EFFECT OF FOLIAR APPLICATION OF NAA ON FRUIT DROP, YIELD AND PHYSICO-CHEMICAL CHARACTERISTICS OF GUAVA (*PSIDIUM GUAJAVA* L.) RED FLESH CULTIVAR

M. Iqbal, M. Qasim Khan, Jalal-ud-Din, Khalid Rehman and M. Munir*

ABSTRACT

A study was conducted in the Department of Horticulture, Agriculture Faculty, Gomal University, D.I. Khan, Pakistan during 2005. NAA (naphthalene acetic acid) @ 0, 15, 30, 45, 60, 75 and 90 ppm concentration was sprayed on summer crop of 28 trees of guava (cv. Red Flesh) at two fruit development stages (marble and walnut stage). Results revealed that NAA significantly reduced pre-harvest fruit drop. Maximum reduction (8.83%) in fruit drop was observed with 45 ppm/spray followed by 30, 60, 75 and 90 ppm. Fruit yield was significantly increased by NAA application. Maximum yield (44.80 kg per treatment) was recorded in case of 45 ppm closely followed by 60 ppm (44.60 kg). Significant variation was observed among various quality parameters i.e. pulp/seed ratio, TSS, total sugars, acidity and ascorbic acid contents in fruits of different treatments. NAA application increased all these ingredients except acidity which was reduced. Maximum pulp/seed ratio (11.31), total soluble solids (11%) and total sugars (7.45%) were recorded in 45 ppm treatment. The same treatment proved as most effective in reducing fruit drop and produced better quality fruit than all other treatments. At higher concentrations fruit quality was inferior. Fruit drop exhibited negative correlation with all other characteristics except acidity whereas pulp seed ratio had positive correlation with TSS, total sugars and ascorbic acid contents and negative association with acidity.

KEYWORDS: ***Psidium guajava;*** **NAA; chemico-physical properties; Pakistan.**

INTRODUCTION

Guava (*Psidium guajava* L.) belongs to family Myrtaceae and is one of the most common fruits of Pakistan. It can be grown successfully in all provinces. During 2005-06 area under its cultivation was 192274 hectares with 552222 tons production (2). Pakistan exported 384308 kg guava fruit to various countries and earned 5640 thousands rupees (2). It is a rich source of vitamin

***Department of Horticulture, Faculty of Agriculture, Gomal University, Dera Ismail Khan, Pakistan.**

C which is 2 to 5 times more than fresh orange juice and a fair source of vitamin-A, calcium phosphorus, pantothenic acid, riboflavin, thiamin and niacin (23).

Pre-harvest fruit drop is a wide spread problem in various fruit species, Guava trees also suffer badly from this menace. Usually 50 percent of flowers and young fruits shed during growth, consequently causing total yield losses affecting a great economic loss to the growers (11). In the past, different cultural methods, alongwith use of organic and inorganic manures, have been applied to prevent fruit drop, but no marked success was achieved. In the present era of scientific advancement, growth regulating substances appear to rescue fruit growers (10). The plant growth regulators act as messenger and are needed in small quantities at low concentrations. Generally their site of action and biosynthesis are different. Most of the plant growth regulators exhibit a broad spectrum and thus a single PGR may influence several entirely different processes. Such as NAA affects fruit formation, abscission cell elongation, apical dominance, photoperiod and geotropism. Growth regulating substances such as NAA, 2, 4-D, 2, 4-5-TP and IBA have been used by some workers to control pre-harvest fruit drop in mango, citrus and apple and have reported very encouraging results (10). El-Shewy (7) observed that 50 mg NAA and 50 mg GA3 per litre at full bloom and three months after 1st spray were most effective treatments in reducing pre harvest fruit drop as well as fruit seed contents in guava. Similar results were also reported by Maurya and Singh (15). Dutta and Banik (5) applied GA and NAA before flowering, followed by three weeks after fruit setting and observed that foliar application of NAA significantly increased fruit length, diameter and fruit weight and ultimately crop yield. Jain and Dashora (12) recorded higher yield of guava under 500 ppm Paclobutrazol treatment. Javachandran *et al.* (13) while testing three PGRs observed that GA3 at 100 ppm gave higher moisture contents (82 to 90%), ascorbic aicd (225.9 mg/100 g) and total sugars (7.3%) Ravi *et al.* (18) reported that foliar application of plant growth regulators had favourable effect on physico-chemical characteristics of guava fruit (cv. Sardar). Dubay *et al.* (4) reported that NAA sprayed at 250 ppm resulted in higher guava yield and quality (cv. Allahabad Sufeda). Yaday *et al.* (26) reported that NAA at 60 ppm gave higher yield, TSS, total sugars and vitamin-C (ascorbic acid) contents.

