

Week - 11: Kiwifruit cultivation

Objective:

The aim of this lecture is to provide knowledge to students on kiwifruit cultivation with respect to area, production, varieties, rootstocks, propagation, planting density, training and pruning, Manuring and fertilization, after care, weed management, use of growth regulators, irrigation, harvesting and post harvest management.

INTRODUCTION

Taxonomical details

Family = Actinidiaceae

Genus = Actinidia

Species = deliciosa

Basic chromosome number = 29

Introduction

- The kiwifruit (*Actinidia deliciosa* Chev.) is a deciduous fruiting vine native to Yangtze river valley of south and central China.
- This is known as “China’s miracle fruit” and “ Horticulture wonder of New Zealand”.
- Although this fruit vine is originated in China, yet its full economic potential was exploited by the New Zealanders, which accounts for over 70 per cent of world trade.
- In other countries of the world, its cultivation gained momentum after 1960 and now it is cultivated on a commercial scale in USA, Italy China, Japan, France, Germany and Australia.
- In India, it was first introduced at Lal Bagh garden, Banglore, but the plant did not come in to bearing due to lack of chilling requirement during winter for its bud break.
- Later on, in 1963, it was introduced in Shimla hills, where the plant came in to bearing in 1969.
- Kiwifruit is rusty brown with hairy surface and looks like a spota fruit. Fruit has refreshing and delicate flavour, pleasing aroma and high nutritive and medicinal value.
- It is rich in Vitamin-C and contain more of potassium, phosphorus and iron and low in calories.

Area and Production

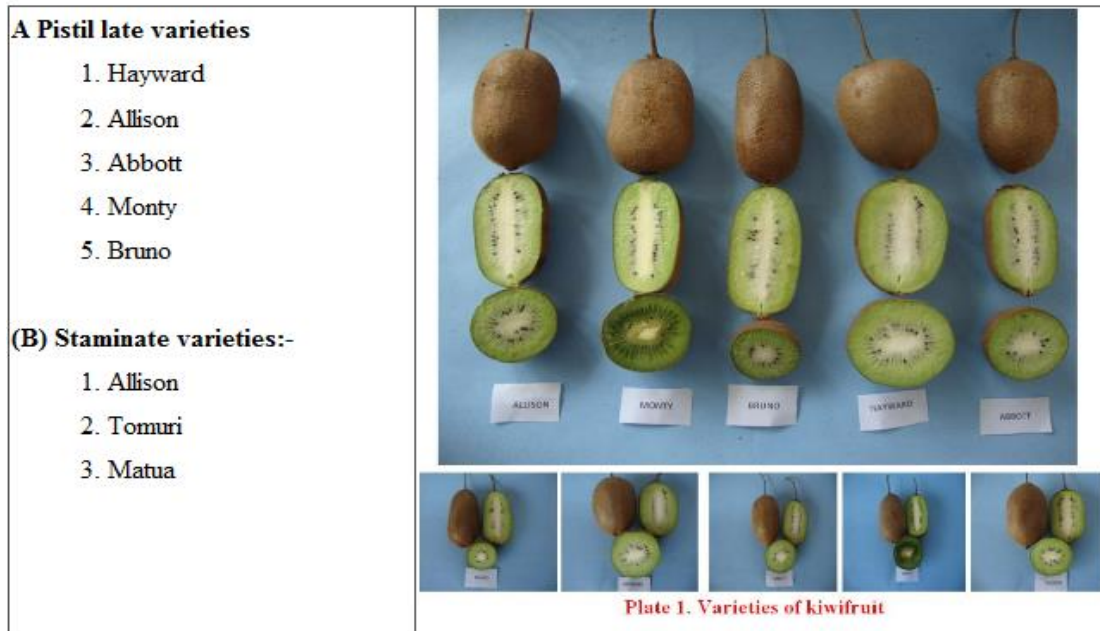
- Kiwifruit is mainly grown in New Zealand, China, USA, Italy, France, Australia and Israel.
 - In the world, it occupies an area of 88012 ha. with a production of 1377233 MT (FAO,2009).
 - In India it is grown in mid hills of Himachal Pradesh, J&K, Uttarkhand, Sikkam, Arunachal Pradesh, Meghalaya, Nagaland and Nilgiri hills of south India.
 - In HP it is grown in 128 ha and production is 154 MT (Annon, 2009-10)
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Soil and climate:-

- Kiwifruit can be grown in almost all types of soil provided adequate soil moisture is available.
- Deep well drained, sandy-loam soil with good amount of organic matter is ideal for its cultivation. Heavy clay soil with poor drainage is not suitable.
- A soil pH 5.5 to 6.5 is considered ideal for vine growth and fruit production.
- Although, kiwifruit is very hardy deciduous vine can withstand a wide range of climatic conditions, yet for the production of good crop of quality fruits it has specific climatic requirements.
- It can be grown successfully in warm temperate to sub-tropical regions lying between 3000 to 5500 feet a.m.s.l, which provide 600-800 chilling hours to break dormancy.
- Low temperature (-2.5oC or below) and frost during spring and autumn is very injurious, which kills immature shoots and fruit buds.
- In summer, high temperature >38oC accompanied by high insulation (loo) and low humidity may cause scorching of leaves and sunburn of fruits and even death of the plants.
- A rainfall of about 120-150 cm, well distributed throughout the growing period is sufficient for proper growth and development.
- High velocity of wind during April and May cause breakage of young tender flowering shoots, whereas low temperature, hails and rainfall during flowering hamper the fruit set.

