Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(3): 3849-3853
Received: 04-03-2019
Accepted: 06-04-2019

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Study of post harvest management in kinnow

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Abstract
Food processing sector is critical to India's development, for it establishesa vital linkage and synergy between the two pillars of the economy Industry and Agriculture. India is the world's second largest producer of food and holds the potential to acquire the numero uno status with sustained efforts. The enormous growth potential of this sector can be understood from the fact that food production in the country is expected to double in the next 10 years, while the consumption of value-added food products will also correspondingly grow. The growth of this industry will bring immense benefits to the economy, raising agricultural yields, enhancing productivity, creating employment and raising life-standards of a large number of people across the country, especially those in rural areas.

Horticultural crops in India are currently grown on 12 million hectares representing 7% of the country's total cropped area. Annual horticultural production is estimated at 100 million metric tonnes, which is over 18% of India's gross agricultural output. India is the third largest producer of fruits after Brazil and the United States, while its vegetable production is exceeded only by China.

Kinnow a first generation hybrid of "King" and "Willow leaf" mandarins, was evolved by late Dr. H.B. Frost at University of California, Regional fruit station USA. It was first introduced in India during early 1940's at the fruit experiment station of Punjab Agriculture College and Research Institute Lyallpur by S. Bhadur Lal Singh.

Owing to the poor post harvest infrastructure, wastage of kinnow fruit is over 25% to 30% of the total national production amounting to 0.32MMT. This is mainly due to perishable nature of fruit along with the major hurdles like lack of precooling and cold storage infrastructure facilities, low price due to seasonal glut and stem puncturing. Therefore the only alternative is to process this fruit in the form of juice and other juice-based product. Presently only 5% of this is processed.

Post harvest activities include cooling, curing, handling, storage, processing, packaging, transport and the market phase. Post harvest management is about maintaining quality from production in the paddock to the vegetables being placed on a plate for consumption. Maintaining vegetable quality requires good systems and communication throughout the supply chain as each step is influenced by the previous; it is a chain of interdependent activities.

In most of the packhouse, the operational line is: fruit from field brought i to packhouse blemished/damaged fruit discardedfruits are washed (detergent and fungicides)-rinsed (fresh water)-waxed-dried-sorted-stamped-sizedpacked- and then either temporarily held in cold store or transported to the market. However, there are variations in operational lines and operations may be modified, as under some conditions the process of degreening and colouring may also be needed. Storage and shipping Citrus is a wonderful fruit, as it can be stored on tree, even after attaining full maturity. However, the duration of on tree storage varies with the cultivars.

In case of postharvest storage, mandarins are kept at 5-8 °C, while oranges at 4-8 °C, with relative humidity of 90-95% (Kader and Arpaia, 2002). Although, fruits could be stored at low O2 (3-6%) and CO2 (2.5-4%) concentrations for >5 months (Sun and Sun, 1998), however, controlled atmosphere is not commercially used due to high cost with little advantages. In Pakistan, the potential storage of Kinnow mandarin is yet to be exploited.

Keywords: Post harvest management, kinnow

Introduction
India's share in global food trade of over $520 billion is likely to grow exponentially (from the existing 1.5%) if the expected market access in the developed world materialises in the new WTO regime. Opportunity co-exist. Rapid growth of food processing sector is inevitable since urbanisation.

Increasing demand for value added food products, more and more women joining work force need sheer convenience of processed food, and large export opportunities exist globally where price realization is much better. Accordingly, the vision 2015 set out is to realise the vast potential Indian agriculture by trebling the size of the processed food sector so as to enhance farmer income, generate employment opportunities, provide choice to the consumer at affordable price and contribute to overall national growth by increasing (a) the level of processing of perishables from 6% to 20%. (b) value addition from 20% to 35%, and (c)

Increase in global food trade from 1.5% to 3%. In the early 90s, the sector grew rapidly and large domestic and foreign investments and IEM's were made. However, growth in the late 90s slowed among others due to relatively high cost and low quality of food products. While cost and quality are partly attributable to the farm gate, obsolete/inappropriate technology and inefficient conception and management of food processing units are the major factors. It is often complained that financial institutions are unwilling to finance food processing units because of risk factors such as seasonality, perishability and high term loan requirements. Financial institutions, however, attribute it to lack of good projects and perceived lack of ability of such promoters to manage the business ventures professionally. With a view to bridge this critical gap, this Ministry has been running EDPs through various institutions. The objective has been to enable trainees to establish commercially viable enterprises in food processing sector by providing knowledge of project formulation and management including technology and marketing, motivating them and instilling confidence, showing them opportunities and providing escort services. However, results are not very satisfactory.