The present study was undertaken to see the effect of different concentrations of naphthalene acetic acid (NAA) at various stages of fruit development on pre-harvest fruit drop, yield and quality of guava.

MATERIALS AND METHODS

This study was conducted in the Department of Horticulture, Faculty of Agriculture, Gomal University, Dera Ismail Khan, Pakistan during 2005. Eight years old 28 trees having uniform size and vigour and growing under identical conditions of soil fertility were selected from Model Farm, district D. I. Khan. Sixteen shoots of same diameter scattered on all four sides of each tree were selected randomly and tagged for application of growth regulator and data collection. Layout system was simple randomized complete block design with seven treatments and four replications using a single tree as an experimental unit. NAA was applied as foliar spray at two different stages of fruit development (marble and walnut stage) on summer crop of guava. First spray was made 15 days after fruit setting and second 40 days after first spray on May 21 and June 30, respectively. NAA concentrations used were; 0 (control), 15, 30, 45, 60, 75 and 90 ppm.

One thousand ppm stock solution of NAA was prepared by method recommended by Tukey (24) dissolving one gram of naphthalene acetic acid (NAA) in a small quantity of 95 percent ethanol and volume of 100 ml was made by adding distilled water. The required concentrations were made from stock solutions at the time of spray. Desired solutions were sprayed on tagged shoots of guava trees with a hand flit sprayer on May 21 and June 30, 2005 at 9.00 a.m. on well sunny day. Data were recorded on following characters:

Fruit drop (%): After first spray fruits dropped upto 2nd spray were counted and mean calculated. Then again after 2nd spray fruits were counted and mean calculated.

Yield: Matured fruits were picked at full ripened stage on August 20, 2005 from each treatment. Total fruits from each treatment were weighed separately and average fruit yield per treatment was calculated.

Fruit weight: Ten fruits were taken at random from each treatment, weighed with a triple beam balance and average weight per fruit was calculated.

Fruit size: Length and diameter of ten fruits, randomly taken from each treatment were measured in centimeters with vernier caliper and their mean values were recorded.

Pulp seed ratio: After separating pulp and seeds of weighed fruits, pulp was weighed and seed weight was recorded by subtracting pulp weight from whole fruit weight. Pulp and seed ratio was worked out by dividing pulp weight by seed weight.

Total soluble solids: For determining TSS, procedure suggested by Erickson and Hass (8) was adopted.

Acidity: Acidity of juice was determineld in terms of citric acid according to AOAC (1).

Total sugars: Total sugars were determined in accordance with the procedure described by Lane and Eynon (14).

Ascorbic acid: Ascorbic acid (vitamin C) was estimated by indophenol titrimetric method of Ruck (19).

All data were statistically analyzed according to Gomez and Gomez (9) and Snedecor and Cochran (20).

RESULTS AND DISCUSSION

Fruit drop (%)

The results (Table 1) indicate that NAA had significantly reduced fruit drop as compared to control. Maximum fruit drop after first spray (19.45%) occurred in control (untreated) whereas minimum fruit drop (15.80%) was observed in case of NAA at 45 ppm which significantly differed from control and was at par with other treatments except 75 ppm. However, 60 ppm and 75 ppm treatments also significantly differed from control. In other words NAA at 45 ppm reduced first drop by 3.65 percent over control followed by 90 ppm (3.50%) and 30 ppm (3.45%).

In case of second spray NAA at 45 ppm again resulted in minimum fruit drop (11.02%) as compared to all other treatments. Maximum fruit drop (16.20%) was recorded in control followed by 90 ppm (12.95%) and 15 ppm (12.20%) but it differed significantly from each other. Similarly, 45 ppm, 60 ppm and 75 ppm NAA were at par among each other. Whereas 45 ppm, 30 ppm and 60 ppm were also statistically similar. However, there was an overlapping of various groups and results obtained were not very clear.

NAA at 45 ppm resulted in 5.18 percent less fruit drop as compared to control followed by 60 ppm (5%), 30 ppm, (4.95%) and 15 ppm (4.85%).

