

Study of Value Chain for Grapes

Nasik, Maharashtra



**National Committee for Plasticulture Applications in Horticulture
(NCPAH)**

**Ministry of Agriculture & Farmers Welfare, Govt. of India,
New Delhi**



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Executive summary

Nasik district of Maharashtra is very famous and popular in the world for cultivation and exports of table grapes for more than 25 years. The grape growers in Nasik are very progressive and doing progressive advanced farming of grapes to achieve and maintain world quality standards of grapes. Majority of grape growers have obtained a Global GAP certificate for cultivation of grapes and following practices of cultivation as mentioned in Global GAP. The farmers are using all plasticulture techniques like micro irrigation systems, fertigation techniques, pre cooling and cold chambers for storage of grapes maintaining cold chain, following IPM and INM practices to maintain MRL global standard values. However, there are some issues/bottlenecks that prevent the farmers to be number one in Global market and facing some difficulties while competing with other global exporters of grapes like Chili, South Africa, Spain, and Italy etc.

National Committee for Plasticulture Applications in Horticulture (NCPAH) working under Ministry of Agriculture and Farmers welfare MoA&FW conducted a study on Value chain assessment of grapes cultivation in Nasik district to understand the GAPS in the supply chain of grapes and suggested some VALUE ADITION techniques to overcome the issues faced by the farmers to compete the world leaders of grapes cultivation, to reduce the production cost thereby increasing the annual income of farmers in the cluster. The study is done under Mission for Integrated Development in Horticulture MIDH New Delhi with the cooperation from State Horticulture Mission Maharashtra state.

NCPAH representatives visited many progressive grape growers, Maharashtra Grape growers association (MRDBS) officials, state Horticulture mission officers, grape traders and exporters, Input suppliers, NHB officials in Nasik, National Research Center (NRC) Grapes Pune officials to collect information on grapes supply chain, GAPS/issues they are facing and probable value addition that can be adopted at all levels of value chain to improve the supply of grapes all over the world. Thus all backward linkages from Nurseries, planting materials



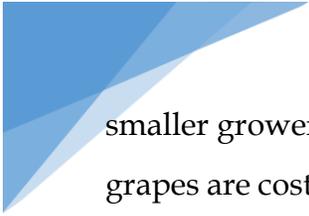
to forward linkages up to exports are studied and results in details are included in the study report. If the suggestions mentioned in the study report are implemented with immediate effect by all the stake holders of the chain including MIDH and Mo A & FW, it will be a great help to the farmers in the cluster and Nasik cluster will be world no 1 grape cultivator and exporter in recent future.



Introduction

Nasik district of Maharashtra is world famous for grapes cultivation and exports of Grapes to various countries. It is the biggest cluster of grapes cultivation in India. Government of India with the help of Department of Agriculture and Horticulture Maharashtra state is helping grape growers of Nssik to produce world class quality grapes through many motivational subsidy schemes. A proper supply chain of grapes is established in Nasik with the help of all the stake holders of grape cultivation industry for the benefits of crops. This study of value chain of grapes crop in Nasik will help growers and exporters of Nasik to analyze gaps and lacking/gaps in the existing chain and suggested value inputs that can be implemented for further betterment of grapes growers to improve their crop economics and profits.

The commercial production of grapes started in India only after seedless varieties were introduced in Maharashtra during the 1960s. Maharashtra accounts for 70 percent of India's total grape acreage, and 63 percent of production.¹ Varieties grown include Thompson Seedless, Sonaka, Sharad Seedless and Tas-e-Ganesh, and harvesting lasts from early February to early April. Within Maharastra, the grape crop comprises 12 percent of the total fruit acreage, with 42,500 acres. Sangali, Solapur, Pune and Ahmednagar are the other locations, with more than 2,500 acres each under grape. Nashik district, located in the north-west part of Maharashtra state, has 10 percent of its area under F&V, as against only 4 percent at the state level. Vegetables are the main cash crops, with onion alone accounting for 5 percent of gross cropped area (GCA). Fruit represents 6 percent of GCA, with that under grapes more than 2 percent and pomegranate another 1.3 percent. The average size of holding in Nashik is the same as the average for the state (1.67 ha). A total of 39 percent of its main workers are farmers and 21 percent agricultural labourers. Of farmers in Nashik, 73 percent are small or marginal and operate 40 percent of land (ibid.). There are more than 10,000 grape growers in Nasik district, of whom only about 1,000 produce to export quality. In India, there are large individual export growers, and organized (through cooperatives and PMOs)



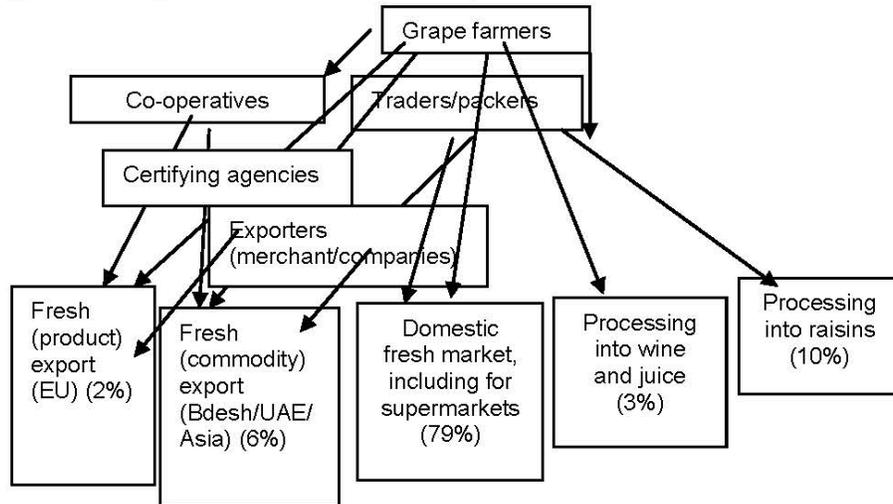
smaller grower exporters. In Nasik, there are not many small farmers in grape cultivation, as grapes are costly and risky to grow. As a procurement manager working with a company for nine years and earlier with a grape growers association for one year remarked, 'It is a rich farmers' crop'. On the other hand, in Sangli, it is mostly small farmers who are into grape cultivation, given small holdings and family labour crop care, and the exportable quality crop proportion is higher (70-80 percent) in this area. Nashik district accounts for 78 percent of grape acreage and 80 percent of production of grapes in the state. It also contributes 55 percent of India's and 75 percent of Maharashtra's grape exports (NCAP n.d.). The region has a fairly well-established marketing infrastructure. More recently, agricultural marketing reforms have been carried out, under which the state has issued 83 licenses for direct purchase from farmers and 12 private wholesale market licenses (during 2007/08 to 2010/11) (NABARD 2011).

India is a small producer of grapes, with a world share of less than 2 percent. India produced more than 1.2 million tonnes of grapes from 0.11 million ha in 2010/11, of which 8 percent was exported. Grapes account for 2.7 percent of production and 1.4 percent of total fruit area in India. Although the area under grapes has expanded at a rate of 9 percent per annum over the 2000s, production and yields have remained stagnant over the past two decades. Of this production, 87 percent was used as table grade, 10 percent dried, 2 percent for juice and 1 percent for wine (Figure 1). Grapes are one of India's important fruit exports, with a 9.1 percent share in all fruit and nut export (Sharma and Jain 2011). By the late 1990s (1997/98), the export market for fresh grapes (which had previously been Gulf countries) shifted significantly to the EU, accounting for 60 percent, with the Gulf making up only 15 percent (Rath 2003). Four countries (Netherlands, Bangladesh, the United Arab Emirates [UAE] and the UK) accounted for 75 percent of the volume of Indian exports and 67 percent of the value in 2010/11. The Netherlands and the UK took a 25 percent share in quantity and 41 percent in value, whereas Bangladesh and the UAE took a 50 percent share in quantity and a 26 percent share in value exported.³

In 2008, there were 125 exporters of grapes from India, who dispatched 3,200 containers. Most of the exports (50 percent) were from merchants, followed by growers or their groups and

the corporate agencies. Export market buyers tend to have formal contracts with growers, given the quantity and quality commitment in these markets. The major grape exporters to the EU markets include Bharati Field Fresh, which has collaboration with Rothschild, Mahagrapes (the grape cooperatives' company), Eurofresh, Fresh Trop, MSSL, Tata Khet se and Namdhari Fresh, which all procure from the same grape-growing belt in Maharashtra. There are also some grower exporters who receive export orders through commission agents. The value chain mapping in grapes revealed the following trade channels and use of the product (Figure 1).

Figure 1: Grape trade and utilization pattern in India



Source: Field survey and www.apeda.gov.in

A GLANCE

- GRAPE CULTIVATION CLUSTER IN NASIK

S. No	Particulars	Numbers
01	Area under grapes in Nasik	Approx 200000 Acres
02	No of farmers engaged in grapes cultivation	Approx 30000
03	No of people dependent on Grapes farming	Approx 1000000
04	Total production of grapes per year -	20 Lac MT
05	Export grapes quantity in grapes	2.00 Lac Mt
06	Name the countries where Nasik grapes export	EU, Far East Countries, China, Russia, Gulf, Bangladesh, Canada
07	Quantity in domestic market	18.00 Lac Mt
08	No of grape nurseries in Nasik	25 to 30
09	No of grape plants required every year in Nasik	Approx 2.00 - 2.50 Crore
10	Production per plant	12 kg
11	No of packing houses available in Nasik -	115
12	No of cold storages available in Nasik	115
13	Export value in Rs/kg	Rs. 50/- Per Kg (Avg for EU, Gulf, far East, Russia, Other Export Markets)
14	Total export value per year	Rs. 2000 Crore (Tentatively)
15	Domestic value in Rs/kg	Rs. 30/- per kg
16	Total domestic value per year	Rs. 7500 Crore (Tentatively)

Initiatives to develop the grape sector

In India, 90 percent of the grape production is of table variety. Grape farming is a highly profitable venture for farmers, but it is also highly risky as farmers have to invest heavily for production. In case of a price crash, farmers face huge losses leading to an additional debt burden along with the initial high investments. Despite the challenges, the grape sector has a lot of potential. Being a high-value commodity, it is one of the largest foreign export earnings. To address the farmers' concerns and capitalize on the market opportunities, the state and central government agencies, farmers' organizations and other parastatal organizations and institutions have undertaken various initiatives to support processing, exports and marketing of grapes. The key initiatives are described below.

