Week -5 – Pear cultivation

- **Objective:**

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

Taxonomical classification

Order	=		Rosales
Family	=		Rosaceae
Sub-family	=		Pomoideae
Genus	=		Pyrus
Species	=		communis
Basic	chromosome	=	17

Somatic number = 34

Introduction

- Pear (*Pyrus communis*) is next only to apple in importance, acreage, production and varietal diversity amongst the temperate fruits.
- The genus Pyrus has probably originated in the mountainous regions of Western China.
- Vavilov (1951) proposed three centres of origin for the cultivated pear.

    1. **Chinese centre:** It is primary gene center comprising the regions of north and central China, Japan and Korea. The important species which originated in this track are *P. pyrifolia, P. ussuriensis, P betulifolia* and *P calleryana*.
    2. **Central Asiatic centre:** Western Tian-shan, Uzbekistan, North-west India and Afghanistan are included under this centre. The indigenous species *P communis, P. paishia , P. salicifolia*. originated under this centre.
    3. **Near Eastern centre:** Asia minor and Caucasus mountains are the tracks where great variability exists in *P. communis, P. syriaca* and *P. caucasica* are the important species found in this centre.

- There are 22 primary species, which are classified in to 4 groups on the basis of geographical distribution.

    1. **European group:** *P. communis, P nivalis, P cordata, P. caucasica*
    2. **Asian group:** *P. calleryana, P. betulifolia, P. dimorbhophylla, P Koehnei*
    3. **North Africa group:** *P. longipes, P. memorensis, P. gharbiana*
    4. **East Asian group:** *P. pyrifolia, P. ussuriensis, P. hodoensis*

- Both European and Asian pears were domesticated by hybridization and selection from local wild species in prehistoric times.

- Chinese and Japanese migrants took Asian pear to USA as seed and scion material.
- In India, various English missionaries introduced pear along with other fruits some times during 1970 and planted them in Kullu, Shimla in Himachal Pradesh and Kumaon hills in Uttarakhand.
- After this many varieties of pear were introduced from England, France, Italy and Japan.
- Pear in temperate areas of the state are mostly grown as intercrops in apple orchards.
- However, in recent years some compact orchards of pear have been established in Kullu and Shimla districts of Himachal Pradesh and Kashmir valley.

Area and Production:

- Due to wide genetic variability pear is cultivated in many temperate and tropical countries of the world.
- In the world the area under pear is 1580876 ha and production is 22460529 MT.
- In India, pear is
- HP has the grown in more than 9 states and area is 38160 ha, production is 317244 MT.
- Himachal Pradesh has maximum area of 7382 ha with a production of 17381 MT.

Plant description:

- Plant is a deciduous, tree or shrub, leaves serrate, crenate rarely lobed.
- Flowers are with or before leaves, in umbel like raceme, white rarely pinkish, sepals reflexed or spreading.
- Petals suborbicular to broad oblong, stamen 20-30, anthers red to purple, style 25, free, closely constricted at base.
- Ovules 2 per locule.
- Fruit- a globose or pyriform, pome with persistent or deciduous calyx.

Climate and Soil :-

- Pear can be grown in wide range of climatic conditions, as it can tolerate as low as –26oC temperature during dormant season and as high as 45oC during growth period.
- A large number of pear cultivars require about 1200 hour below 7oC during winter to complete their chilling requirement to flower and fruit satisfactorily.
- However, Bartlett needs about 1500 hours compared to other temperate pears
- Pear variety Patharnakh needs only 150 hours of chilling and also with stand high temperature and hot winds during summer.
- The medium chilling requiring pear cultivars. like Le Conte, Kieffer, Gola perform well in areas experiencing mild winter.
- Spring frosts are detrimental to pear production and temperature at –3.3oC or below kills the open blossom or flowers. Therefore, low lands should be avoided for its planting.
- North eastern slopes are better for pear plantations because warmer aspects have a problem of spring frost which kills the bloom.

- Pear grows best in deep, well-drained, fertile medium textured loamy soil. It is more tolerant to wet soils but less tolerant to drought than apple .
- Pear even do well on poorly aerated heavy soil with high water table which is heavy in texture for most of deciduous fruits.
- A pH range of 6.0 to 7.5 is desirable because Fe deficiency appears in alkaline soils.

