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Response of pre harvest spray of calcium nitrate and gibberellic acid on fruiting characters of guava cv. l-49

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Abstract
The objective of this study was to determine the effects of calcium nitrate, gibberellic acid and their interaction on fruiting characters of guava cv. L-49. Forty eight plants of uniform age and vigour were selected for the studies at ten year old orchard (Khengar Vav Farm, Fruit Research Station, Department of Horticulture, JAU, Junagadh) tree spaced at 6 x 6 m which are maintained under recommended schedule of fertilizer, irrigation and insect - pest control. The selected trees were pre harvest sprayed with the different concentrations calcium nitrate and gibbrellic acid at the time of fruit set and 25, 15 days before harvesting during *kharif* season of the year 2018-19. Guava trees were sprayed with 0, 0.5, 1.0, and 1.5% of calcium nitrate and 0, 50, 100 and 150 ppm GA_3. Generally higher concentration of calcium nitrate and medium concentration of gibberellic acid alone with T_{15} in combination of C_3 + G_2 were found superior over all the treatments.

Keywords: Pre harvest spray, calcium nitrate, gibberellic acid, fruiting characters, guava cv. l-49

Introduction
Guava (*Psidium guajava* L.) is one of the most popular fruits cultivated in many tropical and subtropical countries for their nutritive fruits. Guava belongs to family Myrtaceae with 150 species under genus *Psidium*, Hayes (1970) [4]. Due to its wider adaptability in diverse soils and agro-climatic regions, low cost of the cultivation, prolific bearing and being highly remunerative fruit with nutritive values, it has gained more popularity among the fruit growers. In western and southern India, the guava tree flowers thrice a year, *i.e.* February- Ambe bahar, June-July- Mrig bahar, October- Hast bahar. Thus, guavas in these regions bear fruits throughout the year. Among all the three bahars "Mrig bahar" gives fruits during winter season *i.e.* November-January, which are better in quality, taste and vitamin-C content. So, "Mrig bahar" is most commonly used. Guava fruit is best relished when properly ripe and freshly plucked from the tree. It emits sweet aroma, is pleasantly sweet and refreshingly acid in nature. Its whole fruit is edible and almost merged with the pulp. Guava takes nearly five months from time of flowering to mature. Fruits attaining maturity show signs of change in colour from dark green to yellowish green. This is the right stage of harvesting of fruits. Guava is very popular as a fresh fruit because of its excellent taste, high vitamin content and 100 per cent edibility. Calcium plays an important role in cell division, elongation, maintenance of membrane integrity, development and functioning of roots. It has been reported that calcium controls enzymatic and physiological process, namely cell division, cell elongation and protoplasmic strengthening, Dhillon *et al.*, (1982) [2]. Gibberellins are group of growth substances. They are synthesized in the young fruit by the developing seeds and are believed to participate in promoting early fruit growth (Leopold and Kriedemann, 1975) [6]. Exogenous application of GA_3 promoted cell enlargement and cell division.

Materials and methods
Experimental location
The present investigation was conducted at Khengar Vav Farm, Fruit Research Station, Department of Horticulture, Junagadh Agricultural University, Junagadh during *kharif* season of the year 2018-19.

Experimental material

In the present investigation, ten year old plants of guava cv. L-49, uniform in vigor and productivity, were selected as experimental material to find out the response of pre harvest application of calcium nitrate and gibberellic acid on fruiting characters of guava fruits.

Experimental details

Forty eight plants of guava cv. L-49 of uniform age and vigour were selected for the present studies in ten year old orchard tree spaced at 6 x 6 m. These plants were maintained under recommended schedule of fertilizer, irrigation and insect - pest control. The selected trees were pre harvest sprayed with the gibbrellic acid at the time of fruit set and 20, 10 days before harvesting with calcium nitrate of different concentrations. Total 16 Treatments of Factor A: Calcium nitrate ($Ca(NO_3)_2$) with different levels of C_0: Calcium nitrate 0%, C_1: Calcium nitrate 0.5%, C_2: Calcium nitrate 1%, C_3: Calcium nitrate 1.5% and Factor B: Gibberellic acid (GA_3) with different levels of G_0: Gibberellic acid 0 ppm, G_1: Gibberellic acid 50 ppm, G_2: Gibberellic acid 100 ppm, G_3: Gibberellic acid 150 ppm. T_1: C_0G_0, T_2: C_0G_1, T_3: C_0G_2, T_4: C_0G_3, T_5: C_1G_0, T_6: C_1G_1, T_7: C_1G_2, T_8: C_1G_3, T_9: C_2G_0, T_{10}: C_2G_1, T_{11}: C_2G_2, T_{12}: C_2G_3, T_{13}: C_3G_0, T_{14}: C_3G_1, T_{15}: C_3G_2 and T_{16}: C_3G_3. Data is statically analyzed by factorial RBD with 3 replications.

