Original Research Article

Response of Foliar Application of NAA and Zinc on yield and quality attributes of Guava (*Psidiumguajava*L.) *cv.*L-49

Abstract

An experiment was carried out at Old campus, Horticulture Garden, Department of Fruit Science, SardarVallabhbhai Patel University of Agriculture & Technology Meerut (U.P), India during two consecutive years i.e., 2021 and 2022 to assess the "Influence of foliar Spray of NAA & Zinc on growth, flowering, fruiting, yield and quality of Guava (*Psidiumguajava*L.) *cv.* L-49 Under western U.P. conditions" The foliar spraymicronutrients along with plant growth regulators play an important role in manipulating many physiological phenomena, improving the yield and quality and enhanced the productivity of plants by fulfilling the nutritional needs of fruit crops. Twelve treatments viz., three level of NAA (0, 50, and 75 ppm) and four level of Zinc (0, 0.4, 0.6, and 0.8 %) with their combinations were used, which were replicated in FRBD. From the experiments, it is reported that spray of NAA @75 ppm (N_2)individually yield kg/ Plant (53.75 and 53.06 kg/plant) maximumand application of Zinc at 0.8 % (Zn_3) concentration, significantly maximum high yield kg/ Plant (53.86 and 53.17 kg/plant) and during both year of investigation. Interactive effect of NAA and Zinc (N_2Zn_3) significantly treatments high yield kg/ Plant (59.56 and 58.81 kg/plant) and quality parameter pectin (%) highrange (0.79 and 0.80 %) treatment NAA @75 ppm (N_2) individually significantly and application of Zinc at 0.8 % (Zn_3) concentration, significantly maximum Pectin percent (0.80 and 0.82 %) both year of investigation. Interactive effect of NAA and Zinc (N_2Zn_3) non- Significantly treatments Pectin percent maximum (0.87 and 0.89 %),

***Keywords:** Guava, Zinc, NAA, yield, Pectin*

1. INTRODUCTION

The guava, often known as the Apple of the Tropics (*Psidiumguajava* L.), is India's sixth most popular fruit crop after papaya, mango, banana, citrus, and citrus fruits. It is a member of the myrtaceae family and is native to tropical America, spanning from Mexico to Peru **(Agnihotri*et al.* 2013**). The trees were cultivated more than 2000 years ago, and soon after the discovery of the new world by the Spanish and Portuguese, they spread quickly across the globe's tropics. It is now present in tropical and subtropical regions of many nations, including India, Hawaii, Brazil, Mexico, Thailand, New Zealand, Philippines, China, Malaysia, Cuba, Sri Lanka, Venezuela, Australia, Burma, Myanmar, Israel, Pakistan, and Bangladesh. Guava is mostly produced in India. In India, there are 6967 thousand hectares of land used for fruit farming, and 102924 thousand metric tonnes of fruit are produced annually. With an annual fruit yield of 4516 thousand metric tonnes, guava is grown on 307 thousand hectares of land in India. India has a 14 MT/ha guava production rate. A total of 11259.24 thousand metric tonnes of fruit are produced on 505.13 thousand hectares

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of land in Uttar Pradesh. One advance estimate for 2021–22 suggests that out of these, guava farming will cover 52.25 thousand hectares, producing 983.59 thousand tonnes per year **(Anonymous, 2022)**. The major guava-producing states of India are Uttar Pradesh, Maharashtra, Bihar, Andhra Pradesh, Gujarat, Madhya Pradesh, Karnataka, Punjab, and Orissa. Uttar Pradesh produces the best quality guava, and Allahabad has a distinct reputation for growing the best guava in the country as well as in the world. Mature fruits of guava are rich in nutrition. Its composition varies in different cultivars, seasons and not only within the cultivar from place to place but also at one location owing to changes in yearly climatic conditions and cultural practices followed. The fruit (berry) is an excellent source of vitamin C (210-305 mg/100 g fruit pulp) and pectin (0.5-1.8%) but has low energy (66cal. /100 g). The ripe fruits contain 12.3-26.3% dry matter, 77.9-86.9% moisture, 0.51-1.02% ash, 0.10-0.70% crude fat, 0.82-1.45% crude protein and 2.0-7.2% crude fiber. The fruits are also rich in minerals like phosphorus (22.5-40.0 mg/100g pulp), calcium (10.0-30.0 mg/100g pulp) and iron (0.60-1.39 mg/100g pulp) as well as vitamins like niacin (0.20-2.32 mg/100g pulp), pantothenic acid, thiamine (0.03-0.07 mg/100 g pulp), riboflavin (0.02-0.04 mg/100g pulp) and vitamin- "A"**(Mitra and Bose, 2001)**. It has an astringent property due to which its mature leaves, fruits, roots and bark are used in medicines to treat gastroenteritis, diarrhea and dysentery **(Ojewaleet. *al.,* 2008)**. Most of the guava varieties produce medium to small inferior quality fruits having ta greater number of seeds which are hard to chew. During the last 50 years, considerable research work has been done in the country on various aspects such as varieties, propagation, irrigation, training and pruning, etc., to increase the yield and quality of guava fruits. The production of poor-quality fruits is a matter of common experience; it would be, therefore, worthwhile to improve the yield and quality of fruit crops by use of micronutrients and plant growth regulators. The importance of micronutrients and synthetic plant growth regulators in achieving higher yields and better quality of fruit crops have been well recognized in recent time. Micronutrients help in the uptake of major nutrients and play an active role in the plant metabolism process starting from cell wall development to respiration, photosynthesis, chlorophyll formation, enzyme activity hormone synthesis, nitrogen fixation and reduction **(Das, 2003).**