In order to boost the export of grapes from Maharashtra, the cooperative partnership firm "Mahagrapes" was established in 1991 with the help of the Maharashtra State Agricultural Marketing Board in Pune. Till date a total of 16 grape grower cooperative societies are member societies of Mahagrapes from Sangli, Solapur, Latur, Pune and Nasik areas. The main objective of Mahagrapes is to boost the export of grapes for which facilities like precooling and cold storages have been erected at each grape grower cooperative society. Mahagrapes is now a well-established brand in the international market; it has exported grapes to the European Union and the Middle East over the past ten years. All technical guidance and financial support has been given by the state marketing board.

Agri-export zones (AEZs) for grapes have been set up in Maharashtra and Andhra Pradesh. The objective of these AEZs is to promote the crop so that abundant raw material be available at low cost; AEZs integrate various assistance programmes of central and state government agencies. The zones provide fiscal incentives to exporters, integrating all the activities till the produce reaches the market. The AEZs are implemented through public and private sector participation. The Indian Council for Agricultural Research (ICAR) has set up the National Centre for Grape Research at Pune to cater to the research and



extension needs to develop new varieties keeping in mind the need for processing and exports. Extension support is provided to extend the findings to the farmers.

APEDA has developed the “GrapeNet”, a web-based software that will help trace export of grapes from India to the European Union. This initiative was aimed at reducing the export rejects due to high pesticide residues. The GrapeNet tracking system will help to monitor pesticide residue and achieve product standardization, thus boosting grape exports to the European Union. If there are any complaints concerning pesticide residues being present in grapes, the software will be able to indicate the farms from where the grapes originated. The software will give details about the authorities issuing the certificate, inspection reports, laboratory analysis, certificate of residue analysis and the packing house details. It is designed to reach at the root of any grape export transaction. The software is already being used by about 40 000 farmers. Because of higher accountability and transparency in the system, the farmers’ returns have also increased according to APEDA.

To give impetus to the grape processing and wine industry in the State of Maharashtra, the state government has specifically provided in Maharashtra's Industrial Policy, 2001 that Wine Parks be set up in Sangli and Nashik districts to encourage the wine industry in the state.

Agriculture Value Chains in India

The agriculture system in India has undergone rapid transformations over the past few decades particularly after the economic reforms of 1990s. The emergence of integrated agriculture and food supply and value chains is one of the most visible market phenomena in India. Increasing concentration on processing, marketing and export is being observed in all the segments of the chain. The traditional way of food production is being replaced by practices more similar to manufacturing processes, with greater co-ordination across farmers, processors, retailers, exporters and other stakeholders in the agriculture value chain (Kumar et al. 2011).

Agricultural Gross Domestic Product (GDP) increased at an annual rate of 3 percent between 1980 and 2012-13, making India the third largest agricultural producer by value after China and USA. However, this sector is yet to realise its full potential. The sector currently fulfils only 60 percent of yield for most crops, particularly fruits and vegetables. Yet for many crops India does not have global scale processing facilities. In India only 4 percent of the fruits are processed compared to China (23 percent), Indonesia (50 percent) and Brazil (70 percent) (Shivakumar 2016). Apart from these, another issue is loss of agricultural products. Post- harvest losses in India are too high (25-30 percent of total production) (Joshi et al. 2007).

Thus, fruits and vegetables are suitable areas for consideration to revive Indian agriculture. Fruits and vegetables can provide 2-4 times higher incomes to farmers and consume 40-80 percent less water per hectare in comparison to cereals. China's success in apple can be a meaningful lesson for India where China's export of processed apple increased from US\$50 million to more than US\$1.4bn in eight-nine years (Shivakumar 2016).

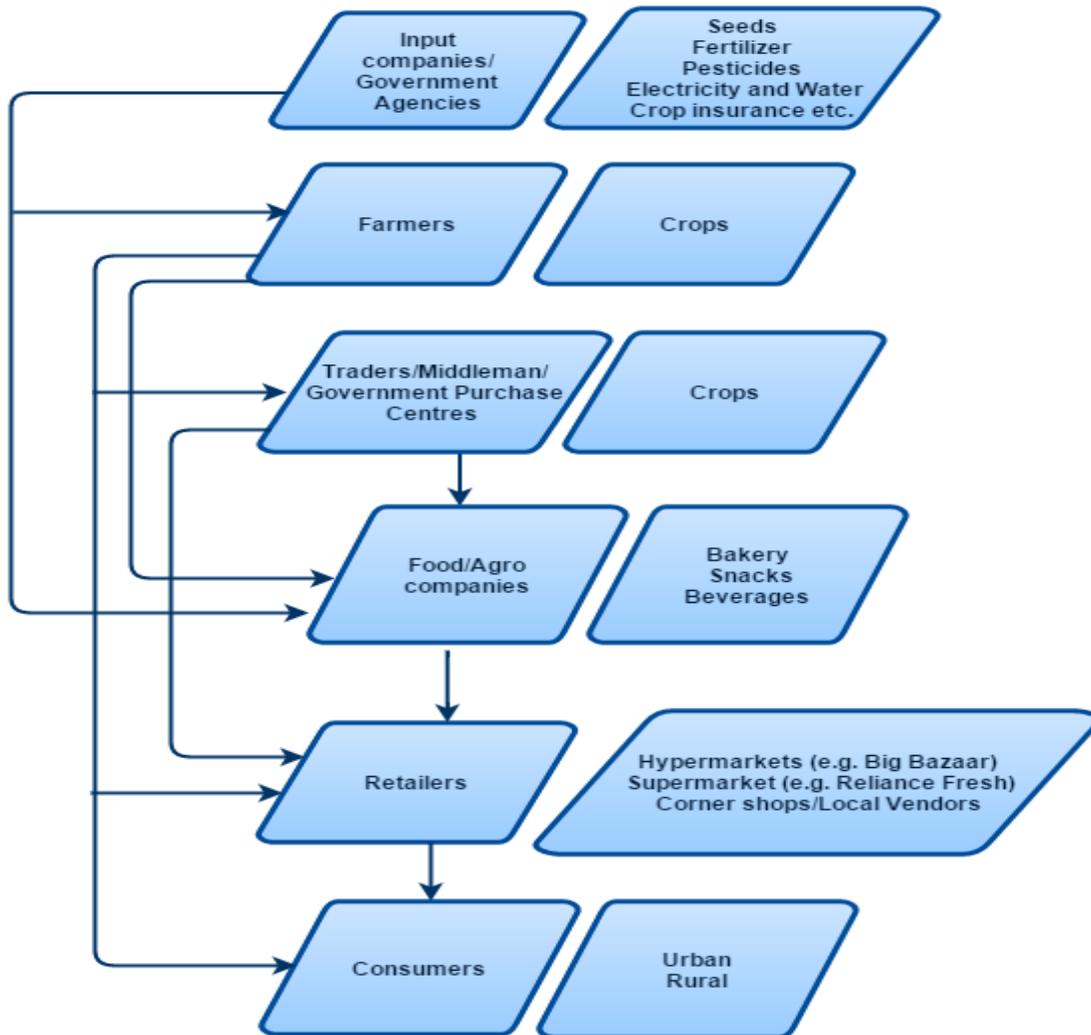
Apart from it, with steep rise in income of middle class, change in preferences and lifestyle, transformation in work profiles and demography has created a huge demand for high-value commodities and products, such as fruits, vegetables, livestock products etc. Other



than these, changes in tastes, preferences and food-habit of Indian towards frozen and pre-cooked or ready-to-eat items have also increased particularly youth and working class and with the rising numbers of shopping malls and eating joints. This has also necessitated changes in quality and safety of products, production and processing process and distribution methods. Farmers have to grow and try to diversify their production systems accordingly and in some of the areas they are trying to do this. This also opens a huge opportunity in the expansion of domestic market for non-conventional, crops, such as fruits and vegetables.

Agriculture value chains in fruits and vegetables provide an alternative for the diversification of agriculture in view of high income, employment, foreign exchange earnings and a new method to combat challenges of food security. These products have high income elasticity of demand. Whenever and where-ever income of the population goes up, demand for these products also goes up mainly in the middle-income groups of developing countries. The rise in income and stress on quality has influenced the demand side while new technologies and trade agreements have the potential to influence the supply side.

Figure 3: A Model of Agriculture Value Chain of Fruits and Vegetables in India



There have been examples in India where successful agro-business models incorporated small and marginal farmers in their network and linked them with markets. The following cases briefly analyses such examples, which have been working very well in India for the development of agriculture value chains and linking the farmers to the domestic and external markets.

Backward linkages in Grape value chain

Backward linkages in Grape value chain include the activities from Nurseries, plantation up to harvesting. Nursery management, plant propagation, field preparations, plantation, intercultural operations, irrigation and fertigation, pest and disease management, record keeping, harvesting are the measure activities given priority in backward linkages.

1. Nurseries for Grapes plant propagation in Nasik

a. Theory and practice with Hardwood Cuttings

For obtaining hardwood cuttings, 3-4 year old disease free vigorously growing mature vines, which has produced a good crop in the previous year should be selected after October pruning. Cuttings from very young and very old vines or those subjected to heavy fruiting during the previous year should be avoided. Medium-size canes having internodal length of 8-10 cm are desirable. 30-45 cm long cuttings of pencil size thickness with at least 3-4 nodes are cut from the middle portion of the selected canes. A cut should be made straight across 1cm below the node at the lower end of the cuttings, while slanted cut at the top is taken 2-3 cm above the bud. The cuttings are then immediately planted in bed or in polythene bags in the nursery. In case of delay in planting, the cuttings are stored by burying in moist sand or sawdust at 5 -7.50 C.

In nursery, the cuttings are planted in well-prepared flat beds of 1.2m width of convenient length. A mixture of Leaf mould, FYM, Sand and Super phosphate is thoroughly mixed in the soil before forming the bed. Cuttings are planted 20 cm apart in lines. While planting the cuttings at least two nodes should be inside the soil with one bud above the soil. Care should be taken to maintain the polarity while

planting the cuttings, since grape cuttings planted upside down do not grow. Soil is pushed back into the furrows and pressed firmly around each cutting.