Food processing sector is critical to India's development, for it establishesa vital linkage and synergy between the two pillars of the economy Industry and Agriculture. India is the world's second largest producer of food and holds the potential to acquire the numero uno status with sustained efforts. The enormous growth potential of this sector can be understood from the fact that food production in the country is expected to double in the next 10 years, while the consumption of value-added food products will also correspondingly grow. The growth of this industry will bring immense benefits to the economy, raising agricultural yields, enhancing productivity, creating employment and raising life-standards of a large number of people across the country, especially those in rural areas.

The liberalisation of the Indian economy and world trade and rising consumer prosperity has thrown up new opportunities for diversification in the food-processing sector and opened new vistas for growth. A recent study has revealed that there is tremendous potential in India to build a profitable business in the sector. This industry ranks fifth in the country and employs 16 lakh workers, comprising 19% of the country's industrial labour force. It accounts for 14% of the total industry output with 5.5% of the GDP. Its turnover is estimated at Rs.1,44,000 crore, of which Rs.1,11,200 crore is in the unorganised sector. The industry has started producing many new items like ready-to-eat food, beverages, processed and frozen fruit and vegetable products, marine and meat products, IQF products, etc. The Indian consumer is being fast introduced to newer high quality food products made by using the latest state-of-the-art technology, that is also giving the industry a competitive edge.

Horticultural crops in India are currently grown on 12 million hectares representing 7% of the country's total cropped area. Annual horticultural production is estimated at 100 million metric tonnes, which is over 18% of India's gross agricultural output. India is the third largest producer of fruits after Brazil and the United States, while its vegetable production is exceeded only by China.

Out of the 5198 F&VP enterprises in 1999, 2002 (38%) were home-scale (household) units, 1083 (21%) cottage, 834 (16%) small-scale, 598 (12%) large-scale and the remaining 681 (13%) were only relabellers. The growth trend from 1994 to 1997 remained upward, being 21.8% in the first year, 25.2% in the second and 11.76% in the third. During 1997–1998, this sector showed a negative trend of 4.2% over the preceding year and 1998–1999 registered a positive growth of 3.3%. Though the detailed reason for this trend could be ascertained by ground-level research, the factor responsible for negative growth in 1997–1998 was excise duty of 8% on processed (Fruit and Vegetables) F&V products, as against no duty in the preceding years.

In order to define post-harvest losses it is important to do a systematic analysis of the production and handling system and therefore the supply chain for the product. For tropical food supply chains for products such as mango and avocado there are common features and characteristics. There is often large variations in the supply of products and variability in product quality due to different growing seasons, weather changes and production technology used. The production is mostly scattered and undertaken by a large number of small farmers which are producing for local markets with a limited amount of traders. To reach more central markets there is commonly a large number of middlemen between the producers and consumers.

Globally India stands second in the production of fruits with its current production of around 32MMT and thus accounts for about 8%of the total world's total fruit production. The diverse agro climatic zones in the country makes it possible to grow almost all the varieties of fruits and vegetables in India. The major tropical fruits are mango, banana, citrus fruits, apple, guava, papaya, pineapple and grapes. India holds third rank in respect of the production of citrus fruits in the world with the produce of around 4MMT annually. Of these kinnow, a hybrid of citrus nobilis and citrus delicosa has an annual production of over 0.32MMT.

Kinnow a first generation hybrid of "King" and "Willow leaf" mandarins (citrus nobilis and citrus delicosa), was evolved by late Dr H.B. Frost at University of California, Regional fruit station USA. It was first introduced in India during early 1940's at the fruit experiment station of Punjab Agriculture College and Research Institute Lyallpur by S. Bhadur Lal Singh. Since then it has assumed great importance among north Indian growers and a large acreage is being brought under its cultivation particularly in Punjab, Harayana, Rajasthan and Himachal Pradesh. Punjab tops amongst the states in terms of production with the annual production of over 0.175 MMT.