2. MATERIALS AND METHODS

The present investigation was carried out in the Old Campus, Horticulture GardenDepartment of Fruit Science, College of horticulture, SardarVallabhbhai Patel University of Agriculture and Technology, Meerut during two subsequent year 2021-22 and 2022- 23.

2.1 Experimental Design and Treatments

Lucknow-49 Guava cultivar tress that was uniformhealthy, and well established were chosen for the experiment's goal the tress, which were around 15-year-old, were maintained in good condition by adhering to the recommended Fertilizer doses and other horticultural practicesThe experiment was laid out in Factorial Randomized Design with three replications and Twelve treatments. Three level of NAA (0, 50 and 75 ppm), and four level of Zinc (0, 0.4, 0.6 and 0.8 %) and these combinations were takenThe treatments were follows- T_1Control (water spray),T_2 (Zinc 0.4 %), T_3 (Zinc 0.6 %), T_4(Zinc

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0.8 %), T_5 (NAA 50 ppm), T6 (NAA 50 PPM + Zinc 0.4 %), T_7 (NAA 50 ppm + Zinc 0.6 %), T_8 (NAA 50 ppm + Zinc 0.8 %), T_9 (NAA 75 ppm), T_{10} (NAA 75 ppm + Zinc 0.4 %), T_{11} (NAA 75 ppm + Zinc 0.6 %), T_{12} (NAA 75 ppm + Zinc 0.8 %).NAA (water spray), NAA (50 ppm), NAA (75 ppm) are denoted as (N_0, N_1, N_2,)respectively, Zinc (water spray), Zinc 0.4 % , Zinc 0.6 % , Zinc 0.8 % are denoted as (Zn_0, Zn_1, Zn_2, Zn_3)respectively. The micronutrient (Zinc) and Plant growth regulator (NAA) were sprayed on the tree. Five newly initiated shoot on the current season's growth were randomly selected and tagged for taking the observation,the observation pertaining to Yield (kg/plant), Pectin (%). Were carefully recorded using prescribed standard methodology.

2.2 PARAMETERS OF STUDY

2.2.1 Yield (kg/Plant)

The weight of fruits was recorded at every harvesting under each treatment and total yield per tree was calculated at the final harvesting.

2.2.2 Pectin (%)

The fruits of each treatment were crushed by means of pestle and mortar. About 100 gm of the crushed sample was taken and 200 ml of water was added to it and boiled for half an hour. The process was repeated twice and the extract was made up to 250 ml. The sample was then tested for starch content with 0.1 percent iodine solution, which was negligible. Again 100 ml of the extract was centrifuged to get a clear solution and 50 ml of this solution was taken out for estimation of pectin according to the method of **Kertesz (1995).**

2.3 Statistical analysis:

The observation recorded during the course of the investigation were subjected to statistical by adopting appropriate modelanalysis of variance (ANOVA)According to the procedure described by **Panse and Sukhantme (2000).** Critical differences (CD) within the treatment were calculated to compare the treatment at 1 percent 5 percent level of significance only:

(1) $$C.F = \frac{GT^2}{N}$$

(2) $T.S.S = (X^2_1 + X^2_2 + X^2_3 \ldots\ldots X^2_n) - C.F.$

(3) S.S. for error = TSS – Tr.S.S.

