



## IMPORTANCE AND SCOPE OF VITICULTURE INDUSTRY (GRAPE CULTIVATION) IN INDIA

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### Introduction:

Grape (*Vitis vinifera* L.) is an important commercial fruit crop belonging to family Vitaceae. Grape is the fourth most important fruit crop in India, after mango, banana and citrus. *Vitis vinifera* is the most important species grown in India. In North India particularly, Punjab its cultivation is being taken in a big way. Due to heavy initial investment on erecting the system of training and occurrence of rains at the ripening time of grapes, the area under grapes may not increase further. Grapes originated in Armenia near Caspian Sea. In India, introduction of cultivated grapes took place in the 12<sup>th</sup> century from Iran and Afganistan. Durind 1962, Chief Minister of Punjab, Partap Singh Kairon are imported Perlette and Anab-e-Shahi cultivars from California. In India, grape is grown on commercial scale in Maharashtra, Karnataka, Tamil nadu, Telangana, Andra Pradesh and Mizorum. In India, grape is cultivated commercially in an area of 118.7 thousand hectares with a production of 2585.3 thousand MT and national productivity are 21.8 MT/ha (NHB Database, 2014). Grapes are rich source of calcium, phosphorus, iron and vitamins. Generally grapes are eaten fresh as table fruit. Red wine can be prepared from grape juice. Berries are used to prepare resin.

### Climate:

In India, grapes are grown in both temperate and tropical condition. In tropical climate vines remain evergreen. It requires a long, dry and moderately hot season during maturity of canes and ripening of berries followed by cool winter for quality grape production (Olmo, 1976). Those regions are not suited for grape cultivation that have heavy rainfall or hail storms. The mild climate of Bangaluru is suitable for growing wine grapes. In Kinnaur district of Himachal Pradesh, local grapes are used for making wine indigenously, called angoori. Neither very cold winter and frost spring nor high temperature and humidity during growing season is conducive for viticulture.

### Soil:

Best soil for grapes cultivation are well drained loam to sandy loam with good organic matter. Grapes do well on soils having less than pH 8.7 and EC upto 1.5 mmhos/cm, calcium carbonate up to 10 percent and lime concentration up to 20 percent. Poorly drained, alkaline soils should be discarded.

### Cultivars:

There are over one thousands grape cultivars. However, only few are under wide cultivation.

Group	Cultivars
Coloured seeded	Red Globe, Bangalore Blue, Muscat Hamburg
Coloured seedless	Shared Seedless and Flame seedless.
White seedless	Thompson Seedless and its clones (Tas-A-Ganesh, Sonaka and Manik

**Perlette:**

Perlette is hybrid cross between Scolokertek Keralynoje x Sultanina Marble 26, evolved at the University of California, Davis (USA) in 1936 developed by H.P. Olmo. This is early ripening white seedless cultivar which was released for cultivation in Punjab in 1964(Pandey, 1982). At present this is the only cultivar under cultivation throughout North India. Vine is medium vigorous and heavy yielder on bower training system. Bunch is medium, conical, compact and attractive, berry greenish yellow to golden yellow, required berry thinning.

**Thompson Seedless:**

This cultivar was also released for cultivation along with perlette. But due to berry shatter problem its cultivation was stopped. The bunches are long and conical. The berries become golden yellow in colour at full ripe stage (Jawanda, et.al., 1974). These are elongated in shape and are seedless. Now the area under this cultivar is again increasing in north India due to its better quality grapes and changed climate.

**Anab-e-Shahi:**

This is a vigorous cultivar and performed very well only on bower system. This cultivar brought from West Asia by Mr. Abdel Baquer Khan in 1890. This cultivar has large and loose cluster with large uniform and attractive greenish yellow berries. Berries have bold seeds, which are not edible. It ripens in July under north Indian conditions. This is highly sensitive to brackish water and susceptible to powdery mildew, anthracnose and fruit rot. (Pandey, 1982)

**Flame Seedless:**

It is performing very well in the plains of Punjab and Haryana. The vines are vigorous than perlette. Bunches are medium in size and well filled, with light purple, seedless berries. It is an excellent table grape cultivar. The cultivar can do well on head system of training.

**Beauty Seedless:**

Beauty Seedless is hybrid cross between Scolokertek Keralynoje x Black Kishmish, evolved at the University of California, (USA) and released from IARI, New Delhi for commercial cultivation in the north India(Pandey, 1982). Vine is medium vigorous and heavy yielder on bower system. It is an early ripening cultivar, which ripens in May end to mid June. Bunches are of medium in size, with bold, seedless bluish black berries.

