Pollination Requirements for Various Fruits:

1. Generally, all fruit plants require pollination in order to produce fruit. Two major exceptions are known. They are **apomixes**, which occurs in citrus and **parthenocarpy**, which can occur in Bartlett pears and in bananas.
2. Pollination is the transfer of pollen from the male part (anther) of a flower to the female part (pistil) of the same or another flower of the same sort. The plant that supplies the pollen is called the pollinizer. While the agent, usually a honeybee or other insect, that does the transferring is called a pollinator
3. To be an effective pollinizer a variety must:
   - Have a bloom period which overlaps that of the variety to be pollinated.
   - Have a diploid chromosome make-up.
   - Produce viable pollen.
   - Be grown in close proximity to the variety to be pollinated.
4. Several climatic factors effect pollination:
   - Temperature below 55-60° F reduces bee activity.
   - Temperature above 85-90° F dries stigmatic surface and pollen grain doesn't germinate.
   - Windy weather — it slows bee activity.
   - Rain during anhesis (time stigmatic surface is receptive).
   - Presence of other flowers — the fruit plants generally are poor nectar producers and bees will naturally seek out the best nectar producing flowers.
   - Most insecticides will reduce bee activity — therefore do not spray them during bloom.
5. Pollination Situation — General conditions for several fruit crops. Those fruits listed are self-fertile and will set fruit with their own pollen.

Apple: Cross pollination always needed to produce adequate fruit crop.

Apricot: All varieties are self-fruitful but cross pollination is helpful.

Blackberry: Most are self-fruitful but a few are not and to get a crop require cross pollination.

Blueberry: Fruit set and crop size is improved by cross pollination.

Cherry:

(1) Sweet--most varieties are self-un-fruitful. However there are newer varieties that are self -fruitful such as Lappins, Stella, Whitegold, Sweetheart and Blackgold.

(2) Red tart--the commercial varieties are self-fruitful.

Gooseberry: Most varieties are self-fruitful.

Grape: Most are self-fruitful

Nectarine: Most varieties are self-fruitful; while some of them will require cross pollination.

Peach: All commercial varieties are self-fruitful.

Pear: A few varieties are self-fruitful. But a pollinator will improve crop.

Plum: A wide diversity occurs in the plums:--about half of the varieties are self-fruitful and half are not. To be on the safe side pollinators should be provided.

Quince: All varieties are self-fruitful.

Raspberry: Black--mostly self-fruitful. Purple--self-fruitful. Red--mostly self-fruitful. But crop size is improved by cross pollination.

Strawberry: Varieties are known which produce imperfect flowers but most varieties planted are self-fertile.

Persimmon: American--Self-fruitful Japanese--Three types of flowers are produced on the same tree. It is a good idea to plant at least two varieties to assure good fruit production.

Almond: Must be cross pollinated by another variety.

Black Walnut: Self-fertile but often the pollen is not shed when stigma is receptive. Use at least two varieties or seedlings to assure good crops.

Chestnut, Chinese: All are self-sterile. Two or more varieties or seedling trees are necessary to assure adequate cross pollination.

Pecan: Self-fertile. Wind pollinated.

Pistachio: Must be cross pollinated.

Avocado: Flowers bisexual but function as male and female at different times over a two day period. Some varieties are self- compatible within the variety, others need other varieties that produce compatible pollen. Flowers produce nectar. Honeybees and native bees recommended.

Banana: Female flowers are produced first followed by male ones. Cultivated types do not require pollination. Wild types are pollinated by birds, bats and insects. Flowers produce nectar.

Cocoa: Flowers are bisexual but appear to be self- incompatible. Pollination by very small insects - midges and ants.

Cashew nut: Bisexual and male flowers are produced in the same panicle. Insect pollination is necessary. Flowers produce nectar.

Citrus: Flowers mostly bisexual. Lemon and lime may have some male flowers. Washington navel flowers do not produce pollen and do not require pollination. Honeybees are recommended. Citrus flowers produce nectar.

Coconut: Male and female flowers on each panicle. Most varieties are not self-pollinating as male flowers open before the female ones. Dwarf varieties appear to be self-fruit-setting as flowers overlap. Insects and wind appear to cause cross pollination. Flowers produce nectar.