(4) Table for analysis of variance

3. RESULTS AND DISCUSSION

3.1 Results

Yield kg/ Plant: The applied NAA and Zinc as foliar spray with two different levels alone or in combinations have a numerically influence on guava fruit to increase the yield. It was observed that among allNAA treatmentwere significant during the experimental trial and it was found that treatmentT_9NAA 75 ppm has showed the maximum Yield (kg/Plant) (45.89 kg/Plant) and followed by

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treatment T_5 NAA 50 ppm (45.57 kg/Plant), while under control treatment (Water Spray) has showed the minimum Yield (kg/Plant) (36.75 kg/Plant) and Zinc has showed the significant result during the experiment. It was found that the treatment T_4 Zinc 0.8% has showed the maximum Yield(kg/Plant) (45.74 kg/Plant) and followed by T_3 Zinc 0.6 % (42.16 kg/Plant) and T_2 Zinc 0.4% (39.70 kg/Plant) while the minimum Yield(kg/Plant) under the control treatment (water spray) (37.23 kg/Plant) and second year data (2022-2023) data were recorded all NAA and Zinc treatment were significant during the experimental trial and it was found that treatment T_9 (NAA 75 ppm) has showed the maximum Yield(kg/Plant) (45.89 kg/Plant) and followed by treatment T_5 NAA 50 ppm (45.57 kg/Plant), while under control treatment (Water Spray) has showed the minimum Yield(kg/Plant) (36.75 kg/Plant) and all the treatment of Zinc has showed the significant result during the experiment. It was found that the treatment T_4 Zinc 0.8% has showed the maximum Yield(kg/Plant) (45.15 kg/Plant) and followed by T_3 Zinc 0.6 % (42.62 kg/Plant) and T_2 Zinc 0.4% (39.18 kg/Plant) while the minimum Yield(kg/Plant) under the control treatment (water spray) (36.75 kg/Plant).

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The interaction between NAA and Zinc treatment on the Yield (kg/Plant) of guava cause significant variation during experiment trial. It was observed that treatment T_{12}NAA 75 ppm + Zinc 0.8% has showed the maximum Yield (kg/Plant) (59.56 kg/Plant) and followed by treatment T_{11}NAA 75 ppm + Zinc 0.6% (57.63 kg/Plant) and T_8NAA 50 ppm + Zinc 0.8% (56.28 kg/Plant) and while the minimum Yield (kg/Plant) was observed in control treatment T_1 N_0Zn_o (37.23 kg/Plant) and followed T_6NAA 50 ppm+ Zinc 0.4% (49.84 kg/Plant) and T_{10}NAA 75 ppm + Zinc 0.4% (51.31 kg/Plant) and final year 2022-23 data were recorded NAA and Zinc treatment on the Yield(kg/Plant) of guava cause significant variation during experiment trial. It was observed that treatment T_{12}NAA 75 ppm + Zinc 0.8% has showed the maximum Yield (kg/Plant) (58.81 kg/Plant) and followed by treatment T_{11}NAA 75 ppm + Zinc 0.6% (56.90 kg/Plant) and T_8NAA 50 ppm + Zinc 0.8% (55.56 kg/Plant) and while the minimum Yield(kg/Plant) was observed in control treatment T_1 N_0Zn_o (36.75 kg/Plant) and followed T_6NAA 50 ppm+ Zinc 0.4% (49.21 kg/Plant) and T_{10}NAA 75 ppm + Zinc 0.4% (50.65 kg/Plant).

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Pectin %:NAA treatment were significant during the experimental trial and it was found that treatment T_9NAA 75 ppm has showed the maximum Pectin content (0.68%) and followed by treatment T_5NAA 50 ppm (0.66 %), while under control treatment (Water Spray) has showed the minimum Pectin content (0.64%) and Zinc treatment has showed the significant result during the experiment. It was found that the treatment T_4Zinc 0.8% has showed the maximum Pectin content (0.69%) and followed by T_3 Zinc 0.6 % (0.68%) and T_2 Zinc 0.4% (0.65%) while the minimum Pectin content under the control treatment (water spray) (0.64%) and Second year data (2022-2023) data was recorded among all NAA and Zinc treatment were significant during the experimental trial and it was found that treatment T_9NAA 75 ppm has showed the maximum Pectin content (0.69%) and followed by treatment T_5NAA 50 ppm (0.67 %), while under control treatment (Water Spray) has showed the minimumPectin content (0.66%).

