

# HORTICULTURE

## GRAPE CULTIVATION FOR EXPORT

Grape is one of the most exotic fruits for centuries the world over. India has been exporting Grapes to Europe and Gulf countries, as well as to neighboring countries like Sri Lanka and Bangladesh. Newer markets for export are emerging in South-East countries through Singapore and Hong Kong centers. The Indian grape growers have been continuously adopting stringent quality control demands of the importers, by implementing new and advanced techniques in grape cultivation and post harvest management. The National Research Centre for Grapes (NRCG), Pune has developed package of practices for grape cultivation for export.

### QUALITY STANDARDS FOR EXPORT

Table grapes meant for export need to look good and tempting. Therefore, the bunch should be well filled with berries of uniform colour and size. The characteristics of a good bunch generally preferred in export markets are:

- Loose bunches of uniform colour, size and shape, weighing between 400 to 600 grams.
- Fresh stalk, green, turgid and disease free.
- Damage free from scars or damage due to sun, diseases or pests.
- Berries of 16 to 18 mm diameter and firm to touch.
- Fresh and green pedicel.
- Total Soluble Solids (TSS) of 17–18°Brix
- Brix: acid ratio of 25 to 30 and no pesticide residues.



Export quality bunch of grapes

### PACKAGE OF PRACTICES

#### Canopy development and quality improvement after foundation pruning (April)

- The vines should be given rest for about a month after harvest and thereafter all the canes are pruned by retaining only one basal node.

- Immediately after pruning, spray 1% Bordeaux mixture to kill the inoculums of pathogens. Thereafter, the buds are swabbed with Hydrogen cyanamide at the rate of 30 milliliters per liter to ensure early and uniform bud break.
- Keep 5–6 well-developed canes for each square meter area of canopy space. For this purpose only one shoot is retained on each node. This helps in avoiding competition for space, nutrients and sunlight while ensuring proper growth and maturity of the retained shoot and easier disease management.

### Quality improvement after fruit pruning (October)

- Five to seven days earlier to pruning, all the leaves may be removed and the canes twisted to activate the dormant auxiliary buds.
- Vines are then pruned just above the fruitful bud. The short internodal length generally indicates the location of the fruitful buds that can be confirmed by bud testing under the microscope.
- After pruning, 1% Bordeaux mixture is sprayed and Hydrogen cyanamide is applied to the top 2 to 3 buds to induce uniform sprouting.
- At 3-leaf stage, if excessive shoot growth is observed, spray 250 to 500 ppm CCC spray.

The production of loose bunches is essential for export, which can be achieved by elongation of the rachis as well as by berry and bunch thinning. Rachis elongation can be induced before bloom by Gibberellic Acid ( $GA_3$ ) application. The first spray of 10 ppm is applied at the parrot green stage of the cluster, followed by a spray of 15 or 20 ppm  $GA_3$  after 4 to 5 days. Use about 400 to 600 liter solution per hectare for each spray. Subsequently the cluster should be dipped in 40 ppm  $GA_3$  solution. To avoid short berries formation, care must be taken not to dip the clusters in  $GA_3$  solution at full bloom or from full bloom to shatter stage, i.e. till the berries are 3 to 4 mm.

The rachii of the cluster need to be thinned out manually, immediately after berry set, retaining the top three branches and thereafter every alternate branch. Then, to increase the size of the berries, bio-regulator treatments should be given. The first treatment is given after the berry shatter stage, that is when the berries are about 3 to 4 mm in size and then after 7 days. The use of hormones generally depends upon the leaf area available per bunch. In case of adequate leaf area of about 15 leaves, the first dip should be with 2 ppm N-(2-chloro-4-pyridyl) -'N'-phenyl urea (CPPU) and 40 ppm  $GA_3$ . The second dip should be of 1 ppm CPPU and 30



Well raised vineyard before harvest

ppm GA<sub>3</sub>. To harvest optimum yield of 15 kg of good quality fruits from a vine, the excess load is recommended to be removed.

