ISSN: 2581-3749 (online) Advanced Agricultural Research & Technology Journal ▪ Vol. III ▪ Issue 1 ▪ JANUARY 2019
IMC-2018 Special

Status and Strategies for Mechanization of Mango Crop

V. M. Mayande*

B-504, Mont Vert, Biarritz-II, Baner-Pashan Link Road, Pashan, Pune-411021

Abstract

Mango is most important fruit crop of India, covers 39 % of total fruit area and is grown widely all over country. India ranks first in the world in area and production contributing 46% world production. However, the productivity is low. Mechanization interventions in mango crop for production, post -harvest operations and value addition are relatively low and need to be focused. Precision in operations at different stages of growth will address the challenge of enhancing productivity and profitability of mango crop. A review of mechanization technologies developed and future strategies for mechanization of mango crop in India are suggested.

Keywords: Grafting, harvester, precision farming, canopy management, rejuvenation

Introduction

Mango crop has thousands of varieties specific to agro-climatic zones. Varietal selection is foremost important for higher productivity. Multiplication and use of genuine planting material and region-specific grafting technologies play an important role in mango production system. Crop geometry, planting, precision operations, enhancing water and nutrient use efficiency, pest & disease control, hedging, topping, training & pruning technology, rejuvenation of senile orchards, management of flowering & bearing, harvesting, cleaning, grading, ripening, packaging, transport, marketing, value added products and export are some of the areas that require mechanization interventions. Mechanization of mango crop has not been addressed adequately. Some location specific interventions are documented. There is a need to understand how mechanization can play a role in boosting mango productivity and shortlisting of key intervention areas.

Correspondence: vmmayande@gmail.com
Dr. V. M. Mayande is former Vice Chancellor, Dr Punjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra (India)

Received Date: 10.05.2018; Accepted Date: 24.12.2018

According to Bung (2017) the level of mechanization and automation at farm level operations is negligible. Comparison of the operations of Indian cultivators with the Brazilian ones reveals that both groups stand miles apart when we consider mechanization and automation of processes involved. Brazilian cultivators use advanced technologies not only for harvesting but also for all other operations like grading, processing, packing etc. Higher level of mechanization and automation of processes involved enable Brazilian cultivators to reap the benefits of higher economies and compete in the international markets through pricing their produce much below the international price. This will further question the ability of Indian cultivators to compete with countries like Brazil in the international market. Moreover Brazilian companies are targeting potential markets like India, which mean Indian companies might lose their market share in the domestic market as well.

Important parameters for enhancing productivity

Following parameters should be addressed to improve productivity of mango:

1. High Density or Ultra High Density plantation
2. Micro irrigation and fertigation system
3. Better canopy management
4. Mechanization in crop cultivation
5. Pre- and post-harvest handling of fruits
6. Harvesting with pedicel, de-sapping, plastic crates etc.
7. Rejuvenation of old orchards
8. Growth regulators on flower induction and fruit setting

Mechanization of mango crop has not been adequately addressed. Possible interventions are discussed here.

Mechanization Interventions

Tools and machinery required for different operations in mango crop right from mango nursery till final product reaches consumers need to be addressed. The operations of harvesting, transporting, raw material storing, grading, processing, packaging and marketing of the output need to be relooked at. Cooperative effort amongst farmers and integration of all the activities addressing value chain starting from production to consumers need interventions.

Mango Nursery and grafting tools

Most of the mango-production areas use traditional methods of plant propagation such as inarching. But, mango can be commercially propagated by veneer grafting in north India, soft wood grafting in eastern India, side grafting in central India and stone grafting in western India. Coastal areas with higher humidity and moderate temperature are suitable for mass multiplication through soft wood grafting. However, protected nurseries in poly houses and use of sprinkler and drip is becoming common for raising humidity level, which is required for higher grafting success rate in mango. Experiments have shown that veneer grafting technique can be used with high success in Madhya Pradesh, Andhra Pradesh, Uttar Pradesh and Bihar and softwood grafting are suitable for Konkan region of Maharashtra and other coastal regions. Nursery equipment includes rooting media siever, power screener, soil shredder, screening bucket, media mixer, media sterilizer, dibbling machine, root trainers, pot filling, bag filling, grafting machine, grafting robots. Grafting tools include professional graft pliers for notch graft, omega graft and bud graft and top grafters for bark graft, bench grafter, field whip & tongue grafter, grafting machine for commercial nursery (Mandar 2016).