Varieties:

- Pear varieties belongs to 2 groups:- European Pears and Asian Pears
- European pears fruits are pyriform in shape without any grit cells, whereas asian pears are roundish in shape with grit cells.

(1) European Pears: Bartlett, Clapp‟s Favourite, Anjou, Conference, Winter Nelis, Flamish Beauty, Doynne du Comice, Max Red Bartlett, Red Bartlett. Starkrimson, Laxton‟s Superb.
(2) AsianPears: Shinseiki, Chojuro, Kosui, Nijisseiki, Kikisu, Yali

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ROOTSTOCKS AND PROPAGATION

- Pear is commercially propagated through grafting on seedling or clonal rootstocks
- Seedling rootstocks are seedlings of Kainth (P pashia) and Shiara (P serotina).
- Clonal rootstocks are Quince A (vigours), Quince B (Intermediate) and Quince C (dwarf) and BA 29.
- In Punjab, root suckers of cultivated pear are also employed as a rootstock
- Some clonal rootstocks like OH X F-230 (semi-dwarf), Oregon 211 (dwarfing), Oregon260 have been recently released and found promising.

Propagation of seedling rootstock:-

- For raising seedling rootstocks, seeds are extracted from fully mature fruits of Kainth and Shiara.
- For good germination, the seeds are stratified for 30-40 days in alternate layers of moist sand at low temperature (4-5oC) during December- January.
- The pre-stratified seeds are sown in the nursery beds at a distance of 6-10 cm seed to seed and 10-15 cm in rows at a depth of 3-4 cm.
- In very cold areas, the seeds are directly sown in the nursery beds during December. After sowing of the seeds in the nursery beds, the beds are mulched with grass mulch and light irrigation is given.
- When the seeds start germinating and attain 2-3 inch growth mulch material is removed.
- Regular weeding, hoeing and irrigation is required for proper growth of the seedlings. About 80-90% seedling are ready for grafting with in a year.

Clonal rootstocks:

- Clonal rootstocks are multiplied through mound or trench layering as discussed under apple.

Raising rootstocks from root suckers:

- In plains, the root suckers from pear trees are separated during October-December along with its roots. These suckers are planted in the nursery beds at 15-20cm distance in rows 30cm apart.

Own rooted:

- Hard-wood cuttings are taken during dormant season from one year old shoot. Before planting, the cuttings are treated with 100ppm IBA for 24 hours.

Propagation of scion:

- The seedling and clonal rootstocks are grafted with tongue or cleft method of grafting during February.
- The clonal rootstock Quince is not compatible with most of varieties, particularly with Bartlett group, therefore Beurre Hardy and Old Home are used as interstock.
- T-budding during April-May also gives good bud-take success.

Planting and planting density:

- The land selected for pear plantation should be cleared off and all the old stems and roots of earlier growing trees and shrubs need to be removed.
- After cultivating the soil thoroughly, green manuring crops are grown to improve the soil fertility.
- A planting plan is prepared adopting a particular layout system before actual planting.
- The layout system depends on the plant density to be adopted and topography of the land.
- Generally square and rectangular system of planting is followed in flat land, while terrace and contour system in sloppy lands.
- Under high density, hedge row and bed system is used for pear plantation.
- The planting distance ultimately depends upon the soil fertility, cultivars, rootstock and training system.

Table 3. Grading and packing of pear

Grade	Equatorial diameter (mm)	Size of box (inner in cms)	No. of layer
Extra large	<75	45.5 x 30.5 x 30.5	4
Large	70-75	45.5 x 20.5 x20.5	3
Medium	65-70	Do	3
Small	60-65	Do	3
Extra small	55-60	Do	4
Culled	<55	45.5 x 30.5 x 30.5	Loose

- Planting is done during December- January.
- Pits of 1x1x1 m size are dug and filled with a mixture of soil, 50-60kg FYM and one kg of single super phosphate about one month before planting..