Coffee: Flowers bisexual and usually self -fertile. Bees may increase yields. Flowers produce nectar.

Date palm: Male and female flowers on separate trees. Cross pollination to a limited extent by wind. As no nectar is produced, bees collecting pollen from male flowers are not attracted to female flowers.

Fig: Varieties produce only female flowers that do not require pollination to set fruit. Smyrna figs require a special pollination variety and cross pollination by a small wasp.

Guava: Flowers bisexual but require insect transfers of pollen. Honeybees are recommended. Flowers produce nectar.

Loquat: Flowers bisexual. Pollination by honeybees recommended. Flowers produce nectar.

Mango: Bisexual and male flowers appear on panicles. Insects recommended for pollination. Ratio of male to bisexual flowers varies greatly within varieties. Flowers produce nectar.

Mulberry: Separate male and female flowers in varying amounts on most trees with some varieties producing only male or female flowers on the tree. Honeybees visit male flowers but pollination by wind is suspected.

Oil palm: Male and female flower clusters on the same plant but are functional at different times. Pollination by insect or wind.

Pecan nut: Male and female flowers on each plant. Wind pollinated. Some varieties are self-fertile, others are not.

Persimmon: Flowers may be bisexual, male or female. Fruit of some varieties set without pollination while flowers of others require a pollination variety planted at regular intervals. Flowers produce nectar.

Pineapple: Flowers bisexual but not self-fertile. No pollination is required for fruit to form. Flowers produce nectar. Humming birds (not found in Australia) are regarded as the main pollinators where pollination is desired.

Strawberry: Flowers are bisexual. Female parts receptive before pollen are released. Honeybees are recommended for adequate fruit size.

Tamarind: Flowers are bisexual and most likely insect pollinated. Flowers produce nectar.

Tea: Flowers are bisexual but often self-sterile. Cross pollination is recommended for seed setting.

What is double fertilization?

Characteristics of insect-pollinated plants:

- Flowers relatively large.
- Petals (or bracts) often brightly coloured.
- Flowers may incorporate nectar guides, or landing pads for larger insects.
- Often scented with nectaries.
- Anthers are smaller and remain inside the flower.
- Small amounts of pollen are produced.
- Pollen is often larger, rough or sticky in texture.
- Stigmas remain inside the flower, flat or lobed.

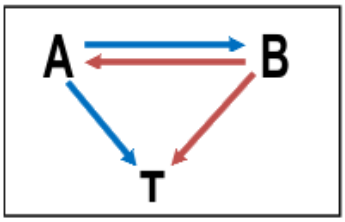
Characteristics of wind-pollinated plants:

- Flowers small and inconspicuous.
- Petals often green.
- Rarely scented, nectaries are absent.
- Anthers loosely attached - the slightest movement initiates pollen release.
- Large amount of pollen produced.
- Pollen grains smooth and light.
- Large feathery stigmas hang outside the plant.

The horticultural importance of pollination:

Apples and pears are divided into a number of 'pollination groups' depending on their time of flowering: some new trees are self-fertile, but generally two trees are needed to produce a good crop by cross-pollination – the tree's own pollen is not recognized and accepted.

Some apple and pear cultivars are triploid – their pollen does not fertilize other apples, so for a successful crop three trees are needed:



Pollen from Apple A fertilizes Triploid Apple T, and Apple B, but pollen from Apple B is also needed to pollinate Apple A.

Triploids have extra sets of chromosomes which make them very robust plants and worth growing despite this disadvantage. Bramley's Seedling and Jonagold are triploid cultivars.

Many fruit rely on insect pollination - commercial orchards are reliant on bees, if the weather is bad and bees won't fly if it is wet, the annual crop will be low.

Wild flowers have sometimes evolved to be dependent on one specific insect pollinator, which can lead to the loss of the plant if the insect becomes extinct.

Cross pollination is the basis of plant breeding to improve size and quality of flowers and fruit - selecting plants with the best characteristics to cross pollinate, then selecting again from their offspring**.**

Bud – A stem's primary growing point. Buds can be either leaf buds (vegetative) or flower buds (reproductive). These buds can be very similar in appearance, but vegetative buds are smaller and pointed in shape, while flower buds tend to be larger in size and flattened or round in shape.

