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Response of different levels of fertigation and mulching on quality parameters of Guava (*Psidium guajava* L.) under ultra-high density planting in Chhattisgarh

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Abstract
A field experiment was conducted during the year 2017-18 and 2018-19 in mrig bahar crop at research field of Precision Farming Development Centre (PFDC), Department of Fruit Science, Indira Gandhi Krishi Vishwa Vidyalaya, Raipur (C.G.). The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications and nine treatments namely (Variety) Lalit, Allahabad safeda and L-49, (Fertigation levels) 60% RDF, 80% RDF and 100% RDF and (Mulch levels) Natural mulch, Silver mulch and Without mulch. The objective to study the Effect of different levels of fertigation and mulching on quality of guava under ultra-high density planting. Results revealed that all the quality parameters like Total soluble solids, ascorbic acids, pH of fruit juice, reducing sugar, non-reducing sugar and total sugar were recorded highest with Lalit variety, 80% RDF and silver mulch and also found minimum in variety L-49, 60% RDF and without mulch.

Keywords: Guava, fertigation, mulching, fruit quality, ultra high density planting

Introduction
Guava (*Psidium guajava* L.) is very popular fruit in India. It belongs to family "Myrtaceae" and an important commercial fruit crop of tropical and sub-tropical region of India. It is known as 'Apple of tropics' and rich in Ascorbic acid (Vitamin C) and pectin content besides being a good source of other vitamins and minerals.

Ultra high density planting or meadow orchard system is the fastest way of reducing the gestation period and simultaneously increasing the productivity of the orchards. Accommodation of the maximum number of precocious plants per unit area to get the maximum profit per unit of the tree volume without impairing the soil fertility status is called the high density planting. The meadow orchard is a modern method of fruit cultivation using small or dwarf tree with modified canopy. Water stress during the critical stages of fruit growth and development is main reason for low productivity. For efficient water and weed management under such situation, drip irrigation along with mulching is the best option which saves 25-30% irrigation water.

Fertigation is a new concept gaining momentum in India. The nutrient consumption per hectare and fertilizer use efficiency is very low in India. The main reasons for the low efficiency are the type of fertilizer used and its method of application adopted by Indian farmers. Farmers are using solid fertilizers for fruit crop production but these are not totally water soluble and hence, are less available to the plants. Hence, there is a need to develop a suitable method of application of fertilizer through drip system, which will improve the quality and quantity of fruit crop production.

Mulching plays an important role in soil moisture conservation, improving soil structure, regulate soil temperature and reduces weed growth (Reddy and Khan, 2000) water loss is reduced under plastic mulch. The soil under plastic mulch remains loose, friable and well-aerated. Continuous use of organic mulches also improved the organic matter content of soil and better soil aeration (Borthakur and Bhattacharya, 1992). The encouraging results of mulching have been so far reported in fruit crops like banana.

Materials and Methods
Field experiment was carried out during the year 2017-18 and 2018-19 in mrig bahar crop at research field of Precision Farming Development Centre (PFDC), Department of Fruit

Science, Indira Gandhi Krishi Vishwa Vidyalaya, Raipur (C.G.). The experiment was carried out with factorial randomized block design with 3 replication and 9 treatment comprising of three cultivars of guava [lalit, allahabad safeda and sardar (L-49)], three level of fertigations scheduled at 60%, 80% and 100% recommended dose of fertilizer per plant in Accordingly, the estimated amount of 60%, 80% and 100% of recommended doses of fertilizer was 385:555:250 gm N:P:K/plant and three levels of mulches (Natural mulch, Silver mulch and Without mulch) with twenty seven treatment combinations. The fertilizer was dissolved in a tank and irrigation was applied weekly as per treatments. The water requirement of the crop was computed on daily basis by using the following equation as suggested by Shukla *et al*., (2001) [9].