The Northern region of India is considered to be as natural home of citrus (http://ww.ipgr.org/region/apo/publication/tfasia/heptri.pdf). The reason behind this is the adaptability to the agro climatic conditions of the region. Kinnow has shown to have superior characters such as heavy bearing, wide adaptability and fruit quality but is also reported to have short shelf life. Presently 95% of the production goes for fresh fruit market. The availability of large quantities of fruit over a short period of time poses a problem for efficient marketing and utilization.

Owing to the poor post harvest infrastructure, wastage of kinnow fruit is over 25% to 30% of the total national production amounting to 0.32MMT. This is mainly due to perishable nature of fruit along with the major hurdles like lack of precooling and cold storage infrastructure facilities, low price due to seasonal glut and stem puncturing. Therefore the only alternative is to process this fruit in the form of juice and other juice-based product. Presently only 5% of this is processed. The single most hindrance in the popularity and processing of the juice is the development of bitterness, a phenomenon called delayed bitterness among the citrus fruits.

This is of great importance in kinnow processing due to its high intensity

Post harvest activities include cooling, curing, handling, storage, processing, packaging, transport and the market phase. Post harvest management is about maintaining quality from production in the paddock to the vegetables being placed on a plate for consumption. Maintaining vegetable quality requires good systems and communication throughout the supply chain as each step is influenced by the previous; it is a chain of interdependent activities.

An estimated 10 to 40% of the food that is grown is never eaten because of damage, rotting, pests, and the consumers' demand for "perfect" produce. Generally, fresh produce losses are higher than those of processed food. These losses are often higher in warmer, more humid climates as in Northern Australia. The climate makes it more difficult to control diseases in the field, and take out field heat. Long transport distances also make it more challenging to maintain an adequate cool chain.

Post harvest losses mean that production resources such as land, water, energy, fertilisers, labour and effort are wasted, and ultimately, profitability for growers is reduce

Many post harvest losses are a direct result of production management. Vegetables that are affected by weeds, pests and diseases, inappropriately irrigated and fertilised, generally of poor quality before harvesting, or harvested past optimum maturity can never be improved by post harvest treatments.

Post Harvest Issues

According to the report of India's National Commission on Agriculture, defects and in adequate facilities in postharvest handling transport storage and marketing cause up to 20 to 40 percent loss of fruit and vegetables. This is true for Kinnow as well and the value of this loss amounts to millions of rupees annually. Following are the prominent causes of pre and Post Harvest loss of Kinnow in India.

a) Poor Farm Management
b) Improper Harvesting
c) Absence of anti-fungal treatment
d) Delays in the lifting of Harvested crop
e) Poor non-refrigerated transportation
f) Below standard Fruit Markets (Sabzi-Mandies)
g) Inadequate Packing
h) Absence o proper cold storage facility

The present scenario has resulted from the lack of cohesive and integrated planning of the industry, keeping in mind specific needs of various regions, their produce and special industries, which could be energised to work at optimum capacity. The policy initiatives thus far have gone by the assumption that this industry has high risk and low return and that seasonalities of produce dictates the levels of capacity utilisation; that any multi-line projects will become unviable, for there is paucity of marketing outlets and lack of other infrastructural facilities. These problems cannot be viewed in isolation nor can they be tackled by a single department/ministry. It is important to adopt a holistic approach in formulating any viable policy for this nascent sector. The planning should be bottom up and not top down, for in India, the initiative has to come from the rural sector constituting 70% of the population. This is where tapping of Panchayat Raj institutions and networking of cottage, small and medium industries can viably provide the primary and secondary processing for take-off by large-scale industries. What is envisaged is an integrated model wherein cottage, small and medium enterprises act as input factors for further development of products by larger enterprises, by creating primary/ secondary processing facility centres within a radius of 15 to 25 km from the farm. These centres will provide appropriate packing techniques for farmers. Other facilities that could be envisaged at these centres include treatment, washing, sorting and grading, packaging and cold storage.

