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Unfruitfulness in Fruit Crops: Causes and Remedies

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Abstract

Unfruitfulness is a major problem in many fruit crops result in a huge loss to growers and make fruit cultivation less profitable. Unfruitfulness is due to lack of balance between growth and fruiting and lack of flower and poor fruit set as a result of various internal and external factors in different fruit and their cultivars. The success in fruit growing chiefly depends upon one is, knowledge of the natural habit of growth of the plant, one has to know, when the plant puts out new growth and flowers, when it ceases to grow vegetatively and mature its wood and when it takes rest, the crops or varieties should be chosen on the basis of climate and edaphic factors, with this knowledge, the grower should be able to manipulate his cultural methods and treatment in a way to make the tree fruitful.

Introduction

India is an important fruit growing country in the world and having second position after China with total fruit production about 97.36 million tons during 2017-18 (Horticultural Statistics at a Glance 2018). Unfruitfulness refers to produce abundant blossoms by fruit trees but there is no fruiting at all. It is a major problem in many fruit crops result in a huge loss to growers and make fruit cultivation less profitable. In spite of adequate flowering, low fruit yields in orchards have been experienced because of low initial fruit set and subsequently higher fruit let abscission.

Causes of Unfruitfulness

- Lack of balance between vegetative growth and fruiting.
- Lack of flowering and pollination is a cause of poor fruit set.
- Heavy cropping, leading to inhibition of fruit bud production and poor crop in the following year.
- Sterility also leads to unfruitfulness due to impotence, incompatibility or the abortion of embryo.

External Factors Leading to Unfruitfulness

1. Environment

Many environmental factors like temperature, rainfall, light and wind are responsible for unfruitfulness in fruit plants.

2. Insect Pests and Diseases

Bees and other pollen carrying insects work more effectively in a still atmosphere. The flowers of many fruit trees are subject to the attack of various insect pests and diseases. The result is serious reduction in the fruit set. Mango hopper can attack mango tree at blossom and damage flowers to a great extent. Malformation of flower

panicles in mango, and anthracnose, die-back and fruit-rot in citrus plants cause heavy losses through poor fruit set and blossom drop (Figure 1).



Figure 1: Severe effect of Mango hopper

3. Chemicals and Pesticides

The use of pesticides can kill honey bees, housefly and wasp, therefore reducing pollination. Some pesticides can also be toxic to delicate flowers causing abortion and loss of fruit.

4. Nutrient Supply

Application of fertilizers and manures a few days before blossom emergence is generally believed to favor fruit set. Excess supply of nutrients and water may result in high vegetative growth, poor flowering and poor fruit bearing.

5. Locality

A variety suitable for one locality may not suit for another locality and thus may lead to unfruitfulness.

6. Disturbed Water Relations

Moisture deficit created at a critical stage of flowering and fruit set will result into low fruit set.

7. Cultural Practices

If a fruit orchard is unmanaged the weed population may rob the nutrients from the field which lead to poor fruit set. Pruning also plays an important role in fruitfulness of fruit crops. Pruning induces the fruit set in grape, fig etc. Defective pruning may result in unfruitfulness.

8. Age and Vigour of Plants

Age and vigour of plant is influenced not only the flowering but different part maker of the flower.

Internal Factors Leading to Unfruitfulness

It has been divided into 3 major categories

Evolutionary Tendencies

The evolutionary factors leading to unfruitfulness are:

- Imperfect/defective flowers
- Heterostyly
- Dichogamy
- Protandry
- Protogyny
- Abortive flowers or aborted pistils or ovules

Genetic Influences

Genetic incompatibility is a condition in which the pollens of a variety are incapable of fertilizing the flowers of another variety, or of the same variety. Hybrids of distantly related plants produce self-sterility. These trees may blossom and bear flowers but they may be without pistils and petals. Sometimes the ovules and the pollens of these flowers are fertile in themselves but fail to conjugate e.g. Mango, Sweet cherry, Plum, Pear, Almond and etc.

Physiological Influences

These include premature or delayed pollination. When mature pollen grains are applied to immature pistils, they penetrate the styles and enter the ovules and if the ovules are not ready for fertilization, the flowers soon fall off. In some trees male and female sex organs develop and mature at different periods. This will inhibit the self-pollination of the perfect flowered plants (the perfect flowers are those which have both male and female sex organs). This is known as dichogamy.

Nutritive Condition of Plant

For the better development and satisfactory growth, a balance should be maintained between carbohydrate and nitrogen. This balance of carbohydrates and nitrogen in the plant is called C/N ratio. The building up of a surplus food material (carbohydrate) *i.e.* over and above the requirement of plant's physiological activities and new tissue formation is a pre-requisite to fruitful condition of a tree. This accumulation may occur due to the rapid manufacture of carbohydrates or to their less utilization.

C/N Ratio

On the basis of nutritional status fruit plants are divided into four general groups of C/N ratio-

- **C/NNNN:** Plants of this group make poor growth and bear little or no fruits. These plants contain small quantity of carbohydrates and abnormally large quantity of nitrogen.

- **CC/NNN:** Plants of this class have excess nitrogen with sufficient amount of carbohydrates. Practically no excess carbohydrate is produced except for its growth. This represents the normal growth period for trees too young to bear or for mature trees.

- **CCC/NN:** A fair growth and fruits are produced. The balance of carbohydrates is right for both growth and fruitfulness. This is the nutritional balance preferred by the producers.

- **CCCC/N:** These plants have poor growth and small amount of fruits. They have high build-up of carbohydrates with very little quantity of nitrogen.

It tends to pass from group (1) or (2) to (3) and then to (4). The problems of the grower are to keep the plant in class (3) or CCC/NN balance. This class represents the proper nutritional condition for good fruiting (Singh, 2008).

