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PRE-HARVEST FACTORS AFFECTING YIELD, QUALITY AND SHELF LIFE OF MANGO CV. AMROPALI

Sherajum Monira, M. Abdur Rahim* and M. Ashraful Islam

Department of Horticulture, Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

***Corresponding author:** M. Abdur Rahim, E-mail: marahim1956@yahoo.com

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ABSTRACT

An experiment was conducted to investigate the effect of six pre-harvest treatments on yield, quality and shelf life of a particular Mango cv. Amropali under field condition. The experimental factors were Control, Decis and Savin @ 2 ml L^{-1}, Pheromone trap, Boron 2 mg L^{-1} and Magic growth @ 2 ml L^{-1}. The plants were of age about 15 years at BAU Germplasm Centre- FTIP, Bangladesh Agricultural University (BAU), Mymensingh during January to July 2013. The experiment was laid out in a Randomized Completely Block Design (RCBD) with three replications. Amropali produced higher number of fruits $plant^{-1}$ when treated with Boron @ 2 ml L^{-1} followed by Magic growth 2mlL^{-1}. Maximum number of fruits $plant^{-1}$, higher yield $plant^{-1}$ and higher TSS% were recorded in the treatment Boron 2mlL^{-1}. Boron treatment also extended the shelf life of mango as well. The maximum shelf life was found from large sized fruits. Similar performance on yield, quality and shelf life were obtained from Magic growth treatment @ 2 ml L^{-1} followed by pheromone trap treatment. Control treated fruits exhibited the minimum number of fruits per plant with lower quality but better TSS%. Smaller fruits were obtained from untreated control plants.

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INTRODUCTION

Mango (*Mangifera indica* L.) is an excellent fruit belongs to the genus *Mangifera*, consisting of numerous species of tropical fruit plants belongs to the family Anacardiaceae. Mango is one of the most extensively exploited fruits for food, juice, flavor, fragrance and color, making it a common ingredient in new functional foods often called super fruits (Candole, 1984). Flowering of mango starting from January to March ends with harvesting during May to June. Therefore availability of mango in market is very shorter. Now the main concern is to extend the availability of mango either before or after the season. Irregular bearing, alternet bearing, low fruit set as well as poor quality of fruits are main problems of mango production. In spite of adequate flowering, low fruit yield in mango orchards have been experienced because of low initial fruit set and subsequently higher fruitlet abscission (Singh and Singh, 1995). Fruit abscission is a very complex physiological process, occurs in many cultivars of mango and at all stages of development, but it is particularly high during the first 3–4 weeks after pollination and accounts for over 90 % loss of fruit lets (Bains *et al*. 1997, Wahdan 2011).

The use of growth substances and some chemical compounds may regulate fruit set in mango. Availability of fruits beyond the season over a longer period, increasing the yield and quality can be prolonged by using different treatments. Using of pheromone trap and chemical pesticides increases fruit bearing, retain ability of fruits in plants, boron helps in increasing fruit set, number of fruit cluster^{-1} and plant^{-1} and others characteristics, growth hormone increases fruit size, quality and ultimately total production. There is a lot of work on Mango those are separate work either management practices for production or shelf life performances of Mango under different conditions. Therefore, it is necessary to study the management practices or the pre-harvest factors which might have influence on yield, quality and shelf life of mango

