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UNFRUITFULNESS IN TROPICAL AND SUB-TROPICAL FRUIT CROPS: CAUSES AND REMEDIES

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Fruit growing is one of the most important and profitable venture in horticulture. The art and science has now developed into one of the most deviled, skillful and intensive forms of land utilization. Today the standard of living of different people of countries is judged by the production and per capita consumption of fruits.

What is unfruitfulness?

Fruitfulness' refers to the state where a plant is not only capable of flowering and bearing fruit, but also takes these fruits to maturity. The inability to do so is known as 'unfruitfulness' or 'barrenness'. Unfruitfulness is one of the leading problems in many fruit crops which results in huge loss to growers thus make fruit cultivation less profitable. Although tree produce adequate flowering, low initial fruit set and subsequently higher fruit-let abscission leads to unfruitfulness.

The causes of unfruitfulness in fruit plants have been broadly classified into two categories

1. Internal factors
2. External factors.

Causes of Unfruitfulness

External Factors: comprises of Environmental factor *viz.* Temperature, Rainfall, Wind, Frost, Hailstorm, Cloudy weather, Light intensity.

- And there are many other factors which affect the unfruitfulness such as Disturbed water relations, Nutrient supply, Rootstocks, Seasonal influence, Spraying fruit plants during flowering, Insect-pest and diseases, Miscellaneous factors.

Internal Factors: Impotence, Incompatibility, Abortion

Classification and Explanation of Unfruitfulness

1. **External factors** :- Environmental factors

Temperature: - It affects the flowering, pollination, fruit set, growth and development of the plants. Every species requires certain optimum range of temperature for growth, flowering and fruit set. Extreme temperature fluctuations and continuous high temperature etc., are injurious to fertilization process.

Example:- The pollen of most of the fruit crops grown in temperate climate, like apple, pear, cherry, plum, walnut, pecan nut etc., germinate freely at a temperature of 50^0F or above, but the fertilization process is practically inhibited if the temperature falls below 40^0F. Of the different climatic factors, temperature appears to have some relation with the variability in the incidence of mango malformation. Higher temperature and dry atmosphere appear to be associated with the increased production of pollen per anther in mango crop. It have indirect influence on fruit set through its effect on the activity of pollen carrying insects. Influence of temperature on fruit set has also been reported in papaya such as sex reversing male plants.

Wind:- It is an important pollination agency in many fruit plants like walnut, pecan nut, oak, hickory, hazelnut, coconut etc. (Anemophilous or Wind pollinated) In insect pollinated fruit plants, wind hinders rather than help in pollination, because pollen carrying insects work more effectively in a still atmosphere. It may also cause the stigmatic fluid to dry prematurely thus affecting the pollen germination.

Frost:-These factors responsible for causing even a regular bear cultivar or a plant in an orchard to become an irregular bearer. Spring frosts are harmful to the plants in temperate climate. It may either kill the sexual organs of a flower or completely destroys the blossoms, thereby influencing the fruit set and ultimately the fruitfulness (mango, banana, guava, litchi, etc.)

Cloudy weather:- It also make unfruitfulness in many fruits plants by making conditions favourable for development and spread of diseases. For example, powdery mildew, a most serious disease of many fruit crops, usually appears immediately following cloudy weather which consequently dry up and drop. It is most destructive during March-April, especially during cloudy weather.

Nutrient supply:- Balanced supply of nutrients is always desirable for realizing optimum fruit production. However, it is often impossible to distinguish clearly between the influence of nutritive conditions within the plant and the conditions without nutrient supply on fruit set, fruitfulness and fertility. Excess supply of manures and fertilizers, though, may result in vigorous growth of the plants, but it affects flowering and fruiting adversely. It is assumed that overfed plants have low C: N ratio, which is not desirable for proper set in fruit plants.

Example: Jonathan apple self sterile on rich land in Victoria (Australia), becomes self-fruitful when grown on land of low productivity. The Hope grape (perfect flower variety) and Muscadine group, produce hermaphrodite flowers only when proper nutrient supply is given. Under inadequate management practices, most of the flowers produced by these varieties are staminate. Some cultivars of strawberry produce perfect flowers and are productive when grown under ordinary management cultural practices, but produce only little pollen for satisfactory crop when grown on rich soils.

Rootstocks:- Rootstocks are known as the backbone of fruit industry, thus many rootstocks are used for inducing various desirable benefits on the scion cultivar. In some instances, stocks exerts considerable influence on flowering and fruit set of the scion cultivar.

Example: Troyer Citrange (Citrus), Dogridge (Grapes), Pusa Srijan (Guava), Khirni (Sapota), etc. Seedlings plants are relatively slow to come into bearing, but it can be hastened by grafting on trees of some kind that are bearing. Thus, rootstocks, directly or indirectly influence the fruitfulness of the plant.

