

## GRAPE

**Botanical Name:** *Vitis vinifera*

**Family:** Vitaceae

**Origin:** Armenia near Caspian Sea

The grape is one of the most delicious, refreshing and nourishing fruits. Grapes owing to their taste, nutrient content, composition and low calorific value are refreshing fruits. It is probably and obviously the largest produced fruit of the world. It is considered to be the fruit of the temperate region but it has been successfully acclimatized to several sub-tropical countries. In India, all most all our produce is consumed as table fruit, while in European countries 99% of their produce is used for preparation of wines. Grapes are also used for preparation of other products like raisins, fresh juice and Jams etc. The grape fruits are rich in sugar and particularly in hexose and are easily digestible. It is fairly a good source of minerals like Calcium, Phosphorous and Iron and vitamins B1 and B2. The juice is mild laxative and acts as a stimulant to kidneys. In Andhra Pradesh it is grown in the districts of Mahbubnagar, Rangareddy, Medak, Anathapur, Chittoor and Kurnool districts in an area of 1676ha with a production of 33,520 tonnes.

**Climate:** Grape is a semi arid subtropical crop. It requires warm and dry summer and cool winter. Humid weather is not congenial for sweetness of the fruit, causes cracking of fruits and encourages fungal diseases. Parts of India having more than 100cm of rainfall are not suitable. A rain free period of 90 days from the time of pruning is most desirable. Frost does great damage if it occurs during its growing period. It thrives well in regions with a temperature range of 4.5OC and 45OC.

**Soils:** Light soils are ideal but they can grow on any well drained soil which is the most important requisite for grape vine. Water table should be deeper than 2 meters. Soils at least 1meter depth with no hard pan up to 2 meters is suitable whether they are rich or poor. Compared to other horticultural crops grape vines are relatively tolerant to salinity and alkalinity but excessive lime is harmful.

**Varieties:** The commercial varieties of grapes grown in India belong to *vitis vinifera* (European grapes), which is indigenous to Mediterranean region. American grapes belong to *vitis labrusca* and *vitis rotundifolia*, where the skin separates easily from pulp when ripe. The important commercially grown varieties are- Bangalore blue, Gulabi, Anab-eShahi, Dilkush, Patcha Draksha, Puas seedless, Thompson seedless, Beauty seedless and Perlette

**Commercial classification of grape varieties:** Depending on the use, the grape varieties may be classified into five categories, viz, .Table, Resin, Wine, Juice and Canning.

**Table grapes:** The grapes are used as fresh fruit. These grapes must be attractive in appearance and must have pleasing eating quality and good keeping and shipping qualities. Grapes with Muscat flavour, thin skin, firm flesh and without seeds are preferred. The grapes should also possess the characteristic colour of the variety. Important varieties are Thompson seedless, Pusa seedless, Perlette, Beauty seedless, New perlette, Anab-e Shahi, Bhokri, Cardinal, Black Muscat, Early Muscat, Fakhri, Kandhari, and Kale-Sahebi etc.

**Raisin grapes:** Seedless grapes possessing soft texture, a marked and pleasing flavour, large or very small size after drying and a little tendency to become sticky during storage are classed as good raisin grapes. For safekeeping, the raisins should not have more than 17% moisture. Important varieties are Thompson seedless, Pusa seedless, Kishmish, Black Corinth and Sultana, Muscat, Alexandria etc.

**Wine grapes:** Two types of wines can be prepared from grapes i.e. table wines and desert wines. Table wines are produced from grapes of moderately high sugar content and of moderate or high acidity. The desert wines are produced from grapes having high sugar content and low acid content. Important varieties are Gross Column, Red Prince, Black Champa, Beauty seedless, Cheema Sahebi etc.

**Sweet - juice grapes:** These grapes produce acceptable beverage when it is preserved by pasteurization, germ proof filtration or other means. The juice must be able to retain fresh grape- flavour. Important varieties are Bangalore Purple, Bangalore Blue, Gulabi, Concord, and Pearl of Csaba. Canning grapes: Seedless grapes are used in canning with other fruits, in fruit salad and fruit cocktail. Important varieties are Thompson seedless, Pusa seedless, Perlette, Canner etc.

**Propagation:** Grape can be propagated both by sexual and asexual methods. Sexual propagation is encountered with a no. of hazards like poor germination and long period for germination etc. Asexual or vegetative propagation on the other hand has high percentage of success and it ensures genetical purity. Vegetative propagation in grape is practiced through cuttings, grafting, layering and budding depending on the varieties used and the growing conditions.

