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EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON SWEET ORANGE PHULE MOSAMBI GROWTH YIELD AND QUALITY

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Abstract

The results showed that the best growth attributing characters were recorded with T11: 50% RDN + 20kg FYM/tree + 25% N from Castor Cake + 10ml Bio NPK Consortium + Micronutrients foliar spray (1% Grade IV) at 35.28 cm, 45.73 cm, 45.32 cm, and 0.061 m3, respectively. Many yield metrics, including maximum fruit length (8.11cm), maximum fruit diameter (7.96 cm), maximum fruit weight (241.91 g), maximum fruit volume (251.17 cc), maximum fruit number per tree (255.17), and yield (61.81 kg per tree & 17.18 t/ha) were considerably raised by treatment T11. When compared to the other INM treatments, treatment T9; produced the highest pooled TSS content (9.83°Brix). Comparatively, treatment T10 showed the lowest acidity levels in the fruits (0.491% in total data).

Keywords: *Effect of Integrated Nutrient, Management, Sweet Orange Phule, Mosambi Growth.*

1. Introduction

One of the world's most extensively planted fruit crops is citrus. The refreshing flavour, scent, and taste of citrus fruits, in addition to their various health advantages, are contributing to their rising popularity. Vitamin C isn't the only healthful ingredient found in citrus fruits; flavonoids and carotenoids are also abundant. As members of the Rutaceae family and the Aurantioideae subfamily, the genus Citrus and its close cousins (Fortunella, Poncirus, Eremocitrus, and Microcitrus) are classified as angiosperms. The Himalayan foothills of Southeast Asia are often cited as the place where citrus first appeared. Citrus trees are native to Southeast Asia, where they flourish in the warm, wet monsoon. As the monsoon's influence waned in the late Miocene, citrus trees began to spread over Asia and Australia. As citrus spread to new areas and temperatures, it morphed into a variety of distinct species.[1]

After the banana and the mango, citrus fruits in India are the third most planted and harvested fruit. Citrus sinensis (L.) Osbeck, often known as the sweet orange, is a subtropical fruit that

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is endemic to Southern China. It is a member of the Rutaceae family and the subfamily Aurantioideae. They first appeared in the Western Hemisphere after Columbus's arrival there in the 15th century. Oranges vary in form from round to rectangular and have a high sugar content and few seeds. There are four different types of oranges: round oranges, navel oranges, blood oranges, and acid less oranges. Juice is most often made from round oranges.[2]

Andhra Pradesh, Maharashtra, Karnataka, Punjab, Haryana, and Rajasthan all grow a lot of sweet oranges, making them the second most widely grown citrus fruit in the country. The productivity of the sweet orange industry in India is 17.46 MT/ha, and it uses 187 thousand hectares of land.[3]

Usually only reaching 4.5-5 m in height, the orange tree has a dense, rounded crown. The sweetly scented white blossoms may be found alone or in groups. Juicy and delicious, the fruit's pulp is often segmented into 10-14 bite-sized pieces and comes in hues of yellow, orange, and red. Vitamins A and C and potassium are especially abundant in fruit. Fruits may be consumed in their natural state or turned into juice, a wide variety of sweets, jams, marmalades, etc.[4]

1.1 Impact of Integrated Nutrient Management

Integrated Nutrient Management (INM) is a long-term strategy for controlling agricultural nutrients that reduces pollution and maximises yields. Integrated nutrition management (INM) is the practise of providing plant nutrients from a variety of sources, including organic and inorganic fertilisers, agricultural wastes, and other organic resources. Some of INM's effects on agriculture and the natural world include the following:[5]

i. Increased crop productivity: By ensuring that plants get an adequate amount of each nutrient, INM may boost agricultural yields. This method guarantees that plants get all the nutrients they need to thrive, which might increase harvest success.

ii. Improved soil health: Soil organic matter content, soil structure, and soil fertility may all benefit from INM's application. Better soil health may increase agricultural production and make farms more resistant to natural disasters.

iii. Reduced environmental impacts: By decreasing the need for synthetic fertilisers and other agrochemicals, INM may have a positive effect on the environment. In addition to lowering greenhouse gas emissions and preserving biodiversity, this may also assist minimise soil and water pollution.[6]

iv. Enhanced nutrient use efficiency: With INM, fertiliserutilisation efficiency is increased because leaching, runoff, and volatilization are reduced. This may lessen the financial and ecological toll of using fertiliser.