The interaction between NAA and Zinc treatment on the Pectin content of guava caused significant variation during experiment trial. It was observed that treatment T_{12}NAA 75 ppm + Zinc 0.8% has showed the maximum Pectin content (0.87%) and followed by treatment T_8NAA 50 ppm + Zinc 0.8% (0.85%) and T_{11}NAA 75 ppm + Zinc 0.6% (0.83%) while the minimum Pectin content was observed in control treatment T_1 N_0Zn_o (0.64%) and followed T_6NAA 50 ppm+ Zinc 0.4% (0.75%) and T_{10}NAA 75 ppm + Zinc 0.4% (0.77%) second year data was recorded 2022-2023 The interaction between NAA and Zinc treatment on the Pectin content of guava caused significant variation during experiment trial. It was observed that treatment T_{12}NAA 75 ppm + Zinc 0.8% has showed the maximum Pectin content (0.89%) and followed by treatment T_8NAA 50 ppm + Zinc 0.8% (0.86%) and T_{11}NAA 75 ppm + Zinc 0.6% (0.85%) while the minimum Pectin content was observed in control treatment T_1 N_0Zn_o(0.66%) and followed T_6NAA 50 ppm+ Zinc 0.4% (0.76%) and T_{10}NAA 75 ppm + Zinc 0.4% (0.78%).

Table 1: Effect of foliar sprays of NAA, Zinc and their interactions on Yield (kg/Plant) of guava cv L- 49.

Treatments	2021-22					2022-23				
	Control (Zn_0)	**Zn_1 (0.4%)**	**Zn_2 (0.6%)**	**Zn_3 (0.8%)**	**Mean**	**Control (Zn_0)**	**Zn_1 (0.4%)**	**Zn_2 (0.6%)**	**Zn_3 (0.8%)**	**Mean**
Control NAA(N_0)	37.23	39.70	42.16	45.74	41.21	36.75	39.18	41.62	45.15	40.67
NAA 50ppm (N_1)	46.16	49.84	54.17	56.28	51.61	45.57	49.21	53.48	55.56	50.95
NAA 75ppm (N_2)	46.49	51.31	57.63	59.56	53.75	45.89	50.65	56.90	58.81	53.06
Mean	43.29	46.95	51.32	53.86		42.73	46.35	50.66	53.17	
	N	Z	NxZ				N	Z	NxZ	
C.D	**1.22**	**1.41**	**2.44**			C.D	**1.17**	**1.35**	**2.33**	
S.E.(d)	**0.59**	**0.68**	**1.18**			S.E.(d)	**0.58**	**0.67**	**1.16**	

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Table 2: Effect of foliar sprays of NAA, Zinc and their interactions on Pectin (%) of guava cv L- 49

Treatments	2021-22					2022-23				
	Control (Zn_0)	Zn_1 (0.4%)	Zn_2 (0.6%)	Zn_3 (0.8%)	Mean	Control (Zn_0)	Zn_1 (0.4%)	Zn_2 (0.6%)	Zn_3 (0.8%)	Mean
Control NAA(N_0)	0.64	0.65	0.68	0.69	0.67	0.66	0.67	0.69	0.70	0.68
NAA 50ppm (N_1)	0.66	0.75	0.81	0.85	0.77	0.67	0.76	0.83	0.86	0.78
NAA 75ppm (N_2)	0.68	0.77	0.83	0.87	0.79	0.69	0.78	0.85	0.89	0.80
Mean	0.66	0.72	0.78	0.80		0.67	0.74	0.79	0.82	
	N	Z	NxZ				N	Z	NxZ	
C.D	**0.05**	**0.05**	**NS**			C.D	**0.03**	**0.04**	**0.07**	
S.E.(d)	**0.02**	**0.03**	**0.05**			S.E.(d)	**0.02**	**0.02**	**0.03**	

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3.2 DISCUSSION

Increasing quantitative yields and improving the quality of collected items are two of every researcher's main goals. Foliar feeding of micronutrients or growth hormones is known to affect the metabolic activities of the plants, increasing yields and other potentialities of plants. Treatments with NAA and zinc had a substantial impact on the yield metrics of the plant in the current study. This rise in output may be brought about by bigger, heavier, and higher fruit sets. The greatest yield (kg/plant) values were recorded by NAA 75 ppm treatments throughout both research years, with values of 53.75 and 53.06for the maximum value for each treatment (among all NAA treatments). Similar to how 0.8% Zinc exhibited the highest value for Yield (kg/plant) (53.86 and 53.17)finding of **Dutta and Banik (2007), Awasthi and Lal (2009), Kumar *et al.* (2010)**, **Abbas *et al.* (2014), Tirkey*et al*. (2018), Dhakad*et al*. (2020) in mulberry and Bijay*et al*. (2023) in Pineapple.Bhoyar and Ramdevputra (2016), Baidya*et al*., (2023).**