Varietal status

- Kiwifruit is a dioecious plant, bears staminate and pistillate flowers on separate plants.



PROPAGATION AND CANOPY MANAGEMENT

Rootstock and propagation:-

- Seedlings of some cultivated cultivars like Bruno and Abbott are commonly used as a rootstock in kiwifruit. Seeds of these two cultivars are preferred because of good germination and strong seedling vigour.

Propagation:

- Kiwifruit is commercially propagated through cuttings, grafting and budding and tissue culture.

A.Propagation through cutting :

- This is the most rapid and easiest method.
- Softwood, semi hard and hard wood cuttings are used to raise own rooted plants.
- The ideal cutting is 0.5 to 1.0 cm thick with relatively short internodes, about 10-15 cm in length having at least 4-5 buds.
- Cutting should be taken from middle portion of current season's growth shoot in June-July in case of semi-hard cuttings and from one year old shoot during January-February in case of hard wood cuttings.
- After preparation, the cuttings are dipped in 4000-5000 ppm IBA solution for 10-15 seconds and then planted in mist propagation chamber or in open field conditions for rooting.

B.Propagation through grafting and budding :

- Kiwifruit vines are also propagated by grafting and budding on seedling rootstock. Although this method takes two years to develop a nursery plant, yet is easiest, economical and used for large scale multiplication.
 - Before sowing, seeds are stratified in alternate layers of moist sand for 30-35 days at 0-5°C to break dormancy.
 - Stratified seeds are sown in the seed beds during February. Germinating and baby seedlings are very sensitive to direct sunlight so they must be protected by creating a shade or using shade nets.
 - At three leaf stage the seedlings are transplanted in polybags and then in nursery beds during July-August.
 - The seedlings attain a graftable size within a year. Tongue grafting and Chip budding done in last week of January to end of February gave 90-95 % bud-take success.
 - Nursery management practices like weeding, irrigation, staking of grafted plants are done at regular intervals.
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Planting:-

- Flat land with gentle slope is ideal for planting of kiwifruit.
- Plant spacing varies according to cultivars being grown and training system adopted.
- In general, planting is done at a spacing of 6 m from plant to plant and 4 m from row to row in varieties like Allison, Abbott and Monty trained on T- bar Trellis system.
- Whereas, Hayward is less vigorous and is planted at a spacing of 5m x 5m. In pergola system of training, a spacing of 6m x 6m is recommended for getting better fruit production.
- Planting is done during dormant season (December to January)
- While planting, the male plants are spread throughout the block with every female adjacent to a male. This is achieved by 1:8 or 1:9 male to female ratio.

Canopy management:-

(A) Training:-

- Kiwifruit is a vine like grape, thus require similar training structure but more stronger than grapes.
- A number of training structures are used for training a vine, but T- bar trellis and pergola systems are more popular.
- In T- bar trellis system, the pillars of iron and concrete about 1.8m in height above the ground level are erected at a distance of 6m from each other in a row in straight line.
- A cross arm (1.5m) is fixed on each pole, which carries five outriggers wire at a distance of 45 cm each.
- Vines are trained upto wire as single stem then two leaders in opposite direction along the center wire are selected or developed . From these permanent leaders, temporary fruiting arms 25-30 cm apart are selected at right angle along both sides of each leader.
- Training of vines on pergola system is similar to that of T-bar. A flat topped network of criss-cross wire is prepared on the erected pillars. This systems is costly to prepare but vine trained on this system gives higher yields.

(B) Pruning:-

- The main objective of pruning is to obtain high yield of quality fruits and to manage excessive vegetative growth.
- The following principles should be kept in mind at the time of pruning.

- (1) The fruit is developed on current season's growth arising from one year shoot.
 - (2) Only the basal buds of the nodes 4-12 on current season growth are productive.
 - (3) Vines grow 2-3 m every year, which become overcrowded if not controlled by summer and winter pruning.
 - (4) The shoots developed on older wood by heading back will not fruit normally in the first season.
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- Keeping in mind these principles, the vine pruning is carried out in such a way that the fruiting areas are available every year requiring the wood to be young.
- This is achieved by 3-4 years lateral replacement system. In dormant pruning, the fruiting lateral is cut back to 2 vegetative buds beyond the last fruit.
- In the second year, these vegetative buds produce the fruiting shoots, which are pruned again.
- The arm on lateral shoots are pruned and allowed to fruit for 3-4 years.
- After this the lateral is removed from the main branches and other laterals are selected and pruned accordingly so that the balance between vegetative and reproductive growth is maintained for the continuity in the fruit production.
- In summer pruning shoot is cut beyond 6-8 buds from the last fruit during June-July.