**Kishmish Chami:**

This is a seedless cultivar from Uzbekistan. It is good for table purpose. It bears big bunches like Perlette but less compact. Berries are brick-red in colour and are variable in size; Pulp is pinkish yellow, very sweet with 20 percent TSS and little acidity 0.4 percent.

The promising new hybrids, new have been developed at Indian Institute of Horticulture Research, Bangaluru, IARI, New Delhi and NRC, grape, Pune.

<b>Hybrids</b>	<b>Parentage</b>	<b>Institute</b>
Pusa Navrang	Madeleine Angevine x Rubi Red	IARI, New Delhi
Pusa Urvashi	Hur x Beauty Seedless	IARI, New Delhi
Arka Kanchan	Anab-e-Shahi x Queen of Vineyards	IIHR, Bangaluru
Arkavati	Black Champa x Thompson Seedless	IIHR, Bangaluru
Arka Shyam	Bangalore Blue x Black Champa	IIHR, Bangaluru
Arka Hans	Bangalore Blue x Anab-e-Shahi	IIHR, Bangaluru

Arka Neelmani	Black Champa x Thompson Seedless	IIHR, Bangaluru
Arka Shweta	Anab-e-Shahi x Thompson Seedless	IIHR, Bangaluru
Arka Majestic	Angur Kalan x Black Champa	IIHR, Bangaluru
Arka Chitra	Angur Kalan x Anab-e-Shahi	IIHR, Bangaluru
Arka Krishna	Black Champa x Thompson Seedless	IIHR, Bangaluru
Arka Soma	Anab-e-Shahi x Queen of Vineyards	IIHR, Bangaluru
Arka Trishna	Bangalore Blue x Convent large Black	IIHR, Bangaluru
Medica	Pusa Navrang x Flame Seedless	NRC, grape, Pune
A-18-3	Carolina Black Rose x Thompson Seedless	NRC, grape, Pune

**Propagation:**

In India all the grape cultivars are propagated through cuttings. For this purpose, hard wood cuttings from one year old shoots are prepared. Only healthy cuttings should be planted for rooting purposes to get healthy vines for planting. Cuttings should be prepared from the pruning wood during January.

The length of the cutting should be between 20-25 cm with at least three nodes (buds). The lower cut should be near the bud and upper cut away from the bud. The cuttings should be tied in bundles of 100 cuttings each and placed in moist sand for 15 to 20 days for callusing. These cuttings are then planted in the nursery in the first week of February by keeping 1/3 of cutting above ground. The planted cuttings are applied light irrigation at regular intervals to keep the soil in ‘water’ condition for most the time for high percentage of rooting. Weeds are kept under control by hoeing. To prevent attack of white ants treatment of chloropyriphos @ 2 litre/acre is given after 20 days of planting of cuttings through irrigation water and is repeated in April-May.

**Planting of Vines:**

The rooted cuttings of grape vines are transplanted in the prepared pits in January, before sprouting. The pits are dug at 3mx3m apart the pits are re-filled with mixture of 50 kg of FYM + top soil of the pit. At the planting time of the vines, keep only two to three buds on the new shoot. This will encourage to produce vibrant shoots at sprouting of the vine. Treat the whole field with Dursban 20EC (chloro pyriphos) @ 2 litre per acre at the time of first irrigation to control white ants attack. The same, treatment may be repeated in August-September. The spacing of vines differs greatly depending upon the cultivar and training system. The following table gives number of vines per hectare.

Training system	Planting distance (m)	Number of vines/ha
Head system	2 x 1.5	3333
Kniffin system	3 x 3	1111
Bower system	3 x 6	555

**Training and Pruning:**

Training method differs with the system of training, i.e., bower, kniffin, telephone, y-system or head. For high returns train the vines on bower system. Take the vine straight up-to the height of the bower in the first year itself. This is possible only if the trainer visit the field periodically. Regularly pinch off the sub/side shoots emerging on the growing vine. Pinch the top of vine just below the bower level to encourage emergence of laterals. Select two laterals at the top and allow them to grow on either side, in opposite direction along the central wire. These two laterals shall form the primary arms. The length of these arms and secondary on these arms should not be extended too fast. Regularly head back the arms to develop

sufficient secondary. The entire area on the bower for the framework of the vine should be covered in instalments.

