Proceedings:
International Symposium on
Prospects of Horticultural Industry in Pakistan
28th to 30th March, 2007
Institute of Horticultural Sciences, University of Agriculture, Faisalabad

PREHARVEST MANAGEMENT OF MANGO FOR QUALITY IMPROVEMENT

Mehdi Maqbool* and Muhammad Sohail Mazhar
Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan
*Email: mehdimaqbool@yahoo.com

Abstract

Fruit quality is a very broad term which can be defined in many different ways. Just a few of the characteristics that come under the category of fruit quality include firmness, ground colour, amount of red coloration, size, shape, sugar level, acid content, texture, freedom from defects and general appearance. Almost every cultural practice performed by a grower will influence one or more of these quality parameters. Therefore, the grower can have significant impact on the final quality of his fruit and an understanding of the effects of preharvest practices on quality is important, particularly in relation to storage. Mechanisms for improving a number of quality parameters are relatively well understood (e.g. size, colour, eating quality and mainly involve general plant health, exposure to radiation (especially of the fruit itself), and appropriate leaf:fruit ratio. However, these treatments can affect other quality parameters. In particular, interactions with shelf and storage life are often more difficult to identify and yet can have significant influences in fruit marketing through transport and storage.

Preharvest Factors Influencing Mango Fruit Quality

Many preharvest factors influence the composition and quality of fruits. These include:

1. Environmental
    a. Temperature
    b. Wind
    c. Rainfall
2. Thinning and pruning
3. Insect, pests and diseases
4. Plant growth regulators
5. Irrigation
6. Nutrition
7. Maturity at harvest
8. Harvesting operations

These factors are mutually interactive.

How preharvest factors may influence fruit quality?

Preharvest factors may influence fruit quality by affecting the development and maturation processes of the fruit, physical effects on quality and pack out and by inducing susceptibility to physiological and pathological breakdown.

Preharvest management of factors influencing fruit quality

1) Bagging of fruits

Bagging of fruit for controlling the postharvest diseases and bruises with newspaper or brown bags one month prior to harvest should be done to get maximum fruit quality. The bagged fruits will ripe uniformly without any disease and fruit fly infestation. The problem of blackening and over ripening is overcome. The shelf-life of such fruits is also increased by two or three days. It also checks jelly seed formation (softening of pulp near stone). This technique is eco-friendly and job oriented. However, the bags are not suited for colour varieties.

2) Irrigation

Although the mango tree is considered to be drought-hardy, a good water supply is still important to ensure good growth and high quality fruit. Too much water can lead to waterlogging and root rot and too little can stress the tree and stunt growth (Anonymous, 2003).

The mango stem-end rot fungi are endophytic and grow into the fruit through the pedicel during fruit growth. Therefore, field treatment, (pruning and irrigation) which retard mycelia growth toward the fruit but not at the same time maintain or increase branch or pedicel growth, could reduce fruit colonization. So with holding irrigation during the last few weeks of maturation of mango increases total soluble solids (Crisosto et al., 1994).

3) Mineral nutrition

Once trees are bearing, the time of fertilizer applications is as important as the quantity applied. Vegetative growth should not be encouraged at the expense of flower and fruit production. Too much fertilizer at the wrong time can also affect fruit quality.

Of the nutrients, timing the nitrogen and potassium application is the most critical because high nitrogen is generally associated with maintenance of green colour in mango and potassium has been shown to have a consistent effect on flavour, through increased acidity. Most of the nitrogen and potassium needs are applied as soon as the harvesting is completed. Application of 1 kg Murate of potash or Sulphate of potash along with 2 kg urea and 6 kg Superphosphate during July-August in the basin and incorporation could rectify potassium deficiency. Calcium based nutrition is particularly important during early fruit growth and management practices should be particularly targeted to maximize calcium available to fruit during this period. High fruit calcium concentrations in mango retard green colour loss and softening during ripening (Burdon et al., 1991).

4) Thinning and pruning

a) Thinning

Fruitlet thinning produces the well known response of increasing fruit size. It also reduces total yield so a balance between yield and fruit size must be achieved. Generally, maximum profit does not occur at maximum marketable yield since larger fruit bring a higher price in the market. A grower must rely on his own experience to determine the optimum thinning level for any given orchard and variety. Leaving too many fruit on a tree not only reduces fruit size but also decreases the soluble solid content of each individual fruit. Therefore, fruit quality can be sacrificed in several ways if thinning is not performed correctly (Yeshitela et al., 2003). Davie et al. (1995) explained that an early reduction in the number of mango fruits on the tree, to a quantity the tree can bear up to harvest, greatly reduced further fruit drop.

b) Pruning

The greater the light interception by an individual fruit and surrounding leaves the better the quality of that fruit. Better light penetration also assists fruit colour development. Early pruning after harvest can also help to synchronize shoot growth to achieve more uniform flowering (Fivas and Grove, 1998). To develop a strong trunk the trees should be allowed to grow

to over 1 meter in height initially then cut back to a height of between 0.6 to 0.7 m. First pruning should be done immediately after harvest while the second pruning should follow the floral rather than a vegetative flush appearance.

5) Rainfall

Rainfall immediately before harvest of mango has been consistently related to increased skin browning following bruising or hot water dipping for disease control.