Propagation through hardwood cuttings is the most popular method of propagation in grape. Cuttings made from well matured one season canes from productive vines which are of medium in thickness (0.7 to 0.8 cm), with an internodal length of 8-10cm and 25-30cm in length with at least 3-4 buds and dormant should be selected preferably from the October prunings. They are planted in well prepared flat beds, leaving two nodes above the soil surface. In North India these cuttings are planted in the nursery after allowing them to form callus by burying them in moist soil or sand for 4-5 weeks. The rooted cuttings will be ready for planting in the main field only after one year. In India grape is planted on its own roots. However, use of resistant rootstocks is necessary under infestation by nematodes and other pests and diseases and also for saline soils. The scion variety can be chip budded on suitable root stocks. Phylloxera (Aphid) resistant root stocks—St.George and Riparia. Nematode and soil salinity-- Salt creek, Resistant to nematode-- Harmony and Dog ridge

**Spacing:** The spacing that is given between the vines will depend on soil, climate, and vigour of the variety, method of training, pruning and cultivation practices.

**Planting:** Preparation of the land before planting grape vine is essential. The land is prepared thoroughly by deep ploughing and followed up by tillage and the land should be levelled. Pits of 1m<sup>3</sup> are dug at required spacing. October is the ideal time for planting unrooted cuttings directly in the field. Rooted cuttings are planted in January or February. When rootstocks are planted, budding or grafting is done in July-August. Either chip or wedge grafting is followed.

**Training and Pruning:** Proper methods of pruning and training contribute towards higher production of better quality fruits in grape. Training mainly concerns with giving the form and the direction of the trunk and arms and the position of the shoots. Training determines the form while pruning affects the functioning of the vine. It is done to concentrate the activity of the vine to the parts left after pruning. Pruning is the most important operation for the maintenance of fruitfulness and quality along with vigour of the vine. Before actually discussing the subject of training and pruning it is necessary to understand the various terms commonly used in these operations to make the subject more intelligible.

## **Parts of Grape Vine Source:**

Trunk -- The main stem of the vine which is vertical

Arms/Cordons (Primary) --The main branches arising from the trunk or extensions of the trunk usually grow vertically

Arms/Cordons (Secondary) – The branches arising from primary arms or extensions of the primary arms or cordons

Head --The region of the trunk from which the arms or canes arise

Shoot --The young growth (herbaceous) of the current season developing from a bud situated on the arm or trunk

Cane --The matured shoot of the past season

Spur --The shortened cane or part of the cane left after pruning

Fruiting spur --The spurs having a few buds some of which (usually the apical ones) sprout and grow into fruiting shoots.

**Training:** In the natural habitat, a grape vine is robust climber but it can be trained on any fashion. Although a no. of training systems are known only four namely bower, kniffin, telephone trellis, and head system are followed in India.

**Head System:** This is the cheapest and easiest system of training grape vines. In this system the vines are trained like dwarf bush. Less vigorous varieties and varieties producing fruitful shoots from the basal buds are suitable for this system. Ex. Beauty seedless, Perlette, Delight and Gold. In this system the plants are spread very closely to accommodate 2000-2500 plants per acre. The vine is allowed to grow to a single stem with the help of stakes. After attaining a height of 3' the plant is topped and two lateral branches are encouraged. The plant is again topped at 4' height by which two or more laterals are developed. After keeping 4 laterals, 4' above the ground in all directions, the rest of the shoots are thinned out. These later cut to two buds at the first dormant pruning, will produce secondary arms. Generally two arms of about 20-30cm are kept on each lateral. At the time of second pruning, normally 1-2 fruiting spurs are kept on each secondary arm. After 3-4 years, the vine becomes like a dwarf bush and needs no stake.

**Advantages:** Simplicity in shape, Ease in training In expensive to establish Possibility of cross cultivation  
**Dis-advantages:** The vines are slow to come to full production Increased possibility of bunch rot and poor colour The bud and flower drop is maximum compared to other systems.