Cuttings can also be planted in polythene bags. Polybags (25x15 cm and 150-200 gauge) are filled with a mixture of soil, sand and FYM in equal proportion along with Superphosphate. One or two cuttings may be planted in each bag. Preventive sprays to control common diseases are given during the growing period.

b. Chip Budding

Chip budding is the best method for propagating vines on rootstocks. In this method a wedge-shaped piece containing the bud (chip) along with a portion of wood is removed from the desired variety. The scion buds should be plump and taken from well-mature healthy canes, equal in maturity level and thickness to that of the rootstock.

A notch, sufficient to accommodate the chip, is made on the rootstock 10-15cm above the ground. The chip is placed in this notch and wrapped with a polythene strip exposing the bud.

Normally two budding are done on every mature stem 15 cm apart. When these buds sprout and grows to about 15 cm, the rootstock portion above it is cut off. The sprouts on the rootstock below the bud joint are removed regularly.

c. Rootstocks

Of late due to some soil borne problems such as nematodes, soil salinity and drought, use of rootstock has been felt essential. The following rootstocks have been identified for combating the soil/ climate related problems and also as a potential tool for manipulating the vine growth and productivity -

Purpose/Rootstock	Name of the rootstock
Drought tolerant	110 Richter, 140 Ruggeri, 1103 Panlsen, SO 4 and St.
Salinity tolerant	Dogridge, 1613, Ramsey and 140 Ruggeri.
Nematode resistant	1613, Dogridge, Salt Creek (Ramsey), Harmony,

GAPS observed in Nursery management/Propagation:

1. At present, there are around 30 big nurseries and around 50 small nurseries producing grape plants in Nasik cluster producing 2 to 2.2 cr plants per year. The planting materials requirement in the cluster is 2.5 to 2.7 cr per year and demand of good quality plants is increasing every year. Many farmers in the region have their own root stock plantation on their farms. They make the plants on their own by using skilled workers who are having good skills in grafting the plants. Such workers are called from Konkan region during the season. Around 30000 workers get temporary employment during the season. No record keeping is available for planting materials, root stock, varieties etc as on today.
2. Most of the existing nurseries are using only one root stock that is Dogridge and excessive use of hormones and additives are used in nurseries.
3. The nurseries are not standardized and there is no guaranty of good quality plants. Not a single nursery is accredited under NHB or any other scheme.
4. Unorganized nurseries - The nursery business is completely unorganized without any record keeping. Mixing of plants is a big issue and rarely the farmers get the planting material in full quantity as he desires and expects. It is observed that the mixing percentage varies from 5% to 15% which is very high and it affects the production quantity thereby returns as well.

VALUE ADDITION for improvements:

1. The nurseries which are not standardized, need to be standardized as per existing standards by competent authorities. NHB or NHM under their schemes can visit all the nurseries and help the nurserymen to standardize the nurseries as well as accredit as per the norms of the scheme. This will help common farmers to get proper desired variety planting materials in time and with best quality free of pests and diseases. The accreditation of



nurseries can also help the nursery men to start exporting the plants and earn good returns/profits.

2. Formation of a cooperative society/nurseries association and working together can help in improving quality of plants in turn will help farmers to gain more profits.
3. Proper use of additives/hormones, fungicides etc is must and as per requirement only that may reduce the cost of plants. The association of grapes nurserymen along with National Research Centre for Grapes Pune can develop package of practice to produce best quality plants for the farmers at reasonable costs. They can also find good markets for plants in domestic Indian market as well as abroad market.
4. Research and introducing new root stocks that can help producing resistant varieties and best quality plants free of pests and diseases. NRC grapes has already done some research on this however it needs to be done on a bigger extent. It is also possible to import improved root stock from other countries and test here in Pune/Nasik. If found satisfactory and better than the existing root stocks, the improved root stocks can further be multiplied in the region to provide to nurseries/individual farmers who produce their own plants.

2. Grape varieties

a. Anab-e-Shahi

This variety is grown in the states of Andhra Pradesh, Punjab, Haryana and Karnataka. It is widely adaptable to different agro-climatic conditions. This variety is late maturing and heavy yielding. Berries are elongated, medium large, seeded and amber coloured when fully ripe. Juice is clear and sweet with TSS 14-16%. It is highly susceptible to downy mildew. Average yield is 35 t/ha. Fruits have a good keeping quality and mostly used for table purpose.

b. Bangalore Blue

This variety is grown in Karnataka. Berries are small sized, dark purple, ovoid, seeded with thick skin. Juice is purple coloured, clear and pleasantly flavoured with 16-18% TSS. Variety has a good keeping quality and mainly used for making juice and wine. It is resistant to anthracnose but susceptible to downy mildew.

c. Bhokri

This variety is grown in Tamil Nadu. Berries are greenish yellow, medium large, seeded with medium thick skin. Juice is clear with 16-18% TSS. Variety has a poor keeping quality and is used for table purpose. It is susceptible to rust and downy mildew. Average yield is 35 t/ha/year.

d. Gulabi

This variety is grown in Tamil Nadu. Berries are small in size, deep purple, spherical and seeded. The TSS is 18-20%. Variety has a good keeping quality and is used for table purpose. Variety is not susceptible to cracking but it is susceptible to rust and downy mildew. Average yield is 10-12 t/ha.

e. Kali Sahebi

This variety is grown in the states of Maharashtra & Andhra Pradesh on a small scale. Berries are large, oval cylindrical, reddish-purple and seeded. The TSS is 22%. Variety is susceptible to rust and downy mildew. Average yield is 12-18 t/ha. The variety is suitable for table purpose.

f. Perlette

This variety is grown in the states of Punjab, Haryana and Delhi. Berries are seedless, small sized, spherical to slightly ellipsoidal and yellowish-green in colour. The juice is clear and green with 16-18% TSS. Keeping quality is good and is used for table purpose. Variety is not suitable for raisins due to compactness of clusters. It is highly susceptible to anthracnose. Average yield is up to 35 t/ha.

g. Thompson Seedless

Mutants of this variety are Tas-A-Ganesh, Sonaka and Manik Chaman. This variety is grown in Maharashtra, Andhra Pradesh, Tamil Nadu and Karnataka. It has wide adaptability with seedless, ellipsoidal-elongated, golden-yellow berries with medium-thin skin. The juice is straw coloured, sweet with a TSS of 20-22%. Variety has a good keeping quality and is used for table purpose and raisin making. Average yield is 20-25 t/ha. The mutants Tas-A-Ganesh and Sonaka are mostly cultivated in Maharashtra.

h. Sharad Seedless

It is a variety local to Russia called as Kishmish Chorni. The berries are seedless, black, crisp and very sweet. The TSS is upto 24OBrix. It responds well to GA and has a god shelf life. It is grown mainly as table purpose variety.



GAPS observed in grapes varieties:

1. Though there are number of varieties of grapes available in market, very few varieties like Thomson seedless, Sharad seedless are popular and used by farmers.
2. No research for development of new varieties by research centers in India. The variety developed by NRC Pune is not suitable for market and hence not popular among the farmers. It was discussed that the farmers from Chili, South Africa, Spain



etc. are producing different varieties those having good demand in European market and thus Indian growers are not able to compete these countries. Hence though the export volume from India is increasing every year, Indian growers do not get good prices and expected returns. The European customer demand of grapes is based on color, size, and aroma, weight of berry and shape of berry. Red variety Flame fetches best rates in European market but no Indian grower has that variety to grow. Similarly there are certain other varieties from the breeders of California, Israel and Spain those have a great demand in European market. Also these varieties are pest and disease free varieties with natural color development and size and shape of the berry. Thus these varieties do not require and sprays of growth promoters or hormones. Similarly the cost of control of pests and disease is minimum as compared to present varieties cultivated in India. Thus if Indian growers plant these varieties, possibly the production cost will be less as compared to existing one and returns through exports will be much higher thereby gaining huge profits.

3. It was requested by MRDBS that is Maharashtra Rajya Draksha (Grapes) Bagayatdar Sangh in 2013-14 to MoA & FW and also to state Horticulture Mission Maharashtra to help the farmers by importing varieties from various abroad breeders and test in NRC on various root stock to find out the feasibility. It was decided that a fund will be raised by MIDH, APEDA and MRDBS for importing the new varieties for testing and multiplication to distribute to farmers. A tentative budget required for imports was approximately 30 crores rupees. It was decided that MIDH will bare 10 crores, APEDA will bare 10 crores and remaining 10 crores will be borne by MRDBS Pune. Many meetings were conducted st state and national level for bringing new varieties from outside breeders. However, the decision could not take place and yet the farmers are waiting for new varieties. It is expected that with planting new varieties, the income of the farmers will be nearly double with same or less investment. Also GOI will get more foreign revenue through grapes export. The discussions among MRDBS, Maharashtra state SHM, MIDH and



APEDA are still in progress on the said issue and a favorable decision in this regard is expected.

4. The quarantine process for new imported varieties in India is very lengthy and tedious. It is needed to simplify the norms of quarantine procedure so that the farmers will get the new varieties in time.

VALUE ADDITION:

1. Research on new varieties that will be resistant to major pests and diseases and giving more production suitable to existing climate need to be developed. It is expected that with the help of state and central Horticulture mission, NRC Pune will develop/import new varieties for testing. These new varieties will be tested on various root stock at various locations in Maharashtra on the fields of farmers and select some of the varieties to multiply and distribute among the farmers for cultivation.
2. Unless the new varieties are introduced in Nasik/Indian clusters for grapes, it is difficult for grape growers to survive in coming days. Hence decision at state and central level for introducing new varieties need to be taken and implemented at the earliest.



Imported New Varieties



3. Field preparation, media, climate and plantation techniques in Grapes with existing Gaps and value addition Theory and practices -

a. Land Preparation

The land is thoroughly ploughed and levelled. The vine rows are oriented in the north-south direction in order to expose the leaves on both sides of the vines to sunlight. Orientation of rows is important only when the vines are to be trained to telephone, kniffin or tatura trellises.

b. Season of Planting

Normally the planting is done during November-January in Central India, December-January in south Karnataka and Tamil Nadu and February-March in North India. In areas with limited irrigation facilities planting can be done with the onset of monsoon.

c. Spacing

Spacing of the vines varies with training system and the variety. In central Maharashtra and north interior Karnataka, for bower trained Thompson Seedless vines a spacing of 1.2 x 3.6m or 1.8 x 2.4m is adopted. The spacing between the rows of the vines trained on 'T' trellis may vary from 1.8-2.4m. However, in case of tractor operation the row-to-row distance should be kept at 3m. The commonly followed spacing are 4.5 x 4.5m (Anab-e-Shahi), 7.2 x 3.6m (Bangalore Blue) and 3.0 x 3.0m for Perlette and Beauty Seedless varieties.

d. Pit Digging

As per the layout plan the pits are marked in the field. Pits of size 60-90cm³ should be opened at least one month prior to planting and exposed to sun. Each pit is filled with topsoil first followed by subsoil mixed with well-decomposed FYM, 1kg Superphosphate and 500g Sulphate of Potash. Prior to planting, pits are watered and one year rooted cuttings are planted in the pits. New growth starts 20-25 days after planting. The young plants are staked and trained after one month of planting.



