Week - 16: Chestnut and Hazelnut cultivation

Objective:
The aim of this lecture is to provide knowledge to students on chestnut and hazelnut cultivation with respect to area, production, varieties, rootstocks, propagation, planting density, training and pruning, manuring and fertilization, after care, weed management, irrigation, harvesting and post harvest management.

CHESTNUT

Taxonomical classification

Family	=	Fagaceae
Genus	=	Castanea
Species	=	dentata

Basic chromosome = 12

Introduction

- The chestnut is similar to the acron of oak. The chestnut trees are growing in temperate climate of the world for more than 4000 years for beauty, fuel and shelter.
- The sweet chestnut is a nutritious low in fat and rich in vitamin B.
- Freshly harvested nuts contains about 50 per cent moisture, 40-42 per cent carbohydrates, 2.9 per cent proteins and about 1.5 per cent fats.
- In addition to good food source to human being, chestnut also provides food for number of wild life species. Its wood is durable and used for timber and furniture work
- Chestnut and chinquapins are exception to all other nut trees in that they contain little oil and are high in carbohydrate particularly in starch.

Area and Production

- There is no organized plantation of chestnut in India, Only stray plantation exist and some plants grows wild in the forest of Himachal Pradesh, Darjeeling and Khasi hills.
- Leading countries in the chestnut production are USA 526000MT, China 101000MT, Turkey 99000MT; Korea70000MT Italy 53000MT; Japan 48000MT and Spain 31000MT;
- Total world production of chestnut is nearly 477,568 metric tons in an area of 18430 ha plantation with average productivity of about 1.84 T/ha (FAO,2008).

Flower and fruits

- The Chinese chestnut is latest tree to bloom. The flowers are produced in two kind of catkins borne on current season shoots near the terminal portion of the shoot.
- The fruit of the Chinese chestnut is borne in a spiny involucre known as bur.

- Three nuts are usually produced in each bur (upper, left and right)
- The bur is a vegetative structure that encloses the nuts or fruits. Botanically, each nut is a complete fruit
- The shell of the nut develop from the ovary wall.
- The kernel of the nut is a young embryo plant that develops from the fertilized eggs of ovule.
- The edible portion of the kernel is made up of two fleshy cotyledons and minute internal growing points of shoots and root.
- The kernel is enclosed in a membranous covering called the pellicle, which originate from the integument of the ovule.

Soil and climate
Soil:

- Chestnut can be grown in all types of soil but it grows best in well drained sandy or sandy loam soil.
- The soil should be moderate to slightly acidic. The chestnut trees withstand moderate drought after well establishment.

Climate:

- The chestnut can be grown in a wide range of climate in temperate areas.
- It is as hardy as peach and can withstand as low as -29oC temperature in deep dormancy.
- It requires less chilling to break bud dormancy in spring. Buds respond quickly to warm temperature and thus become subject to damage by late spring frosts.

ROOTSTOCKS AND PROPAGATION

Rootstocks:

- Some species of chestnut are used as rootstock for propagation.
- Chestnut are highly cross pollinated and hybrid seedling used as rootstock is a possible cause of graft union failure in chestnut. Therefore mixed hybrid strains should not be used as rootstock.

Propagation:

- Chestnut seeds planted immediately after harvest showed poor germinate.
- The seeds are stratified for 50-60 days in moist sand at 0 to 2.2 oC to break dormancy of chestnut embryos and ensure uniform germination.
- The chestnut stratification in moist sand kept in wooden boxes at cool shady place proved better than in refrigerator because of fluctuating temperature under field condition help in promoting the seed germination.
- The stratified seeds are sown in nursery beds in the month of March.

Grafting and Budding:

- The chestnut has only one bud at each node and if it is killed by spring frost bud break fails. So early grafting should be avoided.
- Splice grafting and tongue grafting done in March are generally used for the propagation of chestnut,. Chip budding also perform well.