v. Enhanced crop quality: Improved fertiliser management with INM may increase crop yield and quality. As a result, food crops may have more beneficial nutrients, improving people's health.[7]

2. Literature review

Dutta, P. &Dhua, R.S. (2019)conducted a comprehensive research to identify the optimal integrated nutrient management treatment for improving the development, production, and quality of sweet orange in Bharsar, Uttarakhand. The research concluded that the optimal combination of fertiliser dosage (150g/tree) + organic manure dose (FYM-6kg/tree) yielded the greatest fruit quality features, including TSS, reducing sugar, total sugar, and non-reducing sugar.[8]

Ambaliya, N. B., & Raut, H. M. (2018)verified an improvement in sweet orange quality and biochemical parameters when using either Azospirillum or PSB alone or in conjunction with chemical fertilisers. Treatment consisting of 100% NPK (800:400:400g) +200g Azospirillum +200 g PSB per plant outperformed the other eleven combinations. It helped improve the taste and physicochemical properties of sweet oranges.[9]

Eide, D., &Guerinot, M.L. (2017)investigates the potential of Pseudomonas flourescence strain 843 and Azospirillumbrasilense strain W24, two microbial strains, to improve the quality of Washington navel orange fruit and reduce the persistence of nematodes in the soil. During the course of the experiment, the strains were administered to the trees at two concentrations (300 ml and 500 ml per tree, 10-8 cells/ml) once every month. Fruit quality, total soluble solids, and juice yields of Washington navel oranges were significantly increased after bio-fertilizer inoculation with the growth-promoting rhizobacteria Pseudomonas fluorescence strain 843. In contrast, inoculation with Azospirillumbrasilense strain W24 increased these values but did not significantly improve fruit quality.[10]

Barakat, M. R., &Sayad, B. M. (2017)experimented with the impact of various concentrations of zinc (zinc sulphate, 0.5%), boron (Borax, 0.2%), and iron (iron sulphate, 0.4%) on the productivity and quality of the sweet orange cv. Zinc+boron+iron improved fruit retention (78.6%), fruit number per plant (205), and fruit weight (163 g) in Mosambi (budded on Citrus aurantium) in West Bengal, India. For both TSS (10 0Brix) and ascorbic acid (68.4 mg/100 ml), zinc+boron came out on top. Juice recovery was 43.1% and total sugar content was 7.04 % with zinc+boron+iron.[11]

Gautam, U. S., & Ashish, K. (2016). Researchers in India's Aurangabad area studied the impact of multi-micronutrients on the production and qualitative parameters of delicious oranges produced in inceptisols. Applying a balanced dosage of NPK (160.2, 55.4, 110.8 kg/ha, annually) in addition to a multi-micronutrient (BoracolTM BSF-11: Mg-0.6%, B-1.2%) and trace elements (Fe-4.0%, Mn-2.0%, Zn-6.0%) improved the amount of fruits produced by each tree. The treatment that received multi-micronutrients via the soil also had more fruit weight per tree. The addition of multi-micronutrients to the prescribed NPK increased yields from 20.06 to 39.83 t/ha. Multi-micronutrient and NPK fertilization or fustigation improved fruit quality in terms of juice, total soluble solids, fruit girth, ascorbic acid content, reducing and non-reducing sugars.[12]

3. Methodology

During the months of March and October in 2019 and 2020, the experiment "Effect of integrated nutrient management on growth, yield, and quality of sweet orange [Citrus sinensis (L.) Osbeck] cv. Phule Mosambi" was carried out.

3.1 Experimental site

The research was conducted at the College of Horticulture's Horticultural Research Farm at the Anand Agricultural University in the city of Anand, Gujarat, India. Located at 22°35' North latitude and 72°56' East longitude, this location has an elevation of 45.1 metres above mean sea level and belongs to the Middle Gujarat agro climatic zone (Zone-III) of Gujarat.

