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Effect on organoleptic quality in mango by pre-harvest application of chemicals and pesticide

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Abstract
Mango (*Mangifera indica* L.) is a dicotyledonous plant having order sapindales belonging to the family Anacardiaceae is juicy, with a single large kidney-shaped seed. The flavor is pleasant, rich and high in sugars and acid. Mango, often considered as king of tropical fruits, is an important fruit crop cultivated in the region. Mango has turn out to be one of the imperative commercial fruit crops in the whole world, being the second largest tropical crop next to bananas in terms of production, acreage, and popularity. The mango fruit having different shape as heart shaped, slender and long, kidney shaped, round and oval. Skin colour of ripened mango fruit can vary and it may be green, yellow, red, yellow green and yellow red. The yellow orange flesh have been surrounded the single flat seed which is contained in every mango. About 0.6% protein, 1.1% fiber has been contained by ripened mango pulp and from the above concentration considerable amount (2-4%) is of starch and calcium pectate has been anticipated to be 0.7%. The human diet can be maintained or balanced by consuming mango which provides up to 64-86 calories of energy to the humans. Chemical preservatives are used for providing the preservation effect to the stored mango pulp. These are also used for the control of microorganisms, or cease the activity of enzymes and also maintain the keeping quality of stored mango pulp. Of the pre-harvest treatments, application of Dehydrated Calcium Chloride (3%) + Carbendazim (0.1%) had better organoleptic quality (4.50). Poorest organoleptic quality among the pre-harvest chemicals and pesticide treatments was however observed in silver nitrate treated fruits (2.58-3.25). Addition of Carbendazim in the treatments significantly improved the organoleptic quality in comparison with treatments containing no Carbendazim.

Keywords: mango, organoleptic, chemicals, pre harvest

Introduction
Mango fruit has a high nutritional value and health benefits due to important components. The present manuscript is a comprehensive update on the composition of mango fruit, including nutritional and phytochemical compounds, and the changes of these during development and postharvest. Mango components can be grouped into macronutrients (carbohydrates, proteins, amino acids, lipids, fatty, and organic acids), micronutrients (vitamins and minerals), and phytochemicals (phenolic, polyphenol, pigments, and volatile constituents). Mango fruit also contains structural carbohydrates such as pectins and cellulose. The major amino acids include lysine, leucine, cysteine, valine, arginine, phenylalanine, and methionine. The lipid composition increases during ripening, particularly the omega-3 and omega-6 fatty acids. The most important pigments of mango fruit include chlorophylls (*a* and *b*) and carotenoids. The most important organic acids include malic and citric acids, and they confer the fruit acidity. The volatile constituents are a heterogeneous group with different chemical functions that contribute to the aromatic profile of the fruit. During development and maturity stages occur important biochemical, physiological, and structural changes affecting mainly the nutritional and phytochemical composition, producing softening, and modifying aroma, flavor, and antioxidant capacity. In addition, postharvest handling practices influence total content of carotenoids, phenolic compounds, vitamin C, antioxidant capacity, and organoleptic properties.
The core producer of the mango is Asia which is contributed about 76.9% of the overall world production, which is followed by America having 13.38% contribution, Africa having 9% and less than 1% contribution each one for Oceania and Europe. The decline in export of mangoes can be attributed to lack of proper post-harvest handling which is yet a significant reason of poor quality of this fruit. Moreover, farmers are not able to determine the proper time of fruit maturity. In the global market the attractiveness of mango is owing to its stunning colour, striking fragrance, pleasing flavour, good taste and healthy nutritional properties. When we considered the losses of mango fruit after harvesting especially considering the developing countries, then the 247 post harvest losses of mango are extremely conspicuous.

The losses are basically due to the mango fruit harvesting at inappropriate maturity, offensive field handling, chilling injury, fruit softening, mechanical injury, decay of mango fruit, lenticels discoloration, squishy tissue, sap burn and pest or disease damage. The basic nutritive and quality losses are occur due to stiff fruit packing, by using inappropriate transportation and meager field management. Mango fruit are commonly processed into juice or puree form and added to many different types of food systems, including fruit juice blends. Fruit juice blends containing mango are becoming more popular with the rise of tropical fruit juices. Processed mango products undergo heat treatment, or pasteurization, to destroy all pathogenic and spoilage organisms. Pasteurization is effective in assuring sanitation; however, application of heat treatments can adversely affect quality characteristics with regard to aesthetic and nutritional quality. As the chemical preservation is the most economical method among the other preservating techniques, so in India commonly the mango pulp is preserved with the help of these chemicals. Prevention of the food spoilage due to microbial attack is done by using the chemical preservatives. And these chemicals showed their batter effect when use in different combination and concentration for the control of microbial growth. No preservative on its own is absolutely efficient against the entire microorganisms. For the longer time storage or preservation of fruit pulp especially mango, the frequently used preservatives are potassium metabisulphite (PMS), citric acid and sodium benzoate (SB) because of their superior antimicrobial action. Sodium benzoate concentration has a direct impact on the microorganism inhibition, as greater amount of sodium benzoate manifest the better antimicrobial effect, when applied on different species of Aspergillus. In the pulp preservation sodium benzoate and potassium metabisulphite have an inhibitory effect to all bacteria and other microorganisms, while addition of chemical preservatives adversely affects the sensory attributes and physicochemical characteristics of mango pulp. Unsystematic use of these chemicals is a huge concern to the healthiness and physical conditions of the human beings, and has been the basis for the development of resistant bacteria and microorganisms, and as a result leading to the incidence of up-and-coming food borne diseases.