Pollination requirement and role of Pollinators

- The Kiwifruit crop is highly dependent on pollination as the plants are functionally dioecious.
- For effective pollination, one male plant is planted for every 9 pistil late plants.
- Wind and insects play a very significant role in pollination, however, introduction of honeybees in the orchard further increase fruit set and size of the fruit.
- Honeybees colonies about 8-9 per hectare are required in kiwifruit orchard for effective pollination.
- Besides, insect pollination, hand pollination is essential to get fruits of better size and quality.

CULTURAL PRACTICES

Orchard Floor Management:-

- Clean cultivation with mulching of the tree basin area with 15 cm thick hay grass or black polythene mulch is recommended for kiwifruit orchards.
- During the initial two years, intercrops like strawberry, peas, beans, cowpeas and vegetable crops like tomato. ginger etc. can also be grown in the vacant area between the trees.

Nutrition:-

- The vines make much vegetative growth, yield heavily, thus requires adequate amount of manures and fertilizers for normal vine growth and fruit production.
 - The quantity of fertilizers to be applied vary with soil fertility and age of the vine.
 - In general, a basal dose of 20 Kg FYM alongwith 0.5 Kg of NPK fertilizers mixture containing 15 per cent N be applied each year of age.
 - For fully bearing vines (8 years and above) 60-80 kg FYM, 800g N, 560g P₂O₅ and 1200 g K₂O/vine is applied every year per vine.
 - FYM along with full dose of P₂O₅ and K₂O is applied during December-January, while N fertilizer is applied in two equal dressing, half before bud-burst and remaining full dose at the onset of monsoon i.e. in July.
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- Application of 2/3rd dose of recommended NPK fertilizers through drip irrigation in eight equal split doses from bud burst at 10 days intervals is recommended which results 25 per cent saving of fertilizers and increase yield of quality fruits over traditional method of fertilizer application.

Irrigation:-

- Water requirement of kiwifruit is very high because of vigorous vegetative growth and larger leaf surface area.
- In general, fully grown vines require 80-100L of water for total daily transpiration from 16-17 m² canopy area during summer.
- Due to irregular distribution of rainfall in most of kiwifruit growing areas, the supplemental irrigation is important for improving productivity of fruits.
- Young vine should be irrigated at 2-3 days intervals, while bearing vines are to be irrigated at 20% depletion of soil moisture from field capacity (5-6 days intervals) during summer to get better size fruits.
- Drip irrigation at 100 per cent ETC gave higher yield of quality fruits.

Crop and quality regulation:-

- All the cultivars of kiwifruit except Hayward bears heavily every year. This heavy crop create a severe competition between the fruits for water, nutrients and photosynthates, which leads to production of small size fruits. Therefore, to harvest quality crop of good size hand thinning is essential as chemical thinning is ineffective.
- In a study on thinning in kiwifruit, hand thinning (20% thinning) to the extent of retaining 4-6 flower buds or fruits/ flowering shoot produced more fruits of A grade without any adverse effect on total yield as chemical thinning was found ineffective in kiwifruit.
- In hand thinning only lateral flowers or fruits are removed .

Maturity indices, Harvesting and Marketing:-

- In kiwifruit, determination of optimum fruit maturity is difficult because no change take place into the skin or flesh colour or size of fruit at fruit maturity.
- A maturity index of 6.20B TSS is considered is satisfactory for fruit harvest.
- Days from full bloom to harvest along with TSS was found the best index to judge the optimum harvesting time.
- Beside this, at maturity the hairs present on the fruit skin are removed very easily
- and can be used to judge the harvesting or maturity.
- Harvesting is done manually by giving gentle twist to fruit and fruits are plucked without stalk,

Grading and Packing:-

- There is no standard for grading and packing in India, However, following grades are under „A“ grade >70g, „B“ grade (50-70g), „C“ grade <50g. but international standard of grading is „A“ grade is above 100g, B 70-100g. <70g is C grade.
 - In India kiwifruit is packed in 3-5 Kg boxes of Cardboard. However in other countries the kiwifruit are packed in tray packs.
 - Standard tray consists of an out case of cartboard or plastics, a performed plastic packet tray-packs, a polliners corrugated strawboard and a cardboard lid. In a tray 33 fruits of 100 g/fruit weight are accommodated.
 - Kiwifruit has excellent keeping quality, storage of fruits should be done with hours of picking.
 - Fruits can be stored at ambient temperature for 6-7 weeks, but for good commercial storage refrigeration is necessary. It can be stored for 4-6 months in cold storage at 0oC and 90% relative humidity.
 - Fruits are eaten fresh or combined with other fruits in sealed.
 - A large number of processed products such as jam, jelly, candy, squash and wine are prepared from kiwifruit.
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