3.2 Experimental details

3.4.1	Crop and variety	:	Sweet Orange cv.Phule Mosambi
3.4.2	Year	:	2019and2020(Twoyears)
3.4.3	Design	:	CompletelyRandomizedDesign(CRD)

3.4.4	Numberoftreatments	:	11
3.4.5	Numberofrepetitions	:	3(Two plantsperrepetition)
3.4.6	Plantingdistance	:	6 x6 m
3.4.7	Ageof tree	:	7yearsold
3.4.8	Totalnumberoftrees	:	66

3.3 Varietal description

One of the best sweet orange varieties is the Phule Mosambi cv, which was developed at the Mahatma Phule Krishi Vidyapeeth in Rahuri, Maharashtra. This is a clonal strain developed at Nucellar Mosambi. This variety's fruits keep their brilliant green colour even after ripening, and its output may reach 20 t/ha. The typical fruit weighs about 240g and has a high juice content of 47%. It thrives in the humid heat of the tropics and may be grown there.

3.4 Methodology adopted in recording observations

Growth Parameters

- Additional plant height in centimetres
- N. & S. plant expansion (in cm)
- Gradual East-West (cm) Plant Spread
- Canopy volume increase (in m3)

Yield Parameters

- Inches of fruit size
- Inches of fruit size.
- Fruit mass in grammes
- Measurement of fruit volume in millilitres

3.5 Procedure

In order to clarify the 25 ml of juice pulp that had been homogenized, 2 ml of a 45% basic lead acetate [$Pb(C_2H_3O_2)_2$] solution was added to a 250 ml volumetric flask. The lead was removed from the solution by adding an excess of potassium oxalate crystals and waiting 10 minutes. Filtered through Whatman No.1 filter paper and topped up with distilled water to a total of 250 ml.

After removing a 25 ml aliquot from the filter, 5 ml of hydrochloric acid (1:1) were added, and the mixture was inverted at room temperature for 24 hours. Finally, the volume was brought up to 100 ml by cooling the contents and neutralising them with 40% sodium hydroxide (NaOH) while monitoring their progress using phenolphthalein. Whatman No. 1 filter paper was used to filter the solution. After collecting the filtrate in a burette, it was titrated against a boiling combination of Fehling's solutions A and B (5 ml of each) until the blue hue vanished. After that, we added a couple of drops of methylene blue indicator (1% strength) and kept titrating until the liquid became a deep brick red. The titrate value was recorded, and the decreasing sugar % was determined using the following formula.

The following formula was used to convert the proportion of total sugar to invert sugar.

$$\textbf{Total Sugar (\%)} = \frac{\text{Glucose eq. of Fehling solutions (0.052)}}{\text{Titre value}} \times \frac{\text{Total volume made up}}{\text{Vol. of the juice}} \times \frac{\text{Volume made up after inversion}}{\text{Aliquot taken for inversion}} \times 100$$

3.6 Sample preparation

Ten millilitres (10 ml) of homogenised sweet orange juice pulp was added to a 100 ml volumetric flask. The original 60 ml volume was raised to 100 ml by adding oxalic acid solution (4%). After 30 minutes, Whatman No.1 filter paper was used to filter the suspension. Before titrating, the 2, 6-dichlorophenol indophenol (dye solution) was titrated against a standard ascorbic acid solution to establish a dye factor. Five millilitres of the filtrate were used to titrate against a known concentration of a dye solution. After 15 seconds of titration, a persistent pale pink colour was seen.

The following formula was used to determine the amount of ascorbic acid present:

$$\textbf{Juice (\%)} = \frac{\text{Juice weight per fruit}}{\text{fruit weight}} \times 100$$

3.7 Statistical analysis

Statistics were broken down by year. The pooled analysis was also performed to examine the cumulative impact of various treatments over time. The 'F' test was used to compare the treatment means of all characters in both separate and combined analyses, and a 5% difference was considered statistically significant.

4. Results

Effect of integrated nutrient management on the development, production, and quality of sweet orange [Citrus sinensis (L.) Osbeck] cv. Phule Mosambi was the title of a study done in the field by researchers at the B. A. College of Agriculture, Anand Agricultural University in Anand (Gujarat). The experiment was place between March and October in both 2019 and 2020. A totally randomised plan with three replicates was used to conduct the experiment.

4.1 effect of integrated nutrient management on growth parameters

Table 4.1 displays information on the effect of several integrated nutrient management (INM) treatments on the overall plant height. Sweet orange plant height was shown to be considerably impacted by the treatments.