Digging of pits and concreting the support system

e. Training of Grape Vines

Training of grape vines is important as it helps to maintain the stature and spread of the vine in a way that is convenient to carry out the intercultural operations. Various structures that provide support the grapevines are called as trellises. An ideal trellis should be economical, facilitate different cultural operations, provide good leaf exposure, provide area for large number of fruiting units and allow more light and ventilation into the vine canopy. The most prevalent are Bower, 'T' trellies, Kniffin and Head system.

f. Bower System

This system is also called overhead, arbour or pergola. Owing to vigorous of the vine and pronounced apical dominance in the tropics, this system is found most suitable for many of the commercial grape cultivars. Though it is very expensive, it was found most appropriate one and associated with highest yield. Bower system of training provides a desirable microclimate in the vine canopy and reduces the adverse effects of arid and hot weather on vine metabolism and life.

g. 'T' Trellis

It is locally called as telephone. This system is suitable for moderately vigorous varieties with more apical dominance. It is an improvement over 'bower' system with respect to ventilation and light penetration. It is relatively less expensive than 'bower', and facilitates mechanized spraying

and many other cultural operations. However yields in this system are less as compared to the 'bower' system due to less number of canes per unit area.

In 'T' trellis, the vines are allowed to grow straight up to a height of 1.5-1.6m. Two primaries are developed on the main stem. On each of these primaries short secondary of 30-45 cm are developed on both sides of the primary to form an umbrella type framework. Canes are developed on these short secondary.

h. 'Y' Trellis

This system has good provision for light interception and favorable fruit bud formation. When the trellis is fully covered with foliage, both foliage and bunches are protected from the sun burn. 'Y' trellis consist of a vertical post 120-135 cm above the ground and two inclined arms measuring 90-120 cm placed at an angle of 90-110°. The main stem is pinched at 120-135 cm above the ground level and a single pair of primary arm is developed on the wire. The secondary and the canes are allowed to trail on wires fixed 10-15 cm apart on the inclined surface of 'Y'.



Y Trellis



i. Climate

Grapes generally require a hot and dry climate during its growth and fruiting periods. It is successfully grown in areas where the temperature range is from 15-40°C. High temperatures above 40°C during the fruit growth and development reduce fruit set and consequently the berry size. Low temperatures below 15°C followed by forward pruning impair the budbreak leading to crop failure.

The fruitfulness of buds is influenced by light. Light intensity of 2,400-ft. candle is essential for optimum growth. However, low light intensities during the active growth stage (45-75 days after pruning) and fruit bud formation adversely affects the crop.

It is most successfully grown at elevations ranging from 200-250m above m.s.l.

Area with annual rainfall not exceeding 900mm well distributed throughout the year is ideal. However, rainfall during flowering and fruit ripening is not favorable as it leads to the spread of downy mildew disease.

High atmospheric humidity is detrimental during vegetative growth and fruiting. At a high humidity the vegetative growth of vines is vigorous which affects the fruit size and quality. Similarly high humidity during 30-110 days after forward pruning favors the development of fungal diseases.

j. Soil

Grapes can be cultivated in variety of soils including sandy loams, sandy clay loams, red sandy soils, shallow to medium black soils and red loams. The soil should be well drained, having good water holding capacity and devoid of any hard pan or impervious layer in the top 90-cm, with water table at least 6.5m below. Grapes can also be grown successfully over a wide range of soil pH (4.0-9.5) however, soils having pH range of 6.5-8.0 are considered ideal.

GAPS observed in cultivation practices:

1. The temperatures in the region are increasing every year causing deterioration of quality of produce. Record keeping of climatic data of various climatic factors like temperature, relative humidity etc need to be maintained along with disease forecasting system in every cluster of Grapes in Nasik. Reduction in quality and quantity of grapes produce reduce the demand in market thereby reduction in returns.
2. Untimed rains, hail storm etc causing huge damage to quality produce resulting in losses. Particularly in last 4 to 5 years, untimely rains with hail storm is observed every year that causes heavy damage to grape fruit bunches and saleable produce quantity is drastically reduced. Weather forecasting systems in every village/cluster is a must.
3. Some of the farmers started using protected structures with polyfilms as cover, however such structures are very costly.



Damages due to untimely rains and hail storms

VALUE ADDITION required to minimize observed gaps -

1. To avoid the problems due to adverse climatic conditions, protective structures with poly covers can be introduced. The experiments on production of grapes under

such protected structures is in progress at NRC Grapes Pune. Research is required to find out low cost technologies affordable to common farmers and the grape crop can be brought under such low cost protected structures. Different types of imported and domestic polyfilms are installed on structures at NRC Pune and research is in progress on such protective covers. The research is done on fruit size and production, climatic conditions under poly covers, pest and disease management under poly covers etc and initial observations under these poly covers are interesting and encouraging. NCPAH New Delhi can help in designing and selecting proper polyfilms for installations of such protected structures and make policy for them to be brought under subsidy schemes of state and central ministry of Agriculture and Farmers welfare.

2. Proper weather measuring stations to be installed at every village/tahasil place in Nasik and instead of judgmental forecast, scientific forecasts to be used for better precautions to avoid losses.
3. A mobile based agro advisory system can be developed for the grape growers in the clusters. Now a days every farmer/his son have smart mobiles. It is suggested to develop a mobile based advisory system for the grape growers under MRDBS or NRC Grapes Pune. The advice based on weather and disease forecast can be messaged through voice mail to the farmers every day along with solutions. The farmers can implement the advice for their betterment. Such programs are already designed and implemented by some computer based firms like Tata consultancy services.



Grape crop under poly cover

4. Intercultural operations

a. Weed Control:

Weeding in the vineyards is generally done mechanically. Frequent weeding is required to allow feeder roots to absorb the nutrients and moisture without any competition. Bullock-drawn or tractor drawn implements can be used for inter cultivation and weed control, if sufficient space is provide between the vines. In the vineyards, where close spacing are adopted manual weeding or digging the plots with garden forks and lifting the weeds once in three months is a common practice. Periodical cultivation with disc harrow to turn the soil and push nutrients into the deeper layers is essential. This practice in case of black soils helps to loosen the top 8cm soil to facilitate aeration to the roots. Problematic weeds like *Cyanodon dactylon* and *Cyperus rotundus* are removed manually by digging deep to remove their deep-seated runners. The exposed roots after drying are collected and burnt. As the manual labour is becoming costly, pre-emergence application of herbicides such as Diuron, Simazine or Atrazine @ 2 kg a.i. /ha and Goal (Oxyfluorfen) @ 1 kg a.i. /ha after pruning is recommended to control most of the weeds. Glyphosate @ 10 ml/litre mixed with 5g of Ammonium Sulphate and detergent, as a post-emergence spray is effective in controlling weeds for a period of 4-6 months.

b. Pruning:

Removal of any vegetative part in a vine is called pruning. It is a critical operation in grape cultivation. Therefore much care and precision needs to be exercised in pruning a vine. The main objective of pruning of grapevines is to increase productivity, facilitate intercultural operations, and maintain desired vine shape and vitality of the vine for constant productivity.

Pruning is normally done only once in North India during January- February by heading back half of the mature shoots for fruiting and the balance half are pruned for renewal spurs, which develop into fruiting canes in the next year.

In Maharashtra north Karnataka and Andhra Pradesh the vines are forced to undergo rest for about a month immediately after harvest. This helps in storing the food material in the mature parts of the vine. The canes are cut back in April by

keeping 1-2 buds which develops into canes in 4-5 months. The dried canes are also removed. Here it is called 'back pruning' or 'growth' pruning. In the month of September-October these canes are pruned for fruiting. This pruning is called 'forward pruning' or winter pruning. Vines, which have attained the age of one year can be subjected to this pruning. The level of forward pruning depends upon the region, variety and vine vigour. Normally the vines start yielding in about 5 months from forward pruning.

In Tamil Nadu pruning is done during November-December for summer crop harvested during March- April. While pruning in May-June results in second crop during August-September. In the south interior Karnataka, the forward pruning is done during October-November for summer crop harvested during February-March and during April-May for the second crop harvested during July-August. It is important to retain the desirable number of fruiting buds on a vine after pruning for optimum yield and better quality fruiting. Retention of more canes on vine (light pruning) results in a heavy crop, while retention of less canes (severe pruning) results in a light crop. All canes in a vine cannot be equally fruitful. Canes that are away from the trunk are more fruitful than the ones nearer to the trunk. Hence the former are pruned lightly than the later.



Pruning of crop

c. Shoot Pinching:

Shoot pinching is a part of pruning, mainly done to promote fruitfulness and regulate the current season growth. Shoot pinching is done when the main shoot attains 7-8 leaf stage. During pinching the tip of the mature shoot is pinched by retaining only five nodes. As a result the terminal bud along with 1-2 laterals resumes growth. These laterals are called as sub-canes. Buds up to third node from the base on the sub-cane were found to be invariably fruitful resulting in 2-3 clusters/cane.

GAPS observed in cultivation practices -

1. Most of the farmers are using Micro irrigation systems like drip irrigation for water application and fertilization. Very few farmers are using automated fertigation systems. Such systems require high costs, maintenance costs and repair problems. Proper design and quality materials used is also sometimes a problem.
2. Regarding pests and diseases/disorders problems, most of the farmers are using judgmental forecasts many times resulting in failure and economic losses. Also insects like stem borer, no reliable source is available.
3. It was pointed out by farmers that it takes a long time to receive the subsidy for micro irrigation systems from concerned departments. Many a times it creates big problems if the inspection of the installed systems is not done in time.



