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Crop Regulation

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Crop regulation is an important practice in fruit crops to ensure a consistent and high-quality harvest. The main aim of crop regulation is to force the tree to rest and then produce profuse blossoms and fruits during any one of the two or three cropping seasons. The competition between fruits is one of the principal factors affecting crop regulation. Thus, growth regulation practices are used to force the tree to rest and produce profuse blossoms and fruits during the desired season. The selection of *bahar* at a location is mainly determined by prevailing production constraints like availability of the irrigation water, quality production, and occurrence and extend of the damage by the disease and pests and several market factors. The *bahar* treatment or "winter dormancy break" is a practice that involves manipulating the tree's environment to break dormancy and force early growth, resulting in abundant blooms and high-quality fruit. Crop regulation is the premise for the regular and excellent crop. Few strategies are used to boom production with high-quality through crop regulation. it may be done through manual thinning, chemical thinning, selective harvesting, training, summer season and wintry weather pruning, prevention of pre harvest fruit drop and many others.

Principle of crop regulation

The principle behind crop regulation is to induce flowering and fruiting in the desired season of the year, which contributes to the increased fruit yield and quality.

This concept is based on the fact that most of the crops bear flowers only on new, succulent, vigorously emerging vegetative growths. These new growth flushes can be either on new emergences of lateral bud on older stems or extensions of already established terminals of various size and vigour. Guava, citrus, pomegranate etc. are the best examples that accomplish such features for crop regulation.

Objectives of crop regulation

The objectives of crop regulation are to achieve a better balance between vegetative growth and reproductive growth, to control the timing and duration of fruiting, to improve the quality and size of fruits. Specifically, crop regulation aims to

Manage the vegetative growth of plants: By controlling the vegetative growth of plants, can promote the growth of fruits and other reproductive structures. This helps to improve yield, quality, and uniformity of crops. It can also help to reduce pest and disease incidence by providing better ventilation and sunlight penetration.

Promote consistent fruiting behavior: By regulating the timing and duration of fruiting, farmers can ensure that they have a consistent supply of high-quality fruits throughout the growing season. This involves controlling the number of flowers that develop into fruits, and ensuring that the fruits develop evenly and to a consistent size.

Reduce biennial bearing: Some fruit trees have a tendency to produce a large crop one year, followed by a small crop the next. Crop regulation can help to reduce biennial bearing by controlling tree vigor and promoting consistent flowering and fruiting.
Improve fruit quality: By regulating plant growth and development, farmers can improve the quality of fruits. This includes controlling fruit color, size, and firmness, as well as flavor and aroma.