### Water management

Most of the new vineyards are coming on rootstock. In areas having the problems of salinity and water stress, rootstocks offer a better option for the survival and better economic returns from the vineyard in the long run. Since the growth stage influences the water requirement of the vines, an appropriate irrigation schedule based upon pan evaporation as given in the following table must be adopted.

Stage	Growth stage	Quantity of water (liter/ha) per mm of evaporation
<b>Foundation pruning</b>		
I	Shoot growth (1–40 days)	4200
II	Fruit bud differentiation (41–60 days)	1400
III	Shoot maturity (61–120 days)	1400
IV	Fruit bud development (121 days to pruning)	1400
<b>Forward pruning</b>		
V	Shoot growth (1–40 days)	4200
VI	Bloom to shatter (41–55 days)	1400
VII	Berry growth (56–105 days)	4200
VIII	Ripening (106 days to harvest)	4200
IX	Rest period (harvest to back pruning)	-

### Nutrient management

Apply every year 660 Kg Nitrogen, 880 Kg Phosphorus (P<sub>2</sub>O<sub>5</sub>), and 660 Kg Potassium (K<sub>2</sub>O) per hectare. However, by fertigation, the nutrient

Growth stage	N (kg/ha)	P <sub>2</sub> O <sub>5</sub> (kg/ha)	K <sub>2</sub> O (kg/ha)
<b>April pruning (Back pruning)</b>			
Pre-bud differentiation (1–30 days)	80	—	—
Bud differentiation (31–60 days)	—	213	—
Post-bud differentiation (61–120 days)	—	—	80
<b>October pruning (Forward pruning)</b>			
Pre-bloom (1–40 days)	80	—	—
Bloom set and shatter (41–70 days)	—	107	—
Berry growth up to veraison (71–105 days)	80	—	80
Veraison to harvest (106 days to harvest)	—	—	80
After harvest (Rest period of nearly 20 days)	27	35	27
<b>Total</b>	<b>267</b>	<b>355</b>	<b>267</b>

requirement can be substantially reduced. The growth stage wise fertigation schedule given below need to be followed.

### Disease management

Three major diseases in grapes are Downy Mildew, Powdery Mildew and Anthracnose. Under rain or high humidity conditions, Downy mildew can be very devastating from the 3rd leaf stage till fruit set. To control downy mildew, the following measures should be adopted:

- At the 3 to 5 and 7 leaf stages of the shoot growth, systemic fungicide sprays be undertaken.
- Give prophylactic sprays of non-systemic fungicides at 5 to 7 days' intervals from berry set till the berries develop to about 13 millimeter in diameter.
- Do not spray dithiocarbamate fungicides such as Mancozeb or Ziram after 75 days of pruning as it leads to residue of Ethyl thiourea which is a carcinogenic compound in berries.

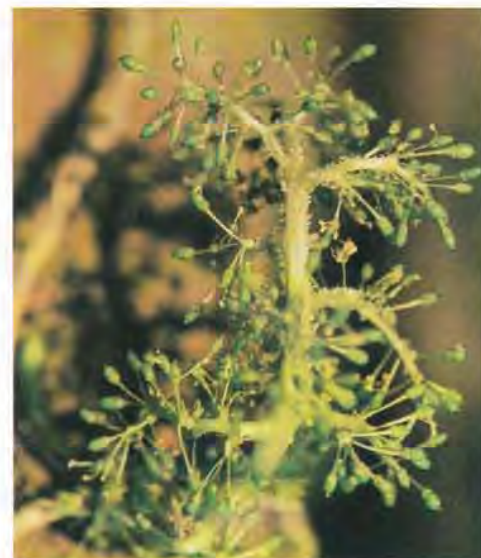
Powdery mildew occurs both on the leaves and on bunches. For the crop to be exported, appropriate disease control measures must be undertaken, as due to blemishes on the surface of berries, its market value gets reduced. As soon as the symptoms of powdery mildew are noticed, spray systemic fungicides during the active vegetative growth. When the shoot growth stops after berry set, sprays of non-systemic fungicides should be preferred. To avoid development of resistance, do not spray more than 2 to 3 sprays of systemic fungicides per season.