Farmers using drip system for water and fertilizers management

VALUE ADDITION -

1. Research on quality micro irrigation systems at low costs need to be developed and popularized. The farmers are using drip irrigation systems for irrigation and fertilization purpose. The farmers get subsidy for installation of such systems under the schemes of central and state government department of horticulture/Agriculture. To avail subsidy, the farmers need to install the systems from registered suppliers and as per the norms/specifications as set in the scheme. However, many farmers groups complain that even the registered suppliers do not supply quality materials and hence many maintenance problems are observed in the systems. It was also pointed out that the farmers/system users should be given a basic training for using the system with minor repair techniques. Many suppliers do not follow the norms of the scheme.
2. Use of plastic mulching will also help to reduce costs on fertilizers, pesticides in addition increasing production and quality thereby increasing revenue of farmers. Very few farmers have used plastic mulching and found that water and fertilizers are saved in considerable quantity. Also the famers saved money in removal of weds. It is therefore required to conduct studies for use of plastic mulch/any other mulch on grapes crop at various different locations on farmer fields as well as at research stations and PFDC centers. The field trials like the percentage of water and fertilizer saving, saving of labor costs, any other benefits, side effects if any by using plastic mulch need to be undertaken and conclusions to be circulated to the farmers through NRC Pune or MRDBS for implementation to gain benefits.
3. The verification/inspection of the installed micro irrigation systems under the subsidy schemes need to be done in time rather immediately after the installation and accordingly the subsidy amount should be released to the concerned farmers. This will help the farmers to maintain their cost economics in grape projects.



Use of plastic mulch for grape crop



Use of wheat straw for mulching



Saving the berries and bunches of grapes against insects/sun heat/physical damage

5. Integrated Pest Management -

Integrated pest management (IPM) is a common practice among the farmers. Most of the grape growers have Global GAP certification and follow the pest disease management practices as described in Global GAP manual. However, the farmers are facing many problems in controlling some measure insects and diseases due to unavailability of proper chemicals/bio pesticides and proper equipment.

Main diseases causing damages to grape crop and their measures are given below.

Anthracnose (Elsinoe ampelina):

This disease is prevalent in all grape-growing regions of the country attacking mainly the leaves and young shoots. Small light brown or grayish black lesions develop on tender shoots, young leaves, flowers and young berries. It causes short holes in the leaves and thus reduces the effective leaf area. Affected blossoms fail to set fruits. The fungus



also causes cankers on the petioles and veins, and leaves become twisted and deformed. On berries, the disease causes circular brown sunken spots with dark brown margins. If severely attacked, berries may crack exposing the seeds. Bunches with anthracnose affected berries lose their export value. Rain and dew are highly favourable for the spread of the disease.

Control: Prophylactic measures should be followed for effective control. All affected twigs or canes showing cankers should be removed while pruning. The pruned twigs and leaves should be burnt or buried deep in the soil. This disease is more problematic during October and November. The new shoots and young branches should be given protective sprays during this period. Spraying of the grapevines at 3-4 leaf stage with fungicides like Bordeaux mixture @ 0.8% or Copper Oxychloride @ 0.25% or Carbendazim @ 0.1% are effective against this disease.

Downy Mildew (Plasmopara viticola):

Light and continuous rains or heavy dew associated with high humidity and low temperatures favours the development of the disease. The disease attacks the leaves, flowers, cluster and young fruits. Initial symptom appear as light yellow spots on the upper surface of young mature leaves with corresponding white spots on the lower side. Affected portions of the leaves turn brown and cannot support the bunch development due to reduced photosynthetic activity. The losses are very high when the clusters are attacked before fruit set. Entire clusters decay, dry and drop down. Infected small berries turn brown and become mummified. Once berries begin softening and change colour, they cease to get infected.



Control: Pruning of the vines after the second week of October helps to minimize the damage by this disease. All affected portions of the vine should be removed at the time of pruning and destroyed immediately. Bordeaux mixture (1%), Copper Ox chloride (0.2%), Mancozeb (0.2%), Metalaxyl (0.2%) or Fosetyl Al (0.2%) are effective against this disease. Systemic fungicides are more effective than non-systemic ones. However, more than 2-3 sprays of systemic fungicides should be avoided. Continuous sprays with systemic fungicide encourage the disease to develop resistant to these fungicides and help in the resurgence of new diseases like Alternaria, Botrydiploia and others.

Bacterial Leaf Spot (Xanthomonas campestris):

The disease is more prevalent during June-August and again in February-March. Temperature range of 25-30^oC and relative humidity of 80-90% is favourable for the development of the disease. The young growing shoots are affected first. Disease infects leaves, shoots and berries. The symptoms appear as minute water soaked spots on the

lower surface of the leaves along the main and lateral veins. Later on these spots coalesce and form larger patches. Brownish black lesions are formed on the berries, which later become small and shriveled.

Control: Collecting and burning the infected plant parts minimizes the spread of the disease. Streptocycline (500 ppm) is very effective as a prophylactic spray. Weekly sprays of copper fungicide and Bordeaux mixture given from last week of October are effective to prevent the incidence and spread of the disease.

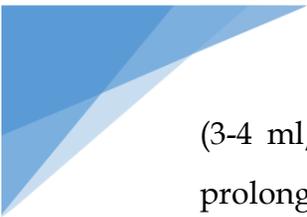
Powdery Mildew (Uncinula necator)

It is the second most destructive disease after downy mildew but more important one in the viewpoint of export of fresh grapes, as it leaves blemishes on the affected berries and deforms them. The disease develops under warm and dry conditions. Shade or diffused light also helps in the development of this disease.



The disease is characterized by the presence of white powdery (ash like) coating in patches on both sides of the leaves, young shoots and immature berries. The affected leaves turn pale and curl up. Affected shoots remain weak and immature. The buds affected during growing season, fail to sprout after October pruning. Thus the productivity of the cane and the number of productive canes are reduced. If blossoms are affected they fail to set fruit. When young berries are attacked they become corky. Berries attacked at 50% maturity turn dark and become distorted in shape. If severely attacked they are enveloped with a white powdery coating and crack eventually. Loss of yield results from both berry drop and reduced size of berries.

Control: Powdery mildew can be controlled easily by spraying Wettable Sulphur (1.5kg/200 litres of water). Care should be taken while spraying as they scorch the berry skin leaving minute black specks. Sulphur dusting (20kg/ha) in the morning hours controls the disease effectively. The affected plant parts should be thoroughly coated with the dust. Systemic fungicides like Bayleton (1g/litre of water) or Calaxin



(3-4 ml/10 litres of water) or Benomyl (5g/10 litres of water) offer better and prolonged control of the disease. Fungicidal spray against this should be done from November to February. No single chemical should be sprayed more than twice. In between two successive systemic fungicides a spray of non-systemic fungicide as Wettable Sulphur is taken to avoid the development of disease resistance.

Leaf Blight and Bunch Necrosis (Alternaria alternata):

It appears in the month of June and December. The disease attacks both leaves and fruits. Small yellowish spots first appear along the leaf margins, which gradually enlarge and turn into brownish patches with concentric rings. Severe infection leads to drying and defoliation of leaves. Symptoms in the form of dark brown-purplish patches appear on the infected berries, rachis and bunch stalk just below its attachment with the shoots.

Control: If the disease on the berries is not controlled in the field, it can lead to berry rotting during transit and storage. Bordeaux mixture (1.0%), Mancozeb (0.2%), Topsin-M (0.1%), Ziram (0.35%) or Captan (0.2%) is to be sprayed alternatively at weekly intervals from Jun-August and again from December until harvest to keep this disease under check. Two to three sprays of systemic fungicides should be given per season.

Rust (Phakopsora vitis):

The weather conditions in Bangalore present during July-December favors the development of the disease. The symptoms are in the form of numerous orange colored pustules on the lower surface of the leaves. In case of severe infection such pustules cover the entire leaf surface leading to severe defoliation.

Control : Rust on Bangalore Blue is being successfully controlled in vineyards by applying 3-4 sprays of Baycor (0.1%) or Chlorothalonil (0.2%) at fortnightly intervals during July- August and January February gives effective control of rust under Bangalore conditions.

Bitter Rot (Greenaria uvicola):



The disease causes considerable losses in field, storage and in transit. The disease infects the leaves, canes and berries. The disease is most serious on older leaves. Initially the infection starts as dark brown water soaked spots covering the entire leaf lamina on either side of the veins and veinlets. The infection on the cane is prominently visible which initially becomes white and later turns black. The infected cane shows reduced growth and wilts. The young infected green berries get shriveled, turn black and become mummified. The raisins made out of the infected berries taste sour and have a poor shelf life.

Control : IIHR, Bangalore recommends pruning of the canes followed by sprays of Rovral (0.2%), Baycor (0.1%) and Thiophanate Methyl (0.1%) for effective control in the field and the storage.

Black Rot (Guignardia bidwelli):

Warm and moist climate with extended periods of rain and cloudy weather favours the development of the disease. The disease attacks the leaves, stem, flowers and berries. All the new growth on the vine is prone to attack during the growing season. The symptoms are in the form of irregularly shaped reddish brown spots on the leaves and a black scab on berries. Occasionally, small elliptical dark coloured canker lesions occur on the young stems and tendrils. Leaf, cane and tendril infection can occur only when the tissue is young, but berries can be infected until almost fully-grown if an active fungicide residue is not present. The affected berries shrivel and become hard black mummies.

Control : Mummified berries left on vines should be collected and destroyed. Cultivation practices should ensure free circulation of air. Spraying Bordeaux mixture (4:4:100) once or twice on young bunches prevents the infection. Copper fungicides are preferred for spraying on bunches, as they do not leave any visible deposits on the fruit surface.

Dead Arm (Phomopsis iticola) :

The disease is mostly prevalent in South India. The disease is first noticed as angular small spots on the leaves, stems, canes and flower clusters. Most of the spots have yellowish

margins with dark centres. Frequently the spots grow together and form large brown areas on the canes. Later on the canes start to dry rapidly. In severe cases the fungus spreads on the woody part where it gradually attacks the water conducting tissues. In case of severe infection the drying extends to the roots and the whole plant wilts.

Control: The pruned canes should be collected and destroyed. The dead canes should be pruned to the region where healthy tissues are seen and it can still be further pruned so as to avoid any chance of mycelial growth left out in the canes. Such pruned cane should be pasted with Bordeaux paste immediately after the pruning. Later on the vines should be sprayed with Bordeaux mixture (5:5:50) followed by Difolatan (0.2%) or Daconil (0.2%) or Dithane Z-78 (0.2%) at fortnightly intervals till the canes become hard.