MATERIALS AND METHODS

The main objective of the experimental study was to find out the most important per-harvest treatment to get the maximum fruit yield with better quality and shelf life of mango. Experiment was carried out at the Fruit Tree Improvement Program (FTIP) BAU Germplasm Centre (GPC) during January to May, 2013. The area in under sub–tropical monsoon climate, which is characterized by high temperature and heavy rainfall during the months of April to September and scanty rainfall associated with moderately low temperature during the rest period of the year. The single factor experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Mango variety (Amropali) with pre-harvest treatments were used for this study. There were five treatments like control, chemical like Decis and Savin @ (2 ml L^{-1}), Magic growth at 2 ml L^{-1}, Pheromone trap and Boron (2 ml L^{-1}) were used for this study. Every chemical used as foliar spray eg. Decis (2 ml L^{-1}), Savin (2mlL^{-1}), Magic growth (2ml L^{-1}) and Boron (2 ml L^{-1}) dissolving in water and the supernatant used as the spray solution. The trees were treated by spray using a foot-pump sprayer. Sprays of each treatment were done at 15 days interval after flowering stage to harvest period. Another treatment of pheromone trap was used as sex trap to control fruit fly of mango. The fruits were harvested periodically at full maturity stage. Sixty mangoes from each plant were taken for further study of shelf life.

Data collection was started from the first to final periodic harvesting. Fruits of selected plants of each replication were counted and then the average number of fruits for each plant was determined. Diseased and insect infested fruits were separated from the lot and fresh fruits were stored at room temperature for further study of quality and shelf life. Length and diameter of each fruits were measured by a slide calipers to determine the fruit size. Single fruit weight and total fruit weight of each at 2 days interval were recorded to report the shelf life. Total soluble solid (TSS) of 10 randomly selected fruits from each treatment was determined by a hand refractometer and the average was worked out.

The recorded data on different parameters of the experiment was tabulated and analyzed (Gomez and Gomez, 1984) using MSTAT statistical package. The treatment means were separated by least significant difference (LSD) test at the 1% and 5% levels of probability.

RESULTS

Fruit number per plant

Number of total fruits plant^{-1}

There was a significant difference of chemical sprays on number of total fruits plant^{-1} (Table 1). It was found that the 2 ml L^{-1} Boron as foliar spray resulted the maximum number of total fruits plant^{-1} (241.67) followed by Magic growth (210.0), Pheromone trap (169.67) and Decis (160.33) where Desis, Magic growth and Pheromone trap were statistically significant at 1% level of probability. However, least number of fruits plant^{-1} (113.67) was observed in control.

Effect of different chemical treatments showed significant difference at 1% level of probability in respect of number of total fruits plant^{-1}.

Number of fruits drop plant^{-1}

Performance of chemical treatments on fruit persistence on plant was observed to differ significantly at 1% level of significance (Table 1). It was observed that maximum fruit drop occurs at Pheromone trap treated plants. It is also indicated the effect of spraying various treatments on mango trees was different. The yield as number of fruits drop plant^{-1} was maximum in Pheromone trap (80.33) while it was minimum (57.67) in Dacis and Savin sprayed plants. Among the other chemical treatments, Magic growth, Boron and control were showed statistically significant regarding fruit drop (80, 70 and 59.33, respectively) plant^{-1} at 1% level. (Table1).

Number of retaining fruits plant^{-1}

After dropping of fruits, the number of fruits remaining in the plant showed significant difference due to the different chemical treatments. It was observed that, the highest number of fruits retained in T_4 (Boron treated plants) and the lowest in Control. Analysis of variance of data regarding number of fruits retain finally on plant showed significant difference at 1% level of significance. It was clear that final number of fruits (160.0) remaining plant^{-1} was maximum in Boron sprayed and minimum in Control (54.33). Among the other treatments, remaining fruits per plant were 130, 102 and 99 by using Magic growth, Decis and Pheromone trap, subsequently which was found significant at 1% level of significance.

Size of mango fruits

Different types of pre-harvest chemical treatments had different effect on the fruit size. Analysis of variance regarding fruit size had significant variation due to the main effect of various chemical treatments. Treatment of Magic growth 2 ml L^{-1} had the largest fruit (6242.96 mm^2) which was statistically more or less similar to Boron (5832.72 mm^2). However, spraying of De cis, and use of Pheromone trap were recorded to be statistically identical (5189.82 and 5398.117 mm^2, respectively) at 1% level. Control (T_1) has statistically similar rank at 1% level (4692.947 mm^2 and 4627.410 mm^2), respectively. On the other hand, control treatment produced the smallest fruits (4541.07 mm^2) among other treatments. Size of mango fruit showed statistically significant difference among the fruits of different chemical treatments. (Figure 1).