In case of cumulative effect, NAA significantly reduced fruit drop of guava. Highest fruit drop (35.65%) was recorded in control followed by 90 ppm (28.90%) and 15 ppm (28.40%) (Table 1). Minimum fruit drop was noted in 45 ppm (26.82%) which differed significantly form untreated trees but was significantly at par with all other treatments.

Applied concentrations of NAA reduced 6.75 to 8.83 percent fruit drop over control which agrees with the findings of El- Shewy (7). The growth regulator upto 45 ppm concentration was more effective while at higher concentrations it was less effective. This decrease may be due to delayed development of an abscission zone in fruit and also probably due to synchronizing with critical period of stress of environment and physiological condition. The abscission brought about by the development of abscission layer can be regulated by the use of growth regulating substances like NAA. The time of NAA application also affects.

The data (Table 1) further show that maximum yield (44.60 kg/tree) was obtained by applying NAA of 45 ppm while minimum yield (37.40 kg) was recorded in control. NAA at 30, 60 and 75 ppm were also at par with 45 ppm giving 41.75, 44.50, 42.95 kg fruit per tree, respectively. Yield was observed to be inversely proportional to percent fruit drop. Statistically all concentrations of NAA gave significantly higher yeild than control.

Table 1. Effect of NNA on fruit drop percentage, total fruit drop and yield.

NAA (ppm)	Fruit drop (%)			
	1st spray	2nd spray	Total fruit drop (No)	Yield (kg)
Control	19.45	16.20c	35.65a	37.40c
15	16.20c	12.20c	28.40b	41.00b
30	16.00c	11.25de	27.25b	43.20a
45	15.80c	11.02e	26.82b	44.80a
60	16.50bc	11.20de	27.70b	44.60a
75	17.00c	11.35d	28.35b	43.90a
90	15.95c	12.95b	28.90b	41.40b
LSD	2.22	3.22	5.27	4.6

Means followed by similar letter(s) do not differ significantly from one another (P = 0.05)

These results are in accordance with those of Dutta and Banik (5) and Yaday (26) who recorded that NAA at 40 ppm increased fruit yield of dates as compared to untreated fruits.

Average weight of mature fruit

The results (Table 2) revealed that average fruit weight was also affected with NAA application. Heaviest fruit (69.50 g) was recorded in application of 75 ppm NAA followed by 60 ppm (61.34 g), 45 ppm (60.80 g) and 15 ppm (53.12 g). NAA at 90 ppm produced the lightest fruit (32.69g) followed by control (36.80 g). Statistically all treatments were non-significant.

Fruit length and diameter

The fruit length increased with increasing NAA level. It ranged from 5.30 to 7.27 cm being maximum in 90 ppm NAA level and minimum in control (Table 2). Fruit diameter varied from 4.45 cm to 6.55 cm being lowest in control and highest in 75 ppm NAA.

Table 2. Effect of NAA sprays on physical characteristics of guava fruit.

NAA (ppm)	Av. weight/ fruit (g)	Fruit length (cm)	Fruit diameter (cm)	Pulp/seed ratio
Control	36.80	5.30	4.45	4.82c
15	44.96	5.82	5.07	8.341ab
30	53.12	6.35	5.52	8.648ab
45	60.80	7.15	6.07	11.313a
60	61.34	7.05	6.10	9.988ab
75	69.50	7.25	6.55	9.654ab
90	32.69	7.27	5.85	7.117b
	NS	NS	NS	3.71

Means followed by similar letter(s) do not differ significantly from one another (P = 0.05).

Fruit diameter also tended to increase with increasing NAA concentration upto 75 ppm whereas it decreased at 90 ppm but was higher than control, 15 ppm and 30 ppm.

Although fruit length and diameter improved with NAA application yet its effect was statistically non-significant.

Fruits possessing higher pulp as compared to seed are considered to be superior to those having lower pulp/seed ratio. Fruits collected from NAA applied treatments possessed significantly higher pulp/seed ratio than control. NAA at 45 ppm was significantly better than all other treatments but was at par with 60, 75, 30 and 15 ppm. The untreated trees gave fruits of lowest pulp/seed ratio (4.82) while higher ratio was recorded in 45 ppm NAA (11.31).