Botrytis Rot/Grey Mould (Botrytis cinerea) :

It is one of the most important diseases in storage and is capable of growing at low temperature. In the vineyards, the fungus attacks the shoots and clusters or destroys stalks leading to premature fruit drop. In the early stages of infection the skin of the affected berries just below the infection become loose. When rubbed with fingers the skin slips from the berry leaving the firm pulp exposed. The infected berries shrivel, rot and turn dark brown showing the presence of greyish growth of the fungus.



Control: Careful handling in the field, precooling and refrigeration helps in controlling the disease. Pruning and thinning of the vineyard reduces humidity around the clusters. Prophylactic sprays with Captan (0.2%) and Benomyl or Bavistin (Carbendazim) (0.1%) minimize the development of the fungus during transit and storage.

Black Rot

It is a post-harvest disease. High storage temperatures and humid conditions favour the development of the disease. The fungus enters the berries through the injuries caused due to poor post-harvest handling operations. The pulp of infected berries is reduced is reduced to watery consistency.



Control: Careful handling and prompt refrigeration to 1-2⁰ C or below prevents the disease in storage. Inclusion of SO₂ releasing pads in the boxes while packing helps to control the disease.

Rhizopus Rot (Rhizopus sp.)

It is a post-harvest disease. Under warm and moist conditions the fungus grows rapidly producing a coarse grey mat of mycelium. Injury caused to the berries by tight packing and storage temperature help the fungus grown during storage. If the infected berries are trimmed at harvest, it does not occur after harvest under ideal storage conditions.



Control: Pre-harvest fungicidal sprays of Captan or Benomyl reduce the disease inoculum on berries. Inclusion of SO₂ releasing pads in the boxes while packing, removing of diseased berries during grading, avoiding injury to the berries while packing and handling helps to restrict the growth of fungi. Maintaining cold storage temperature between 0-1⁰ C prevents fungal growth.

Major insects/pests affecting growth and quality of grapes are mentioned below.

Flea Beetles (*Scelodonta strigicollis*):

The adult beetles scrap the sprouting buds after each pruning. Damaged buds fail to sprout. The beetles also feed on tender shoots and leaves, and tendrils causing substantial damage. The tender shoots may wither and drop down. The losses are heavy when the sprouting buds are damaged after forward pruning.

Control: Removal of loose bark of the stem and applying paste of Copper Oxychloride and Carbaryl 50% WP after forward pruning to exposes and kills the beetles. Spraying of insecticides like Carbaryl (0.15%) or Quinalphos (0.05%) from the fourth day after pruning at an interval of 3-5 days until the emergence of the leaves is effective in protecting the sprouting bud from the attack. The spraying should preferably be carried out in the evening.

Thrips (*Rhipiphorothrips cruenta*):

Thrips are oval, black coloured tiny insects which deposit eggs on the underside of the leaves. Both the nymphs and adults suck cell sap from the lower surface of the leaf. The injured surface is marked by a number of minute spots thereby producing a speckled silvery effect, which can be detected from a distance. In case of heavy incidence, the leaves may dry up and drop off the vine.



Thrips also attack blossoms and newly set berries. The affected berries develop a corky layer and become brown on maturity. Fruit setting is poor and yield is considerably reduced.



Control: Alternate spraying of insecticides like Phosphamidon (0.05%) or Monocrotophos (0.1%) or Malathion (0.05%) offer a good control over the pest. Prophylactic sprays immediately after flowering and during fruit set is essential.

Scale Insects (Aspidiotus lataniae; A. cydoniae):

It is the most common pest found in the vineyards of Punjab. The adult female lays eggs in the crevices or loose bark of the vine, trunk and its arms. These insects suck the cell sap from the leaves, petioles, main veins and tender shoots of the grapevine.

Weak shoot growth with appearance of golden-yellow leaves indicates the advanced stage of pest attack. As the arms become dry, wood-boring insects may cause further damage. Frequent attack in subsequent years leads to the death of the vine.

Control: The loose bark should be removed at the time of pruning. The encrustations should be scraped and the vine should be sprayed with Trithion (0.05%). Cuttings free from the infestation of the pest should be used for planting. Ants which act as carrier of the scales should be controlled to check the spread of the disease.

Leaf Hopper (Arboridia viniferata; Typhalocyba sp.; Empoasca sp.; Chlorita lybica):

It is mostly found on grapevines in north India. The pest is most active during June-August. The nymphs and adults suck sap from the underside of the leaves. The damage first appears as a scattering of small white spots. With severe infestation and continuous characteristic greyish speckling of the leaves is observed. The leaf colour changes from yellow to brown before it dries up and drops off.

Control: Insecticides like Quinalphos (0.05%) and Monocrotophos (0.1%) are sprayed as soon as the infestation of the pest is observed.

Mealy Bugs (Maconellicoccus hirsutus):

Mealy bug is a soft insect with oval shaped flat body. The nymphs of mealy bugs generally referred, as crawlers are pink to light orange in colour. They are found to be active from June-August and again from November-March under peninsular India conditions.



Nymphs and adults of mealy bugs suck sap from the leaves, tender shoots, and the fruits. Leaves show characteristic curling symptoms similar to that of a virus. A heavy black sooty mould may develop on the honeydew like droplets secreted by mealy bugs. If the flower blooms are attacked the fruit set is affected. When the fruits are infested they can be entirely covered with the mealy bug. The infestation may lead to fruit drop or the fruits remain on the shoots in a dried and shriveled condition. Various species of ants feed on the honeydew. Ants drive away the natural enemies and act as carriers of bugs.

Control: An integrated approach is followed for successful control of the pest. The plants in the vicinity of the vineyard serving as alternate hosts for the mealy bugs should be destroyed. Removal of the loose bark on the stem and pasting it with a mixture of Copper Oxychloride and Carbaryl after October pruning helps to minimize the pest population. Pasting a grease band of 5cm width on the main stem of vine at 150 cm from the ground after forward pruning prevents the crawlers from reaching the bunch. Unlike the adults, the crawlers are free from waxy coating and therefore the crawler stage is the most effective for spraying pesticides. Spraying of insecticides like Dichlorvos (0.02%) or Chlorpyrifos (0.05%) with fish oil rosin soap was found to control the insect population. Spraying Nuvan (2.5ml/litre of water) controls the ants. Release of the predator *Cryptolaemus montrozeiri* @1500 beetles at fortnightly intervals for 4-5 times from the time of October pruning offer an economical and effective control measure over the mealy bugs. To ensure the best effectiveness of predator beetles they

should be released in spots having adequate mealy bug population. Spraying of insecticides lethal to the predators should be avoided

Grape Leaf Roller (Sylepta lunalis):

This is a serious pest in South India, which is most active in the months of August-November. Yellowish-green caterpillars roll the leaves from the edges towards the midrib and feed within. In case of severe infestation complete defoliation is observed.

Control: A simple method to control the pest population is to collect and burn the infested leaves. Spraying of Malathion (0.05%) or Endosulphan (0.05%) have been recommended for effective control of the pest.

Stem- Borer (Cecosterna scabrator):

The adult beetles lays eggs on the trunk, branches or the stem and the grubs, which hatch, bore into the stem directly. Wood dust and faecal matter at the base of the vine is indication of the borer activity. The adults feed on the outer bark of the vine by scraping. The portion of vines above the damaged part has a sticky appearance.



The leaves turn yellow in patches that resemble micronutrient deficiency, which ultimately dry and drop down.

Control: Sanitation in the orchard, removal of dead woods and loose barks regularly help in preventing the infection. The eggs can be eradicated by removing the bark of the infested vines and applying paste of Carbaryl (50WP) 6g + Copper Oxychloride 3ml + Dichlorvos 3ml + neutral pH sticker soap 1ml. Injecting Dichlorvos solution into the hole followed by sealing with mud or cow dung mixed with Copper Oxychloride in 1:3 ratio is also effective. The spread of the infection can be controlled by spraying the entire orchard with Quinalphos (0.06%) + Dichlorvos (0.08%).

Tobacco Caterpillar (Spodoptera litura):

This pest is of common occurrence in Maharashtra and Hyderabad. The adult moth lays eggs on the lower side of the leaves. Young larvae feed on the lower epidermal layer of the underside of the leaf and make the leaf surface papery. The larvae of the pest also feed on the leaves and inflorescence. They cut down the rachis of the grape bunches. The adult moths are most active during August-September.

Control: Caterpillars can be effectively controlled by spraying of Chlorpyrifos (0.08%) or Carbaryl (0.125%) or Dichlorvos (0.1%). A mixture of Methomyl (0.05%) and Wettable Sulphur (0.2%) is effective to control the larvae in its young stage of growth. Use of pheromone trap is effective in catching the adult moths and also to know the population built up of the pest.

Stem Girdler (Sthenias grisator)

The adult beetles girdle around the main stem 15 cm above the ground level at night. They also girdle the young green branches, which later dry up. The adult beetle lays eggs in the girdled portion. After the hatching of the eggs the grubs tunnel into the dry wood. Girdling results in considerable damage to the plant. During the day the adults hide on the lower side of the leaves or under the forking of the branches, but actively move about at night avoiding the light.

Control: Hand picking of the adults at night with the help of torchlight is effective. The beetles should be handpicked and killed as and when noticed. Since the eggs are also laid in the bark of the girdled branches which get dried up very soon, collection and burning away of such dried twigs from vineyards would be a good check against future outbreak of the pest. A piece of cloth is soaked in an insecticide solution like Chlorpyrifos and then wrapped around the stem. Spraying of Chlorpyrifos (0.1%) is also effective.



Reniform Nematode (Rotylenchulus reniformis):

The nematodes mostly damage the secondary and the feeder roots. The affected roots show brownish discoloration. The affected portions rot and get sloughed off. As a result the nutrient uptake is affected and the vine appears sick.

Control: Soil application of Carbofuran (2.5kg a.i. /ha) or neem cake (1t/ha) helps to control the reniform nematode. Application of organic manures reduces the nematode population when applied to grapevines.

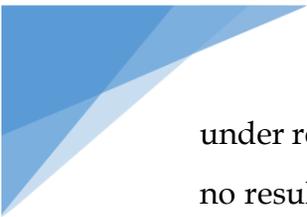
Root-knot Nematode (Meloidogyne sp.):

The affected roots exhibit severe galling. Galling is the result of the proliferation of cells of the affected roots. The vines show stunting and poor growth. Young shoots remain short and chlorotic. In severe attack, the vines get defoliated.