Fruit weight characteristics

Weight of single fruit

Weight of single fruit showed significant variation due to the effect of different chemicals. Although Amropali is a comparatively small fruit, Magic growth treatment produced comparatively larger fruits among other treatments. Effect of various chemical treatments had significant effect on single fruit weight. The highest weight of single fruit (198 g) was found in Magic growth and it was statistically significant at 1% level with Boron (189 g) and Pheromone trap (187 g). Treatments like T_1 and T_2 showed statistically similar results (164 g and 178 g, respectively). Among them, the lowest weight of single fruit (164 g) was obtained from control.

Fruit weight ha^{-1}

A significant variation was found due to the effect of different chemicals regarding total fruit weight ha^{-1}. Amropali gave the highest fruit weight ha^{-1} (21886.4 kg) at the treatment Boron spray. The variation in fruit yield per plant^{-1} was found due to the variation in the production of total number of fruits plant^{-1}. Main effect of chemical treatments as foliar spray and Pheromone trap for pest control also showed significant variation in respect of total fruit yield (13162.7 and 13331.7 kg ha^{-1}). Among the spraying chemical treatments, 2ml/L Boron recorded the highest production of total fruits plant^{-1} (21886.4 kg). Magic growth (18509.5 kg) showed statistically significant production. On the other hand, the lowest production of fruit yield (6408.93 kg) was obtained from the control treatment.

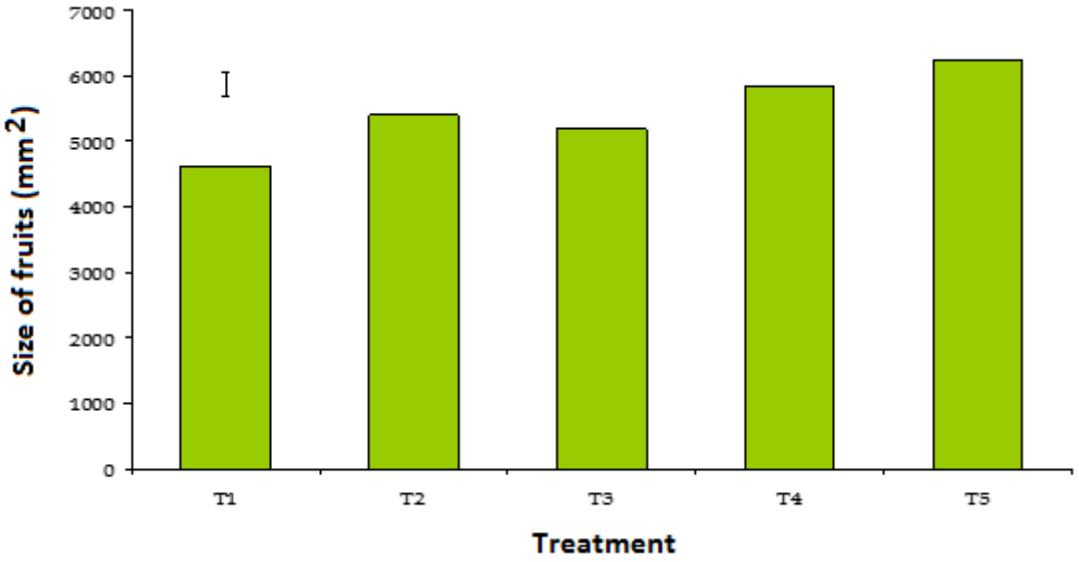

Figure 1. Effect of different pre-harvest treatments on size of the fruits. Vertical bar represents 1% level of probability. Here T_1: Control T_2: ICM T_3: Decis T_4: Boron T_5: Magic growth.