Fruit Tree Buds

Terminal Bud: The fat bud at the branch tip grows the fastest. Bud at the tip of a stem. In many plants, auxin (a plant hormone) released from the terminal bud suppresses development of lateral buds, thereby focusing the growth of the plant upward rather than outward. If the terminal bud is removed during pruning (or natural events) the lateral buds will develop and the stem becomes bushy.

Leaf Bud: Flat triangular buds on the sides of a branch will form leaves. Cut off the stem above it and it will grow.

Flower Bud: flower-forming buds, the first to swell in the spring. On fruits with stone pits, they grow. Alone or beside leaf buds, on Apples and pears, they contain a few leaves.

Spurs: Squat twiglets tipped with fat flower buds. They grow on older branches of apples, pears, plums and apricots. Don't remove them; they produce flowers, then fruit.

Bud Scar: Ring on a branch marking where the terminal bud began growing after the dormant season. Marks the beginning of the present season's growth.

Bud position:

- Axillary bud: born laterally at axils of the leaves
- Apical bud: born terminally on tips of the shoots

Bud Types:

- Simple: This developed to vegetative organs (shoot and leaves) or reproductive organs (flower or inflorescences).
- Mixed: This developed to vegetative and reproductive organs.
- Compound: there are primary, secondary and tertiary buds in the same eye. The primary developed to vegetative and reproductive organs.

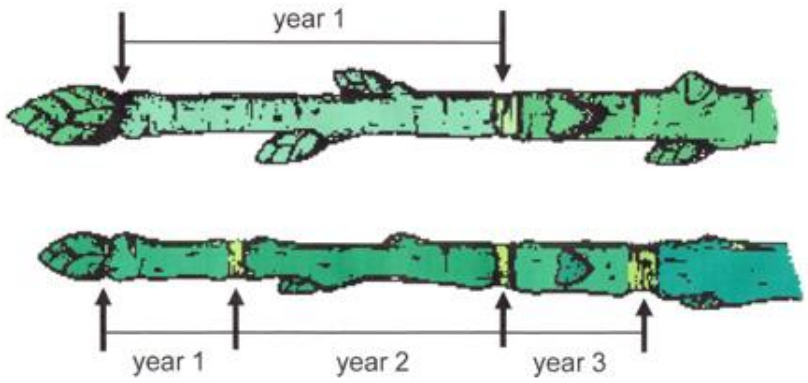
Shoot types:

- One year old shoot (1-year old shoot): shoot grew the previous season.
- Current growth: shoot grow this season.
- Fruit spurs: very short stem upon which flowers and fruit develop.

- **Lateral buds** grow from the leaf axils on the side of a stem.
- **Naked bud** – Bud without a protective bud scale Features of a stem (terminal bud, lateral bud, leaf scar, bundle scar and lenticels) are used in plant identification.

- **Leaf scar** – Mark left on stem where leaf was attached. Often used in woody plant identification.
- **Bundle scar** – Marks left in the leaf scar from the vascular tissue attachment. Used in woody plant identification.

Terminal bud scale scars or **annual growth rings** – Marks left on stem from the terminal bud scales in previous years. Terminal bud scale scars are an external measure of annual growth. Therefore, they are important in assessing plant vigor.



The terminal bud scar is a tool to evaluate tree vigor. Compare how the typical length of grow changes from year to year.

- **Node** – Segment of stem where leaves and lateral buds are attached. Note: Roots do not have nodes.
- **Internode** – Section of a stem between two nodes.

Node (location of buds) and internodes (stem section between buds).

- **Bark** – Protective outer tissue that develops with age. Used in woody plant identification.

Fruit Growth Terms:

- **Bud development** – On temperate-zone woody plants, buds typically develop mid-summer of the previous year. An exception is on summer flowering shrubs, where the buds develop on the current season's wood.
- **Pollination** – Transfer of pollen from the male flower to the stigma of the female flower.
- **Fertilization** – Union of the pollen grain from the male flower with the egg cell in the female flower.
- **Drop** – Fruit drops when not pollinated or fertilized and when too much fruit sets on a tree.
- **Growth** – What we see as growth is primarily cell enlargement as the cells fill with water.