**Pendal System:** This system is also called as Arbour, Pergola, Mandwa, Over head or Bower system. Owing to the vigorous growth of the vine and pronounced apical dominance in the tropics, this system is most suitable for many of the commercial grape cultivars. This is more popular system for Anab-e-shahi in A.P. This is best suited for vigorous varieties, which don't perform well on other systems. In spite of being the most expensive; this is being adopted on a large scale almost in all the grape growing regions of India. In this system the vines are spread over a criss cross net work of wires usually 7' (2.1m) above the ground supported by pillars (Concrete, stone or iron). Galvanized wires of 5, 8 and 10 gauge thickness and turning buckles are used. Only the best growing shoot from the plant is allowed to grow upright along the stake provided up to the bower height. When the vine reaches the wires, it is pinched off 15cm below the pendal level to facilitate production of side shoots close to the wires. Two vigorous shoots in opposite direction are selected and allowed to grow in opposite directions on the wires overhead. These two shoots develop into primary arms. On each primary arm three laterals on either side at a distance of 60cm (2') (along the wires) are kept as secondary arms. Thus, there will be 12 secondary arms on each, which after maturity form fruiting canes. These primary and secondary arms form the permanent frame work of the vine. The vines are allowed to trail straight along the wires by tying intermittently with banana fibre.  
**Advantages:** Greater spread of the vines. Better exposure of the foliage to the sun, resulting in better maturity of the canes. Higher production. More uniform bunch colour Superior quality of fruits, which are free from sunscald. The vines in general give uniform performance. It gives good protection to the canes against hot desiccating winds with ease in bird scaring.  
**Dis advantages:** It is the most expensive than all other systems Pruning, training and spraying operations become difficult The spraying material cannot reach effectively the leaves and shoots.

### **Steps (A-H) in training a grape vine on Pendal system**

**Telephone system (Over head trellis / Telephone trellis system):** This system is suitable for moderately vigorous varieties with more apical dominance. The chief demerit of kniffin system, where the lower arms are rendered

unproductive, is modified in this system by wires, stretched at one height like telephone wires. It is also an improvement over bower system in respect of ventilation and light penetration. It is relatively less expensive than kniffin system. The usual spacing provided for each vine is 3x3m. Trellies are erected by using the granite stone pillars of 8' length and 6"x6" thick at the ends and 8"x4"x4" in the middle of the lines. The middle pillars may be spaced at 20' distance. Cross arms of 4 1/2' length are fixed on each pillar at a height of 5'. These can be iron blades of 4" width and 1/4" thick or the angle iron pieces of 2"x2" width and 1/4" thick. Three wires of 8 gauge thick galvanized iron are pulled horizontally over the cross arms at a regular spacing of 2' using turning buckles at the end of pillars are supported side ward. In this system the vines are allowed to grows straight up to a height of 1.5m (5') and then trained over head on a canopy of usually 3 or 4 wires (45-60cm apart) fixed to the cross angle arms supported by vertical pillars or posts. The young growing vines are supported by bamboo sticks. After reaching the height of telephone (5') the tip should be pinched off to encourage side shoots close to wires. Two vigorous side shoots (cross to wires) are selected as primary arms from which four vigorous laterals on each side along the wires are allowed to develop on secondary arms. Each complete secondary arm can carry 6-8 fruiting units.

### **Telephone system**

**Advantages:** Greater spread of the vine Better exposure of the foliage to the sun resulting in the better maturity of canes. Higher production More uniform bunch colour Superior quality of fruits free from sunscald Vines in general give more uniform performance.

**Dis advantages:** Cost of establishment is high. At present rates it may cost 60-70 thousand rupees. It is a system difficult to develop i.e. vine training needs a lot of skill and effort. The bunches are not as well exposed to light as kniffin system. Not suitable for vines making low to moderate growth.

**Kniffin System:** It is also called as espalier system. It is a system of training grape vine in which the arms of the vine are tied to horizontal wire at the same level above the ground. This system is not as common as the bower system. It is suitable for the moderately vigorous varieties with less apical dominance. Closer planting is adopted for this training system within the row and 3m (10') between the rows. Galvanized iron wire of 8 gauge thickness is stretched parallel to the ground at a height of 75cm above which two or more wires are

stretched at successive heights of 60cm. when the plant crosses the first it is topped leaving a bud above the wire. Two laterals are developed on either side of the plant along the wire and the terminal shoot is allowed to grow vertically. Similarly, a pair of laterals is developed along the second and third wire. Thus each vine will have six arms. In some cases only two pairs of laterals are developed at a height of 4 1/2' (1.35m) and 6 1/2' (1.95m) from the ground level and in such cases it is called four arm kniffin system. This system is suitable for Beauty seedless, Early Muscat, Bhokri and Delight.