Total soluble solids (TSS)

The statistical analysis of data showed significant effect of NAA on TSS of fruit pulp. Maximum TSS (11.00%) was observed in 45 ppm NAA treatment which differed significantly from all other treatments (Table 3). It was followed by 30 ppm (10.50%). NAA concentrations upto 60 ppm increased TSS content of fruits. The growth regulator at higher concentrations (75 ppm and 90 ppm) produced significantly less TSS (9.25 and 9.75%) than control.

Total sugars contents

The data revealed that total sugars behaved like TSS. Upto 45 ppm NAA concentration, total sugars of fruits significantly increased (7.45%) while beyond this concentration it decreased (Table 3). At higher concentration i.e. 90 ppm it was statistically less than all other treatments including control. NAA at 45 ppm performed significantly better but was at par with 30 ppm (7.35%). Similarly 30 ppm and 60 ppm as well as 60 ppm and 15 ppm treatments were statistically alike at 5 percent level of significance.

Table 3. Chemical composition of guava fruits as affected by NAA application.

Treatments	TSS(%)	Total sugars(%)	Acidity(%)	Ascorbic acid (mg/100g)	Sugar/acid ratio
Control	9.75cd	7.00e	0.65abc	105.75f	10.855
15	10.25bc	7.20c	0.62bc	117.25e	11.622
30	10.50b	7.35b	0.60bc	130.50d	12.310
45	11.00a	7.45a	0.59c	150.00c	12.702
60	10.00c	7.30bc	0.64abc	185.40b	11.410
75	9.70cd	7.05d	0.68ab	190.60ab	10.530
90	9.25e	6.80f	0.70a	197.80a	9.725
LSD	1.01	0.397	0.071	65.98	N.S.

Meas followed by similar letter(s) do not differ significantly from one another (P = 0.05).

NAA had also significant effect on acidity content of fruits which varied from 0.59 to 0.70 percent. The lowest value was noted in fruits collected from 45 ppm NAA treatment while the highest value was observed in 90 ppm NAA applied fruits. The untreated fruits contained 0.65 percent acidity which was lower than that in fruits treated with 75 and 90 ppm NAA. Statistically all treatments overlapped with each other and no clear cut results could be obtained. In general this ingredient decreased with increased NAA concentration upto 45 ppm.

Ascorbic acid content

Like other chemical constituents, ascorbic acid contents were also appreciably affected with NAA application which ranged from 105.75 to 197.80 mg/100 g of pulp being minimum in control and maximum in 90 ppm.

In contrast to other constituents this ingredient increased with increased NAA concentration and was maximum in 90 ppm treatment which differed significantly from all other treatments.

Sugar/acid ratio

Sugar/acid ratio of matured fruit serves as the index of fruit quality. The wider the ratio, the better the quality. This ratio varied from 9.725 to 12.702 being minimum in fruits sprayed with 90 ppm NAA and maximum in 45 ppm NAA concentration. It reflected that fruits of 45 ppm were superior in quality and fruits of 90 ppm were inferior to all other treatments. The fruits from control treatment with 10.855 sugar/acid ratio was better from those obtained from 75 ppm and 90 ppm. This ratio in fruits tended to increase with increased NAA concentration upto 45 ppm where it was maximum. NAA application affected sugar/acid ratio in guava fruit but its effect was statistically non-significant.

It was observed that growth regulator (NAA) beside controlling fruit drop successfully improved the quality of guava fruits. NAA significantly increased pulp/seed ratio, TSS, total sugars and ascorbic acid contents of the fruits

while weight of fruit, length and diameter (size) and sugar/acid ratio were increased non-significantly. Acidity of the fruit was significantly decreased. There was a marked increase in the acidity and ascorbic acid content of the fruits with the increase in concentration and these were higher at higher concentration. Pulp/seed ratio, TSS, total sugars and sugar/acid ratio were higher at 45 ppm which indicates that dose produced superior quality fruits as compared to other concentrations. These findings are in accordance with those of earlier workers (9, 13, 18) who reported that grapes size could be increased considerably with NAA spray. Similarly, Eecher *et al.* (6) found that NAA had greater effect on increasing soluble solids and acidity of apples. These results also agree to those of Rajput *et al.* (17) who reported an increase in fruit size, TSS, ascorbic acid and pectin contents of guava fruit with NAA (40 and 80 ppm) and GA (15 and 30 ppm). Some other scientists (3, 15, 22) also noted increased fruit size, fruit weight, TSS, total sugars and reduced acidity contents by applying different growth regulating substances on various fruit crops.

