Introduction

Regardless of their place of origin, deciduous fruit and nut species are grown wherever climate, soil, and moisture conditions are suitable. Climate determining the limits of distribution of species, and world climate is regulated by such things as:

1 - Wind direction in relation to large size of water.

2 - The angle of incoming solar rays.

3 - The length of day (latitude).

4 - The amount of carbon dioxide (CO_2) in the atmosphere.

5 - Water vapor and carbon dioxide molecules trap heat waves, which are radiated outward from the sun-warmed surface of the earth.

Deciduous fruits and nuts generally are grown in area where the species are climatically adapted and in desert areas where irrigation has been developed. Temperate deciduous species are confined mostly to the middle latitudes, from about 30° to 50°. Production may extend to lower latitudes at high elevations and to higher latitudes in regions where large size of water have a moderating influence, as in western Europe, where the Atlantic Ocean has a warming effect.

The suitability of a plant species depends in part upon its adaptation to the climate in which men places it. Many kinds of trees are used in areas to which they are not native. Thus, an understanding of the inter-relationship of climate and plant function is necessary to study them properly. **The general climatic requirements for temperate-zone trees and shrubs are as follows:**

1- Winter temperatures must not be so cold that they kill the trees.

2- Winters must be cold enough to give buds adequate chilling to break winter rest period.

3- The growing season (number of frost-free days) must be long enough to mature the crop.

4- Temperature and light during the growing season must be adequate for the species in question to develop fruit of good quality.

The concentration of the commercial production of each species in relatively few areas has occurred **because** the species are best adapted to the climates of those areas: apples are best adapted to the coldest commercial areas; pecans and almonds do best in the warmest areas; other nut crops and peaches are grown in latitudes just north of the pecan belt; pears, cherries, and plums are grown in latitudes just south of the apple belt. **The many exceptions to these generalizations are due to:**

1 - Influences of elevation.

2 - The proximity of large size of water.

3 - The variety of differences within a species.

Orchard Site:

The site of an orchard is very important and can determine the success or failure of the venture. High, slopes, or flat- land sites are good, provided the soil is suitable. The choice should take into account the local effects of temperature inversions in the spring, average spring air drainage, and wind velocity. Because the cold air from radiation cooling at night moves down a slope to the lowest part of a valley, the orchard

should not be planted less than about .015 meters up from the base of a slope.

The summer and winter temperatures at the site are important, but spring temperatures may be the critical factor determining suitability. In some valleys, each 30-metter rise in elevation results in higher nighttime minimums in the spring of three to six degrees Celsius. Such an advantage can save the grower thousands of dollars in frost protection costs over the years. Local obstructions should be considered in choosing sites. The windbreak trees are like reservoirs of cold air and many also compete for soil nutrients, water, and sunlight. Also, windbreaks below orchards prevent good air drainage and may create frost pockets. For these reasons, planting should not be closer than about 25 meters to the windbreak trees.

The direction of a slope is important and should be considered in choosing a site. North-facing slopes retard bud development in the spring; south-facing slops accelerate development. The delay of bloom on north-facing slops can be of value in preventing frost damage. If early maturity of the fruit is of economic importance, however, then south-facing slops should be considered. On cold nights in spring, the warmest slope is one against which a slight wind is blowing. The layer of cold air generated by radiation inversion at the earth's surface will move down a slope, unless a gentle breeze mixes it with the warmer air aloft. Thus slopes in those directions are sometimes planted with windbreaks on one or more sides of an orchard to protect it from strong winds or to deflect cool ocean winds upward if a warmer growing temperature is desired for the specific kind of fruit being grown.

As previously mentioned, it is not desirable to choose a site near the climatic limit (with regard to winter lows, summer temperature, length of growing season, and forth) for that particular crop. Flowers and young fruit are more tender than mature fruit, so **spring frosts are much more hazardous than early fall frosts.**

Seasonal changes:

The temperate deciduous tree or shrub responds to seasonal changes in a number of ways, depending upon the extent to which its internal physiology is affecting by external environment. If the plant is ideally suited to the climate, then each seasonal change evokes such physiological changes in the plant as are necessary to survive that season and anticipate the next.

1- Fall season:

In the beginning, during the later summer season, the deciduous tree must stop growing, drop its leaves, and acquire winter hardiness. The details by which this is accomplished are not all known, but it seems clear that growth inhibitors and growth promoters play important roles. Recent studies indicate that abscisic acid (ABA) is produced in rather large amounts by leaves as the day length begins to shorten in late summer. This substance, being a growth inhibitor, can cause terminal buds to form, if they have not formed earlier; after a short time, enough of the inhibitor will accumulate in the buds to prevent further growth. There is recent evidence that winter rest period is regulated by a balance of inhibitors and promoters rather than simply by the inhibitor level.

2- Winter season:

The state of dormancy just described, in which growth will not occur even when the plant is put in a favorable environment for growth, is termed rest period. Rest is naturally broken by winter chilling, the required amount of which depends upon the species or variety. Many temperate-zone trees have optimum chilling temperatures near 5 °C, but a few have somewhat higher optima. Temperatures much below 0°C seem to be ineffective in breaking rest. Thus, there seem to be enzymatic reactions at above-freezing temperatures that alter the growth promoter / inhibitor balance. Generally, the optimum chilling temperature is (1.5 – 7.2) °C for many temperate-zone species. Subsequently it was noted that warm days in winter could reverse the effects of chilling and de-chilling effects of high temperatures was a more important factor in cancelling chilling requirements

3- Spring season:

Plants adapted to a specific spring climate respond to their environment in such a way that flowering and growth proceed only after the danger of late freezes or killing frosts are over. Some trees whose native habitat is at high elevations or at high latitudes respond unfavorably to the average temperate spring. Often the growing season is short in high elevations and latitudes, and in that circumstance it is adaptive to begin growth at lower temperatures in the spring, so that the crop can mature before the first killing frosts of autumn. But when trees native to that climate are placed in a climate having several frosts during the spring season, both the blossoms and young shoots often are killed because growth starts too early. Examples of such species are apricot and the (Persian) walnut.

4- Summer season:

Young vigorous trees under favorable conditions will grow during the entire summer, stopping only when temperatures drop in early winter. But mature bearing trees usually grow most in early summer, after which terminal buds form and the major growth for the rest of the season is root and fruit growth. The buds, however, can be forced into growth by summer pruning or by the stimulus of fertilizer and nitrogen, until the production of inhibitors and reduction of promoters in the buds, as earlier described, results in the onset of rest.

The deciduous fruit trees are dividing into two main groups:

1- **Temperate Zone fruit trees.**
2- **Tropical and Subtropical fruit trees.**