Observations recorded

Fruit set (%) was noted at full flowering stage by tagging (5) random shoots/tree. Flowers and flower buds were counted in each shoot at this stage and then flowers having setting into fruits were counted and fruit set was expressed in percent. The fruit drop was recorded on the each treatment. The observations were recorded 15 days interval, fruit were counted to fruit drop. For days to maturity, fruits under each treatment were harvested at maturity and time taken was counted. The number of fruits was counted at a time of every harvest from tree and then sum up to all harvesting and averaged. Fruits harvested in different picking were weighed to record the fruit yield. The sum of all pickings performed a specific period gain yield per tree. The fruit yield was expressed in kilograms per tree.

Results and discussion

It is evident from the statistical analysis of the data that the different levels of calcium nitrate and gibberellic acid had significant effect on the fruiting parameters of guava viz., fruit set, fruit drop, days to maturity, number of fruits per tree and fruit yield.

It was observed that the maximum fruit set (65.09%) and minimum fruit drop (23.03%) was recorded with calcium nitrate 1.5% (C_3) and regarding gibberellic acid concentration, significantly the maximum fruit set (65.92%) and minimum fruit drop (23.22%) was registered with gibberellic acid 100 ppm (G_2). The interaction effect of calcium nitrate and gibberellic acid was found non significant with respect to both fruit set and fruit drop. Calcium nitrate generally improves the nutritional status of the tree which reflected on increasing fruit set reported by Sarrwy *et al*., (2012) [8] in date palm. Gibberellin has an effect on cell elongation ultimately resulting in higher fruit set. Similar trend was observed by Patel *et al*., (2010) [7] in custard apple.

Calcium improves the formation of cellulose and lignin. These materials are required for building plant structure or preventing the abscission layer formation and consequently the reduction in fruit drop reported by Sarrwy *et al*., (2012) [8] in date palm. Gibberellins prevent the abscission and facilitate the ovary to remain attached with shoot resulting in lower fruit drop. These results are in close conformity with the findings of Yadav and Chaturvedi (2005) [10] in ber.

Table 1: Effect of pre harvest spray of calcium nitrate, gibberellic acid and their interaction on fruit set and fruit drop of guava cv. L-49

Treatment	Fruit set (%)	Fruit drop (%)
Calcium nitrate		
C_0	41.10	39.70
C_1	56.60	28.08
C_2	60.49	26.22
C_3	65.09	23.03
S.Em.±	1.54	0.85
C.D. at 5%	4.44	2.45
Gibberellic acid		
G_0	45.82	35.87
G_1	53.78	29.52
G_2	65.92	23.22
G_3	57.75	28.42
S.Em.±	1.54	0.85
C.D. at 5%	4.44	2.45

Table 2: Effect of pre harvest spray of calcium nitrate, gibberellic acid and their interaction on days to maturity in guava cv. L-49

Treatment	Days to maturity
Calcium nitrate	
C_0	99.17
C_1	95.33
C_2	93.25
C_3	88.33
S.Em.±	1.36
C.D. at 5%	3.92
Gibberellic acid	
G_0	97.17
G_1	94.75
G_2	90.75
G_3	93.42
S.Em.±	1.36
C.D. at 5%	3.92

Significantly minimum days to maturity were recorded with calcium nitrate 1.5% (C_3) (88.33 days) and gibberellic acid 100 ppm (G_2) (90.75 days) individually. However, interaction effect of both was found non significant. The effect of calcium and gibberellic acid was supported by Vishwakarma (2015) [9] in guava and Deshmukh *et al.*, (2016) [1] in acid lime, respectively.

