

CULTIVATION OF GRAPE

BOTANICAL NAME	--	<i>Vitis vinifera</i>
Family-		Vitaceae
Chromosome Number—		2n - 38
Origin Place -		Black to Caspian Sea
Type of Fruit-		Berry
Edible Part –		Pericarp and placenta
Inflorescence –		Panicle
Type of Parthenocarpy –		Stenospermocarpy

INTRODUCTION

Grape is one of the oldest fruits domesticated and being grown by man . It is a deciduous crop of temperate origin .It is a unique fruit crop which can be successfully grown in temperate , subtropical and tropical region in India. Cultivated grapes are believed to have being introduced in to the north India by the percian invaders 1300 AD and also known to be introduced in southern region i.e. salem and Madurai districts of Tamilnadu by the French Christian missionaries around 1832AD. Grape is grown mostly fore vine making (90%) in the world over . The cultivation of graspe is called viticulture and study of wine from garpes called viriculture . The science of wine making is called enology.

ORIGIN AND DISTRIBUTION

Vitis vinifera is thought to be native to the area near black to Caspian Sea. Grape founding father of north India is Sarder Bahadur Lal Singh and grape founding father of south India is R. Shanker Pillay. The distribution of wild species is the north America, central Asia and south eastern Europe particularly in the region of black sea. It is believed that there were two main centres . Most of the American species originated from *vitis labrusca* type, while the European grapes originated from *vitis vinifera* type. Thus *vitis vinifera* spp. *Sylvestris* is considered as progenitor species existing in the central Asia , western Africa and Asia minor .

TAXONOMY AND SYSTEMATICS

The genus *vitis* is split into two sub genera :(1)*Eu*vitis (2)*Muscadinia* .

(1)*Eu*vitis –True grape ; elongated clusters, berries that adhere to stem at maturity, forked tendrils, loose bark that detaches in long stripes. *Vitis vinifera* and *Vitis labrusca* are concord grape.

(2)*Muscadinia*-Small fruit clusters, thick skinned fruit, berries that detach easily as they mature, simply tendril.

In India, it is believed that there are over 25 wild species spread in Himalayan region. The cultivated *Vitis vinifera* is derived from crossing of *Vitis labrusca* and *Vitis vulpina*.

Vitis vinifera

Vitis labrusca

Vitis lantana

USE AND COMPOSITION

Grape is most refreshing fruit it is rich sugar , acid , minerals and vitamins . The predominant sugar in grape is fructose . Tartaric acid and malic acid constitute about 90% of the total acid in grape grape is used for preparing a number of products such as desert purpose , raisins , munnakka, juice , wine and canned grapes . Grapes are considered as laxative stomachic ,diuretic and cooling . Resveratrol is an antioxidant found in grape which have anti cancer property

CLIMATE

Temperature , humidity and light are important for grapes. Hot and dry climate is ideal , Areas with high humidity and high rain fall are not suitable . The climatic requirement of *vinifera* are different from those of *labrusca* grapes. Mild temperature not exceeding 35⁰c in summer. High night temperatures (above 25c) during ripening hamper the colour development in coloured grapes . Cool night and hot days even though congenial for coloured grapes undr high

humidity conditions, the vines put forth excessive vegetative growth and disease incidence is high. Rainfall during flowering and berry ripening cause berry cracking and rotting.

SOIL

Grape are grown on a variety of soils in India, alluvial in north , heavy black clay in Maharashtra and red loam in southern Karnataka and Tamil Nadu .Soil with good drainage and water holding capacity in a PH range of 6.5 -7.5 is ideally suited for grapes. Presence of excess salts, particularly sodium and free calcium is detrimental for grapes. Manganese deficiency always found in grape cultivation areas.

VARIETIES

COLOURED SEEDED: Bangalore Blue, Gulabi, Pusa Navrang, Red Globe.

COLOURED SEEDLESS: Beauty Seedless, Sharad Seedless, Flame Seedless.

WHITE SEEDED: Anab-e-Shahi, Dilkhush.

WHITE SEEDLESS: Perlette, Pusa Seedless, Thompson Seedless, Tas-A-Ganesh, Sonaka, Pusa Urvashi.