Compared to other treatments such as T7, T10, T2, T8, T6, and T9 in both 2019 and 2020, T11 [50% RDN + 20 kg FYM/tree + 25% N from Castor Cake + 10 ml Bio NPK Consortium + Micronutrients foliar spray (1% Grade IV)] yielded significantly higher value in terms of incremental plant height (34.83 cm and 35.73 cm, respectively). Similar to T10, T7, T2, and T8, T11 produced considerably greater incremental plant height (35.28 cm) in pooled study. Treatment T3 (75% RDF + 20 kg FYM/tree) had the lowest average increase in plant height (25.15 cm) across all collected data.

Table 4.1: Increased sweet orange plant height: the result of comprehensive nutrition management

Sr. No.	TreatmentsDetails	Incrementalplantheight (cm)		
		2019	2020	Pooled
T_1	RDF(800:300:600NPKg/tree)+20kg FYM(Control)	26.77	26.83	26.80
T_2	125%RDF+20 kgFYM/tree	32.30	32.67	32.48
T_3	75%RDF+20 kgFYM/tree	25.63	24.67	25.15
T_4	75% RDN+20kgFYM/tree+25%Nfrom Vermicompost	27.70	29.67	28.68
T_5	75% RDN+20kgFYM/tree+25%Nfrom CastorCake	28.73	29.33	29.03

T_6	75% RDN+20kgFYM/tree+ 25%N fromVermicompost + 10 ml BioNPK Consortium	31.40	31.83	31.62
T_7	75% RDN+20kgFYM/tree+25%Nfrom CastorCake+10 mlBioNPKConsortium	33.53	31.57	32.55
T_8	50%RDN+20kgFYM/tree+25%NfromVermicompost+Micronutrientsfoliarspray (1%Grade IV)	32.17	32.47	32.32
T_9	50% RDN+20kgFYM/tree+ 25%N fromCastorCake+Micronutrientsfoliarspray(1 %GradeIV)	30.50	30.40	30.45
T_{10}	50% RDN + 20 kg FYM/tree + 25% N fromVermicompost+10mlBioNPKConsortium+ Micronutrientsfoliarspray(1 %GradeIV)	33.50	34.83	34.17
T_{11}	50% RDN+20kgFYM/tree+ 25%N fromCastor Cake+10ml BioNPK Consortium + Micronutrientsfoliarspray(1%GradeIV)	34.83	35.73	35.28
T	S.Em±	1.51	1.71	1.14
	C.D. (P= 0.05)	4.42	5.02	3.25
Y	S.Em±	-	-	0.48
	C.D. (P= 0.05)	-	-	NS
YxT	S.Em±	-	-	1.61
	C.D. (P= 0.05)	-	-	NS
C.V.%		8.52	9.59	9.08

The effects of several INM treatments on the lateral (North-South) distribution of plants are summarized in Table 4.2. In terms of additional N-S plant spread, the findings were determined to be considerable.

T11 showed significantly greater N-S plant spread increments in 2019 and 2020 (45.07 cm and 46.40 cm, respectively). In 2019, it was shown to be on par with T10, T7, T8, T2, and T6, and in 2020, T9 was determined to be on level with all of these therapies as well. T11 had the greatest incremental North-South spread (45.73 cm) in the combined study, surpassing T10, T2, and T7 by a wide margin. However, T3 (35.25cm) was where we saw the lowest total pooled value.

Table 4.2: Increased sweet orange plant expansion (north to south) as a result of integrated nutrition management

Sr. No.	TreatmentsDetails	Incrementalplantspread [N-S](cm)		
		2019	2020	Pooled
T_1	RDF(800:300:600NPKg/tree)+20kg FYM(Control)	36.33	38.33	37.33

T_2	125%RDF+20 kgFYM/tree	41.50	43.87	42.68
T_3	75%RDF+20 kgFYM/tree	35.33	35.17	35.25
T_4	75%RDN+20kgFYM/tree+25%N fromVermicompost	39.00	39.67	39.33
T_5	75%RDN+20kgFYM/tree+25%N fromCastorCake	38.90	40.43	39.67
T_6	75%RDN+20kgFYM/tree+25%N fromVermicompost+10mlBioNPKConsortium	41.10	41.97	41.53
T_7	75%RDN+20kgFYM/tree+25%N fromCastorCake+10mlBioNPKConsortium	42.53	42.17	42.35
T_8	50%RDN+20kgFYM/tree+25%Nfrom Vermicompost+Micronutrientsfoliarspray(1 %GradeIV)	41.90	42.37	42.13
T_9	50%RDN+20kgFYM/tree+25%N fromCastorCake+Micronutrientsfoliarspray(1 %Grade IV)	39.13	41.40	40.27
T_{10}	50% RDN + 20 kg FYM/tree + 25% N fromVermicompost+10mlBioNPKConsortium+Micronutrientsfoliarspray(1 %GradeIV)	44.60	45.47	45.03
T_{11}	50%RDN+20kgFYM/tree+25%N fromCastorCake+10mlBioNPKConsortium+ Micronutrientsfoliarspray(1 %GradeIV)	45.07	46.40	45.73
T	**S.Em±**	**1.66**	**1.72**	**1.19**
	C.D. (P= 0.05)	**4.87**	**5.04**	**3.40**
Y	**S.Em±**	-	-	**0.51**
	C.D. (P= 0.05)	-	-	**NS**
YxT	**S.Em±**	-	-	**1.69**
	C.D. (P= 0.05)	-	-	**NS**
	C.V.%	**7.10**	**7.16**	**7.13**