Control: Soil application of Carbofuran (2.5kg a.i. /ha) or neem cake (1t/ha) helps to control the root knot nematode. Application of organic manures reduces the nematode population when applied to grapevines

GAPS observed in implementing IPM techniques -

1. Many farmers are confused and not able to identify the insects/diseases symptoms that lead to increase the infection resulting in damage of the crop. Many times the symptoms of diseases and deficiency / toxicity symptoms of nutrients look alike thus confusing the farmers what action to take to control.
2. Use of pesticides/bio pesticides is confusing. Different consultant/scientists suggest different chemicals/bio pesticides against the pests/diseases. It creates problems as it may increase the residual value beyond the MRL that causes rejection in exports.
3. There are hundreds of bio pesticides manufacturing units in Nasik promoting and marketing their products on various platforms. Use of bio pesticides is proved beneficial in case of domestic and exports of grapes. However, quality of such bio pesticides is a big issue. There is no law/ rule for registration of such manufacturers



under registration act of pesticides. The farmers feel that they are cheated if there is no result after using such bio pesticides. Moreover it increases the production cost of produce.

4. Proper sprayers, nozzles, parts of spraying equipment available in India are very costly and sometimes need to be imported. Appropriate spraying equipment should be available with parts at reasonable rates.

VALUE ADDITION in IPM practices -

1. The farmers should be trained to identify the normal insects/disease at first instar with suggested measures to be taken. The farmers can make a colored poster with all insects/diseases at farm and regularly observe it. It may help the farmers to identify the insects/disease, their stages and accordingly the farmers can decide to go with preventive/curative measures as required.
2. The tendency of the farmers is that whenever they find any insect/disease attack on crop, they use chemicals for control of the same. However, as per IPM techniques, chemical sprays should be the last option to use. The farmers can use physical methods, cultural methods, biological methods to control the pests and diseases. If the same is not controlled, then only one should use the chemical sprays. A proper training on IPM should be arranged for the farmers by recognized institutes/KVKs/PFDCs etc to train the farmers in IPM techniques.
3. The registration for bio pesticides is not a procedure under pesticides registration act of India. It should be made mandatory for all the manufacturers to register the bio pesticides they are manufacturing under some act. The necessary changes in the pesticide act need to be done with immediate effect or a separate Bio pesticide registration act need to be introduced at the earliest. This will save time and money of the farmers and also the farmers will get assured quality supply of bio pesticides. Regular inspection of such manufacturers/krishi seva kendras need to be done by authorities to control unauthorized traffic/use of such non registered bio pesticides.

4. If any farmer/farmers producers' organization want to import the bio pesticides from abroad, the procedure for importing should be easy and the farmers should get such bio pesticides in time.
5. Imported spray equipment and parts should be made available to farmers at cheap rates. Also Indian manufacturers should develop low cost technologies/spray equipment with the help of Agri universities research units/ICAR engineering research units like CIAE Bhopal.



Spraying equipment mounted on tractor for use in grape farm

5. Harvesting -

The proper stage for harvesting the grapes is adjudged by the development of characteristic color of a variety and also by touching the grapes from the apical portion of the bunch. In grapes three major colors, viz. White, red and black are found. The criteria used to judge ripening differ according to the use of the grapes. For making raisins, harvesting at a late stage is preferred, to get more sugar in grapes for increasing the weight of the dried product. For all other purposes, ripening is judged on the basis of sugar: acid ratio for getting proper blend required for table purpose or wine making. The correct blend of sugar acid ratio should be between 25-30.



For harvesting grapes for export market, the following parameters are considered-Berry size- should be more than 16mm in diameter.

1. TSS- should be more than 170 Brix.
2. Bunch weight- should be between 300-750 g.
3. Bunch colour- milky green.
4. The selected bunch should not be compact.
5. All the berries should be of uniform colour and size in a bunch.
6. Less than 2% sunburnt or Sulphur bleached, bruised or crushed berries.
7. Pedicel should be fresh and green.

For local markets, the grapes are harvested early in the morning by cutting selected bunches with long nose scissors. Care must be exercised not to injure other berries by the scissors. While harvesting, care should be taken to avoid erasing the waxy coating by holding the stem of the bunch by hand. The harvested bunches are kept in perforated plastic trays. Bunches should be trimmed by removing the decayed or otherwise defective berries before packing.

For export purpose, harvesting has to be done in early hours of the day. It should be stopped when the berry temperature rises above 200 C. It is advisable to close harvest by 10 a.m. otherwise the berry temperature cannot be brought down to 40C within the stipulated time of six hours by precooling. The selected bunches are harvested by giving a cut above the knot present on the stalk of the bunch. Any type mechanical injury to berries should be avoided while harvesting and handling. The injured portion of skin serves as the entry point for many fungi causing decay. Harvested bunches are placed gently in clean perforated plastic trays in not more than two layers and shifted to the packing shed without losing time.

Yield -

A well-maintained vineyard starts yielding from 3 years after planting under north Indian conditions and even in less than 2 years under tropical conditions. A well-maintained

vineyard of Perlette gives a yield of 25-30 t/ha in North India while Thompson Seedless gives 15-20 t/ha.



Quality checking while harvesting

GAPS observed during Harvesting -

1. The workers are not trained to follow the harvesting guidelines. The harvesting of the bunches should be done on maturity and on other factors like color development, berry size, shape, weight, no of berries etc. Most of these parameters need to be judged as the scale is not available. Thus only skilled workers can harvest the correct quality bunch ready for cut/harvest. Harvesting of wrong bunch not as per the guidelines lead to loss of the farmer.
2. Proper harvesting tools.

VALUE ADDITION to minimize the gaps -

1. Every harvester must undergo a skill development training specially to understand the techniques of harvesting as harvesting at proper stage and proper size, color, no of buds etc.
2. Availability of proper hand tools for harvesting.



Harvesting of grapes



www.alamy.com - CE73RT

Harvested grape bunches



Forward linkages in grape cultivation with GAPS and VALUE ADDITION

Forward linkages include post-harvest activities like grading, sorting, packing, storage, transport etc. Further to transport, it also includes minimal processing, major processing on fruits and convert them in some another form.

For example, grapes are processed to prepare wine/resins (manuka) etc.

1. Grading/sorting

The harvested bunches are graded as per their size of the berries and their color. Before packing, the broken, decayed, deformed, undersized, and discolored berries are removed by their pedicels from the selected bunches, using a long nosed scissors. While cleaning, harvesting or trimming bunches should be held by their stalk, preferably by wearing rubber gloves. This care is taken not to erase the fine waxy coating called 'bloom' from the berry surface. Otherwise it leads to rapid loss of water through the skin of berries and they shrivel during storage.

In many cases, the grading is done as per the market/customer demand. In Nasik cluster two types of grading is popular viz manual grading and mechanical grading. Most of the farmers who are selling their produce in local/domestic markets, prefer for manual grading. The workers collect all the harvested bunches on one table and then the grading is done manually as per color development, shape of bunch, size and shape of berries, weight of bunch etc. It is very easy method of grading however not accurate.

Major Farmers producers organizations prefer mechanical grading where grading machines are used for grading the bunches. The capacity of such machines is very high. The cost of such machines is also high and need good space for installation of such

machines. Individual farmers cannot afford such machines. Such machines are used by FPOs/exporters for export of grapes.



Grading line for grapes - very fast and accurate

2. Packing

The grapes sent to the local market are packed in ventilated corrugated boxes accommodating 2-4 kg of grapes. These boxes are lined with newsprint paper. Fine paper shred or fine hay is spread at the bottom and top of the box for cushioning. The open flaps of the box are secured firmly by an adhesive tape. Table grapes for overseas market are packed in 5 ply corrugated boxes of size 500x300mm accommodating 5 kg of grapes. The graded bunches are weighed into 5 kg lots in plastic trays. One or two bunches weighing between 350-650 g are placed in small and thin polythene pouches. Before placing the pouches in the carton, bubble sheet is spread with its rough surface facing towards the base of the box. A white and soft polythene liner is spread over the top of the bubble sheet. These pouches are arranged in a single layer in a slanting fashion in the carton. The flaps at the open end of the carton are folded before precooling. After precooling, dual purpose SO₂ releasing pads are placed over the pouches and the polythene liner is folded in.



Packing of grapes for domestic/export markets

3. Storage

The grapes should be pre-cooled promptly after harvest in separate rooms with large refrigeration capacity, high air velocity and high relative humidity. They are normally pre-cooled at 1-2°C within 6 hours of harvest. After pre-cooling, the dual releasing Sulphur dioxide pads (Grape guard) are placed with their coated surfaces downwards on the filled plastic pouches and covered with the polythene liner. The boxes are closed and shifted to cold storage rooms where the temperature and humidity are maintained at 0-2°C and 95% respectively. The arrangement of boxes in the cold storage to ensure uniform cooling of all berries in a box and all boxes is very important.

4. Cool Chain

Cool chain is essential during the transport of export quality commodity all the way from the farm to the customer. This helps in maintaining the temperature inside the box at the same low level as in the cold storage.

The various stages of the cool chain are:

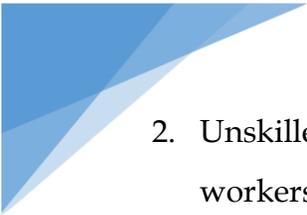
1. Coldstore at the farm.
2. Refrigerated truck from farm to the airport
3. Coldstore at the airport.
4. Building up of the pallet in a coldstore at the airport.
5. Loading the aircrafts directly from the coldstore in a short time.
6. Cargo aircraft maintains coldstore temperature in hold.
7. Offloading direct into a cold store in the receiving country.
8. Refrigerated truck to the customers.



Cold storage for storage of grapes

GAPS observed in forward linkages –

1. The existing number of pack houses/cold storages are less as compared to the volume produced every year. The existing cold storage capacity can handle only 50% of produce and remaining has to be sold in local market just because precooling and cold storage facilities are not available.