CANE PRUNED : Pusa Seedless, Kishmish Chorni, Gulabi.

SPUR PRUNED: Perlette, Beauty Seedless, Bangalore Blue.

RAISIN VARIETY : Thompson Seedless, Black Korianth , Gold, Kishmish Beli, Arka Vati.

JUISE VARIETY: Bangalore Blue, Beauty Seedless, Arka Krishna, Champion.

HYBRID VARIETY OF GRAPE

ArkaVati: It is a cross between Black Champa and Thompson Seedless. Berries are medium, Seedless, Sweet with 22-25% TSS . It is multipurpose variety used for making raisin and wine.

Arka Neel Mani: It is a cross between Black Champa and Thompson Seedless. It is suitable for red wine and table purpose. Berries are black coloured.

Arka Krishna: It is a cross between Black Champa and Thompson Seedless, released in 1996. It has 21-22 %TSS. The variety is suitable for juice making.

Arka Kanchan: It is a cross between Anab-e-Shahi and Queen of Vineyards. The variety has a TSS of 19-22% and suitable for table and wine making.

Arka Soma: It is a cross between Anab-e-Shahi and Queen of Vineyards, released in 2006. Pulp is meaty and has muscat flavor with 20-21%TSS. This variety is tolerant to anthracnose, downy mildew and powdery mildew.

Arka Hans:It is a cross between Bangalore Blue and Anab-e-Shahi. Berries are seeded with pleasant flavor and used for wine making.

Arka Shyam:It is a cross between Bangalore Blue and Black champa. The variety is resistant to anthracnose. It is suitable for table and wine making.

Arka Trishna:It is a cross between Bangalore Blue and Convent Large Black. Variety is resistant to anthracnose and tolerant to downy mildew.

Arka Shweta:It is a cross between Anab-e-Shahi and Thompson Seedless. Variety is suitable for table and has a good export potential.

Arka Majestic:It is a cross between Angur Kalan and Black Champa. It is tolerant to anthracnose and has good export potential.

Arka Chitra:It is a cross between Angur Kalan and Anab-e-Shahi. Variety is tolerant to powdery mildew. The berries are very attractive and suitable for table purpose.

Pusa Navrang:It is a cross between Madeleine Angevine and Rubired. It is an early ripening and teinturier variety. It is ideally suited for coloured juice and wine making and is resistant to anthracnose.

Pusa Urvashi:It is a cross between Hur and Beauty Seedless. It is suitable for table and raisin making.

PROPAGATION

Grape is mostly propagated by hard wood cuttings. Four noded cuttings from well mature canes on proven vine are made. The diameter of cuttings should be 8-10mm. Cuttings are mostly obtained from October pruning in the

peninsula. Rooting of cutting is not a problem. However to increase the rooting of cuttings, they should either be soaked or dipped to cover the basal buds in IBA solution. For overnight soaking 500ppm IBA solution is used, while 2000ppm solution is used for quick dipping for 10sec. before planting the cuttings for better rooting. Cutting are planted in nursery either in bed or polybag for rooting. The beds or polybags should be under partial shade. The bed or rooting medium should be treated with chloropyriphos or furadan granules to prevent termite damage. Light frequent watering is to be given to the cuttings.

ROOTSTOCKS

Grafting and Budding are not generally practiced under normal condition. But under some problematic conditions like disease infection, productivity loss or soil salinity these method of vegetative propagation are practiced. T-budding or Chip budding are successfully practiced in grape. Selection of rootstock is an important aspect for vegetative propagation. There are many rootstock are used in grapes in problematic area are following:

1613- nematode resistance.

Dogridge and Salt creek- tolerant to saline soil.

Riparia Gloriea- phylloxera resistance.