6) Plant Growth Regulators

Plant growth regulators are defined as substances which are naturally produced in plants, control growth or other physiological functions, at a sight remote form its place of production and active in extreme minute quantities. By using 2,4,5-T fruit setting and yield can be increased. Similarly, IAA, IBA and NAA induced higher fruit set. Plant growth regulators affects on mango when sprayed well before maturity. Gebberellic acid (GA) decreases total soluble solids (TSS)/Acid ratio (Khader, 1999). Similarly, gibberellins sprays well before harvest also delayed ripening of mangoes.

7) Insect, Pest and Diseases

Proper identification and early interventions are essential for successful insect pest management. Regular monitoring, careful pesticides selection and good timing are the keys to good pest management with minimal adverse effects.

a) Major Mango Pests

Mango scale, fruit fly, mango hopper, fruit spotting bugs, mango seed weevil mango shoot caterpillar, mango tip borer, flower eating caterpillar.

b) Diseases

The approach to disease control is different to that for insect and mite pests. As disease organisms are microscopic, they cannot be seen and their arrival and build up in the crop cannot be as easily monitored. In most cases, disease control requires routine preventative spraying to protect the crop from possible infection. The major diseases controlled through spraying are anthracnose, stem-end rot, mango scab, bacterial black spot (which damage fruit and shoot) and powdery mildew (which affects flowers) (Johnson et al., 1992).

Insect, Pest and Disease Management

1. Bagging will provide shelter to the fruits and checks the development of postharvest diseases and fruit fly infestation.
2. If bagging has not been done, pretreatment of fruits is required for controlling postharvest diseases. Harvested fruits should be dipped in 0.025% Carbendazim in hot water (52±1°C) for 10 minutes.
3. Fixing of wooden block Methyl Eugenol traps @ 3-5 traps per hectare commencing from first week of March to mange fruit fly (Mossler and Nesheim, 2003).
4. Three sprays per hectare of 2.0% Calcium chloride at 10 days interval prevent the jelly seed formation and it also delays the ripening.
5. Anthracnose can be controlled by weekly sprays of Cu based fungicides from panicle appearance until fruit set.

8) Harvesting Practices

Harvesting practices have probably the most dramatic effects on fruit quality. As a fruit approaches maturity, many quality parameters are changing rapidly. Total soluble solid contents and percent red colour are increasing. However, fruit firmness is also decreasing at the same time with many newer varieties, fruit softening occurs at relative slow rate. Therefore, it is possible to leave these fruit on the tree for 3-5 days beyond minimum maturity in order to improve fruit quality and total yield.

a) Recognizing Maturity

The mango fruits should be harvested in a green mature stage so that it can be packed and delivered to market before it ripens and becomes too soft. To achieve good flavour and appearance, mangoes must be fully mature before harvesting. The harvest maturity in Dusehri and

Langra cultivars reaches 12 weeks after fruit set, while in Chaunsa and Mallika it takes about 15 weeks. The best way to observe maturity in mango is the colour of the pulp which turns cream to yellow on maturity and hardening of the stone (Seymour et al., 1990).

a) Harvesting

The harvesting in mango should be done in the morning hours and fruits should be collected in plastic trays and kept in shades. The fruits should not be allowed to fall on the ground as the injured fruits cause spoilage to other fruits during packaging and storage. Mangoes must be harvested and handled very carefully as the fruit is easily damaged during handling. Skin can also be damaged by rough handling and by contact with mango sap. Fruits harvested with 8-10 mm long stalk appear better on ripening as undesired spots on skin caused by sap burn are prevented. Such fruits are less prone to stem-end rot and other storage diseases.

REFERENCES

Anonymous. 2003. Optimization of irrigation management in mango trees by determination of water and carbon demands to improve water use efficiency and fruit quality. Report No. 1136/1/03.

Burdon, J.N., K.G. Moore and H. Wainwright. 1991. Mineral distribution in mango fruit susceptible to the physiological disorder soft-nose. *Sci. Hort*. 48. 329-336.

Crisosto, C.H., R.S. Johnson, T. Dejong and K.R. Day. 1994. Irrigation regimes affect fruit soluble solids content and the rate of water loss of 'O' Henry' peaches. HortScience, 29:1169-1171.

Davie, S.J., M. Van Der Walt and P. J. C. Stassen. 1995. The energy demand of fruit production and its effect on fruit size in 'Sensation'. South African Mango Growers' Association Yearbook, 15:18-20.

Fivas, J. and H. Grove. 1998. Pruning of mango trees. In: E.A. de Villiers (ed). The Cultivation of Mangoes. Institute of Tropical and Subtropical Crops, Nelspruit, pp.72-75.

Johnson, G.I., A.J. Mead, A.W. Cooke and J.R. Dean. 1992. Mango stem end rot pathogens-fruit infection by endophytic colonization of the inflorescence and pedicel. *Ann. Appl. Biol*, 120:225-234.

Khader, S.E.S.A. 1991. Effect of presharvest application of GA_3 on postharvest behaviour of mango fruits. *Sci. Hort*. 47:317-321.

Mossler, M.A. and O.N. Nesheim. 2003. Tropical fruit pest management strategic plan (PMSP). U.S. Department of Agriculture, http://edis.ifas.ufl.edu.

Seymour, G.B., M. N'Diaya , H. Wainwright and G.A. Tucker. 1990. Effects of cultivar and harvest maturity on ripening of mangoes during storage. J. Hort. Sci. 65, 479-483.

Yeshitela, T., P.J. Robbertse, P.J.C. Stassen, J. Grimbeek and M. Van der Linde. 2003. Fruit thinning intensities and their impact on the yield and quality of 'Sensation' mango (*Mangifera indica* L.) fruits. *Tropic. Agric*. 8 (2):123-127.