INTERNATIONAL JOURNAL OF ADVANCED BIOLOGICAL RESEARCH

www.scienceandnature.org

INFLUENCE OF POSTHARVEST APPLICATIONS OF ETHEPHON ON FRUIT RIPENING IN MANGO

*Gill, P.P.S., Jawandha, S.K., Singh, NavPrem., Kaur, Navdeep & Verma, Annu
Department of Fruit Science, PAU Ludhiana 141004
*Corresponding Author's email: parmpalgill@pau.edu

ABSTRACT
The present experiment was undertaken to study the effect of ethephon dip on ripening quality of mango (*Mangifera indica* L.) cv. Langra at Punjab Agricultural University, Ludhiana. Physiological mature mango fruits were dipped in aqueous solution of ethephon at 200, 400, or 800 ppm. After treatments fruits were dried, packed in CFB boxes with paper lining and kept at ambient conditions (33 ± 2ºC and 50 ± 20 % RH) for ripening. Fruit quality in terms of physiological loss in weight (PLW), fruit firmness, TSS: acid ratio and flesh colour was assessed after 48, 72, 96, 120 and 144 hrs of ripening period. PLW increased with increase in concentration of ethephon and ripening interval. It was recorded maximum with 800 ppm ethephon treatment while the control fruits recorded minimum PLW. Higher doses of ethephon treatment decreased fruit firmness as compared to ethephon 200 ppm treatment or control. Similarly, fruit firmness decreased sharply with advancement of ripening period. Ethephon treatments and ripening period increased TSS: acid ratio by increasing TSS contents and reducing juice acidity. The pulp colour of fruits improved with ethephon applications. Highest yellow colour development of flesh was noticed from 72 hrs to 96 hrs of ripening period. The results suggested that ripening in mango fruit was induced by ethephon treatments.

KEY WORDS: mango, ethephon applications, ripening and fruit quality

INTRODUCTION
Among all fruits grown in India, mango ranks first in area as well as production and is also known as 'king of fruits' due to delicious taste and aroma. Mango fruit is utilized from immature stage to ripeness stage depending upon its use such as chutneys, pickles, sucking, or table purpose *etc*. It is cultivated from northern subtropical states to southern tropical regions of country with wide genetic diversity in varieties. In Punjab state mango plantations are concentrated in sub-montane zone adjoining to *Shivalik* hills. The fruit of mango attains physiological maturity with onset of monsoon season and there is heterogeneous ripening on tree itself which pose problem in transport chain. The optimum stage of ripeness and eating quality is determined by variety of attributes at specific step in the supply chain (Padda *et al.,* 2011). Hence, mango fruit is subjected to ripening treatment to induce uniform ripening and ease in marketing. Under local conditions fruits are commonly given artificial ripening by the use of low-cost calcium carbide (Rahman *et al.,* 2008) that decomposes to acetylene and results in poor flavour. It has been reported that if ethylene is applied exogenously, it helps fruit ripening (Medlicott *et al.,* 1988). Ethephon is one of the most common ethylene-generating chemical for post harvest treatments. Ethephon has been reported to hasten ripening of several fruits like apples, cherries, blueberries figs, pineapple, tomatoes, peaches, guava, grapes, citrus and walnut (Watada, 1986; Abeles *et al.,* 1992). The objective of the present study was to evaluate the efficacy of different doses of ethephon as post harvest dip on physico-chemical changes of Langra mango during ripening under ambient conditions.

MATERIALS & METHODS
These investigations were conducted at Post Harvest Laboratory, Department of Fruit Science, Punjab Agricultural University, Ludhiana (India) during the year 2013. Uniform sized and physiologically mature fruits of mango *cv*. Langra were harvested from commercial bearing mango orchard during the morning hours. Fruits with poor quality, misshapened, immature were discarded. The mango fruits were harvested with long stem, and subsequently de-sapping was done. The fruits were given post harvest dip in aqueous solution of ethephon (*SRL* – 40 % aqueous solution) @ 0, 200, 400, and 800 ppm for five minutes in plastic tub. The control fruits were given water dip only. After treatments fruits were dried in air under shade and subsequently packed in corrugated fibre board boxes using paper cushioning material and kept under ambient conditions (33 ± 2ºC and 50 ± 20% RH) for 6 days. The physico-chemical analysis of fruit was done after 48, 72, 96, 120 and 144 hrs after ripening treatments. A random sample of 20 fruits from each replication was taken for physico-chemical analysis. The percent loss in weight after each ripening interval was calculated by subtracting final weight from the initial weight of the fruits and then converted into percentage value. The cumulative loss in weight was calculated on fresh weight basis. Fruit firmness was determined with hand held penetrometer (FT-327, USA) by taking readings on opposite sides along the fruit equatorial region using 8 mm stainless steel probe. The skin of the fruit was removed at reading spot. Pulp colour was measured in the center of one cut cheek with two measurements per fruit. Total soluble solids (TSS) were determined with the help of hand

refractrometer (ERMA, Japan) at room temperature and expressed in per cent. These reading were corrected with the help of temperature correction chart at 20ºC temperature, whereas, titratable acidity was estimated as per standard procedure of AOAC (2000) and from these TSS: acid ratio was calculated. Colour measurements were made using Hunter Lab scale (model *Color Flex*, Reston, USA), with reflectance mode (Hunter, 1975) and were expressed as '*b**' value representing blue (-) to yellow (+) space. The experiment was laid out according to Factorial Completely Randomized Block Design and data were statistically evaluated by using computer software programme CPCS1.