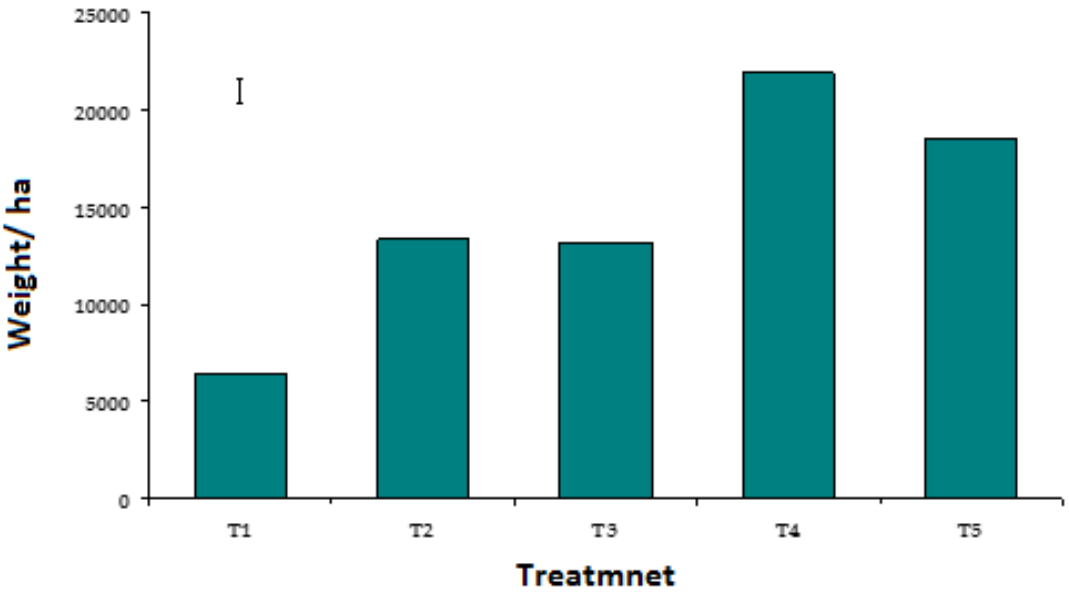

Figure 2. Effect of different pre-harvest treatments on fruit weight of mango ha^{-1}. Vertical bar represents 1% level of probability. Here T_1: Control T_2: ICM, T_3: Decis T_4: Boron T_5: Magic growth

Table 1. Effect of different pre-harvest treatments on yield and yield contributing characters of Mango cv. Amropali

Treatments	Total no of fruits set /plant	No of fruits drop/ plant	Final no of fruits/ plant	Length of fruits (mm)	Diameter of fruits (mm)	Size of fruits (mm^2)	Weight of fruits (kg)	TSS (%)	No. of Fruits/ha (kg)	Weight of fruits/ha (kg)
T_1: Control	113.66	59.33	54.33	80.21	57.69	4627.41	0.164	27.50	39065.66	6408.92
T_2 : ICM	179.66	80.33	99.33	88.02	61.32	5398.11	0.1867	26.00	71420.66	13331.69
T_3 : Chemical	160.33	57.66	102.66	85.89	60.42	5189.82	0.1783	22.00	73817.33	13162.73
T_4: Boron	241.66	70.00	160.00	90.39	64.52	5832.72	0.1893	24.00	115040.00	21886.36
T_5: Magic growth	210.00	80.00	130.00	95.16	65.60	6242.95	0.198	24.50	93470.00	18509.47
$LSD_{0.05}$	7.55	6.14	21.99	2.54	1.71	293.78	0.0175	2.07	15808.89	3350.06
$LSD_{0.01}$	10.48	8.53	30.53	3.52	2.37	407.83	0.0243	2.88	21946.16	4650.61
Level of significance	**	**	**	**	**	**	**	**	**	**

Quality characters of mango fruit

Total soluble solids (TSS) content

Effect of different chemicals Quality characters of mango either influenced by variety or chemical treatment or their combined effect had significant influence on total soluble solids contents. Amropali fruits gave maximum TSS content (27.83%).