**Pruning:**

Recommended pruning intensity for different cultivars in Punjab is as shown on next page. Pruning should be done in January every year when the vines are still dormant (Chadha and Kumar, 1970). Keep only healthy fruiting canes with the recommended number of buds per cane depending upon the cultivar. The rest of shoots are pruned to one or two buds. These are called renewal spurs. These spurs sprout to give healthy shoots which are selected as fruiting canes in the coming years. A balance 1: 2 is kept between fruiting cane and renewal spurs. In Madhurai area staggered pruning is done to get fruit throughout the year.

Cultivars	Planting distance (m)	Training System	Number of canes/ vine	Number of buds/ cane
Thomson Seedless	3 x 3	Bower System	40-50	8
Perlette	3 x 3	Bower System	60-80	4
Flame Seedless	3 x 3	Bower System	60	4
Sarad Seedless	3 x 3	Bower System	60	4
Anabe-e-Shahi	3 x 6	Bower System	80-100	6
Beauty Seedless	3 x 3	Bower System	60-80	4

**Double Cropping in North India:**

Vines go dormant due to severe winter, in north India. To take double crop on some cultivars like Beauty Seedless and Perlette, vines are given a second pruning during end June or first week of July immediately after the harvest of the summer season crop. The autumn crop is harvested in October. The foliage and bunches are protected from anthracnose attack by regularly spraying with 2: 2: 250 bordeaux mixture and Bavistin 0.2 gm/litre of water alternately.

**Berry Thinning:**

Perlette cultivar have compact bunches. To loosen the bunches and reduce the shot berries in the bunch following practice may be adopted.

1. Thin the flower buds a week before full-bloom by leaving 100 to 120 flower buds per panicle.
2. When the berry's size is 4 mm, girdle the vine by removing a 4 mm wide ring of bark from the main stem and dip the clusters in GA<sub>3</sub> solution @40 ppm.
3. After one week of the first GA<sub>3</sub> dipping repeat the dipping second time.
4. Keep the moisture of soil near field capacity throughout.
5. Harvest the crop when desired T.S.S. is attained in the berries.

**Manures and Fertilizers:**

To the newly planted vines apply 20 gm of urea in March and repeat the dose in May and July to complete the growth up the bower in one season. From second year onward for vines planted at 3 x 3 m distance the following fertilizers doses and schedule may be adopted.

Age of vine (Year)	FYM (kg)/ vine	Nitrogen(g)/ vine	Phosphorus (g)/ vine	Potassium(g)/ vine
1	20	400	1500	250
2	35	500	2500	350
3	50	650	3500	500
4	65	800	4000	650

5 and above	80	1000	4500	800
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Apply full dose of farm yard Manure (FYM) and super phosphate as well as half N and half K fertilizer just after pruning. Apply remaining N and K after fruit set in April. Use of these does have encouraged excessive vegetative growth on all vines irrespective of the system of training adopted, particularly in clay loam soils. The excessive growth causes barrenness in vines, profuse growth causes shade in bower system and intermingling of long overgrowing branches. The hanging of shoots particularly in head system encourage fungal diseases. If bearing is heavy in Perlette vines, give two sprays of urea @ 1.0 percent, first at full bloom and second at fruit set to get higher yield and better fruit quality.

***Irrigation:***

The good growth of vines and berries on the clusters depends directly on the supply of irrigation throughout the growing period of vines. The grape vines have fibrous root system which mostly spread in the top 20 cm of soil. A little depletion of soil moisture can cause diffusion pressure deficit within the vines, leading to growth inhibition. During dormancy vines can tolerate soil moisture stress for a sufficient, long time. To keep roots active and check the damage due to frost and low temperature in North India vines may be applied light irrigation if rain is not there during December or January. Following irrigation schedule may be followed for taking good crop from vines.

<b>Time</b>	<b>Number or Irrigation</b>
After pruning in February	One irrigation
At the time of sprouting of buds	One irrigation
After fruit set in April till-May	4-5 days interval- 6 to 8 irrigation
15 <sup>th</sup> May to fruit harvest	Irrigate only when prolonged dry
July to October	Spell is there
November to January	One irrigation if soil get extremely dry in end December

**Weed Control:**

To check the emergence of weeds give pre-emergence application on Hexuron 30 WP (diuron) @ 1.2 kg/acre in the first week of March after thorough cultivation in February. To check the growth of perennial weeds spray gramoxone 24 WSC (paraquat) @ 6 ml/litre of water twice or Round Up 41 SL (Glyphosate) @ 8-10 ml/litre once, when the weeds have attained good height of 20-30 cm. These weedicides should be sprayed on a calm day to avoid drift to the foliage of vines.