RESULTS & DISCUSSION

Different post harvest treatment of ethephon significantly affected the physiological loss in weight of mango fruits (Fig. 1).

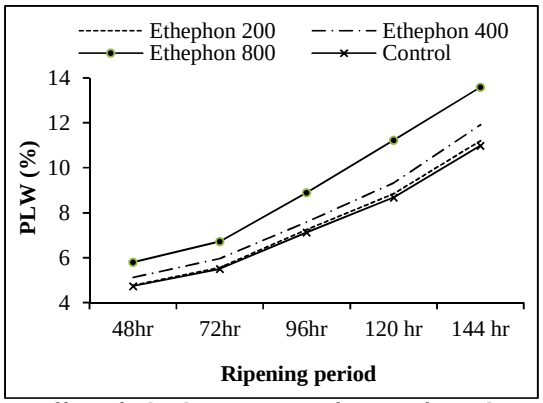

FIGURE 1: Effect of ethephon on PLW of mango fruits during ripening

The mean maximum PLW was noted in highest dose of ethephon treatment (800 ppm) while the mean minimum PLW of fruits was observed in control fruits. Similarly, PLW of fruits increased linearly with ripening period in all the treatments. The mean minimum PLW of 8.39 percent was recorded after 48 after of ripening and maximum PLW of fruits was registered at the end of storage. The difference in physiological loss in weight of among various treatments was lower up to 72 hrs of ripening, afterwards, 800 ppm dose of ethephon resulted greater PLW up to end of storage. Increased weight loss with higher concentration might be due to rigorous effect of ethephon on disorganization of cell wall structure which resulted higher respiration rate (Singh and Tiwari, 1994). Similar increase in weight loss in pear with ethephon treatments were earlier reported by Dhillon and Mahajan, (2011). In mango firmness is one reliable indicator to judge maturity and ripeness during commercial mango handling and important tool for growers, importers, retailers and consumers (Padda *et al.,* 2011). Firmness of fruit with hand held penetrometer can only be estimated up to 96 hr of ripening after post harvest dip of ethephon treatments. After this period, the fruits in all the treatments were soft enough to show any reading on penetrometer. The firmness of the fruit decreased significantly under all ethephon treatments as compared to non treated fruits and maximum mean fruit firmness was noted in control fruits (Fig. 2).

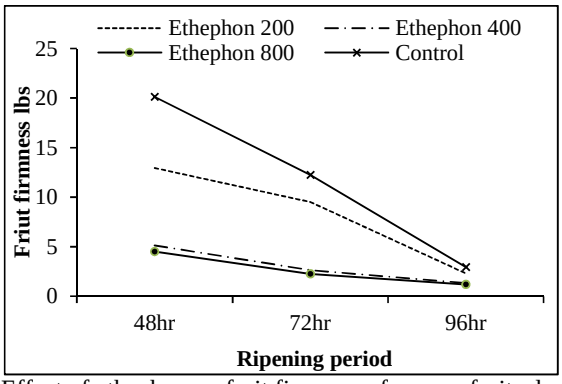

FIGURE 2: Effect of ethephon on fruit firmness of mango fruits during ripening.

As the ripening period advanced fruit started to lose their firmness and it declined sharply from 48 hrs of ripening to 96 hrs of ripening period. The fruits were very hard and inedible after 48 hours of ripening period while after 72 hrs of ripening, higher doses of ethephon (400 and 800 ppm) treatments significantly decreased fruit firmness making the fruit fit for consumption. Likewise, decreased fruit firmness in mango with ethephon treatments has been reported by earlier workers (Singh and Janes, 2001; Wang *et al.,* 2009).TSS: acid ratio is vital characteristics in determining the taste and acceptability of fruit. Various

post harvest treatments significantly affected the TSS: acid ratio of the mango fruit (Fig. 3).