PLANTING

Before planting the rooted or unrooted cuttings in the main field, the land is cleared of all bushes and leveled. Trenches or pits 1m wide and 75cm deep are opened. Pits are filled with FYM, bone meal (1kg) superphosphate(1kg) and allowed to settle by watering. Cuttings are planted in their position by opening a small pit. The soil around the planted cuttings is drenched with a solution of chlorpyriphose. October is ideal time for planting cuttings directly in the main field. Rooted cuttings are planted in January-February. When rootstock plants are planted, budding or Grafting is done in July-August

SPACING

Normally, a spacing 3.0-2.5m for head system and 3.0-3.0m for telephone or bower system or trellis system are provided for low and medium vigour varieties. But for high vigour varieties, a spacing 3.6-3.6m or 3.6-3.0m is provided. Row are arranged in east to west direction to harvest maximum advantage from natural resources.

TRAINING

(1) BOWER SYSTEM- It is also known as pergola. In this system, 2.4m high poles made up of RCC or iron angles are fixed squarely at a distance 3-4m. Heavy iron net is spread over the entire vineyard fixing it over the poles. Climbers space 3-3m are allowed to grown straight, without any bunch, up to the height of 2.4m to disperse shoots and cane afterward and to fruit in course of time. This is more expensive but most protective, spacious, steady and durable method of erecting the structure. This type of structure is most popular in many of the grape growing tract in India. Climbers trained in this system also produce heavily and induce better colour turning without any blemish or damage due to sunscald, rain or birds.

Higher cost benefit ratio upto 1:2.09 with some varieties have been reported under the system of training

(2) HEAD SYSTEM-As the name implies, the climber is allowed to grow single stem, initially, upto a height of 1-1.2m. Although initial props are provided by means of bamboo or wooden poles, these are subsequently withdrawn. As a result, the trunk of the climbers supports their own canopy with any artificial framework. Producing canes from basal bud may be trained in this method for productivity but with late precocity, poor colour development of bunches, higher flower and fruit drop as well as fruit rot.

(3) TRELLIS SYSTEM-This system is also comparatively less expensive than bower system. In this system, meter iron angle poles are placed at a distance of 4.8m and two row of iron wire are fixed on the poles by screw at a height of 0.6-

0.9m from the ground level. The distance of adjacent rows of poles remains 3.0m. The climbers are allowed to disperse four arms and several bearing canes on the both side of the wine and the fruit bunches hang freely from them, get uniform treatment.

(4)TELEPHONE SYSTEM-This system of training is different from the previous, as three parallel rows of wires are hinged horizontally at the height of 1.5-1.8m above the ground level by means of a one meter wide arm on the tops of the RCC or iron poles in the present system.

PRUNING

Pruning of vines is one of the most important and skillful job in viticulture. In north India, vines are pruned in winter (December-January). Half of the canes are pruned to renew spurs and the rest for fruiting canes. One or two buds from the cordon are retained in renewed at spurs and 12 buds are retained on fruiting canes. In south India vine are pruned twice (April-October).The April pruning is generally termed as back pruning or foundation pruning. While October pruning is called fruit pruning or forward pruning. All the canes are pruned to spurs at back pruning. The main object of pruning is encouraged of reproductive growth.

MANURING AND FERTILIZATION

The nutrient status of vines is far in excess than required leading to certain nutrient imbalance, particularly Mg deficiency as a result of heavy doses of K. Grape requires more K than N which in turn is required more than P. However, P is required at the time of fruit-bud formation when N is requirement is less. The N is required more for shoot growth during the fruiting season. Whereas, K is required after bud differentiation for shoot maturity and increasing the size of fruit bud. It is also required after berry set until ripening. Mg deficiency is universal. About 100-120kg of magnesium sulphate per ha. per year. About 25-50 ton well decomposed cattle manure, 5 ton of oil cake and 1200kg of organic matter should be applied every year in a hectare.

IRRIGATION

Grape is shallow feeder. Light and frequent watering is better for grapes. Water requirements of grape are very high during berry growth. This period coinciding with hot and dry weather more water is required at this stage. Least water is required during fruit-bud formation. Too much stress during ripening can also increase the berry drop at and after harvesting. Currently due to the shortage of water, grape are irrigated through drip irrigation system. At the time of berry ripening, if rain is done grape suffer from berry cracking and rotting. Grape is sensitive to chlorides and total salt content in irrigation water.