V = Ep.Kp.Kc.Sp.Sr.Wp

Where,
V = Volume of water required (litre / day / plant)
Ep = Pan evaporation as measured by Class-A pan evaporimeter (mm /day)
Kc = Crop co-efficient (co-efficient depends on crop growth stage)
Kp = Pan co-efficient
Sp = Plant to plant spacing (m) Sr = Row to row spacing (m)

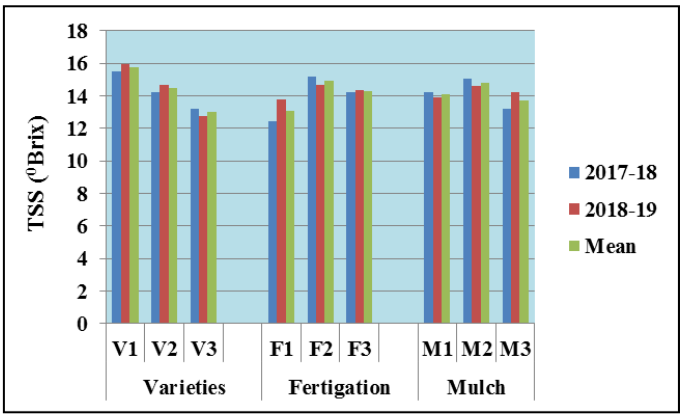
Wp = Fractional wetted area, which varies with different growth stage (0.3 to 1.0) The values of pan coefficient and crop coefficients were taken from (Doorenbos and Pruitt, 1977) [3]. The water requirement of guava crop was estimated on daily basis for all months considered under study. Daily time to operate drip irrigation system was worked out taking the application rate per plant. Drip system was scheduled on alternate days; hence total quantity of water delivered was cumulative water requirement of two days. Observations on water requirement, growth character and yield of guava were recorded and analyzed statistically following the standard procedures (Panse and Sukhatme, 1985) [6].

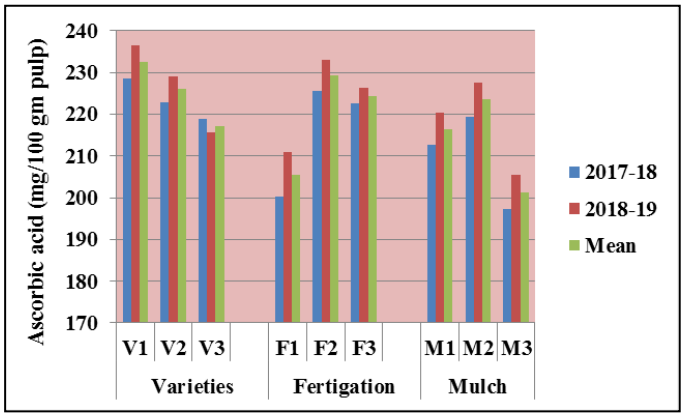
Results and Discussion

Observation recorded on the effect of different levels of fertigation and mulch on quality presented in Table 1. Among the various cultivars, variety, V_1- Lalit produced significantly maximum TSS (15.53 ^{0}Brix and 15.98 ^{0}Brix), Ascorbic acid (228.54 mg/100gm pulp and 236.60 mg/100gm pulp), Reducing sugar (4.98 % and 5.22 %), Non-reducing sugar (5.18 % and 5.35 %) and Total sugar (10.16 % and 10.57 %) in both the years respectively (2017-18 and 2018-19) and also on the basis of mean data (15.76 ^{0}Brix, 232.57 mg/100gm pulp, 5.10 %, 5.27 % and 10.37 %). The lowest values of quality characters was recorded in variety V_3 –L-49. These results are supported by the findings of earlier workers like Paikra *et al.* (2016) [5] also noted that Lalit and Allahabad safeda of guava produced significantly maximum growth and yield attributes from the others.