**Intercropping:**

No intercrop should be grown in vineyards as growing of intercrop shall be at the cost of training of vines. More over juvenile period of grape vine is short and vines are planted very close where no implement can move freely. However, in the first year some vegetable crops like peas, potato, turnip, radish or carrots can be grown.

**Maturity and Harvesting:**

Grapes should be harvested only when all the berries have developed the unique colour and desired TSS of the cultivar. Grapes are harvested by repeated pickings since the bunches do not ripen at one time. Taste is the most valuable indicator of the ripeness of the bunch. The berries at the shoulders ripe first followed by centre and tip of the clusters. There may be some bunches having unripe berries at the tip which may be harvested and unripe portion

clipped for marketing. The bunches should be plucked with secateurs very close to the canes. During harvesting, bunches should be placed in the baskets very gently.

**Post-harvest Handling and Marketing:**

The unripe, small sunburnt, soft and damaged berries in the bunch should be trimmed. Bunches should be graded according to fruit maturity and size. Different grades should be separately packed in containers. For local marketing mulberry or bamboo baskets can be used. For distant markets, CFB boxes of 2-4 kg capacity should be used. In the cold storage maintain the temperature of – 2 to 0°C with relative humidity of 85 to 90 percent where it can be kept for 40 days. Shelf-life can be improved if heat of berries is immediately removed before actual storage by forcing the air through the boxes at 2°C less than cold storage temperature.

**Physiological disorder (Special Problems) :**

**Barrenness:**

It has become the major problem of vineyards of North Indian plains. The vines have developed unproductive wood. At the time of pruning most of the shoots are found to be dry. A few fruiting canes per vine are available, hence reduced productivity. The canes produce bunches with few berries. It has been noticed that excessive vegetative growth of vines leads to over shading or immature elongated shoot growth resulting into failour of production of floral primordia development. There may be many reasons for this physiological state. Over irrigation, excessive nitrogen application, defective training, wrong pruning and keeping of high number of fruiting canes in early years of bearing. Both Perlette and Anab-e-Shahi, cultivars are prone to barrenness. Some workers feel that it is due to lack of flower bud formation due to increased diameter of canes. There is direct relationship with vigour of shoots and dryness. Barrenness of vines can be prevented by following proper pruning practices and plant protection measures. Avoid taking heavy yield from the young vines. The excessive growth can be checked by spraying cycocel (CCC) @ 1000 ppm to 2000 ppm. Just after fruit harvest. Inclusion of Bordeaux mixture 2:2: 250 spray during July-August to control fungal diseases can help in the reduction of barrenness.

**Water Berries:**

Development of water berries in grape clusters is very common. These berries do not develop into full size, remain off coloured, lack normal sugar and have more acidity. The berries look like small cellophane bags half filled with sap and remain hanging on the clusters. The berries do not have firm pulp and shrivel or may dry up by the harvest time. The main reason is overcrowding of berries in bunch. Excessive vegetative growth at the cost of developing of berries in a cluster due to more nitrogenous fertilizer application and over irrigation in heavy soils is also responsible for the water berries formation. Water berry formation can be reduced by applying balanced dose of fertilizers and checking flooding of vines during irrigation.

**Shot Berries:**

The presence of very small berries in the clusters of grape cultivars particularly perlette is very common. These berries- are usually seedless and are called millerandage. Such berries develop due to poor pollination or poor carbohydrate accumulation after fertilization of flowers. Generally small berries drop due to embryo abortion or lack of nourishment. Those

do not drop become shot berries. The treatment of clusters with GA<sub>2</sub> and thinning of the clusters help in checking the formation of shot berries.

**Bud and flower Drop:**

This physiological disorder is known as colour or shelling, which is serious problem of Thompson seedless cultivar. The panicles become necked. The shattering may be due to inadequate pollination/fertilization. Due to heavy shattering clusters become very loose or straggly. Grape cultivars differ widely in their response to shattering. Shattering can be prevented by following proper cultural practices and by spraying plant growth regulators to maintain canopy of vines (Chundawat, *et al.*, 1979). Exogenous applications of NAA or zinc before anthesis can reduce this problem.

**Cluster Apex Wilt:**

The wilting of apex of the cluster is a big problem in Perlette and Thompson seedless cultivars. The apical portions of the clusters contain wilted berries at maturity. These berries remain acidic in taste. Sometimes whole of the apex dries up. This disorder is usually associated with compact bunches and low moisture in soil at development stage of the berries.

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