Varieties

- Most of nurserymen in Western countries grow only seedling plants because of their easy availability at lower price, however, grafted trees are superior to seedling in nut production.
- The cultivars which are of commercial importance are :Abundance, Crane, Kuling, Meiling, Nanking, Orrin, Colby and Hemming :

Planting density:

- The planting is done during winters.
- Before planting, the site should be properly laid out with contour or terrace systems.
- The pit should be prepared well in advance and refilled with soil mixed with 60 kg well rotten FYM.
- Plants should be spaced about 30 feet apart as trees are very large in canopy.

Pollination:

- All cultivars and species of chestnut are self sterile. Two or more cultivars and seedling must be planted in the orchard to ensure cross pollination.
- Young orchard trees may not set nuts when the first flowers are formed because of lack of pollination.
- When young trees start flowering the few staminate catkins apparently do not produce enough pollen to fertilize the pistillate flowers.
- Chestnut is wind pollinated as well as insect pollinated.

CULTURAL PRACTICES

Canopy Management:

- The Chinese chestnut form a low headed tree if left unpruned. Unpruned tree start bearing earlier than severely pruned ones.
- Early pruning stimulates vegetative growth. Hence, for early nut production orchard trees should not be pruned for few years.
- An ideal practice is to allow the trees to come into bearing before any pruning is done, then remove only a few of the lowest branches each year until the tree is properly headed. Lower limbs are removed gradually from the tree and the practice is continued.
- The lowest branch should be kept at a height of one meter from the ground and therefore branches should be spaced spirally at a distance of 40 cm from one another.

Nutrition:

- The chestnut trees are mostly planted on eroded upland soils, so it is important to fertilize trees regularly.
- At least ½ kg 15:15:15 NPK mixture per year age of tree should be applied before sprouting or in early spring.
- The full bearing trees should be supplied with 100 kg FYM and 6-8 Kg of NPK mixture during December – January.

Irrigation:

- Well established trees can withstand a moderate amount of drought
- Chestnut is generally grown under rain-fed conditions but needs adequate moisture for at least 2 months after blooming.
- Irrigation at fortnightly intervals after blooming is desirable for better fruit size, yield and nut quality.

Inter culture:

- Row crops such as corn, soyabean or other pulses can be grown between the trees for the first few years.
- Filler trees of stone fruits can be planted for supplementing income in the early years and should be removed later on after chestnut plants start bearing full crops.

Maturity and Harvesting

- The chestnut mature in the first fortnight of October in Himachal conditions.
- The bur colour changes from green to light brownish and split open during maturity releasing the nuts.
- Chestnut are very perishable crop that require prompt harvesting every third days.
- Traditionally, chestnut are hand gathered from ground after falling naturally.
- In USA and other developed countries the chestnut are harvested mechanically by shaking the burs from the trees and using mechanical pick up device together the nuts.
- The harvested chestnuts are treated with fungicides to prevent spoilage. These nuts are then cured for 5 days at 21oC. on an average, the harvest period of each tree is 23 days as maturity is not uniform in chestnuts.

Yield:

- Seedling tree yielded 26 kg of nuts at 12 years of age.

Storage:

- Fresh chestnut contain 40-45per cent carbohydrates, mostly in the form of starch, about 5 per cent oil and about 5 per cent moisture. These are highly perishable because the nuts

loose moisture rapidly at room temperature, causing the kernel to become hard and inedible.

- For storage, the moisture of nuts must be less than 10 per cent and relative humidity of storage atmosphere must be 70 per cent or lower and storage temperature must be 0oC or lower.
- Mold on chestnut can be destroyed with hot bath (57.7oC for one hour).
- The best way of drying chestnut is to put them in bags at 4.4oC with well circulated air at 70 per cent relative humidity.
- Under these conditions the nuts will cure and dry to the optimum moisture content.

HAZELNUT CULTIVATION

INTRODUCTION AND ORIGIN

- Hazelnut (Corylus avellana L.) belongs to the family Betulaceae is typically a temperate zone nut crop and mostly grown in Turkey, Italy, Spain, Germany, France and England.
- Turkish hazelnut production of 625,000 tons accounts for approximately 75 % of worldwide production.
- The common hazel (Corylus avellana) is native to Europe and Western Asia.
- In Himachal Pradesh, it is found growing wild in Pangi region of Chamba district and locally known as Thangi.
- Hazelnut is also known as cobnut and filbert.
- In UK, a distinction is made between filbert, which have the husk longer than the nut, and cobnut, in which the husks are shorter than the nut. Hazelnuts are extensively used in confectionary to make praline and also used in combination with chocolate truffles.