CULTURAL PRACTICES

Training and Pruning:-
Pear are usually trained according to modified Central leader system.
Modified central leader system:

- Generally, one – year – old whip without a single branch is planted in the dormant season.
- Immediately after transplanting the tip of plant is headed back to 60 to 75 cm above the ground level.
- In the following summer, most of the buds on main branch will sprout. In order to develop clean stem up to 30 cm from the ground the sprouted buds are pinched off soon after their appearance.
- Three or four well spaced buds projecting in spirally around the trunk are retained.

Fig 1.Pruning at planting

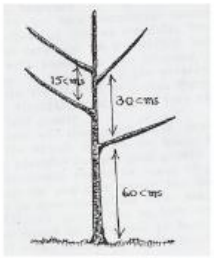

Fig 2.Selection of primary branches

Fig 3.First year pruning

Fig.4.Second year pruning

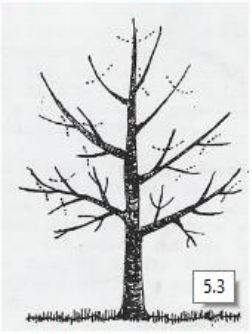

Fig 5.Third year pruning

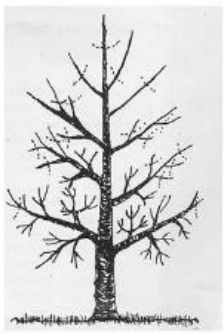

Fig. 6.Fourth year pruning

Modified Leader System of Training

- If summer pruning is not done, then 3-4 well spaced primary branches having wider crotch angle are selected during dormant pruning. The lowest branch should be selected at least 30 cm above the ground and other branches spaced vertically 10-15 cm apart in spiral fashion.
- The branches emerging below 30 cm from ground level and other undesirable branches are pruned off. The selected branches are headed back to ¼ of growth to a bud projecting in the outer direction.
- The leader is also headed back to 30 cm above the last branch.
- During the second dormant pruning, 2-3 well spaced primary branches are selected on the leader.
- On the primary branches selected during previous year, two secondary branches which are growing in outward direction should be selected. The selected primary and secondary branches are headed back to 1/3 or ¼ of the growth.
- The third year training consists of thinning out of unwanted branches and heading back of desirable side branches.
- The central leader should be headed back to a bud or weak shoot, which will develop in the form of a side branch. By fourth year training should be completed.

Pruning:-

- In pruning of bearing tree, certain amount of thinning out and heading back of outward growing laterals is followed.
- Pruning intensity varies with the bearing habit of cultivars and vigour of the tree.
- Pear bear fruits mostly on spurs or sometime on 2 years old wood. Spurs continues to bear for 6 years. The limbs with spurs over 6-8 years old need to be removed in a phased manner.

- The branches and new shoots are headed back to induce new growth. Old planting branches and spurs are thinned out to maintain the vigour of the retained ones.
- The pruning is done during the winter.

Manuring and Fertilizers:-

- The fertilizer dose depend upon the soil fertility, type of soil, kind and age of trees, cultural practices, climate and crop load.
- The dose of manure and fertilizer should be determined on the basis of soil and leaf analysis.
- In an orchard of optimal fertility, nitrogen, phosphorus and potassium are applied in the ratio of 70:35:70g per year age of tree and which is stabilized after 10 years of age (700: 350: 700g N: P: K per tree).
- These application may be supplemented by FYMat the rate of 10 kg per year age of tree with the maximum of 100kg for 10 year old tree.
- N, P and K is applied in the form of calcium ammonium nitrate, single super phosphate and muriate of potash, respectively.
- Since, the response to phosphorus application is poor in phosphorus rich acidic hilly soils, it would be better to apply phosphorus after every 2-3 years or reduce the dose to half annually in such conditions.
- In bearing trees, FYM along with phosphorus and potash should be applied during December-January.
- Nitrogen is applied in the month of February-March in two split doses. Half of N is applied 2-3 weeks before bud break and second half dose one month after flowering, where the irrigation facilities are available.
- The fertilizers should be broadcasted in the tree basins 30 cm away from tree trunk to the canopy drip line and mixed well in the soil. In high rainfall areas with steep slopes having small basins, a band application of nitrogen is preferred.