Irrigation Machinery

Application of water at right place, right quantity and right time is very critical for fruit crops for improving water use efficiency as well as for ensuring adequate moisture availability roots. Trencher, drip line injector and drip laying in field play important role in laying irrigation system in field. Fertigation units ensure use of balanced nutrients for plants. It is recommended that about 4 drippers per plant will provide adequate moisture and nutrition to mango tree (Rajan and Singh 2003).

Tools for manipulation of vegetative growth and flowering

Growth habits of tree, flowering and fruiting of mango tree needs to be understood and accordingly the canopy management and manipulation of flowering practices need to be understood. Mechanical tree pruning machinery plays important role in canopy management and ensuring higher yield and fruit quality.

Canopy management tools

High density planting in mango is now advocated for increasing orchard productivity. Control of vegetative growth, shaping of mango tree after planting is important in high density planting. Canopy management is key to maintain plant height and size of tree (Balamohan et al. 2016). Pruning machines are important tools for canopy management. Power operated tools are available in the market. Early height control and canopy management are important techniques. Topping and hedging of trees is also important practice for increased production efficiency. Tools and equipments for canopy management include secateurs, pruning saw, tree pruner, chain saw etc.

Rejuvenation tools of unproductive orchards

More than 30 year old unproductive orchards can be appropriately rejuvenated by severe pruning in winter for production of new shoots. Successive removal of unwanted shoots and proper development of new canopy is needed. Power operated saw for cutting branches and pruning tools are necessary for rejuvenation of orchards.

Pest and disease management

Efficient management of pests and diseases is essential for growth and development of tree. Fruit, foliage and inflorescence feeders, bud damage, trunk and branch feeders are prominent pest species that incur economic losses. Mealy bug, stem borer, fruit flies, weevils, shoot borer, mango hoppers are some of the prominent pests. Generally mango requires 6-7 spray of pesticides for effective control of these pests. Air-carrier sprayers are most suitable for mango tree. In this type of sprayers spray droplets are injected in air jet and carried to tree canopy where droplets cover complete canopy and both sides of leaves making pest control effective. These designs are commercially available in market.

Harvesting and post-harvest management

Fruits are handpicked or plucked with a harvester. Shaking of branches to drop them should not be followed for better shelf-life. Simple, low-cost and portable mango harvesters, designed and developed at different centres in the country can be used. With the harvester, fruits are harvested with stalks, which appear better on ripening as undesired spots on skin caused by sap burn are prevented.

Fruits are also less prone to stem-end rot disease during storage when harvested in this manner. In recent years, mechanical harvest aids have been developed in view of caustic nature of fruit sap causing sap burn and requirement of stalk attached to fruits for harvesting and de-sapping in the packaging line. Fruits are picked with 2-5 cm fruit stalk to prevent sap spurting. The fruits are then placed in field crates and taken to packaging shade for de-sapping. At present, fruits are harvested by pulling them from the tree using hooks that separate the fruit from the panicle, without stalk. Thus, harvesting by hand with fruit stalk should be preferred. Picking of fruits is followed by washing, de-sapping, pre-cooling, hot-water dipping and fungicide application, grading, waxing, packaging, ripening, transport and marketing. Fruit maturity is very important at the time of harvesting among all the considerations which affect the quality and shelf-life of fruits after harvesting. Hydraulic fruit picking platform has been developed at Central Institute of Agricultural Engineering, Bhopal for harvesting of mango (Kolhe 2009).

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