The data recorded on the effect of different levels of fertigation indicates that maximum TSS (15.21 ^{0}Brix and 14.70 ^{0}Brix), Ascorbic acid (225.64 mg/100gm pulp and 232.95 mg/100gm pulp), Reducing sugar (4.87 % and 5.04%), Non-reducing sugar (4.98 % and 5.12 %) and Total sugar (9.85 % and 10.16 %) in both the years respectively (2017-18 and 2018-19) and also on the basis of mean data (14.96 ^{0}Brix, 229.30 mg/100gm pulp, 4.96 %, 5.05 % and 10.01 % was obtained in case of (F_2) 80% RDF. The lowest values of quality characters was recorded in fertigation level F_1 –60% RDF. It might be due to prolonged availability of nutrients during the growth, flowering and fruiting period from fertigation over basal application which might have improved the fruit set and quality. Similar results have also been reported by Shankar *et al*., (2002) [7] in guava.

Among the various level of mulching, silver mulch (M_2) recorded maximum TSS (15.03 ^{0}Brix and 14.59 ^{0}Brix), Ascorbic acid (219.45mg/100gm pulp and 227.52 mg/100gm pulp), Reducing sugar (4.65 % and 4.49 %), Non-reducing sugar (4.79 % and 4.86 %) and Total sugar (9.44 % and 9.35 %) in both the years respectively (2017-18 and 2018-19) and also on the basis of mean data (14.81 ^{0}Brix, 223.49 mg/100gm pulp, 4.57 %, 4.83 % and 9.40%. The lowest values of quality characters was recorded in mulch level M_3 – Without mulch. These results are in full conformity with the findings of Borthakur and Bhattacharyya (1998) in guava. Mulching treatments had been reported to increase phosphate uptake by crop, principally because it encouraged surface rooting of the crop, kept the surface soil moist for a longer time and avoided fixation of applied phosphorous leading to higher phosphate uptake from surface soil by surface rooting under mulches. Phosphorous being an essential constituent of biologically active macro - molecules (nucleic acids, co-enzyme NAD, NADP, ATP etc) is the integral part in important plant process like photosynthesis, glycolysis, respiration, fatty acid synthesis etc, contributing to the overall better performance of a plant. Hence the increased level of phosphorous uptake under mulched condition might have possibly increased the overall growth of fruit yield of guava plant.





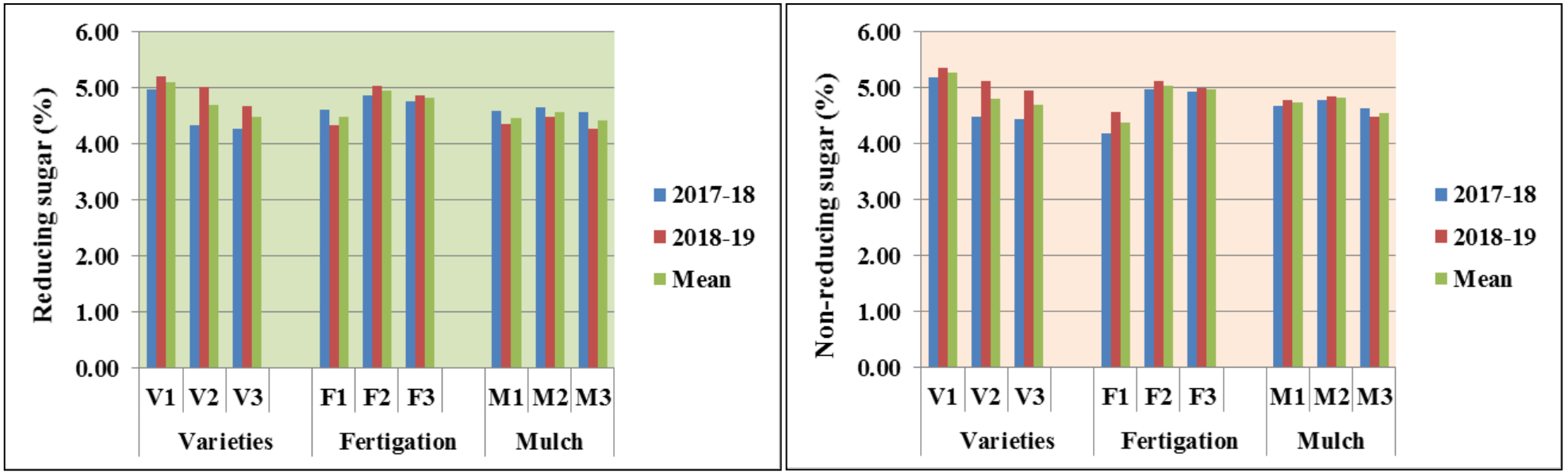
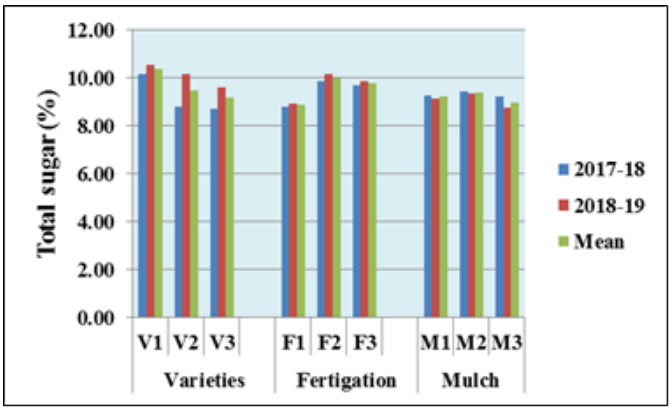