WEED CONTROL

The problematic weeds in vineyards are Bermuda grass and nut grass. Post-emergent weedicide-Paraquat (7.5kg per ha.) or glyphosate (2.0kg per ha.), is also recommended. Glyphosate offers a long time control of weed.

GIRDLING

Girdling is a process of removing 2-3mm wide strip of bark around the stem without injuring the wood. It stop the carbohydrate downward and increase the fruitfulness.

USE OF GROWTH REGULATORS

Growth regulators-CCC, GA, NAA, hydrogen cyanamide and thiourea are being used commercially in grape. The CCC is used to suppress the vigour of vines and increase the fruitfulness of bud. It is sprayed at 50 ppm conc. At 5-leaf stage after back pruning. GA is used invariable in all seedless varieties. It is sprayed at 10 ppm to elongate the clusters,

22-25 days after forward pruning(4-5 leaf stage).It is also sprayed on cluster @ 40ppm at 50% bloom stage for thinning the berries. NAA also used for remove the berry drop at pre harvest. Hydrogen cyanamide is used to hasten and increase the bud-break at winter pruning used in north India. Thiourea (4.0%) mixed with 1% Bordeaux mixture is also used to increase bud-break in south India.

HARVESTING AND POSTHARVEST MANAGEMENT

Grapes are harvested when fully ripe because it is a Non-climatic fruit. Grape should be harvested during cool time of the day. Harvested grapes are trimmed, graded and packed. For local markets, grapes are packed in bamboo strip basket using newspaper and grape leaves as cushioning material. For distant market, wood or corrugated cardboard boxes are used for packing. Old newspaper, hay and paper shreds are used as cushioning material. The size of packing is 6-8kg in wood boxes and 2-4kg in cardboard boxes.

YIELD

The yield potential of grape in India is highest in the world. Grape variety Anab-e-Shahi has recorded yield as high as 92 tonnes per hectare, whereas Thompson seedless has 48 tones per hectare. While that of seedless varieties is 20 tonne per hectare.

PROCESSING

Raisin are the only processed product in India. Approximately 30 % of seedless grape are dried to produce 15000 tonnes of raisins. Golden bleached raisins are produced by shade drying the clusters after in either boiling solution of sodium hydroxide(0.2-0.3%) and exposing to sulphur fumes. Dipping in soda oil containing ethyl oleate and potassium carbonate and shade drying is the most common method of preparing raisin in India.

PHYSIOLOGICAL DISORDERS

(1)-BARRENESS- Barrenness of vines is one of the most problems in India especially in north India. The failure of vine to bear normal crop due to development of unproductive woods, reducing productive life of vine are major feature of barrenness. This problem sometime, so serious that the vine are left with few productive canes.

CAUSE

The cause of death of the floral primordia was reported to be shading. The excessive foliage creates such ecological condition due to which some saprophytic fungi turn into parasitic leading to the death of tissue. The excessive foliage is due to over fertilization especially with Nitrogen.

CONTROL

Adoption of proper training and pruning practices by the grape grower. Following adequate plant protection measures against insect pest and diseases. Avoiding the practices of double cropping.

(2)-WATER BERRIES – These berries look like small, partially filled with sap, which remain hanging on bunches. When touched their pulp is very soft instead of firm. In severe cause, the berries are dull in colour, get shriveled and dry at harvest time.

CAUSE

Overcropping and inadequate nourishment of all the berries in a cluster. Frequent watering and more application of nitrogenous fertilizer in excessive shoot vigours.

CONTROL

Bunch and berries thinning accompanied by cluster clipping. Checking the shoot growth by limiting water and nitrogen application. Applying K and oil cakes. Spraying boric acid @0.2%.

(3)-SHOT BERRIES- Shot berries are usually smaller, round and seedless as compared to the normal berries. It is major problem in Beauty seedless and Perlette which bear compact bunches. Such shot berries are also called as Millerandage.

CAUSE

Poor pollination or fertilization. Poor carbohydrate nutrition to the flower. Compactness of bunches. Deficiency of boron. Inappropriate application of GA.