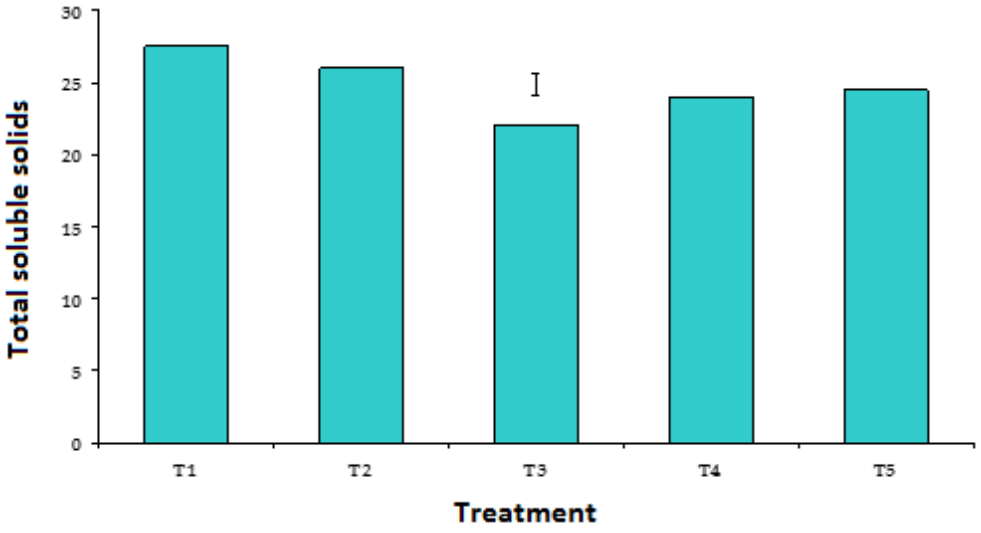

Figure 3. Effect of different pre-harvest treatments on Total soluble solids (TSS) of mango. Vertical bar represents 1%level of probability. Here T_1: Control T_2: ICM T_3: Decis T_4: Boron T_5: Magic growth

TSS content also had been influenced significantly through different effect of chemical treatments. Among the chemical treatments, the maximum TSS was found in Control (27.50%). The minimum TSS (22.0%) Brix was obtained from the Decis spray which was statistically similar (24.50%) with T_5 (Magic growth) at 1% level.

Shelf life of mango

Shelf life is one of the important quality character for fruit production especially for climacteric fruits which might be affected by various factors. Shelf life of mango fruits as influenced by different plant nutrient availability, climatic factors, harvesting, handling and post-harvest management, packaging materials and temperature in storage room. Shelf life is usually calculated by counting the number of days required to ripen fully with retained optimum marketing and eating qualities.

DISCUSSION

The recommended mango variety (cv. Amropali) has significant difference in respect of total fruit, diseased fruit, insect infested fruit and fresh fruit plant^{-1} under different conditions. It was observed that, Amropali gave maximum number of fruit plant^{-1} (241.67), and fresh fruit harvested per plant (160.00) obtained from Boron treatments. However, lowest production obtained from Control treatment. Such result may be attributed due to the genetic adjustment of the treatment or influenced by the climate. Srinivasan (2008) reported that the maximum fruit number was in Mallika closely followed by Dashehari, which occurred due to change in climatic factors or the inherent of genotypic variations. As Amropali is a inbreed variety of these two, it has inherent characters of producing higher number of fruits. Result of the study revealed that application of different treatments increased fruit number than the control. However, variation in fruit number and characteristics were found due to the variation of proper nutrient supply. Nkansha *et al*. (2012) from a similar study found that the growth regulators (GA_3 25 ppm and NAA 25 ppm) gave the best results in terms of increasing fruit set, number