Anthracnose occurs only on tender shoots, young leaves, flowers and young berries. If wet conditions prevail during the active growth stage, new shoots should be protected by systemic fungicides, followed by a spray of any copper fungicide. The infected canes are pruned before the fungicide sprays. Copper fungicides are preferentially sprayed as they can control downy mildew, anthracnose and bacterial canker which occur in wet weather.

### Pest management

Mealy bug is a serious problem in grapes for export, as they grow on the mature bunches and make them unfit for export. Therefore, integrated management of mealy bug is essential. Adopt the following measures for its control:

- Undertake the manual removal of the dead bark during September and paste sticky substance in a ring on the trunk and the angle irons.



Downy mildew affected bunch of grapes



A bunch of grapes affected by powdery mildew



Anthracnose disease of grapes



Mealy bug on a grape bunch

- Sprays of insecticides during active growth of bunch, bio-control by cryptolaemus beetles near veraison and spray of the fungal mycoparasite *Verticillium lecani* after veraison.
- On the fourth day of fruit pruning, undertake spray of Carbaryl at the rate of 0.15% for control of flea beetle.
- At 50% bloom, a spray of any systemic insecticide can be given to control jassid and leafhopper.

## POST-HARVEST MANAGEMENT

To prevent the rotting of grapes during storage, these should be packed with in-package Sulphur di-oxide generators, commonly known as 'grape guard', which are Sodium metabisulphite impregnated craft paper/polythene sheets. Pre-harvest spray of the bio-control fungus *Trichoderma harzianum*, 20 and 5 days before harvest or immediately after pre-harvest rains also gives good control of post-harvest rot and increases the shelf life of grapes.

In order to obtain phyto-sanitary certificate required for export of grapes, report on pesticide residue analysis has become mandatory. Some strategies which can be adopted to minimize pesticide residues are:

- Use only the approved pesticides.
- Do not spray banned as well as non-recommended chemicals.
- Strictly adhere to the recommended dose of application.
- Do not spray pesticides blindly as per pre-decided spray schedules. Decide on the spraying based on prevailing weather conditions and growth stage of vines.
- Strictly maintain recommended Pre-Harvest Interval or Safe Waiting Periods.
- Adopt bio-control measures during last 30 days before harvest.

## HARVESTING

The grapes should be harvested in clean plastic crates, lined with bubble sheets or other soft material for cushioning. While harvesting, the bunch is held by the stalk and not by the berries and cut above the knot present on the stalk, which ensures a longer shelf life. Harvesting is stopped before the temperature rises above 20°C.

## QUALITY CONTROL AND PACKAGING

In the pack house, grapes should be unloaded and tested for quality. Strict hygiene is maintained in the pack-house. The bunches are first graded by size, then the undersized, deformed or damaged berries as well as the water berries are removed. The compact bunches are made loose and the general look of the bunch is improved by selective removal of berries. Bunches are then graded, based on more objective parameters like berry diameter and the uniformity in colour of the bunch. The graded bunches are packed in four and a half, five or in nine kilogram lots as per the requirement of the export and the domestic market.



View of a pack house

Use the boxes made of 4 to 5 ply cardboard which can be interlocked while stacking. The process of cleaning, grading, packing and sending the grapes for pre-cooling should be finished within 6 hours of harvesting. After packing, the boxes are labeled and pre-cooled to 4°C, within 6 to 8 hours and then cold stored at  $0 \pm 0.5^{\circ}\text{C}$  and with 95% Relative Humidity. Before shipment, the boxes are stacked to form pallets containing 850 kg of grapes. Once fully loaded and sealed, the container carrier leaves for the nearest port to reload the container on to a ship, where it is taken to its intended destination.

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