Table 3: Effect of pre harvest spray of calcium nitrate, gibberellic acid and their interaction on no. of fruits/tree and fruit yield of guava cv. L-49

Treatment	No. of fruit/tree	Fruit yield (kg/tree)
Calcium nitrate		
C_0	214.58	24.14
C_1	275.17	28.98
C_2	316.83	31.90
C_3	355.83	34.77
S.Em.±	5.55	0.49
C.D. at 5%	16.04	1.41
Gibberellic acid		
G_0	222.75	25.43
G_1	255.08	28.80
G_2	374.42	35.61
G_3	310.17	29.94
S.Em.±	5.55	0.49
C.D. at 5%	16.04	1.41
Interaction		
T_1 : C_0G_0	194.33	21.30
T_2 : C_0G_1	205.33	23.31
T_3 : C_0G_2	236.67	27.54
T_4 : C_0G_3	222.00	24.40
T_5 : C_1G_0	227.00	26.27
T_6 : C_1G_1	261.67	29.46
T_7 : C_1G_2	369.33	33.46
T_8 : C_1G_3	242.67	26.71
T_9 : C_2G_0	223.00	25.80
T_{10} : C_2G_1	265.67	29.54
T_{11} : C_2G_2	438.33	38.99
T_{12} : C_2G_3	340.33	33.25
T_{13} : C_3G_0	246.67	28.35
T_{14} : C_3G_1	287.67	32.89
T_{15} : C_3G_2	453.33	42.43
T_{16} : C_3G_3	435.67	35.39
S.Em.±	11.11	0.97
C.D. at 5%	32.09	2.81
C.V.%	6.62	5.63

The number of fruit per tree was significantly increased with the pre harvest spray of calcium nitrate 1.5% (C_3) (355.83), gibberellic acid 100 ppm (G_2) (374.42) and treatment (C_3G_2) calcium nitrate 1.5% & gibberellic acid 100 ppm (453.33). The effect of calcium nitrate is in conformity with Kulkarni *et al.*, (2014) [5] in guava.

The marked influence of GA_3 on the number of fruits may be attributed to its effects on better fruit set, which favoured the production of a larger number of fruits. The results obtained by Haribabu (1980) [3] reported that more number of fruits per tree was produced in kagzi lime due to the treatment of chemicals and plant growth regulators.

Significantly the maximum yield (34.77 kg/tree) was obtained with calcium nitrate 1.5% (C_3). Gibberellic acid concentration @ 100 ppm (G_2) also ranks first with maximum fruit yield (35.61 kg/tree). The result indicated that the treatment combination of calcium nitrate 1.5% + gibberellic acid 100 ppm (C_3G_2) was found better with respect to fruit yield (42.43 kg/tree). The increase in fruit yield is possibly due to the direct or indirect involvement of nutrients (calcium) which provide more metabolites for the growth and development of fruits by increase in metabolic activities. These activities improve their size, weight and volume and thus ultimately increased the total yield of fruits. Similar results by Vishwakarma (2015) [9] in guava. GA_3 increased the number of fruits per shoot and promoted the fruit retention thereby increased number of fruits and ultimately produced more yield. The results are in accordance with Patel *et al.*, (2010) [7] in custard apple.

Conclusion

From the forgoing discussion, it can be concluded that pre harvest spraying of calcium nitrate and gibberellic acid, significantly influenced the fruiting parameters of guava cv. L-49 under storage condition. Individual pre harvest spray of calcium nitrate i.e. C_3 (Calcium nitrate 1.5%) and gibberellic acid, G_2 (Gibberellic acid 100 ppm) was found effective with respect to fruiting parameters. Regarding interaction between pre harvest spray of calcium nitrate and gibberellic acid, treatment C_3G_2 (Calcium nitrate 1.5% + gibberellic acid 100 ppm) was remained better for fruiting parameters.

Hence, three spray of combined pre harvest application of calcium nitrate 1.5% + gibberellic acid 100 ppm, first at fruit set stage, second at 25 days before harvesting and third at 15 days before harvesting for obtaining better yield, quality and storage behavior of guava.

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