Under HRD programme, training of farmers, entrepreneurs, field level workers and officers will be taken up. Programme for providing appropriate training to farmers for adoption of high yielding varieties of crops and farming system will be taken up at state level and outside the state. Programme for training of officials concerned with implementation field level workers who will in turn train/guide farmers will also be taken up. Assistance for organizing training courses for Supervisors, Entrepreneurs, Gardeners and Field Functionaries will be continued during XII Plan. Training programme for Supervisors, Entrepreneurs will be organised through selected State Agricultural Universities (SAU), ICAR Institutes, Deemed Universities/Private Universities recognized by UGC having faculty in horticulture and Gardeners training through Krishi Vigyan Kendras and SAUs/ Deemed Universities/Private Universities recognized by UGC recognized by UGC having faculty in horticulture, while departmental staff will be trained under various ongoing training programmes. Training expenses will be met by the Mission. Minimum qualification for Supervisory & Entrepreneurs training programme would be Higher Secondary and for Gardeners it would be Class-VIII (Middle) standard. Institutions identified for training should have minimum infrastructure facilities including class rooms, staff, hostel facilities etc. The courses will be of one year duration for Supervisors and of six months for Gardeners and of three months for Entrepreneurs. In order to attract the candidates and more importantly retain them and prevent their drop out, a monthly stipend will be provided in form of boarding & lodging charges. These courses will be residential. At the end of the training, Supervisors will be awarded a Diploma in horticulture, while Gardeners and Entrepreneurs will be awarded a Certificate of training in horticulture. At least 25 Supervisors, 50 Gardeners and 25 Entrepreneurs will be trained in each participating institution annually. In case States wish to organize specialized training courses on horticulture related subjects, assistance will be provided for the same to concerned Institutes directly, based on recommendation of concerned State (s). Such training would generally be of short duration of 7 - 10 days for 20 to 25 participants. Trainers, who are required to train others, can be deputed abroad for training, for which assistance would be made available for meeting the travel cost and course fee. Concerned State Departments of Horticulture/Agriculture/SHM function as nodal agency for this purpose. Funds will be made available to SHMs for meeting expenses of candidates involved in implementation of Mission programmes based on their specific proposal.

Latest technologies will be promoted on crop specific cultivation, use of IPM/INM, protected cultivation, organic farming through farmer participatory demonstration in a compact area of one ha, which will be organized at strategic locations in farmer's field for which assistance will be limited to 75% of cost. For green house cultivation, area will be limited to 500 sq. meter. Farms in public sector, SAUs, Deemed Universities having faculty in horticulture, could be sites for Front Line Demonstrations, for which 100%

assistance will be provided, and maximum assistance will not exceed Rs. 25 lakh per project.

Kinnow is one of the best varieties of fresh mandarins. It is a rich source of vitamin C having high juice content with special flavor. The soil and climatic conditions in Pakistan have given it a unique flavor which distinguishes it from other comparable mandarins grown in the world. Winter in the plains of Punjab province provides an excellent atmosphere for this fruit and the resulting fruit is sweet and has a very distinct taste.

Citrus is one of the main fruit crops which contribute substantially to the national income. Pakistan is the tenth largest producer of Kinnow in the world (FAO STAT). Due to the inherent good quality of taste, foreign fruit vendors generally prefer Kinnow from Pakistan.

The problems associated with Kinnow export include low produce quality, lack of storage facilities, non-availability of quality packing, poor transportation facilities, high freight charges, weak role of export promoting agencies and inconsistent government policies.

The Kinnow processing project of 10 tons of Kinnow per hour on area of 2 acres needs a capital investment estimated at Rs. 19.81 million for construction, purchasing machinery and equipments. In addition to this, a sum of Rs. 50.40 million is required as working capital, which would be used for purchasing of raw material. The total project cost is estimated at Rs. 70.21 million. This project suggests a plant with capacity of processing 10 tons of Kinnow per hour. This means, that for a total season of 135 days, a total of 10,800 tons of Kinnow can be processed, if the plant runs at 8 hours per day.

There is an old adage that "If you package it right, you can sell just about anything." It's no different for packaging fruits and vegetables they must be packaged so customers will buy them. Proper packaging is especially important when a grower is selling to a wholesale buyer. There is no uniformity in container size or weight standards for all fruits and vegetables, but individual crops have specific industry packaging standards. If the crops are not packaged accordingly, wholesale customers probably will not buy them. Washing, drying, sorting, grading and packing crops into the right container is a good start, but it will not be good enough for most wholesale buyers and brokers. The packed produce must be at a proper storage temperature when it is delivered before most buyers will accept it. Ideally, the produce should be precooled rapidly to storage temperature before or after packing. Precooling will ensure the longest produce shelf life. Packed and precooled produce must be stored at optimum storage temperatures until it is delivered to the buyer.

