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Effect of drip fertigation on yield and quality of guava under ultra high density planting in Tamil Nadu

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Abstract
The new concept of UHDP in mango and guava is still a new technology to the growers of Tamil Nadu to increase the fivefold increase in production and they need an elaborate demonstration to adopt and to practice the technologies for fertigation. The present investigation was aimed at studying the effect of fertigation of guava under ultra-high density planting on growth and yield. An experiment was conducted at Horticultural College and Research Institute, Periyakulam in the year 2018-2019 with a spacing of 3 x1.5m. The trial was laid out in a Randomized Block Design (RBD) with five set of treatments with water soluble fertilizers (WSF) and conventional fertilizers. The pooled yield revealed that the application of 100% RDF through water soluble fertilizers(T_2) recorded highest fruit yield of 39.73 t ha^{-1}, followed by T_1 - 75% RDF through water soluble fertilizers recorded highest fruit yield of 38.15 t ha^{-1}while the control (T_5) recorded the lowest of 24.8 t ha^{-1}, The same treatment recorded the highest in quality parameters with reducing sugar (6.72%), non-reducing sugar(5.05%) and lowest acidity(0.41%) while in However, the cost economics shows that 75% RDF through water soluble fertilizers recorded highest BC ratio of 3.65 over the control of 2.42. Hence 75% RDF as water soluble fertilizers can be advocated in increasing the yield and quality of Guava under UHDP.

Keywords: Drip fertigation, yield, quality, guava, ultra high density

Introduction
Guava is an important fruit crop grown in almost all parts of India and the average productivity of fruits in India is low as compared to many fruit going countries in the world. The area under guava in India is 235.6 thousand ha and production is 3198.3 thousand metric tonnes with a productivity of 13.6 metric tonnes/ha. The main reasons for low productivity are old and senile orchards, low yielding varieties, poor orchard management, inadequate technological up-gradation and adoption by the growers. Ultra high density planting (UHDP) focussed an immediate solution through technology and fivefold increase in production. Fertigation enables adequate supplies of water and nutrients with precise timing and uniform distribution to meet the crop nutrient demand. Keeping this in view the present experiment was carried out to study the response of fertigation scheduling on flowering, fruit yield and quality of guava cv. Lucknow 49 under high density planting

Materials and Methods
The present investigation was conducted at Central Farm, Department of Fruit crops, Horticultural & Research Institute, Periyakulam during 2018-2019. The experimental site was fairly uniform with gentle slope. The soil was red soil, sandy loam in texture, colour and having good drainage. The experiment was conducted on well-established orchard of 3 years old Lucknow -49 guava trees which are planted at 3.0 x 1.5m spacing. The experiment was laid out in Randomized Block Design (RBD) with five treatments replicated four times The treatments are T_1 as 75% RDF through WSF fertilizers, T_2 as 100% RDF through WSF, T_3 as 75% RDF through basal as conventional fertilizers, T_4 as 100% RDF through basal as conventional fertilizers and T_5 as control with four replications. Lucknow- 49 variety was taken as a test crop. The foliar application of these treatments was made at three times of new flush, 30 and 60 days after flowering.

Result and Discussion

Yield parameters

As regards to the number of fruit/ plant, the highest number of fruits/ plant was recorded in the application of T_2 (100% RDF through water soluble fertilizers) recorded the highest of 42.3 followed by T_1(75% RDF through water soluble fertilizers) recorded the value of 40.2 while the control T_5 recorded the lowest of 28.2 while the conventional fertilizers recorded the intermediate values(Table 1).

As regards to fruit weight and fruit diameter, application of T_2 - 100% RDF through water soluble fertilizers recorded the highest value of 174.3 and 7.83 cm respectively followed by T_1 recorded the next higher value of 171.2 g and 8.14 cm, the next higher values were recorded in T_4 and T_3 in fruit weight and fruit diameter while the lowest was recorded with a value of 150.4 g/ fruit and 6.83 cm respectively. The increase in yield under drip irrigation might be ascribed to the better water utilization (Raina *et al.*, 2011) [5], higher absorption and accumulation of nutrients by crop (Rumpel *et al*., 2003) [6] and maintenance of excellent soil water air relationship with higher oxygen concentration in the root zone (Bangar and Chaudhary, 2004) [1].