Methods of crop regulation

There are some methods of crop regulation in fruit crops that are used to manipulate the flowering.
1. **Deblossoming and thinning** : Deblossoming and thinning are critical crop regulation techniques used to optimize fruit quality and yield. Deblossoming is typically done to escape unwanted crop yield in fruit trees. It is often employed in guava, mango, and other important fruit crops to regulate the flowering and increase the size and quality of the fruit. This method can also help preserve the reserves of the shoots that may otherwise be depleted later on in the season. Thinning is typically used when the fruit load on the tree is too high and can lead to small, uneven fruit sizes. Chemicals like NAA, NAD and GA_3 are commonly used as thinning agents in fruit crops like guava. Distinct chemicals triggered deblossoming in rainy season crop and eventually accelerated the winter season crop. Pandey *et al*., (1980) obtained complete deblossoming with 400 ppm of NAA guava. Rathore (1975) noted 96 per cent deblossoming with 100 ppm NAA in guava. Whereas, Kaur (1997) found maximum abscission of flowers by the spray of 0.5 per cent potassium iodide followed by 20 per cent urea. By deblossoming or thinning in April May flowers, the trees become work potential to produce profuse flowering in June- July and fruit harvesting in the month of November to February.
2. Withholding irrigation: In northern plains after harvesting of winter crop of guava withholding irrigation, results in the shedding of flowers and the tree goes to dormancy. In June month apply balance manure and fertilizer with irrigation. After 20-25 days plant produce the profuse flowering and fruit will mature in winter. To induce water stress, withholding irrigation from December to June or until the beginning of monsoon depending on the weather circumstances.
3. Root exposure and root pruning: The plant's roots are exposed to the sun by removing soil up to 7-10 cm from a 40-60 cm radius around the tree trunk, exposing them to the air and sunlight. These induce water stress in the plant, which can lead to the suppression of the rainy season crop and the promotion of a better winter crop. The water is withheld for a month or two earlier than flowering as resulting of water stress, leaves wilted and fall on the ground. Before one month of commence of flowering of preferred bahar, roots are covered with a mixture of soil and FYM and irrigate. Subsequent irrigations are given at suitable intervals. Next irrigations are given at appropriate durations. Therefore, plant produces new vegetative growth, profuse flowering and fruiting. In light sandy and shallow soils, exposure of roots should be avoided and withholding of water for 2-three weeks is sufficient for withering and debilitation of trees. as the availability of water is a trouble in vital India in the course of April-May also, the farmers choose *Mrig bahar* (June) in order that the plant life are forced to rest in April-May also and no water is required for the duration of the length. Plant life placed forth new vegetative increase, observed by means of flowering (July- August) and fruiting for the duration of the approaching season. Root pruning is done by cutting away the outer portions of the roots, which are responsible for taking up water and nutrients from the soil. This reduces the overall root mass and stimulates the plant to focus on fruit production rather than vegetative growth. The timing and severity of the root pruning depend on the specific fruit crop and the desired outcome. In some cases, root pruning is done before transplanting

to encourage the development of a strong root system, while in others; it is done during the dormant season to induce flowering and fruiting.

4. Shoot pruning: When trees are pruned, it causes them to redirect energy and nutrients from vegetative growth towards reproductive growth, which can result in increased fruit production. In guava to avoid *Ambe bhar* terminal portion of shoot up to 20-30cm in length should be clipped during April and avoid excessive pruning. To avoid rainy season crop harvest prune current season growth of spring flush and it has been advocated in northern parts of country. Light pruning increased the number of productive branches and number of fruits per branch of Guava. Pruning the tender's shoots by about 4 to 5 inch during rainy season from their tips reduce the flower drop percentage in guava plants. It was discovered that trimming 25-50 percent of shoots on 20 April, 10 May, or 30 May prevented flowering in the wet season and encouraged guava flowering in the winter.

5. Chemical /plant growth regulators: Babu and Rajput (1982) obtain that February and June flowering was earliest with 2, 4-D at 10 or 20 ppm and latest with GA_3 at 25 or 50 ppm. Duration of flowering was shortest (22 - 24 days) with GA_3 at 50 ppm and longest in the controls (30 - 35 days) whereas Davenport (1983) reported that GA3 applied to Tahiti lime.

6. Nutrition application: For enhancement of winter crop the fertilizer schedule should be modified from April-May to May-June so that it will induce greater vegetative growth that subsequently increases the winter cropping.

7. Bending of shoot: Shoot bending is one of the ways to produce better quality fruits in the off-season of guava. Branch bending was done during May by retaining 10-15 pairs of leaves at apex and removing all the leaves, flowers and developing fruits manually. Branches were bent dawn by applying pressure gradually from proximal to distal end of branch. Studies have shown that bending guava branches at a 45-degree angle during the growth season promotes the growth of new shoots, increases the number of flowers per shoot, and results in a higher fruit yield. When a branch bends, the wood tension of the branch increases and phloem production decreases. So that the photosynthetic product pass slowly from the shoots of bending branch to other parts of tree to maintaining higher C: N ratio and induce greater flowering and fruit set. It stimulates the growth of lateral dormant reproductive buds. As compare to bent branch, upright branch produces fewer flowers and fruits. Profuse flowering and fruiting stimulate by bending, as well as fetching higher returns and regulate flowering by bending of shoots.