After care:-

- Immediately after planting, the basins should be prepared around the plants. The level of the soil near the trunk should be kept slightly higher than the level at basin to avoid direct contact of water with the trunk.
- Irrigation should be given immediately after the planting. Second irrigation is given after 2-3 days of first irrigation and subsequent irrigation is given as and when required.
- The young plants are staked after planting to keep their stem straight.
- The trunk of these plants are white washed to avoid sunburn. The surplus shoots from the plants which are not required for primary frame work should be removed. The sprouts on the rootstock and root suckers should also be removed.

Orchard floor management and weed control

- Pear orchard should be managed with clean basin management system. In this system, the basin of trees are kept clean and free from weeds either by hand weeding, use of mulches and weedicides.

- In the initial years of plantation, the intercrops like peas, beans, cabbage, cauliflower and ginger are grown in the vacant area in between the trees but not in basin area.
- In bearing orchard, the basin area of trees should be mulched with 10-15 cm thick dry grass mulch or black alkathene mulch.
- Sod grasses like white clover, red clover, orchard grass and rye grass are grown in the vacant area between the trees.
- The mulches helps to conserve soil moisture and control the weeds in the basin area.
- To control weeds, both pre-emergence and post emergence weedicides are used. Spray of simazine at the rate of 4 kg/ha in March, followed by two sprays of glyphosate @ 800 ml/ha at monthly intervals in July and August have been found very effective to control the weeds in pear orchards.

Use of growth regulators:-

- Paclobutrazole (PP¬333) @ 500 to 1000 ppm restrict the vegetative growth, increased fruit set in pear. Cv. Flamish Beauty.
- GA3 at 10-20 ppm applied 10-14 days after full increased fruit set, fruit retention but it reduced flower bud differentiation in the following year.
- NAA 5-10 ppm control fruit drop in pear.

Irrigation:-

- Most of the pear orchard in India established in rain fed sloppy areas where irrigation facilities are inadequate. During the summer month, there is very less and low rainfall resulting in drought like conditions.
- The soil moisture stress affects the fruit growth and development. Therefore, irrigation is essential in pear orchards. The most critical period of water requirement in pear is April to June months and peak requirement is after fruit set.
- Irrigation applied at 80% of field capacity increased fruit set and yield, tree growth and reduces fruit drop in Flamish Beauty cultivar.
- In lighter soils, more frequent irrigation and heavier application of irrigation water is required. During the summer month, tree should be irrigated at 8-10 days intervals, while after harvesting the irrigation at 20 days intervals is required till October.
- No irrigation is required during winter months as plants under goes dormancy.

Harvesting and Post-harvest management:-

- Fully mature fruits are harvested for fresh consumption, while firm and green fruits for canning and distant markets.
- For local consumptions, fruits are picked slightly later stage because fruits hanging on trees make considerable gain in size weight and overall fruit quality.
- Fruit weight may increase up to 20% in delayed picking, however, it reduces the storage life.
- The ease with which the stem can be separated from the spur by an upward twist is used as an index of maturity.

- Number of days from full bloom to maturity is fairly consistent in a region but vary between regions.
- In Washington (USA), harvest maturity for pear variety varies from 110 to 115 days for Bartlett, 130-135 days for Bosc and 145-150 days for Anjou.
- Besides this, change in surface colour from green to yellow is also taken as a maturity index for harvesting.
- Generally, Bartlett pear is harvested at 19 pound pressure.
- After harvesting, pre-cooling treatments are given to fruits to remove field heat and arrest ripening.
- Pear fruits are picked individually by giving a gentle twist rather than direct pull.
- Harvesting should be done in2-3 picking at 3-4 days intervals rather than single picking
- In India, no specific grading and packing standards have been fixed for pear, but the farmers grade pear fruits according to fruit size as under.

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- Pear is packed in boxes either in offset or in diagonal styles.
- Stems in first row next to packer should point away from packer, Stems in first fruit in other rows point toward packer.
- Pear are either placed in paper folds or wrapped in individual papers. The wooden, plastic or cardboard boxes are generally used for packing pears.
- The fruits are packed in layers. The bottom and top of the boxes is properly cushioned with newspaper or dry grass for avoiding bruising of fruits.
- Pear can be stored for 120-180 days at- 1oC and 85% relative humidity in cold storage.
-