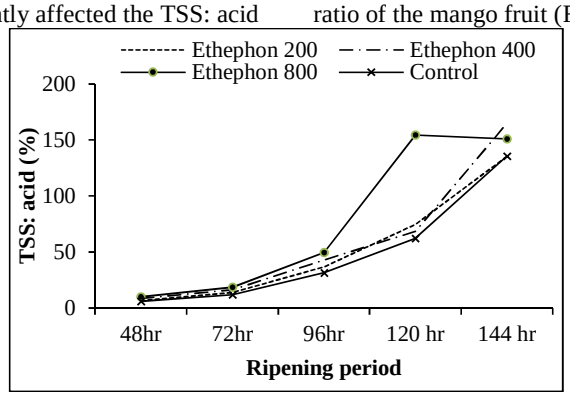

FIGURE 3: Effect of ethephon on TSS: acid ratio of mango fruits during ripening

All the ethephon treatment significantly improved TSS: acid ratio of fruit as compared to control. There was consistent increase in TSS: acid ratio with ripening of fruits up to 144 days ripening. The increase in TSS: acid ratio with ripening was at slower rate up to 96 hr of ripening period; subsequently a abrupt increase in ratio was registered till end of sampling period. The increase in TSS: acid ratio with ethephon treatments and ripening period is attributed to increase in TSS contents and concurrent decrease in juice acid content of fruits for utilization as substrates in respiration. However, excessive TSS:acid content in mango fruit observed after 144 days of ripening is not desirable as it result loss of characteristic flavour. A similar increase in TSS: acid ratio of mango with ethephon treatment was observed by Singh and Janes (2001). Flesh colour of mango fruit is important indices of maturity and ripeness in 'Langra' cv. of mango because peel remains green with maturity and ripening. However, the fruits of this cultivar develop deep yellowish flesh colour on ripeness. Flesh colour was affected by application of ethephon treatments and it changed progressively with increase in concentration of ethephon dose applied up to 120 days of ripening period (Fig. 4).

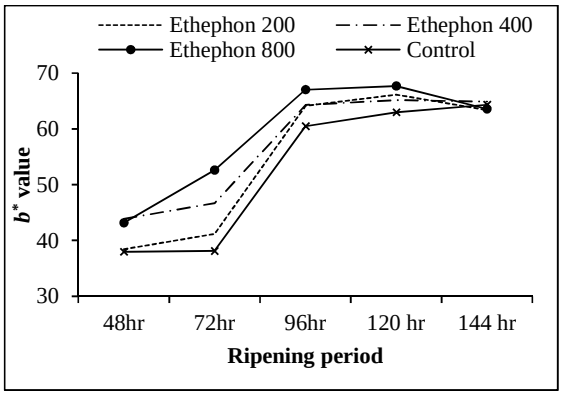

FIGURE 4: Effect of ethephon on pulp colour of mango fruits during ripening.

Afterwards slight reduction in '*b**' values of pulp was noticed in ethephon treated fruits. The yellow colour development of mesocarp was at slow rate from 48 hr of ripening after 96 hrs of ripening followed by rapid colour development up to 72 hrs of ripening period. The appearance of yellow colour with ripening is related to accumulation of carotenoids (Medlicott *et al.*, 1986). In conclusion these results showed that ethephon treatments induced and hastened the fruit ripening of 'Langra' mango fruits under ambient conditions.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the financial support of University Grant Commission - New Delhi through their project F. No. 42-736/2013 (SR).

REFERENCES

A. O. A. C. (2000) Official Methods of Analysis, Association of Official Analytical. Chemists, Benjamin Franklin, Station, 1st edition Washington D.C. USA.

Abeles, F. B., Morgan, P. W. and Saltveit, M. E. (1992) Ethylene in Plant Biology, vol. 15, 2nd ed. Academic Press, San Diego, California.

Dhillon, W. S. and Mahajan, B. V. C. (2011) Ethylene and ethephon induced fruit ripening in pear. *J. Stored Prod and Postharvest Res.* 2, 45-51.

Hunter, S. (1975) The Measurement of Appearance. 304-05p. John Wiley and Sons. New York.

Medlicott, A. P., Bhogal, M. and Reynolds, S. B. (1986) Changes in peel pigmentation during ripening of mango fruit (*Mangifera indica* var Tommy Atkins). Ann. Appl. Biol. 109, 651-656.

Medlicott, A.P., Reynolds, S. B., New, S.W. and Thompson, A. K. (1988) Harvest maturity effects on mango fruit ripening. *Trop. Agric*. 65, 153-157.

Padda, M. S., Amarante, C. V. T., Garcia, R. M., Slaughter, D. C. and Mitcham, E. J. (2011) Methods to analyze physico-chemical changes during mango ripening: A multivariate approach. Postharvest Biol. and Technol. 62, 267-274.

Rahman, A., Chowdhury F. R., & Alam. M.B. (2008) Artificial ripening: what we are eating. J. of Medicine 9, 42-44.

Singh, J. and Tiwari, J. P. (1994) Effect of ethephon on the post harvest quality of guava (*Psidium guajava* L) cv. Sardar. Prog. Hort. 26, 189-193.

Singh, Z. and Janes, J. (2001) Effects of postharvest application of ethephon on fruit ripening, quality and shelf life of mango under modified atmosphere packing. Acta Hort. 553, 599-602.

Wang, B., Wang, J., Feng, X., Lin, L., Zhao, Y. and Jiang, W. (2009) Effects of 1-MCP and exogenous ethylene on fruit ripening and antioxidants in stored mango. Plant Growth Regul. 57, 185-192.

Watada, A.E. (1986) Effects of ethylene on the quality of fruits and vegetables. Food Technol. 40, 82–85.