**Advantages:**

□ This system is cheaper when compared with bower system. □ It is a good system for obtaining full crop on vines, the basal buds on the canes of which are sterile and which require long cane pruning. □ It is good for small clustered varieties which require fruit thinning for improved quality. □ The system allows more lateral spread of fruit bunches than cordon system. □ The average yields are 10-15kg per vine when planted at 3.0 mx3.0 m spacing.

**Dis-advantages:** □ Cultivation is possible in one way □ The lower arms become unproductive after some years. □ The arms produce fruiting wood mainly at the extreme ends only. □ From the pruning point of view, it is very difficult and exacting system. Since the retained fruiting units are very few, they must be perfect and pruner must have a thorough knowledge for their appropriate selection. □ Its cost of establishment is about 50-60 thousand rupees per hectare. This system is mainly confined to research institutes and it is not popular with the farmers in any of the regions of the country.

**Pruning:** In grape pruning is done only once in North India during the month of January to make the fruitful buds to sprout but in south India, pruning is done twice in a year, once in summer and again in winter. Grape vines in these regions grow continuously without any dormancy (due to tropical climate). Hence by pruning in April (summer) the vines are forced to have a rest period, which helps in fruit bud differentiation. Pruning time mainly depends on rainfall and temperature. Pruning is adjusted so that there is no coincidence of rainfall with fresh growth and flowering and also winter doesn't set in with in 8-10 days after pruning. Pruning refers to the judicious removal of any plant part To establish and maintain desired vine shape To increase productivity To facilitate various cultural operations To distribute proper amount of bearing wood over the vein For consistent productivity

**Summer pruning:** It is done during March-April in the states of A.P. and Karnataka, but in July in Tamil Nadu. In this pruning the canes are cut back to one or two bud level for building up the fresh vegetative growth. Hence it is called back pruning or growth pruning. Winter pruning: This is done during the last week of November in A.P. and Maharashtra, during the second and third weeks of October around Bangalore, but at any time of the month of October in the interior northern districts of Karnataka and in December in Tamilnadu. The mature canes (about 6 months old) are pruned. Entire foliage and immature shoots are removed. Levels of pruning differs with varieties. Anab-e-shahi and Bhokri are pruned to 5 bud level, Thompson seedless to 10 buds, Bangalore Blue to 4 buds and Gulabi to 9 buds. This pruning is also called as forward pruning. Some of the varieties like Perlette, Beauty seedless, Bangalore blue, Bhokri etc. produce fruits on the shoots arising from the basal buds on the cane. In such varieties the canes are headed back to 4-5 buds. Such varieties are called Spur pruned varieties. On the other hand the Pusa seedless, Thompson seedless varieties in which the fruits are produced on the shoots arising from terminal buds, the canes are headed back to 8-12 buds. Such varieties are called Cane pruned varieties.

**Manuring:** Grape is a heavy feeder of fertilizers. The following manurial schedule is adopted in different years of growth. At the time of planting: Fill the pit with 50 kg of FYM, 3kg of super phosphate, 5 kg of castor cake or neem cake and two baskets of wood ash with top soil or silt. After the establishment of the vines: The following manures and fertilizers should be applied every season of six months up to two years and properly irrigated after each application. 100kg of FYM, 2-3kg of castor cake or neem cake, 2-3kg of super phosphate, 250g of Ammonium sulphate, and 125g of Urea. From the 3rd year onwards the following manures and fertilizers are applied thrice in a year

### **Manure/Fertilizer After summer pruning (Growth pruning)**

#### **After winter pruning (For fruiting)**

One month after winter pruning FYM 200-250 kg 200-300 kg --- Castor or Neem Cake 10-12 kg 10-12 kg --- Amm.Sulphate  $\frac{1}{2}$  to 1 kg in 2 splits at monthly intervals 1kg in 2 splits at 20 days interval 250g Super phosphate 2-3kg 2-3kg --- Urea -- 125-250gm In two splits --- Potassium sulphate -- 3 kg & 1kg at 15 days interval from flowering to fruiting. 500g



Potash plays an outstanding role in grape cultivation. From the time of October pruning, flowering commences in a period of 90 days, the vine has to produce a crop of 10-15 tonnes. The application of potash even in rich silt, and black clay loams at 1-2 kg per vine at least in split doses has recorded good yields. Repeated sprays of magnesium sulphate and borax at 0.05% to 0.2% strength have helped to overcome most of the deficiency. Due to regular use of Dithane Z-78 in the spray schedule for control of fungus, ample supply of zinc is ensured.