Materials and Methods

The present study was conducted in an experimental orchard and post-harvest laboratory of Department of Horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut. The experimental orchard which was located in Horticultural Research Centre (HRC) of the University was maintained healthy following proper orchard management practices. The university is situated on Meerut-Roorkee road (Near Modipuram), about 11 km away from the Meerut city. Geographically, experimental field is located at 290 01 North latitude, 770 45' East longitude and at an altitude of 237.75 meter above mean sea level.

Results and Discussion

The organoleptic quality of mango is an important parameter which indicates the eating quality of fruit. The organoleptic quality of treated fruits was determined on the basis of colour, aroma, flavour, taste, texture and firmness and the data related to this important trait was exhibited in table and figures. The organoleptic quality in treated fruits varied from 2.58-4.50 at ripening. Among the pre-harvest treatments, the treatment of Dehydrated Calcium Chloride (3%) containing Carbendazim (0.1%) had better organoleptic quality (4.50) followed by 3% calcium Chloride + 0.1% carbendazim (4.00). In comparison with control, all treatments improved the organoleptic quality of fruits. Poorest organoleptic quality was however observed in control fruits (2.50) during storage. Organoleptic quality was improved with the increase in the concentration of treatments. Addition of Carbendazim in the treatments significantly improved the organoleptic quality in comparison with treatments containing no Carbendazim.

Among the pre-harvest treatments of Calcium chloride, Dehydrated Calcium chloride and Silver nitrate, the fruits treated with Silver nitrate had poorest organoleptic quality (2.58 to 2.67) followed by Calcium chloride (3.0 to 3.08) and Dehydrated Calcium chloride (3.42 to 3.83).

Organoleptic quality in one of the important quality attributes which determines the edible quality of fruits. The pulp colour also indicates the edible quality of the mango fruits. Of the different pre-harvest treatments applied in the present study, the fruits treated with Dehydrated Calcium chloride had yellowish red pulp colour, while Calcium chloride treated fruits had yellow pulp. Improvement in pulp colour due to post-harvest application of calcium salts in the present study also reported by Anjum and Ali (2014) [1] who had observed that calcium salts treatment resulted in improved pulp colour and better skin colour. The findings of present study also confirmed the results of Karemera and Habimana (2014) [4] who observed improvement in pulp colour and texture when $CaCl_2$ was sprayed. The results of Sakhale *et al.*, (2009) and Anjum and Ali (2004) [5, 2] are also in accordance with the findings of this study. The findings of their study revealed that calcium chloride treatments at higher concentration (7.5%) resulted in better pulp colour as compared to untreated fruits. Carbendazim treated fruits had better pulp colour and organoleptic quality in the present study possibly be due to its role in delaying the metabolic activity of fruits during ripening (Halfarce and Barden, 1979) [3].

Table 1: Effect on organoleptic quality in mango by pre-harvest application of chemicals and pesticide

Treatments	Organoleptic quality At ripening	Per cent increase (+) or decrease (-) in organoleptic quality over control
Control (Fresh water)	2.50	-
Calcium Chloride 2%	3.00	(+)20.00
Calcium Chloride 3%	3.08	(+)23.20
Calcium Chloride 2% + Carbendazim 0.1%	3.33	(+)33.20
Calcium Chloride 3% + Carbendazim 0.1%	4.00	(+)60.00
Dehydrated Calcium Chloride 2%	3.33	(+)33.20
Dehydrated Calcium Chloride 3%	3.42	(+)36.80
Dehydrated Calcium Chloride 2% + Carbendazim 0.1%	3.83	(+)53.20
Dehydrated Calcium Chloride 3% + Carbendazim 0.1%	4.50	(+)80.00
Silver Nitrate 100 ppm	2.58	(+)3.20

Silver Nitrate 200 ppm	2.67	(+)6.80
Silver Nitrate 100 ppm + Carbendazim 0.1%	2.75	(+)10.00
Silver Nitrate 200 ppm + Carbendazim 0.1%	3.25	(+)30.00
LSD (<0.05%)	0.456	

Fig 1: Greenish yellow skin colour retained in fruits due to the effect of pre-harvest application of treatments containing Calcium salts (without Carbendazim).

Fig 2: Yellowish green skin colour retained in fruits on acount of pre-harvest application of treatments containing Calcium salts + Carbendazim.

Fig 3: Yellow skin colour retained in fruits due to the effect of pre-harvest application of 2-3%Dehydrated Calcium Chloride + 0.1% Carbendazim.

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