Correlation of relationship among different characteristics

From the perusal of data (Table 4) it is evident that among 55 correlations, there existed 35 positive relationships while 20 were negatively correlated. Among positive correlations, only six were highly significant while six were significant. Similarly among negative correlations, three were highly significant and will only one was significant and remaining 39 relationships were statistically non-significant.

Table 4. All possible relationships among fruit drop yield, physical and chemical characteristics of guava fruit as influenced by NAA application.

	Yield	Av. weight	Length	Diameter	Pulp/seed ratio	TSS	Total sugars	Acidity	Ascorbic acid	Sugar/ acid ratio
Fruit drop	** -0.899	n.s -0.564	n.s -0.701	n.s. -0.738	* -0.870	n.s -0.436	n.s -0.522	n.s +0.309	n.s -0.467	n.s -0.402
Yield	-	* +0.806	* +0.803	** +0.880	** +0.955	n.s +0.438	n.s +0.587	n.s -0.271	n.s +0580	n.s +0.409
Av.weight	-	-	* 0.830	n.s +0.722	* +0.824	n.s +0.437	n.s +0.601	n.s -0.322	n.s +0.329	n.s +0.426
Length	-	-	-	n.s +0.488	** +0.881	n.s +0.414	n.s +0.488	n.s -0.028	n.s +0.580	n.s +0.299
Diamter	-	-	-	-	* +0.786	n.s +0.027	n.s +0.160	n.s 0.165	* +0.852	n.s -0.036
Pulp seed ratio	-	-	-	-	-	n.s +0.599	n.s +0.357	n.s -0.429	n.s +0.731	n.s +0.0945
T.S.S.	-	-	-	-	-	-	** +0.935	** -0.971	n.s -0.441	** +0.982
Total sugars	-	-	-	-	-	-	-	** -0.901	n.s -0.288	** +0.953
Acidity	-	-	-	-	-	-	-	-	n.s +0.615	n.s -0.701
Ascorbic acid	-	-	-	-	-	-	-	-	-	-0.487

n.s. = Non-significant, *Significant (P = 0.05), **Highly significant (P = 0.01)

First drop was negatively correlated with all other parameters except acidity whereas yield positively correlated with all other characteristics except fruit drop and acidity. Similarly average weight per fruit was negatively correlated with fruit drop and acidity but had positive relationship with other nine characteristics. TSS and total sugars were positively correlated with each other whereas TSS as well as total sugars were negatively correlated with acidity. Vitamin C content of matured fruits had negative correlation with fruit drop, TSS, total sugars and sugar/acid ratio but was positively correlated with yield, average weight per furit, length, diameter, pulp/seed ratio and acidity.

Coefficient of correlation among different parameters revealed that total fruit drop was negatively correlated with all other characteristics except acidity which indicated that reduction in fruit drop was associated with increase in yield, size, pulp seed ratio, TSS, total sugars, ascorbic acid and sugar/acid ratio and decrease in acidity. Hence it is evident that NAA growth regulator not only reduced fruit drop but also improved fruit quality. Similarly pulp/seed ratio had positive correlation with TSS, total sugars, ascorbic acid and sugar/acid ratio but was inversely related to acidity. This also shows that as edible portion of fruit increases, its quality also becomes better.

CONCLUSIONS

NAA at 45 ppm controlled fruit drop and increased yield, TSS and vitamin-C while acidity decreased. Fruit quality was improved with lower NAA concentrations and deteriorated at higher rates. Negative correlations were observed among fruit drop and other parameters except acidity.

REFERENCES

1. Anon. 1984. Official Methods of Analysis. Association of Official Agricultural Chemists. 10th Ed. Washington D.C. 20.40:271-273.
2. Anon. 2006. Fruit, Vegetables and Condiment Statistics of Pakistan, Govt. of Pakistan, MINFAL. (Economics Wing), Islamabad.
3. Asi, A. A. and N. Ali. 1970. Effect of growth regulators on physico-chemical characteristics and quality of kinnow mandarin. Pak. J. Sci. 22(10):238-243.
4. Dubay, A. K. and D. B. Singh and D. Neeru. 2002. Crop regulation in guava (*Psidium guajava* L.) cv. Allahabad Sufeda. Prog. Hort. 34(2):200-203.
5. Dutta, P. and A. K. Banik. 2007. Effect of foliar feeding of nutrients and plant growth regulators on physico-chemical quality of Sardar guava grown in West Bengal. Acta Hort. 335 (6):407-411.
6. Eecher, T., P. E. Zerbini and L. Verena. 1981. Influence of growth regulators on quality parameter in Starking apples in upland countries. Hort. Absts. 8(53):557.