4.2 effect of integrated nutrient management on yield parameters

The results of several integrated nutrition management treatments on sweet orange fruit length are shown in Table 4.3.

T11 [50% RDN + 20kg FYM/tree + 25% N from Castor Cake + 10 ml Bio NPK Consortium + Micronutrients foliar spray (1% Grade IV)] had the longest fruit in both years of testing, measuring 7.97 cm and 8.25 cm, respectively, and was on par with T10, T8, T6, and T2 in the pooled value (8.11cm). In 2019, T11 had the longest fruits, followed by T2, T6, T8, and T10, but in 2020, T11 was on level with T2, T6, T8, and T10. T3 has the shortest average fruit length (7.23 cm) in our dataset.

Table 4.3: Longevity (in centimetres) of delicious oranges as a function of INM

Sr. No.	TreatmentsDetails	Fruitlength(cm)		
		2019	**2020**	**Pooled**
T_1	RDF(800:300:600NPKg/tree)+20kgFYM (Control)	7.34	7.50	7.42
T_2	125%RDF+20 kgFYM/tree	7.75	7.75	7.75
T_3	75%RDF+20 kgFYM/tree	7.02	7.43	7.23
T_4	75%RDN+20kgFYM/tree+25%Nfrom Vermicompost	7.57	7.47	7.52
T_5	75%RDN+20kgFYM/tree+25%NfromCastor Cake	7.90	7.24	7.57
T_6	75%RDN+20kgFYM/tree+25%Nfrom Vermicompost+ 10ml BioNPK Consortium	7.78	7.79	7.78
T_7	75%RDN+20kgFYM/tree+25%NfromCastor Cake+10ml BioNPKConsortium	7.61	7.37	7.49
T_8	50%RDN+20kgFYM/tree+25%Nfrom Vermicompost+Micronutrientsfoliarspray(1% GradeIV)	7.87	7.88	7.87
T_9	50%RDN+20kgFYM/tree+25%NfromCastor Cake+Micronutrients foliar spray(1%GradeIV)	7.59	7.63	7.61
T_{10}	50%RDN+20kgFYM/tree+25%Nfrom Vermicompost+10mlBioNPKConsortium+Micronutrients foliar spray(1%GradeIV)	7.72	8.17	7.95
T_{11}	50%RDN+20kgFYM/tree+25%NfromCastor Cake+10mlBioNPKConsortium+Micronutrients foliarspray(1 %Grade IV)	7.97	8.25	8.11
T	**S.Em±**	**0.18**	**0.20**	**0.13**
	C.D. (P= 0.05)	**0.52**	**0.59**	**0.38**
Y	**S.Em±**	-	-	**0.06**
	C.D. (P= 0.05)	-	-	**NS**
YxT	**S.Em±**	-	-	**0.19**
	C.D. (P= 0.05)	-	-	**NS**
	C.V.%	**4.05**	**4.53**	**4.30**

Table 4.4 displays the effects of various integrated nutrition management on fruit diameter, showing a very small range of values.

T11 yielded the largest fruit diameter measurements of 7.97 cm in 2019, 7.95 cm in 2020, and 7.96 cm when the data was combined. In 2019, the T11 treatment's fruit diameter was comparable to that of the T6, T7, T8, T9, and T10; in 2020, it was comparable to that of the T2, T4, T7, T8, T9, and T10; and in pooled data, it was comparable to that of the T7, T8, and T9. In aggregate data, T3 produced the smallest fruit diameter (7.28 cm)..