Table 1: Response of different levels of fertigation and mulch on quality parameters of guava (*Psidium guajava* L)

	TSS (^{0}Brix)			Ascorbic acid (mg/100gm pulp)			Reducing sugar (%)			Non-reducing sugar (%)			Total sugar (%)		
Treatments	**2017-18**	**2018-19**	**Pooled mean**	**2017-18**	**2018-19**	**Pooled mean**	**2017-18**	**2018-19**	**Pooled mean**	**2017-18**	**2018-19**	**Pooled mean**	**2017-18**	**2018-19**	**Pooled mean**
(V_1) Lalit	15.53	15.98	15.76	228.54	236.60	232.57	4.98	5.22	5.10	5.18	5.35	5.27	10.16	10.57	10.37
(V_2) Allahabad Safeda	14.23	14.69	14.46	222.94	229.01	225.98	4.34	5.03	4.69	4.48	5.12	4.80	8.82	10.15	9.49
(V_3) Sardar (L-49)	13.21	12.77	12.99	218.87	215.60	217.24	4.28	4.67	4.48	4.45	4.95	4.70	8.73	9.62	9.18
CD at 5%	0.90	0.51	0.71	3.27	5.30	4.29	0.39	0.30	0.35	0.50	0.40	0.45	1.25	0.92	1.09
(F_1) 60% RDF	12.43	13.79	13.11	200.18	210.98	205.58	4.62	4.34	4.48	4.20	4.58	4.39	8.82	8.92	8.87
(F_2) 80% RDF	15.21	14.70	14.96	225.64	232.95	229.30	4.87	5.04	4.96	4.98	5.12	5.05	9.85	10.16	10.01
(F_3)100% RDF	14.21	14.35	14.28	222.54	226.36	224.45	4.76	4.88	4.82	4.94	5.00	4.97	9.70	9.88	9.79
CD at 5%	0.96	0.51	0.74	3.75	4.19	3.97	0.29	0.40	0.35	0.40	0.37	0.39	0.69	0.87	0.78
(M_1) Natural mulch	14.25	13.91	14.08	212.56	220.36	216.46	4.59	4.35	4.47	4.68	4.79	4.74	9.27	9.14	9.21
(M_2) Silver mulch	15.03	14.59	14.81	219.45	227.52	223.49	4.65	4.49	4.57	4.79	4.86	4.83	9.44	9.35	9.40
(M_3) Without mulch	13.21	14.2	13.71	197.25	205.37	201.31	4.57	4.27	4.42	4.64	4.48	4.56	9.21	8.75	8.98
CD at 5%	0.86	0.51	0.69	1.67	2.05	1.86	0.33	0.25	0.29	0.42	0.35	0.38	0.75	0.98	0.87



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