Age and vigour of the plant:- The effects of age and vigour on bearing behavior of fruit plants are well known. The age of the plant has been the factor, apparently associated with the degree or percentage of fruit setting.

Example: Young and vigorous plum trees are known to produce higher proportion of defective pistils than older trees of the same variety. Young vigorous apple trees often fail to set fruits under controlled cross- pollination, whereas old and less vigorous trees of the same variety set freely. The problem of ***coulure*** is very serious disease in the initial years of bearing in Muscat of Alexandria grape, but later it is less serious.

2. **Internal factors**

It is a common observation that some fruit plants even produce abundant flowers, but usually fail to set adequate number of fruits and sometimes they do not produce fruits at all. This failure of fruit set may be due to various reasons, like failure of pollination, sterility or even nutritional deficiency. Stout and his co-workers in 1916 recognized that such type of unfruitfulness is mainly due to the following three internal factors:-

- Sterility from impotence
- Sterility from incompatibility
- Sterility from embryo abortion

Sterility from impotence: - Sterility from impotence arises when one or both the sex organs fail to develop the fruit properly. The impotence may be complete, in which either no flower or no sex organs are formed, or it may be partial, in which either stamens or pistils are abortive.

Sterility from incompatibility : - Sterility from incompatibility arises, when, although the sex organs are completely formed, they fail to function properly. The pollen grains are unable to germinate freely on stigma or stigma is not compatible with the pollen. Thus in incompatibility, the properly developed gametes fail to unite together, although the sex organs are completely formed or functional.

Abortion:- In sterility due to abortion, even after the proper pollination and fertilization, the abortion of the embryo takes place before reaching the maturity. However, sterility associated with the internal factors are based upon the following fundamental processes:

a) Due to evolutionary tendencies:- Due to evolutionary tendencies, cross fertilization must be done in order to maintain the vigor of the species. In these species, self fertilization is difficult.

b) Due to genetic influences:- Unfruitfulness due to incompatibility: Incompatibility between pollen and ovule.

Self incompatibility: Inability of a plant with functional pollen to set fruits or seeds when self pollinated. In mango, self-incompatibility is reported in cvs. Dashehari, Chausa and Langra.

Unfruitfulness due to hybridity: Generally, the wider the cross, greater is the degree of sterility encountered. For example, hybrid between 'Troth Early' peach and 'Wild Goose' plum, which has been named as 'Mule' bears flowers abundantly, but the flowers neither have petals nor pistils. A number of hybrids between *Vitis rotundifolia* and Euvitis group are almost sterile due to hybrid condition.

Inter-fruitfulness and inter-fertility: The ability of two plants or two varieties to set fruits and develop seeds with each other's pollen is called as inter-fruitfulness or inter-fertility.

Example: Smyrna fig, Datepalm, some varieties of Grapes.

Reciprocal Crossings:- In certain fruit species, it has been observed that, if a certain crossing proved sterile, its reciprocal crosses were also sterile and if one variety proved to be incompatible with the other, those two were likewise incompatible with each other. However, in other, a certain set of crossing has been fruitful, but the reciprocal crossing being sterile.

Example:- Tragedy plum (European type) good pollinizer for several varieties of Japanese type, but fail to set fruits when Japanese varieties is used for the Tragedy plum. *Vitis Vinifera, V. labrus*ca and *V. cordifolia* species of grape set fruits freely either with *V. rotundifolia* and *V. munsoniana*, but when *V. rotundifolia* and *V. munsoniana* are used as pollen parents either for *V. Vinifera, V.labrusca* and *V. cordifolia*, they never set fruits freely.

c) Due to physiological factors:-

- Slow growth of the pollen tube (Clementine mandarin)

- Poor pollen germination
- Premature or delayed pollination (Kagzi Kalan)

Remedial measures:-

- ✓ Use of suitable rootstocks
- ✓ Control of frost damage
- ✓ **Proper nutrition:-** Nitrogen application after terminal bud formation led to the development of flower with enhanced embryo sac longevity.
- ✓ Control of pollination
- ✓ Proper used of pollinzers
- ✓ Application of plant growth regulators

Eg. Litchi application of TIBA (2,3,5 Triiodobenzoc acid) and KNO_3 Increase pollen fertility.

Conclusion

It can be concluded that fruiting of a tree is influenced by many factors. So, it is necessary to adopt corrective measures which should begin from planning level and extends to established orchard. Compatible, disease resistant, high yielding rootstocks should be selected. To maintain healthy condition of the tree as well as to get profitable yield it should be supplemented with ample quantity of nutrition. Different varieties should be cultivated and the introduction of effective pollinizer varieties as well as pollinators was essential. Thinning and crop regulation should be practiced to maintain balance between vegetative and reproductive phase. So proper planning in initial establishment of orchard must be done for effective encounter of arising problems that may leads to unfruitfulness.

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