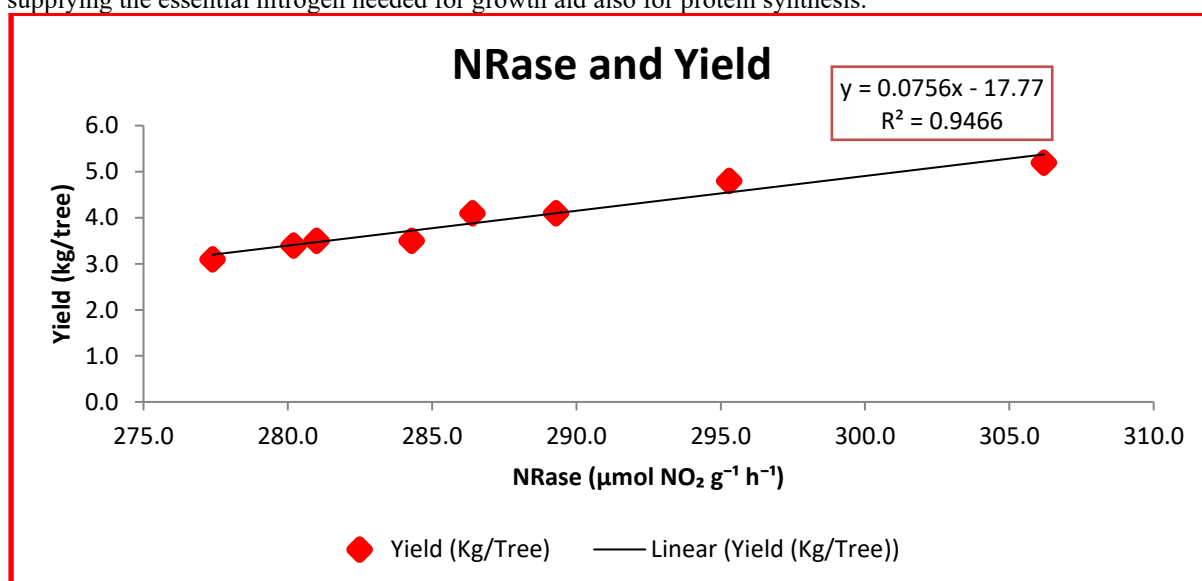


Fig. 4. Scatter plot correlation studies between Nitrate Reductase (NRase) enzyme and Yield.

CONCLUSION

Overall, the results indicate that in situ water harvesting through a sunken basin with a 5% slope towards the centre combined with organic mulching (T_2) is the most efficient moisture maintenance practice for improving physiological performance and maximizing yield in sapota.

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Table 2. Effect of moisture conservation through mulching on the growth and morphological characteristics of sapota.

Treatments	Plant height (cm)	Girth (cm)	Primary Branches	Secondary branches	Spread (m)	
T ₁ : In situ water harvesting in sunken basin with 5% slope towards the centre + organic mulch.	2.60	24.7	2.51	9.87	2.87	2.53
T ₂ : In situ water harvesting in sunken basin with 5% slope towards the centre + organic mulch.	2.72	26.4	2.18	9.08	2.90	2.55
T ₃ : In situ water harvesting in sunken basin with 5% slope + half-moon shaped organic mulch.	2.32	24.6	2.35	9.76	2.72	2.60
T ₄ : In situ water harvesting in sunken basin with 5% slope + half-moon shaped organic mulch.	2.56	22.7	2.30	8.56	2.56	2.42
T ₅ : In situ water harvesting in sunken basin with 5% slope without mulch.	2.28	21.3	2.40	8.47	2.44	2.32
T ₆ : Water harvesting without basin shaping + organic mulch.	2.25	23.80	2.38	8.68	2.42	2.46
T ₇ : Water harvesting without basin shaping + inorganic mulch.	2.30	22.5	2.18	8.73	2.32	2.38
T ₈ : Water harvesting without basin shaping and without mulch (control).	2.25	22.6	2.27	8.70	2.28	2.27
Mean	2.24	24.77	2.31	8.73	2.47	2.41
SEd	0.208	0.098	0.004	0.017	0.007	0.004
CD (P=0.05)	0.446	0.210	0.009	0.038	0.015	0.009

Table 3. Effect of moisture conservation through mulching on the CSI, RWC, Proline, NRase activity and yield of sapota.

Treatments	CSI (%)	RWC (%)	Proline (mg/g Fw)	NRase ($\mu\text{mol NO}_2 \text{ g}^{-1} \text{ h}^{-1}$)	Yield (Kg/Tree)
T ₁ : In situ water harvesting in sunken basin with 5% slope towards the centre + organic mulch.	80.5	86.40	70.2	295.3	4.8
T ₂ : In situ water harvesting in sunken basin with 5% slope towards the centre + organic mulch.	82.2	87.3	70.5	306.2	5.2
T ₃ : In situ water harvesting in sunken basin with 5% slope + half-moon shaped organic mulch.	76.3	83.2	68.8	286.4	4.1
T ₄ : In situ water harvesting in sunken basin with 5% slope + half-moon shaped organic mulch.	77.9	83.2	69.0	289.3	4.1
T ₅ : In situ water harvesting in sunken basin with 5% slope without mulch.	73.5	82.4	68.7	284.3	3.5
T ₆ : Water harvesting without basin shaping + organic mulch.	73.2	82.2	67.9	280.2	3.4
T ₇ : Water harvesting without basin shaping + inorganic mulch.	73.8	82.6	67.6	281.0	3.5
T ₈ : Water harvesting without basin shaping and without mulch (control).	72.1	81.0	67.1	277.4	3.1
Mean	76.19	83.54	68.73	287.51	3.97
SEd	0.126	0.074	0.041	0.321	0.025
CD (P=0.05)	0.270	0.158	0.087	0.687	0.053