CONTROL

Apply Gibberellic Acid immediately after fruit set and before the berry shatter stage. Girdling at right stage. Berries thinning also help in avoiding incidence of shot berries. Avoid boron and zinc deficiency. Given due to the reason that many shot berries around a bold berry in a cluster, where bold berries is compared to hen and shot berries to chicken.

CAUSE

The deficiency of zinc and specially boron are found responsible for this disorder.

CONTROL

To reduce the incidence of hen and chicken disorder by following proper spray schedule before flowering of zinc and boron.

(5)-UNEVEN RIPENING- The presence of green berries in a ripe bunch of coloured grapes is called uneven ripening. It is a varietal character and common problem in Bangalore Blue, Beauty Seedless and Gulabi.

CAUSE

The major reason attributed to uneven ripening are inadequate leaf area and non availability of reserves to a developing bunch.

CONTROL

Cultural practices like cluster thinning, girdeling reduce the incidence of uneven ripening. Use of growth regulators can reduce it. Application of ethephon 250 ppm at colour break stage (verasion stage) is recommended to reduce this problem.

(6)- PINK BERRY- it is a common disorder in bunch of Thompson Seedless and its clone. Pink blush develop on few ripe berries closed to harvesting. The pink colour turns to dull red colour resulting in unattractive bunches. These berries become soft and watery and do not stand for long after harvesting, so these get deteriorated during storage and transportation.

CAUSE

Although the definite cause of this disorder is unknown but scientists believe that excessive use of ethylene is a major cause of pink formation. Large variation in temperature during the period of ripening cause pink berries.

CONTROL

The spray mixture of 0.2% Ascorbic Acid and 0.25% sodium diethyl dithiocarbonate at forth nightly interval commencing berry softening are useful to control this disorder.

(7)-BLOSSOM-END ROT(BER)- In this rot the development of black sunken spot at the blossom end of the berry is seen which later on spreads with water soaked region around it.

CAUSE

Defective calcium nutrition and assimilation appear to be the cause it.

CONTROL

This disorder can be corrected with a spray of 1% calcium nitrate.

(8)-BUD, FLOWER AND BERRY DROP

(9)-BERRY SHRIVEL

(10)BERRY CRACKING

(11)-CLUSTER APEX WILT

(12)-STALK NECROSIS

DISEASES AND INSECT PEST AND THEIR MANAGEMENT

DOWNY MILDEW (C.O.- Plasmopora viticola)

Symptoms

The disease mainly appears on the leaves, but also attacks the flower clusters and young fruits.

Entire clusters decay, dry and drop down.

White powdery mycelium growth develop on the lower surface of leaves.

Control

Spray of Bordeaux mixture at 1%.

Spray of copper oxychloride at 0.2%, mancozeb at 0.2% and metalaxyl @ of 0.2% cause effectively control.

POWDERY MILDEW(C.O.- *Uncinula necator*)

Symptom

The disease is characteristic by the presence of white powdery(ash like) coating in patches on both sides of the leaves, young shoots and immature berries.

Control

Powdery mildew is controlled easily by wettable sulphar formulation.

Spray of Karathane at 0.04% are used to control.

ANTHRACNOSE(C.O.-*Sphaceloma ampelina*)

Symptom

The disease is characterized by small light brown or grayish black lesion on tender shoot, young leaves, flower and young berries.

CONTROL

Bordeaux mixture at @ 0.8%, copper oxychloride @ of 0.25% or carbendazim @ 0.1% is used to control.

GRAPE VINE LEAF ROLL VIRUSE

Symptoms- Appear as leaf roll which has impacts on both vine health and berry quality. Growth and yield may be reduced by 10-70%. The virus reduce yield by inhibiting cluster formation and development. Quality impacts included delayed maturity of grapes, a 25-50% reduce in sugar content. The virus is spread by nematode.

INSECT-PESTA

FLEA BEETLES-*Scelodonta strigicollis*

THRIPS-*Rhipiohorothrips cruentalis*

MEALY BUGS- *Planococcus lilacinus*

SHOT HOLE BORER-*Xyleborus semiopaus*

CHAFFER BETTLES- *Macroductylus uniformis*

ROOT KNOT NEMATODE- *Meloidogyne incognita*