of fruit cluster^{-1} and plant^{-1} and others characteristics. Similar agreement were also found with the findings of Bhatt *et al*. (2012), Wahdan *et al*. (2011), Stino *et al*. (2011) and many other scientists. The control fruits recorded the minimum total (113.67) fruits and harvested fresh (54.33) fruits plant^{-1}. Similar experiments were conducted by Tande (2011) with paclobutrazol 5g. per tree (Cultar 20 ml/ tree); Kosary *et al*. (2011) with spraying of Tradecorp AZll + soil supplementation by 40 cm tree^{-1} in Helpstar and found maximum fruit production from them, therefore application of growth regulators are helpful for better production. Fruit size varied significantly according to the treatments. It is observed that, the larger (6242.957 mm^2) fruit production is induced by application of 2 ml L^{-1} Magic growth as a growth regulator. Among the other treatments, Boron 2 ml L^{-1}, Chemical (Decis, Savin) @ 2 ml L^{-1} and (ICM) Pheromone trap treatment also produce larger fruits which were statistically similar. Control treated fruits were comparatively smaller. Types of nutrients, supplied to the plants cause the variation in size. These results are similar with the findings of Kosary *et al*. (2011). They found that the spraying ½ g/L Tradecorp AZll + soil supplementation by 40 cm tree^{-1} Helpstar increase fruit size. Singh *et al*. (2005) also found some chemicals like Urea (2 and 4%), H_2PO_4 (1 and 2%) and KNO_3 (2 and 3%) were sprayed at the time of panicle emergence and found that the highest fruit length was recorded at 4% urea. Among the fruit weight characters, Amropali produced the highest weight of total fruits (30.24 kg) but lower weight (9.8 kg) in single plant. Although number of total fruit is higher in Amropali but size is smaller. Such result may be attributed by the genetic variability of the variety and might have influenced by the climate. These results are similar with the findings of Pleguezuelo *et al*. (2012) who found that the average fresh fruit weight for different cultivars showed variation for their genetic differences. Also, they found that the variation in fruit yield due to change in climatic factors or inherent genetic reasons. Magic growth was more effective to produce larger fruits and recorded the highest weight of single fruit (0.198kg) and lowest weight in Control (0.164kg) treatment. These results showed difference due to the variation in nutrient supply. Nkansha *et al*. (2012) observed the similar result, when he found the effect of Growth regulators eg. Gibberellic acid (GA_3) and Naphthalene Acetic Acid (NAA) sprays at different concentrations increase fruit retention, fruit quality and yield. GA_3 (25 ppm) and NAA (25 ppm) gave the best results in terms of increasing fruit set, fruit retention, number of fruit cluster^{-1} and plant^{-1}, fruit weight and yield. These results are similar with the findings of Bhatt *et al*. (2012); Wahdan *et al*. (2011); Stino *et al*. (2011) and many other scientists. The fruit weight and volume were the highest within all treatments compared with control.

Amropali got significant differences in respect of quality character (%TSS). It was observed that Amropali is found to be the sweetest variety of mango having the TSS value higher than any other. The treated fruits show comparatively lower (22.00%) TSS due to the chemical activity whereas untreated Control fruits show higher TSS (27.50%). The same result was found by Sarkar (2012). He reveled that, (TSS %) of Control treated fruit is higher than chemically treated fruits because, the chemical effect reduces TSS (%). Patil (1976) stated that the most tricking chemical changes occur during the post-harvest ripening of Banana fruits when hydrolysis of starch and accumulation of sugar occurs. These findings are related to that of Vejendla *et al*. (2008) who found that fruits of mango varieties. Desahari, Hindi Be–Sinnara and Taimour, Mabrouka, Himsagar, Langra and Amropali fruits contained the highest total sugar content that sprayed by single or combined foliar applications of different trace element such as Zn, Fe, Mn, B and Cu. This increase in TSS is also due to the conversion of complex carbohydrates into simple sugars. This is correlated with hydrolytic changes in starch and conversion of starch to sugar being an important index of ripening process in mango and other climacteric fruits and further hydrolysis decreased the TSS (Kays, 1991, Kittur et al. 2001).