Different concentrations of NAA and Zinc, either alone or in combination, significantly impacted the quality metrics of the guava fruitAmong all NAA treatments, NAA 75 ppm recorded significantly higherpectin content (0.79 and 0.80%) during both the corresponding years i.e. 2021-22 and 2022-23Similar to how 0.8% Zinc exhibited the highest value for Pectin (%) (0.80 and 0.82 %) this finding **Badal and Tripathi (2021) (B) in guava**,**Malik*et al*., (2000)**)**in kinnow**,**Balakrishnan (2001)**,**Kar*et al.,* (2002)**,**El-Rahman (2003)**Zinc treatment may have sped up fruit ripening, which may have resulted in acid breakdown and prevented excessive sugar polymerization and build-up in plant cells. As a result, fruits' reduced acid content may have been caused by this process. Additionally, it seems that when acidity decreases in tropical and subtropical fruits, total soluble solids rise. The acid that was affected by zinc may have been transformed into sugars and their derivatives through processes involving the reversal of the glycol tic pathway or may have been utilised in respiration. The higher concentrations of Zinc increased the ascorbic acid content of fruit which may be due to the possible influence of this micronutrient on the biosynthesis of ascorbic acid from sugars or inhibition of oxidative enzymes or both. Zinc is responsible for the improvement of fruit quality as reported in the present study is in accordance with the findings of **Kumar and Tripathi (2009),Singh and Bal(2006),Dodiya *et al.* (2018).**

4. CONCLUSION

The current study reveals that treating guava plants with a mixture of 75 ppm NAA (naphthalene acetic acid) and 0.8% zinc will significantly improve the vegetative development, blooming, fruiting, yield, and fruit quality of guava *cv.* Lucknow-49. According to the study, this treatment can produce better yields (q/h) of high-quality fruits with improved fruit quality. These findings are particularly relevant to the Indo-Gangetic plains in western India. Therefore, based on these observations, it is recommended that guava plants in the mentioned region be treated with 75 ppm NAA in conjunction with 0.8% Zinc to achieve optimal results in terms of yield and fruit quality

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REFERENCES

1. **A.O.A.C. (1980)**. Official Methods of analysis, association of official analytical Chemist, Washington, D.C. U.S.A.
2. **Abbas, M. M., Ahmad, S. and Javaid, M. A. (2014).** Effect of naphthalene acetic acid on flower and fruit thinning of summer crop of guava. *J. Agric. Res*, **52**(1):106- 109.
3. **Abdollahi, M. Eshghi, S. and Tafazoli, E. (2010)** Interaction of paclobutrazol, boron and zinc on vegetative growth, yield and fruit quality of strawberry (*Fragaria* x *ananassa*Duch. *cv.* Selva). Journal of Biological & Environmental Sciences, 4: 11, 67-75.
4. **Adak., Kumar, K., Singh, V. K., and Ganeshamurthy, A, N. (2022)** Response of dashehari mango to different Zn levels on yield and pulp nutrient content grown on sandy loam soils of lucknow*Journal of Horticulture Science*, Vol.**17**(1): 103-109
5. **Agnihotri, A.; Tiwari, R. and Singh, O.P. (2013).** Effect of crop regulators on growth, yield and quality of guava. *Annals of plant and soil Research*, **15**(1): 54 57.
6. **Alila, P., Sanyal, D. and Sema, K. A. (2004).** Influence of micronutrient application on quality of papaya *cv*. Ranchi. *Haryana Journal of Horticulture Science*, **33**(1/2): 25-26.
7. **Anand, M.; Kahlon, P.S. and Mahajan, B.V.C. (2003).** Effect of exogenoapplication of growth regulators on fruit drop, cracking and quality of Litchi (*Litchi chinensisSonn.*) Dehradun. *Agricultural Digest*, **23** (3): 191-194.
8. **Anonymous. (2022).** Area and production of Horticultural crops (1st Advance Estimate- 2021-22- agricoop.nic.in). Ministry of Agriculture, Cooperation and Farmer Welfare, Government of India. New Delhi
9. **Awasthi, P. and Lal, S. (2009).** Effect of calcium, boron and zinc foliar sprays on the yield and quality of guava (*Psidiumguajava* L.*). Pantnagar Journal of Research*, **7**(2): 223-225.
10. **Babu, R and Tripathi, V. K. (2022).** Impact of foliar application of NAA, Zinc and boron on growth, yield and quality parameters of guava (*Psidiumguajava* L.) *Prog. Agric*. **22**(2): 190-194
11. **Badal, D. S and Tripathi, V. K. (2021). (A)** Influence of foliar feeding of NAA and boron on growth flowering, fruiting and yield of winter season guava (*Psidiumguajava* L.) *cv*.L-49. *Biological forum-An international journal*,**13** (3): 387-391.
12. **Badal, D. S and Tripathi, V. K. (2021). (B)** Effect of foliar application of NAA and Boron on physico- chemical parameters of winter season guava (*Psidiumguajava L.*) *cv.* L-49. *The Pharma Innovation Journal***10**(9): 928-932
13. **Baidya, B. K., Kishore, K., Samant D., Dash, S.N., Panda, R.K., Sahu, A. and Shukla K.K. (2023).** Yield attributing traits and economic efficacy of pineapple as influenced by plant growth regulators and micronutrients. *Biological forum-An international journal,* **15**(1):264-267
14. **Bakshi, P., Jasrotia, A., Wali, V.K., Sharma, A. and Bakshi, M. (2013).** Influence of pre-harvest application of calcium and micronutrients on growth, yield, quality and shelf-life of strawberry *cv*. Chandler. *Indian Journal of Agriculture Science*,**83**(8): 831-835
15. **Balakrishnan, K. (2000).** Foliar spray of zinc, iron, boron and magnesium on vegetative growth, yield and quality of guava. *Ann. Plant Physiol.***14** (2): 151-153.