The fruit yield in terms of tonnes/ha also revealed that the application of 100% RDF through water soluble fertilizers at various stages recorded the maximum yield of (39.73 t/ha) followed by the application of 75% RDF through water soluble fertilizers 38.15 t/ha) while the control recorded the lowest value of 20.50 t/ha. The above results are in agreement with the finding of Maji and Das (2008) [3] in guava. Application of water soluble fertilizers increased the nutrients availability and increase sucrose content of fruits. Application of water soluble fertilizers through drip fertigation could enhance soil chemical, physical, and biological properties as well as rate of nutrient turn over within the soil-plant system and increased yield and quality of fruits.

Table 1: Effect of fertigation on fruit and yield characters in Guava under high density planting

Treatment	Particulars	Fruit number/ plant	Fruit weight (g)	Fruit Diameter (cm)	Yield t/ha
T_1	75% RDF through water soluble fertilizers	40.2	171.2	8.14	38.15
T_2	100% RDF through water soluble fertilizers	42.3	174.3	7.83	39.73
T_3	75% RDF through basal application of conventional fertilizers	36.4	165.2	7.24	30.39
T_4	100% RDF through basal application of conventional fertilizers	38.3	152.6	7.62	33.13
T_5	Control	28.2	150.4	6.83	20.50
SEd		0.64	1.12	0.06	1.43
CD(5%)		1.35	2.34	0.13	3.00

Quality parameters

The fruit quality characters are represented in the table no. 2. Application of 100% RDF through water soluble fertilizers recorded highest TSS ^{0} Brix value of 12.84^0 while the lowest was recorded in the control of 11.12 ^{0} brix while the other treatments recorded the intermediate values. The present findings was earlier reported by Gorakh singh *et al.*, 2007 [2]

As regards to the reducing and non reducing sugar, the treatment T_2 (100% RDF through water soluble fertilizers) recorded the highest value of 6.92 and 5.15% respectively while the control recorded the lowest value of 4.63 and 3.48% respectively while the conventional fertilizers through basal application recorded intermediate values. The acidity % was also influenced by different nutrient management practices. The treatments receiving 100% RDF through water soluble fertilizers recorded the lowest acidity value of 0.42% followed by the next value of 100% RDF through water soluble fertilizers of 0.48%. The next higher values was recorded in 75% and 100% in conventional fertilizers while the lowest was recorded in control of 0.72%. Similar report was noticed by Puneshwar Singh Paikra *et al*., 2016 [4] under high density planting.

Table 2: Effect of fertigation on quality characters in Guava under high density planting

Treatment	Particulars	TSS ^{0} brix	Reducing sugar %	Non reducing sugar%	Acidity %
T_1	75% RDF through water soluble fertilizers	12.60	6.65	5.06	0.48
T_2	100% RDF through water soluble fertilizers	12.84	6.92	5.15	0.42
T_3	75% RDF through basal application of conventional fertilizers	12.18	5.72	4.85	0.68
T_4	100% RDF through basal application of conventional fertilizers	12.44	6.21	4.99	0.62
T_5	Control	11.12	4.63	3.48	0.72
	SEd	0.08	0.11	0.08	0.02
	CD(5%)	0.12	0.22	0.17	0.03

Economic Analysis

The BC ratio was highest for the treatment 75% RDF through water soluble fertilizers was 3.65 followed by T_2 (100% RDF through water soluble fertilizers) as 3.03. Generally, application of water soluble fertilizers increased the yield when compared to conventional fertilizers where the solubility of fertilizers is high and thereby higher yield. The control recorded the lowest yield and BC ratio of 2.42

Table 3: Effect of fertigation on Cost benefit ratio in Guava under high density planting

Treatment	Details	Fixed Cost	Variable Cost (Rs)	Total Cost	Yield (t/ha)	Gross Income	Net Income	B: C ratio
T_1	75% RDF through water soluble fertilizers	150000	177760	327840	38.15	1526000	1198160	3.65
T_2	100% RDF through water soluble fertilizers	150000	244420	394530	39.73	1589200	1194670	3.03
T_3	75% RDF through basal application of conventional fertilizers	200000	133320	333380	30.39	1215400	882020	2.65
T_4	100% RDF through basal application of conventional fertilizers	200000	177760	377840	33.13	1325200	947360	2.51
T_5	Control	200000	39996	240014	20.50	820000	579986	2.42

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