7. El-Shewy, A. A. 1999. Response of guava trees to some chemical substances spray. Annals of Agricultural Sciences. Moshtohor. 37(3):1649-1661.
8. Erickson, L. C. and A. R. C. Hass. 1956. Size, yield and quality of fruit produced by Eureka lemon trees sprayed with 2, 4-D and 2, 4, 5-TP. Proc. Amer. Soc. Hort. Sci. (5) 11:77-80.
9. Gomez, K. A. and A. A. Gomez. 1984. Statistical Procedures for Agriculture Research. 2nd Ed. Wiley and Sons, New York.
10. Haidry, G. A. Jalal-ud-Din and M. Munir. 1997. Effect of NAA on fruit drop yield and quality of mango, *Mangifera indica* cultivars Langra. Scientific Khyber. 10 (1):13-20.
11. Iqbal, M. 1984. Effect of NAA on Fruit Drop Control of Guava. M.Sc. Thesis. Department of Horticulture, NWFP Agriculture University, Peshawar.
12. Jain, M. C. and L. K. Dashora. 2007. Fruiting and yield of guava cv. Sardar as influenced by various plant growth regulators. Int. J. Agri. Sci. 3(1):4-7.
13. Javachandran, K. S., D. Sirhari and Y. N. Reddy. 2005. Changes in post harvest quality of guava fruits affected by pre-harvest application of growth regulators. Agric. Sci. Digest. 25(3):210-212.
14. Lane, J. H. and L. Eynon. 1923. Determination of reducing sugars by means of fehling solution with methylene blue as an indicator. J. Soc. Chem. Ind. 42(9):32-37.
15. Maurya, A. N. and J. N. Singh. 1981. Effect of three growth regulators on fruit retention and quality of mango (*Mangifera indica* L.) cv. Langra. J. Agri. India. 16(3):53-56.
16. Muhammed, S. and H. R. Shabana. 1980. Effect of NAA on fruit size, quality and ripening of the Zahdi date palm. Date Palm Res. Centre, Foundation of Scientific Res., Baghadad, Iraq. Hort. Sci. 15(6) 2:724-525 [Hort. Abst. 51(8):6570].
17. Rajput, B., S. N. Singh and M. P. Singh. 1978. Effect of plant growth substances in guava (*Psidium guajava*) fruit. Hort. Absts. 4(9):8665.
18. Ravi, K., B. Shanoo and V. K. Wali. 2005. Effect of foliar application of plant growth regulator on physico-chemical characteristics of guava cv. Sardar. Haryana J. Hort. Sci. 34(1/2): 31-32.
19. Ruck, J. A. 1963. Chemical methods of analysis of fruits and vegetable products. Canada Deptt: Agri. Publication. No. 1154.
20. Snedecor, G. W. and W. G. Cochran. 1980. Statistical Methods. 7th Ed. IOWA State University Press Ames.
21. Srivastava, A. K. 1979. Text Book of Plant Physiology. Chapter 27 p. 448 Kalyani Publisher B-15, Secretariat, New Dehli.
22. Singh, A. R. 1980. Effect of foliar spray of nitrogen and growth regulators on physico-chemical composition of mango (*Mangifera indica* L.). Plant Sci. (8):75-81 [Hort. Absts. 50(5):3777].

23. Singh, S. P. 1992. Fruit drop for vast land. Chapter-8. Guava. p. 93. Pawan Kumar Scientific Publishers, 5-A, New Pali Road, Judhpur, India.
24. Tukey, H. B. 1954. Plant regulator in Agriculture. John Wiley and Sons. N. Y. p. 24-35.
25. Vajai, S. 1980. Effect of growth regulator on growth, yield and quality of guava. Hort. Absts. 53(5):370-376.
26. Yaday, P. K. 2002. Effect of urea, Borax and NAA on yield parameters of guava variety L-49. Progressive Agriculture. 2(2):195-196.
27. Yaday, S., S. K. Bhatia; R. K. Godara and G. S. Rana. 2001. Effect of growth regulators on the yield and quality of winter season guava cv. L-49. Haryana. J. Hort Sci. 30(1/2):1-2.