CLIMATE

- The hazelnut tree is quite hardy but only produces satisfactory crops under moderate climate conditions.
- Temperature of minus 10 0C is critical, especially if accompanied by wind, which may kill both pistillate and staminate flowers.
- The chilling requirement of hazelnut is about the same as that of most commercial cultivars of apple and thus it can be grown successfully in the apple growing regions of Himachal Pradesh, Jammu and Kashmir and Uttarakhand and North-Eastern Himalayan regions of India.

SOIL

- Hazelnuts are more shallow rooted than most fruit and nut trees, and do not tolerate wet soils. However moisture retention in the soil is important since the tree can not tolerate excessive dry summer heat and hot winds.
- Soils must be moderately fertile and heavy clay soils should be avoided. Hazels will grow in pH ranging from 4.5 to 8.5, but around pH 7 is ideal.

VARIETIES

- There are more than 200 cultivars of hazelnut world over but only a dozen or so having the commercial importance.
- Important varieties are Tonda Romana, Barcelona, Negret, Tonda Giffoni, Tonda Gentile delle Langhe,Pauetet,Tombul

PLANTING AND PLANTING DENSITY

- The area for planting should be marked and cleared or sprayed with herbicide.
- Tree spacing is highly variable in the different countries, as they depend on the fertility of the soil, rainfall and variety vigour.
- A planting density of 860 trees/ha is recommended with rows 4m- 5m apart (to allow machinery access) and 2m- 3m within row spacing.
- To ensure adequate pollination it is advisable to plant atleast 10% of other varieties, evenly distributed throughout the stand.
- Planting is usually done during winter months.
- In the orchards of Oregon (USA), trained in vase, tree density normally varies from 270 to 400 trees/ha (6x6m or 5x5m), while in the South-West of France they oscillate between 666 (5x3m) and 800 trees /ha (5x2.5m)..

MANURES AND FERTILIZATION

- Prior to planting and up to bearing age, organic and inorganic fertilizers should be applied according to soil analysis as follow:
- Organic fertilizers like FYM should be applied at around 30 tons/ha if the soil organic matter is below 2 per cent. Where, the soil pH is around 5.5, it should be raised to 6.5 by liming but not more than 5 t/ha should be given in a single dressing.
- Fertilizer application to mature trees should be based on leaf and soil analysis. The fertilizer recommendations for hazelnut is 120 to 150 Kg/ha of N, 60 to 70 Kg/ha P and 100 Kg/ha of K.

TRAINING AND PRUNING

- The traditional training system in hazelnut orchards in the main production areas (Turkey, Italy and Spain) has been a multistem bush, according to its normal tendency of bushing growth.
- However, the training system used in the new orchards of United States, France, Italy and Spain is in vase with only one stem..
- Pruning systems
- Hazelnut bear its fruits laterally and terminally on wood of the previous season‟s growth and the pruning after the tree has come into bearing should be such as to stimulate a moderate amount of new growth each year.

WEED CONTROLL

- Weeds compete the crop for moisture and nutrition and adversely affect the nut yield and quality, thus planting should be kept free of weeds manually or through the use of herbicides .
- The most used herbicides in mature orchards according their application time, are: Simazine, Diuron, Napromide, Oxifluorphen, Propyzamide, Trifluraline in pre emergency and Paraquat, 2,4-D, Aminotrizol, Glyphosate, Ammonium gluphosinate, Terbutilazine + Terbumeton etc. in postemergency.

HARVESTING AND YIELD

- When nuts change from green to brown and the abscission starts, is the best time of harvesting. Usually it comes in mid aut
- Hazelnut trees reach maximum production between fifteen and twenty
- Five years of age and the average yield per plant ranged from 2-2.5 Kg.