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16. **Balakrishnan, K. (2001).** Effect of foliar application of micronutrients on guava. *Madras Agric. J.* **88** (4/6): 316-317.
17. **Bhatia, S.K.; Yadav, S.; Ahlawat, V.P. and Dahiya, S.S. (2001).** Effect of foliar application of nutrients on the yield and fruit quality of winter season guava *cv.* L-49. *Haryana J. Hort. Sci*., **30** (1/2): 6-7.
18. **Bhoyar, M.G. and Ramdevputra, M.V. (2016)**. Effect of foliar spray of zinc, iron and boron on the growth, yield and sensory characters of guava (*Psidiumguajava* L...) *cv.*Sardar L-49. *Journal of Applied and Science*, **8** (2): 701-704.
19. **Borner, J. (1950).** Plant Biochemistry. Academic Press, New York.
20. **Bower, C.A. and Wilcox, L.V. (1965).** Soluble Salts. In: Black, C.A., *et al.,* Methods of Soil Analysis, *American Society of Agronomy*, Madison, 933-940
21. **Briggs, R.H. and Leopoid, A.C. (1958).**Amer. C. Botany, **45:** 447-551.
22. **Chander, S., Jain, M.C., Pareek, P.K., Bola, P.K., Meena, R.R., Sharma, Y.K and Renuka (2017)** Effect of foliar feeding of borax, zinc sulphate and urea on fruiting and yield of guava (*Psidiumguajava* L.) *cv.*Lalit and shweta under high density planting system. *Chemical science review and letters,* 2278-6783.
23. **Chauhan, A.S.; Kumar, K.; Saini, P.K.; Singh, V. and Singh, J. P. (2019).** Effect of NAA and Zinc Sulphate on Fruiting, Yield of Litchi (*Litchi chinensis*, Sonn.) *cv.*Calcuttia. *Int. J. Curr. Microbiol.* App. Sci. **8** (3): 836-843.
24. **Czaja, A. (1935).**Ber. Deut, Botan. Gea. 53, 221. In Growth substances. Plant Physiology. ISBN 81-224-0517-7.
25. **Das, A; Majumder K. and Majumdar B.C. (2001).** Zinc sulphate induced higher sweetness of rainy season guava fruits. *Indian Agric*. **44** (3&4): 199-201.
26. **GirirajJat and H. L. Kacha (2014).** Response of guava to foliar application of urea and zinc on fruit set, yield and quality. *Journal Agriculture Research*, **1**(2): 86-91
27. **Goswami, A.K.; Shukla, H.S. and Mishra, D.S. (2014).** Influence of pre-harvest nutrients application on the physico-chemical quality and storage behavior of guava (*Psidiumguajava* L.) frut*cv.* L-49, *Progressive Horticulture*, 46:54-57.

Comment [A111]: Without title

Comment [A112]: fruit