**Irrigation:** Vine yard irrigation is chiefly governed by the nature of soil, its drainage, the rainfall and its distribution and temperature in the locality. Grape vine requires judicious irrigation for optimum growth and yield. During initial year of planting, vine may be irrigated frequently. While stagnation of water around the root zone leads to mortality of the vine. The excess water from frequent irrigations is conducive to excess and rapid vegetative growth at the cost of the fruiting of the vine. Grape requires 6-8 irrigations after April pruning till the south West monsoon begins. Vines are not irrigated from June-October. 8-10 irrigations may be given at 7-10 days interval after October pruning till March. Each adult vine needs 200 liters of water in winter and 300 liters of water in summer per irrigation. Watering the vine just before pruning may increase the flow of plant sap. Hence; the vines are not irrigated after harvest and allowed rest for 15 days in April before pruning is taken up. This practice of withholding water for a fortnight helps in controlling the flow of plant sap. The flow of plant sap inside the tissue at the time of pruning should be at the minimum, as otherwise, the plant may be get drained off the plant sap through the cut surface after pruning. This draining of plant sap through cut surface is called "Bleeding". Hence; vines should not be pruned when the plant shows bleeding. Again while the berries are ripening, the irrigation of the crop may make the berries less sweet. Hence, withholding of water before pruning and also while the fruits are ripening is a sound practice.

**Inter- culture:** It is not feasible to grow any inter crop and frequent shallow tillage is desirable. The vineyard should be kept free from weeds by shallow digging of 8-10cm depth in 15-20 days interval with spade by manual labour and weeds handpicked. Owing to shade the crop is susceptible to two mildews and anthracnose disease against which a schedule of three prophylactic sprays of bordeaux mixture sprayed after pruning, at flowering and when fruits are developing.

**Fruit thinning:** Thinning of berries at pea stage increases the berry size by 20%, fruit quality with high sugar content in Anab-e-shahi and lowered the acidity in sub-acid varieties like Bhokri. Improvement in colour of berries and earlier maturity are the other advantages due to thinning. It also means to remove diseased, misshapen and shot berries.

**Use of Plant growth regulators:** Encouraging responses were observed both in seeded and seedless varieties of grape by the use of growth regulators. Effect on fruit set: A good fruit set was obtained by spraying the flower cluster thoroughly 4-6 days after full bloom with 100ppm Gibberellic acid or 20ppm Parachloro phenoxy acetic acid. This increased set in current grapes, Thompson seedless and black Corinth. Effect on berry size: Increase in berry size in Anab-e shahi, Kishmis and Bhokri varieties was reported when GA was applied at 40ppm at bud and flower stages. Higher concentrations resulted in the increase in the length of berries. Effect on cluster size: Use of GA, TIBA and PCPA resulted in lengthening the cluster parts especially the pedicles.

**Effect on maturity:** with the application of Benzothiozal A-Oxyacetic acid (BOA) maturity can be regulated. Maturity can be delayed by 15 days with the application of this Benzothiozal A-Oxyacetic acid.

**Harvesting:** Grapes should be harvested when they are fully ripe as they don't ripen any further after harvest from the vine. The criteria for maturity are: □ The bunches should be fully developed and every berry should attain a uniform size, shape and colour. □ The bunch is ready for harvest when the lower most berry of the bunch is soft and sweet. □ The berries should develop translucent look of colour peculiar to the variety. Anab-e-Shahi develop amber or light honey colour. □ The seeds of the ripened berries becomes dark brown □ Total soluble solids also give the indication of ripening. Anab-e-shahi is harvested when it records a brix of 150-160 and Thompson seedless 210-220 □ The bunches should be harvested when they are ripen on the vine as they are not subjected to post-harvest ripening process. The bunches are harvested with secature or scissors. Then the immature and rotten berries are removed with the help of scissors. Then they are packed in wooden or card board boxes or bamboo staked baskets. The paper strips are used to avoid damage to the berries. Yield: Bangalore blue and Patcha draksha--5000 kg/ha, Bhokri - 4500 – 9,000kg/ha, Anab-e-shahi-1000--15000kg/ha and Bangalore blue -30,000kg/ha. Grapes are long lived and may yield up to a century with a good care. But on a commercial scale they may be replaced after about 30 years with advantage.