Mechanical Measures for Controlling Unfruitfulness

a) Root Exposure: About two months prior to blooming, the soil around the trees is removed near the main roots from an area of 60 cm radius. The main roots are exposed and fibrous roots are removed. Water is withheld. The orchard soil is ploughed and the trees are allowed to go dry until the leaves wither and even some of them fall. After some leaves have fallen the exposed roots are covered with a mixture of soil and manure. The root exposure is only practicable in dry weather when the soil moisture and nitrogen can be reduced to the minimum.

b) Root Pruning: It is a well recognized practice for the culture of dwarf fruit trees. Every year the trench is dug a few centimeters further away from the trench of the previous year and the roots are pruned to within 3 to 5 centimeters of the stumps of the former year. After pruning the trench is filled with manures liberally. As a result of this, the circular mass of fibrous roots increases very slowly from year to year and the tree develops a short but stocky and well-ripened shoots (Figure 2).

c) Ringing or girdling: The operation consists of removing a strip of bark from branch or trunk of the tree. This will interrupt the downward movement of the carbohydrates and thus force them to accumulate above the ring. The branches which are 15 to 30 cm thick are ringed by removing a strip of bark about two cm wide all round the base of the branch, a little above the point where it joins another branch. Weak and exhausted trees should not be ringed.

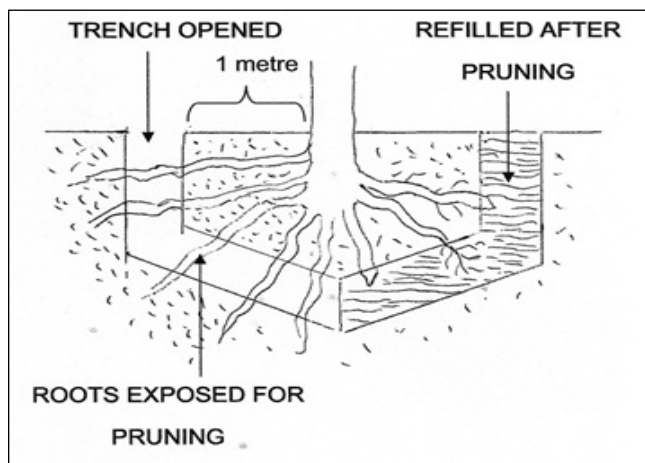


Figure 2: Root pruning

d) Bending: This practice is well accepted in guava plant especially in the erect growing varieties. In guava the flowers are borne on new shoots. In erect growing varieties, the apical buds produce new shoots while the lower buds remain dormant. This practice is not necessary in those guava varieties which naturally spread obliquely and droops giving rise to side branches.

e) Smudging: The tree is smoked heavily and continuously for a week. Thereafter, light fires are made in the morning and evening for about a month or until the trees comes into bloom. The smoking is discontinued as soon as the terminal buds begin to swell. The smudging is applied in mango to produce off-season crop.

Application of Plant Growth Regulators

The unfruitful behaviour of several fruit plants can be overcome by the use of plant growth regulators which may be due to decreased fruit set and abscission at various developmental stages (Table).

Nutrient Supply

Judicious application of manures and fertilizers to the tree at bearing emergence of flower is generally believed to favour fruit set. Although heavy nitrogenous manuring will stimulate vegetative growth, over bearing previous season exhaust the tree and reduce subsequent flowering.

Table 1: Use of plant growth regulator to overcome unfruitfulness in fruit trees

Fruit crop	Growth regulator	Concentration	Response
Litchi	NAA, or GA3	20-30 ppm, 20-50 ppm	Minimize fruit drop
Apple	Cultar (paclobutrazol)	2.8 ai.	Increase spur & reproduction
Mango	NAA or GA3	5 ppm, 10 ppm	Inducing flowering
Pineapple	Ethrel	1000 ppm	Increase fruit set & Flowering

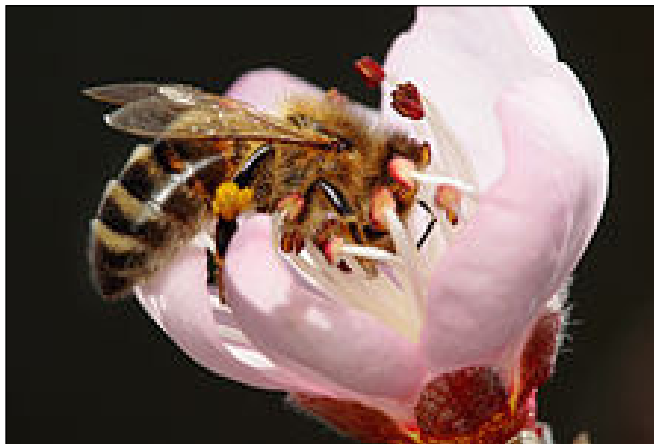


Figure 3: Pollination by bee



Figure 4: Wind breaks

Use of Suitable Rootstocks

Four rootstocks of apple namely: M9, M7, M4 and M1 induced 50% or more bloom in the fifth year in Starking delicious apple and resulted in higher yield efficiency by controlling tree size (Robert and Mellenthin, 1964).

Bees' Culture in Orchard

Bees play a good role in the pollination among all insects.

Planting of Wind Break

Hheavy wind is destroying the fruits and flower so wind break is protected the trees from heavy wind (Figure 3 and 4).

Conclusion

The success in fruit growing chiefly depends upon one is, knowledge of the natural habit of growth of the plant. One has to know, when the plant puts out new growth and flowers, when it ceases to grow vegetatively and mature its wood and when it takes rest. With this knowledge, the grower should be able to manipulate his cultural methods and treatment in a way to make the tree fruitful.

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