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2. Unskilled labors resulting in heavy post-harvest losses. In various pack houses, workers are used for grading, cleaning, sorting, and packing of grapes. Since it is a skilled job, even minor mistakes can cause heavy losses.
 3. Lack of Infrastructures like maintenance of equipment, availability of small parts of imported equipment etc. Most of the machinery used for grading, sorting, packing, cold storages etc are imported and costly. If any damage to the part and machine stops working, it is very difficult to get the parts immediately from the local market.
 4. Lack of proper knowledge and information about post-harvest techniques, export and domestic demands, packing etc.
 5. The infrastructures like pack house, cold storages cold vans are very costly and not affordable for individual farmers.
 6. Heavy transport cost and difficult road clearance process

VALUE ADDITION for improvements -

1. Proper practical training on post-harvest management, packing etc should be given to every farmer and entrepreneur. Such practical training should include stage of harvesting, grading, sorting, packing, maintenance and repairs of the machinery used along with cold storage machinery, handling of equipment like Vernier caliper, weighing balance, record keeping etc. Under skill India development program, such trainings can be organized for the interested farmers, entrepreneurs and workers.
2. Farmers' producers' organization should be formed for all the farmers at village level. The infrastructures like pack houses, cold storages etc should be built on cooperative basis and all members farmers should be able to use them.
3. Cold storage equipment technicians should be available for regular maintenance.
4. Transport through railways to be made easier affordable and popular. Separate bogies preferable AC bogies should be made available for transport of grapes from Nasik to all the measure cities in India at cheap rates or subsidized rates. This will help the farmers to reduce the production cost and increase the profits.



Containers ready for transport of grapes to European market – Sahyadri Farms, Nasik

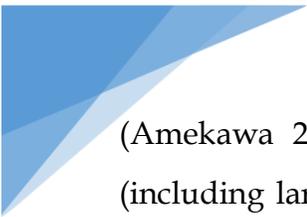


Quality standards in grapes

Eurep GAP (the European retailers' working group on Good Agricultural Practices) was set up in 1999, to cover codes regarding consumer food safety, hygiene, labour conditions, animal welfare and environmental management on farmland. In 2007, it was renamed Global GAP. Starting with FFVs, it now covers aquaculture and livestock and by 2008 September, it embraced 80 countries, 92,000 certified growers and 100 independent accredited certification bodies across the globe; 14 countries had already aligned their GAP with Global GAP (Amekawa 2009).

Although these standards make smallholders unlikely candidates to work with, processors and exporters have continued to work with them, as they are lower cost and help spread the risk of crop failure and default. Global GAP certification requires on-farm facilities like toilets, washing rooms, pesticide stores, spraying equipment and waste pesticide disposal facilities, which smallholders cannot afford, owing to lack of access to loans for such investments.

The Global GAP system provides for four options on certification: individual certification, group certification, benchmarked scheme certification for individual producers and Global GAP benchmarked scheme certification for producer groups. Generally, developing country producers use either the first or the second channel for certification. However, under group certification, producers must be members of a PMO. A PMO is supposed to take legal responsibility for the whole operation of a scheme whereby each individual producer is subject to signing a legally binding contract agreeing to meet all the required specifications of the Global GAP protocol. Importantly, detected non-compliance of one member in the group may result in de-certification of the entire group. Primary marketing institutions (PMIs) take title to the goods, and the facilitating marketing institutions (PMOs) do not take title to the goods they deal in



(Amekawa 2009). In India, some exporting companies organize small growers (including large ones by Indian standards) under Global GAP group certification acting as PMOs for quality exports, which are certified by a third party. The farmers pay the certification charges and the contract agreement specifies rules for participation and reasons for disqualification from the scheme. Maximum residue limits (MRL) certification is not part of Global GAP, but is demanded by individual buyers, who each have their own MRL standard. Normally, contracts are for 18 months, and moving out of the contract leads to no refund of membership fees.

In the export product market, each farmer has a traceability code and each punnet and carton has a grower name and location and pack house details and batch number. The Global GAP record register for each farmer maintains all crop-related information, like plot number, variety grown, area in acres, year of plantation, method of farming, spacing, number of vines, source of irrigation, type of soil, farm map, input use and water management and stock and inventory record for traceability. Around 75 sprays are carried out between October and January under Global GAP (smallholder group certified), Tesco Nature's Choice and BRC standards. Some exporters provide mobile-based food safety alerts regarding chemical residues. Global GAP certification costs Rs. 4,000 per farmer annually under the case study exporter system, owing to government subsidy for exports, but farmers have to invest in infrastructure at the farm level, which is at the level of Rs. 25,000-30,000 per acre per year. The certification cost does not differ by size of holding.

Before harvest, quality is tested in labs, which costs Rs. 12,800 per sample. If a sample fails, the farmer has to bear the cost. Rejected produce could be sold to countries such as the UAE and Bangladesh, which do not demand Global GAP certification, and the Indian domestic market. Details from the lab reports for MRL show that grapes were tested for 171 chemicals, as per Agricultural and Processed Food Exports Development Authority (APEDA) norms for EU markets in 2011/12, up from 98 in 2010 (primary survey). If some isomers/metabolites are added, the number goes up to

224 (primary survey). APEDA provides reimbursement of 50 percent (up to a maximum of Rs. 5,000 per sample) of the cost of testing samples of grapes for residues of these chemicals monitored under Grape Net. This subsidy was withdrawn in 2010 and restored in 2012 at the request of the Grape Exporters' Association of India (GEAI). However, the subsidy is only for shipments routed through the Grape Net system.⁴

Research on farms and pack houses linked to an exporter for this case study indicated that produce quality is checked at farm harvest level, pack house level and final dispatch level. Around 50 percent of the farms were also compliant for German supermarkets such as Metro, Aldi and NettoPass. The farms and pack houses were also compliant with the UK ETI code and legal minimum wages. The farms are monitored by 17 quality and procurement staff of the exporter, with 10 in Nasik, five in Sangali and two in Latur. The leased pack houses are Global GAP certified, which is the responsibility of the owner as part of the lease agreement. There are 36 different packing formats in terms of labels, weight and pack type. There is a flexibility of three to four days in the harvesting schedule of a matured crop, and harvested fruits can be cold stored for up to three months in a pack house, which has the capacity to cold store four to five containers. The processes at the export pack house include: receipt of raw material at pack house; weighing and acceptance of produce; trimming, sorting and grading; weighing, packing and coding; pre-cooling; sulphur dioxide padding; palletization; storage (cold stores); container loading; and transportation.⁵ In contrast, produce destined for the domestic market is packed in crates and weighed on the farm after grading immediately post-harvest, by local women workers, and dispatched to market in trucks by noon.

The quality parameters in export grapes include: bunch and berry size; color; weight; shape; firmness; sugar content; acidity; absence of bruises or blemishes; no off flavor, odor or taste; absence of pesticide/chemical residue; stem color; no split or damaged berry; no pest or chill damage; correct MRL; packing quality; and average check weight (Bhosale 2001; Collins 2000; Roy and Throat, 2008). Attaining quality production requires activities including removing old growth from vines (pruning), tilling,

fertilizing, trimming non-productive branches, monitoring blemishes and diseases, and applying pesticides bi-weekly, selecting the best bunches on each branch and culling the rest, trimming the bunches to export size, harvesting, grading and packing. In export-related production, thinning and dipping are done differently and more carefully, and these two determine the produce quality and amount of labor. Ensuring complex quality levels are met requires skilled labor. Work has to be performed precisely and on time and in the right season and at the right stage of the vineyards (Rath 2003).

Exports of table grapes from India, Maharashtra

Nasik area in Maharashtra is the main cluster for grapes from where maximum exports of table grapes take place every year. Following table shows the exports of grapes for the year 2016-17 from Maharashtra state of India.

Summary of Export in the Current Season	
State Name	Qty. (In MT)
Maharashtra	101503.251
Karnataka	164.920
Total	101668.171

Summary of Export Containers wise as on -12/5/2016 vis a vis 12/5/2017(dd/mm/yyyy)										
Season	MAHARASHTRA		KARNATAKA		ANDHRA PRADESH		TELANGANA		TOTAL	
	No.of Container(s)	Qty.(In MT)								
2016-2017	7699	101676.865	0	0.000	0	0.000	0	0.000	7699	101676.865
2015-2016	6471	84495.356	0	0.000	0	0.000	0	0.000	6471	84495.356
*Note:Due to issuance of PSC from some other location the Export Summary may vary from State wise Report										

Source - APEDA

Following table shows the export of grapes from Nasik for last Three years from 2015 to 2017 in the numbers of containers exported.

	२०१५	२०१६	२०१७
१ . द्राक्ष प्लॉट - नोंदणी	२६२६२	२५२४८	३४११०
२. नोंदणी क्षेत्र - एकर	१७४४३	१७१०३	२२१५४
३. निर्यात कंटेनर संख्या	३८२८	६९८९	८६८३
४ निर्यात मे. टन	५०१८८	१०११७६	१३१८४४

Week wise exports in 2017 -





Logistics for domestic and exports markets

Logistics for domestic market-

Domestic market for grapes in India is very big and grapes from Nsik are sold to every part of India. Individual farmers mostly send their grapes produce in Maharashtra major cities like Mumbai, Thane, Pune, Nagpur etc and in other states major cities like Delhi, Hyderabad, and Bangalore etc. Many farmers are connected with Farmers producers company/organizations and these FPOs collect the grapes from their member farmers at fixed rates and sell the produce in different parts of the country.

In Maharashtra and nearby states/cities, the logistics support is given by tempo, trucks and sometimes by train. However, trains are not used normally for distribution of grapes in Maharashtra. However, the option of train is mainly used when the grapes are sold at far distance like Kolkata, Delhi, Chandigarh, Lucknow, Guwahati, Chennai, Siliguri etc.

Logistics for Exports of grapes

The grapes from Nasik cluster are mainly exports to Europe, Russia, Singapore, Gulf countries and Bangladesh. Bangladesh export is taken place by road through truck/containers whether for all other countries, export is done through sea. Global GAP certification is must for exports and APEDA helps the growers for exports by providing subsidy and other necessary inputs.

GAPS observed in transport of grapes –

1. Due to continuous hike in petrol/diesel, the transport charges are continuously increasing hampering the production cost and thus the returns are lowered.
2. It is observed that the boxes are damaged heavily through road transport resulting in lowering quality of produce ultimately resulting in low prices.
3. No AC vans are used for road transport and no AC bogies are used in trains for transport of such perishable products.



VALUE ADDITION to improve logistics -

1. Instead of marketing individually, the farmers should make a group and hire AC van for transport of grapes in such a way that only one commodity is transported and not mixed with other products as presently done. This will help to maintain the quality of grape fruits through transport and farmers will fetch good returns. The customers will also get fresh quality grapes at the destinations. This will also help in reducing the transport cost thus increasing profits during domestic transport.
2. The trains from Nasik to major destinations in India like Delhi, Chandigarh, Chennai etc should have one AC bogie and the grapes should be transported through AC bogies only.