Table 4.4: The impact of INM on the diameter (in centimetres) of delicious orange fruits

Sr. No.	TreatmentsDetails	Fruitdiameter(cm)		
		2019	2020	Pooled
T_1	RDF(800:300:600NPKg/tree)+20kgFYM (Control)	7.37	7.41	7.39
T_2	125%RDF+20 kgFYM/tree	7.45	7.57	7.51
T_3	75%RDF+20 kgFYM/tree	7.24	7.32	7.28
T_4	75%RDN+20kgFYM/tree+25%Nfrom Vermicompost	7.43	7.63	7.53
T_5	75%RDN+20kgFYM/tree+25%Nfrom CastorCake	7.38	7.44	7.41
T_6	75%RDN+20kgFYM/tree+25%Nfrom Vermicompost+ 10ml BioNPK Consortium	7.52	7.59	7.56
T_7	75%RDN+20kgFYM/tree+25%Nfrom CastorCake+10 mlBioNPKConsortium	7.93	7.82	7.88
T_8	50%RDN+20kgFYM/tree+25% NfromVermicompost + Micronutrientsfoliarspray(1% GradeIV)	7.90	7.89	7.90
T_9	50%RDN+20kgFYM/tree+25%NfromCastorCake+Micronutrientsfoliarspray(1% GradeIV)	7.83	7.84	7.83
T_{10}	50%RDN+20kg FYM/tree+25% Nfrom Vermicompost+10mlBioNPKConsortium+Micronutrients foliar spray(1 %GradeIV)	7.54	7.75	7.64
T_{11}	50%RDN+20kgFYM/tree+25%Nfrom CastorCake+10mlBioNPKConsortium+Micronutrients foliar spray(1 %GradeIV)	7.97	7.95	7.96
T	S.Em±	0.17	0.14	0.11
	C.D. (P= 0.05)	0.50	0.41	0.31
Y	S.Em±	-	-	0.05
	C.D. (P= 0.05)	-	-	NS
YxT	S.Em±	-	-	0.15
	C.D. (P= 0.05)	-	-	NS
C.V.%		3.86	3.13	3.51

4.3 Effect of integrated nutrient management on quality parameters

Table 4.5 displays the estimated total soluble solid content of fruits when exposed to varying levels of inorganic nitrogen fertilization.

T10 (9.78 °Brix) was the highest obtained Total Soluble Solid in the first year (2019) of the experiment in sweet orange fruit treated with 50% RDN+ 20kg FYM/tree + 25% N from Vermicompost + 10 ml Bio NPK Consortium + Micronutrients foliar spray (1% Grade IV). Treatment T9 [50% RDN + 20kg FYM/tree + 25% N from Castor Cake + Micronutrients foliar spray 1%] yielded the highest total soluble solids (TSS) in 2020 and pooled data (9.88 °Brix) and was comparable to T10, T8, and T11 (9.83 °Brix)..

Table 4.5: Total soluble solids (TSS) in sweet oranges as a result of integrated nutrition management

Sr. No.	TreatmentsDetails	TSS (°Brix)		
		2019	2020	Pooled
T_1	RDF(800:300:600NPKg/tree)+20kgFYM (Control)	8.67	8.95	8.81
T_2	125%RDF+20 kgFYM/tree	8.73	8.76	8.75
T_3	75%RDF+20 kgFYM/tree	8.93	8.93	8.93
T_4	75%RDN+20kgFYM/tree+25%Nfrom Vermicompost	8.90	9.13	9.02
T_5	75%RDN+20kgFYM/tree+25%NfromCastor Cake	9.50	8.84	9.17
T_6	75%RDN+20kgFYM/tree+25%Nfrom Vermicompost+ 10ml BioNPK Consortium	9.33	8.93	9.13
T_7	75%RDN+20kgFYM/tree+25%NfromCastor Cake+10ml BioNPKConsortium	9.43	9.05	9.24
T_8	50%RDN+20kgFYM/tree+25%NfromVermicompost+Micronutrientsfoliarspray(1% GradeIV)	9.57	9.53	9.55
T_9	50%RDN+20kgFYM/tree+25%NfromCastor Cake+Micronutrients foliar spray(1%GradeIV)	9.77	9.88	9.83
T_{10}	50%RDN+20kgFYM/tree+25%Nfrom Vermicompost+10mlBioNPKConsortium+Micronutrients foliar spray(1%GradeIV)	9.78	9.75	9.77
T_{11}	50%RDN+20kgFYM/tree+25%NfromCastor Cake +10mlBioNPKConsortium+Micronutrientsfoliarspray(1%GradeIV)	9.60	9.40	9.50
T	S.Em±	0.27	0.25	0.19
	C.D. (P= 0.05)	0.79	0.74	0.53
Y	S.Em±	-	-	0.08
	C.D. (P= 0.05)	-	-	NS
YxT	S.Em±	-	-	0.26
	C.D. (P= 0.05)	-	-	NS
C.V.%		5.05	4.77	4.91