Problems of Citrus Processing Industry

The industry is currently facing following inherent problems:

1. Yield fluctuations, commonly known as alternate bearing phenomenon (low yield in alternate year).
2. The citrus industry as a whole is still underdeveloped with lack of competitiveness.
3. Poor management during harvesting, transportation, packaging, and storage are major causes to the small export market.
4. Kinnow has a great demand in international market but a higher number of seeds are one of big constraint.
5. Moreover kinnow has the longest growing period and is a late maturing variety with short crushing and processing period.
6. The growers suffer from poor quality and low producing seedlings purchased from the unspecified nurseries.
7. Inadequate research and development facilitates and unavailability of internationally accredited
8. The Citrus Processing Industry is labor intensive and facing critical labor shortage of skilled workers. labs is a major drawback to the fruit export market.

Fruit and vegetables that are fresh and have good flavour bring repeat sales and may bring higher prices. How produce is handled directly affects freshness and, with some produce, how well peak flavour is retained.

For most produce, maintaining cool temperatures (to slow deterioration) and high humidity (to prevent moisture loss) are the most effective means of preserving quality. However, there are several things producers, handlers, and retailers can do to assure that fruit and vegetables going to the market or into storage are of high quality.

Harvesting and handling

1. Provide gentle harvesting and handling to avoid cuts, abrasions, and bruising damage that allow decay-causing micro organisms to enter the tissue.
2. Harvest produce at the peak of quality. This assures greatest value at the time the commodity begins a sales period or storage period for later sale. Because most produce begin to deteriorate at the time of harvest, the highest-quality produce will have the greatest shelf life.
3. If possible, harvest during the cool part of the day. Because temperature controls the rate at which produce deteriorates, harvesting when the produce is coolest (usually just after sunrise) will extend their quality.
4. If storage facilities are not available, harvest only as much produce at one time as you can pack or sell before the quality deteriorates. This also allows displays at roadside markets to be replenished with freshly harvested produce throughout the day, which ensures highest quality available to customers.
5. Make successive plantings and use several varieties of varying maturity to spread the harvest season. This ensures that freshly picked material will be available over an extended period.
6. Shade is cheap and important. Use trees or a shade cover on field wagons, trucks, and market areas. Hold produce in a shaded area while awaiting packing. Perform sorting and packing operations in a shaded location. Vegetables exposed to the sun will absorb solar energy and become warmer than those in the shade. This is especially true of dark-collared vegetables, such as zucchini squash, eggplants, peppers, watermelons, green beans, and tomatoes, which are often harvested during the middle of summer when solar energy is at a maximum. Workers will be more comfortable and, thus, work more efficiently in a shaded area. Shade may be provided by an open shed, shade cloth over a simple framework, or even by a large tree.
7. Remind customers to keep produce cool and prevent moisture loss during transportation and storage at home.
8. For commodities that loose quality rapidly and those to be shipped to market, special postharvest washing, handling, and cooling are required to maintain quality. Take care to avoid bruising in transportation to the packing shed, during unloading, washing and grading.

Packhouse operations

In most of the packhouse, the operational line is: fruit from field brought i to packhouse blemished/damaged fruit discarded fruits are washed (detergent and fungicides)-rinsed (fresh water)- waxed-dried-sorted-stamped-sizedpacked- and then either temporarily held in cold store or transported to the market. However, there are variations in operational lines and operations may be modified, as under some conditions the process of degreening and colouring may also be needed. Storage and shipping Citrus is a wonderful fruit, as it can be stored ontree, even after attaining full maturity. However, the duration of ontree storage varies with the cultivars.

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References

1. Bulletin MNS. Fresh Fruits, Vegetables & Herbs Middle East Market News Service (MNS). Bi-Monthly Edition, Schemes of National Horticulture Board National Horticulture Board, Ministry of Agriculture Government of India, 2010.
2. Dinesh Awasthi, Raman Jaggi V, Padmanand A, Manual for Entrepreneurs: Food Processing Industry Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. Mission for Integrated Development of Horticulture, Operational Guidelines, Horticulture Division Department of Agriculture & Cooperation Ministry of Agriculture Krishi Bhavan, New Delhi, April, 2014.
4. Muhammad Naseer. Report on Export of Kinnow, Trade Development Authority of Pakistan, Government of Pakistan, 2014.
5. Nasir Mahmood Nasir R & D and Training Wing Agriculture Business Division, Lahore Policy & Process Guidelines for Farmer Producer Organisations Dept. of Agriculture and Co-operation, Ministry of Agriculture, Govt. of India, 2013.