REFERENCES

1. Bains KS, GS Bajwa and Z Singh, 1997. Abscission of mango fruit lets. In relation to endogenous concentrations of Indole Acetic Acid, Gibbrelic Acid and Abscissic Acid in pedicels and fruitlets. Fruits, 52: 159–165.
2. Bhatt A, NK Mishra, DK Mishra and CP Singh, 2012. Foliar application of potassium, calcium, zinc and boron enhanced yield, quality and shelf life of mango. Horticultural Flora Research Spectrum, 1: 300–305.
3. Candole AD, 1984. Origin of Cultivated Plants. Vegal Paul Trench and Company, London. pp. 1–67.
4. Gomez KA and AA Gomez, 1984. Statistical Procedure for Agricultural Research (2nd edition). Willey. International Science of Publication, pp. 28–192.

5. Kays SJ, 1991. Postharvest Physiology of Perishable Plant Products. Vas Nostrand Rein Hold Book, AVI Publishing Company. pp. 149-316.
6. Kittur FS, N Saroja, M Habibunnisa and RN Tharanathan, 2001. Polysaccharide-based composite coating formulations for shelf-life extension of fresh banana and mango. European Food Research and Technology, 213: 306-311.
7. Kosary EL, EL Shenawy and IE Radwan, 2011. Effect of Microelements, Amino and Humic Acids on Growth, Flowering and Fruiting of Some Mango Cultivars. Journal of Horticultural Science of Ornamental Plants 3: 152-161.
8. Nkansha GO, J Ofosu-Anim and A Mawuli, 2012. Gibberellic Acid and Naphthalene Acetic Acid Affect Fruit Retention, Yield and Quality of Keitt Mangoes in the Coastal Savanna Ecological Zone of Ghana. Journal of Plant Physiology, 7: 243-251
9. Patil M, 1976. Chemical changes occur during the post-harvest ripening of Banana. Journal of Plant Physiology, 11: 543-551
10. Pleguezuelo CRR, VHD VH, JLM Fernández and DF Tarifa, 2012. Physico–chemical Quality Parameters of Mango *(Mangifera indica* L.) Fruits Grown in a Medi-terranean Sub-tropical Climate (SE Spain). Journal of Agricultural Science and Technology, 14: 365–374.
11. Sarkar PK, 2012. Effect of different post-harvest treatments on shelf life and quality of mango MS Thesis, Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh, p 35.
12. Singh P, MK Singh, V Kumar, M Kumar and S Malik, 2005. Effect of physico-chemical treatments on ripening behavior and post-harvest quality of Amropali mango (*Mangifera indica* L.) during storage. Journal of Environmental Biology, 33*:* 227-232.
13. Singh Z and L Singh, 1995. Increased fruit set and retention in mango with exogenous applications of polyamines. Journal of Horticultural Science, 70: 271–277.
14. Srinivasan R, 2008. Integrated Pest Management for eggplant fruit and shoot borer (*Leucinodes orbonalis* Guenee) in south and Southeast Asia: past, present and future. Journal of Biopesticides, 1: 105-112.
15. Stino RG, ABD El–Wahad, SM Habashy and SA Kelani, 2011. Productivity and fruit quality of three mango cultivars in relation to foliar sprays of Calcium, Zinc, Boron or Potassium. Journal of Horticultural Science, Ornamental Plants, 3: 91–98.
16. Tande P, 2011. Physiochemical changes of fruits during ripening. Journal of Horticultural Science, 10-14.
17. Vejendla V, PK Maity and BC Banik, 2008. Effect of chemicals and growth regulators on fruit retention, yield and quality of mango cv. Amropali. Journal of Crop and Weed*,* 4: 45–46.
18. Wahdan MT, SE Habib, MA Bassal and EM Qaoud, 2011. Effect of some chemicals on growth, fruiting, yield and fruit quality of "Succary Abiad" mango cv. Journal of American Science, 7: 651–658.