T9 (50 % RDN + 20 kg FYM / tree + 25 % N from castor cake + 1 % Grade IV micronutrients foliar spray) T10, T8, and T11 may have improved endogenous factors affecting fruit quality and carbohydrate reserves during ripening, which increased the TSS of the fruit; and increased nitrogen and phosphorus absorption, which increased vegetative growth and photosynthesis, which increased the accumulation of carbohydrates, starch, and other metabolites eventually translocated towards the fruits..

Table 4.6 displays the acidity (%) information. Integrated nutrition management solutions varied in their ability to reduce acidity. Both T10 [50% RDN+ 20kg FYM/tree + 25% N from Vermicompost + 10ml Bio NPK Consortium + Micronutrients foliar spray (1% Grade IV)] and T7 [75% RDN+ 20kg FYM/tree + 25% N from Castor Cake + 10 ml Bio NPK Consortium] had significantly lower acidity levels in 2020 than in 2019. In both years of testing, T9 and T8 treatments yielded the greatest levels of fruit acidity..

Table 4.6: Modifying the acidity of delicious oranges with INM

Sr. No.	TreatmentsDetails	Acidity (%)		
		2019	2020	Pooled
T_1	RDF(800:300:600NPKg/tree)+20kgFYM (Control)	0.580	0.590	0.585
T_2	125%RDF+20 kgFYM/tree	0.527	0.523	0.525
T_3	75%RDF+20 kgFYM/tree	0.570	0.553	0.562
T_4	75%RDN+20kgFYM/tree+25%Nfrom Vermicompost	0.553	0.537	0.545
T_5	75%RDN+20kgFYM/tree+25%NfromCastor Cake	0.510	0.507	0.508
T_6	75%RDN+20kgFYM/tree+25%Nfrom Vermicompost+ 10ml BioNPK Consortium	0.530	0.523	0.527
T_7	75%RDN+20kgFYM/tree+25%NfromCastor Cake+10ml BioNPKConsortium	0.587	0.470	0.528
T_8	50%RDN+20kgFYM/tree+25%NfromVermicompost+Micronutrientsfoliarspray(1% GradeIV)	0.597	0.690	0.643
T_9	50%RDN+20kgFYM/tree+25%NfromCastor Cake+Micronutrients foliar spray(1%GradeIV)	0.690	0.610	0.650
T_{10}	50%RDN+20kgFYM/tree+25%NfromVermicompost+10mlBioNPKConsortium+ Micronutrientsfoliarspray(1%GradeIV)	0.470	0.513	0.491
T_{11}	50%RDN+20kgFYM/tree+25%NfromCastorCake + 10 ml Bio NPK Consortium Micronutrientsfoliarspray(1%GradeIV)	0.490	0.507	0.498
T	S.Em±	0.039	0.038	0.027
	C.D. (P= 0.05)	0.114	0.111	0.077

Y	S.Em±	-	-	0.012
	C.D. (P= 0.05)	-	-	NS
YxT	S.Em±	-	-	0.039
	C.D. (P= 0.05)	-	-	NS
C.V.%		12.204	12.03	12.119

5. Conclusion

The growth and yield contributing factors were enhanced by the application of 50% RDN (400g N) + 20kg FYM/tree + 25% N from Castor Cake (4.2kg/tree; Castor Cake) + 10 ml Bio NPK Consortium + Micronutrients foliar spray (1% Grade IV) per tree [T11]. Both the microbial population and the nutrient density of the soil and the leaves have increased. Also statistically similar in most parameters was the treatment consisting of 50% RDN (400g N) + 20kg FYM/tree + 25% N from Vermicompost (11.5kg/tree; vermicompost) + 10 ml Bio NPK Consortium + Micronutrients foliar spray (1% Grade IV) per tree [T10].

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