



## Crop regulation in pomegranate

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Received : 31.12.2019 ; Revised : 13.04.2020 ; Accepted : 15.04.2020

DOI : 10.22271/09746315.2020.v16.i1.1300

### ABSTRACT

Pomegranate bears different flowering flushes throughout the year if left without any treatment. It primarily shows three distinct flowering seasons i.e. February-March (AmbeBahar), June-July (MrigBahar) and October-November (Hasta Bahar) with the corresponding harvest period during rainy (June – July), winter (November- December) and spring season (February- March), respectively. Secondly, Three types flowers namely male, hermaphrodite and intermediate are borne on new and old branches in pomegranate for once, two or three times in a year that are influenced by germplasm, climate and management practices etc. It gives poor quality and low yield at different times and is not commercially profitable. Good quality and higher yield can be achieved by long-term use of limited cultivation resources at the desired time by crop regulation in pomegranate. In order to escape this, crop regulation in pomegranate is done keeping in mind the availability of irrigation, pest and disease infestation and market prices.

**Keywords:** Crop regulation, flowering, quality and yield.

Pomegranate (*Punicagranatum* L.) is one of the ancient known edible fruit crop and it is capable to grow in different agro-climatic conditions ranging from the tropical to subtropical (Levin, 2006 and Jalikop, 2007). Though, it is native of Iran but it is cultivated extensively in Mediterranean and central Asian countries. It is highly suitable for growing under arid and semiarid regions due to its versatile adaptability, hardy nature, low cost maintenance and high returns. India is the largest producer of pomegranate in the world with production of around 2.79 MT from the area of 0.25 million hectare (Anonymous, 2018-19).

The pomegranate belongs to the Punicaceae family and is rich sources of nutrients and phytochemical compounds. Pomegranates are mainly consumed as fresh and processed products like juice, beverages, jam, jelly etc. Due to its multipurpose medicinal uses, it is also known as “Dadima” in *Ayurveda* (Paranjpe, 2001) and as “Super fruit” in the global functional food industry (Martins *et al.*, 2006). Numerous studies reported that phytochemical have been identified from many parts of the pomegranate tree and from peel, juice and seeds parts of pomegranate fruit (Elfalleh *et al.*, 2011). Pomegranate fruits peel is an inedible part obtained during processing of pomegranate juice. Pomegranate peel is a rich source of tannins, flavonoids and other phenolic compounds (Li *et al.*, 2006).

Pomegranate flowers continuously throughout the year under tropical climate. In subtropical central and western India, there are three distinct seasons for flowering but yield and quality is not so well in all crop harvest. It is very vital to identify the flowering and

fruiting behaviors of crops and which bahar will give good crop with considering all the factors related with a particular bahar.

### Objectives of crop regulation

The main objective of crop regulation is to force the tree for rest and produce prolific blossom and fruits during any one of the two or three flushes. Besides, some objectives are as under:

1. To obtain suitable crop at a desired season
2. To regulate a uniform and good quality of fruits
3. To maximize the production as well as profit to the grower.
4. To reduce cost of cultivation because uninterrupted continuous blossom would produce light crops over the whole year and require a high cost for the monitoring and marketing.

Pomegranate has three main flowering and fruiting seasons or bahars, ambebahar (spring season flowering), mrigbahar (June-July flowering) and hastabahar (October- November flowering). The plants under such conditions may continue bearing flowers and bear small crop irregularly at different period of the year, which may not be desirable commercially. For commercial production only one crop is desirable in a year. Selection of bahar depends upon location and some prevailing production constraints like availability of the irrigation water, fruit quality, market prices and occurrence and infestations of the diseases and pests. Water availability is vast concern in arid and semi-arid regions during summer season for pomegranate grower. They always avoid taking ambebahar crop and regulate this crop into

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*mrigbahar* with the onset of monsoon and crop is harvested during winter. Some farmers prefer *hastabahar* with less availability of water.

### **Principles of flower regulation**

The basic principle of crop regulation is to manipulate the natural flowering of the pomegranate plant in desired season that contributes to increased fruit yield, quality and profitability. It is useful for best and long-term use of resources with high yield of quality fruits. Initiation of flowering and regulation of flowering are affected by the environmental and genetic factors. Pomegranate produces blossoms irregularly from February to October in the arid and semi-arid regions. To avoid this, crop regulation is done at specific times in pomegranate by a series of systems. In country, all commercially grown varieties are very sensitive to diseases and pests, especially Bacterial Leaf Blight, Scorching, Nematode, Termite and Mite *etc.* Therefore, availability of irrigation water, climate, pest and disease infestation and market demand are the major issues for flower regulation in pomegranate. Indian varieties are mostly produce flowers throughout the year.

### **Methods of crop regulation in pomegranate**

Flowering is mostly affected by the many factors *i.e.* withholding of irrigation (lack of moisture), defoliants, plant growth hormones, nutrients status and canopy management (training and pruning) *etc.* Withholding of irrigation is done one to two month before taking desired *bahar* in pomegranate. Subsequently, light pruning and then foliar spraying of ethrels defoliant are practiced to shed off leaves. The top soil around the tree equal to the leaf canopy was dug up to 30 cm depth. The manure and fertilizers are applied into the soil which is then leveled. Light irrigation is done after application of recommended dose of manure and fertilizers. The better flowering, good floral sex ratio, higher fruit setting and ultimately higher quality yield of fruits may be taken in year at a desired season by these treatments. There must be good growth and development of pomegranate plants up to first two years. *Bahar* treatment must be started from third year onwards for taking better quality fruit production. *Bahar* treatment is done in the following ways in pomegranate.

#### **1. Flowering due to the stress of water scarcity**

The main principle of withholding of irrigation is to provide rest to the plant. It results in increasing of number of flowers and accumulates large amounts of food to increase growth in the coming season. Withholding of irrigation is done for one month in light sandy soils and for one and half month in loamy soils. The ideal condition

for crop regulation is practiced when pomegranate plants get the desired leaf fall (50 to 70 %). Under water stress conditions, plants produce osmatin, proline and arginine protein. Proteogenic amino acids like prolines *etc.* accumulates under stress and non-stress conditions as a beneficial solute in plants and provide the high capacity for tolerance to stress condition and these amino acids helps in stimulates the flowering in the plants under water stress condition. Therefore, plants produce more flowering, good sex ratio and more fruits.

#### **2. Use of chemicals for flowering**

In recent times, the foliar spray of ethrel (1-2 ml per litre) is extensively practiced for crop regulation in pomegranate crop. Ethrel hormone stimulates the enzymes *i.e.* cellulase and polygalacturonase for cell smelting. This condition is considered good for achieving more flowering, good sex ratio and high yield.

#### **3. Flower regulation by cultural practices**

Canopy management practices *viz.* training, pruning and nutrients management (carbon nitrogen ratio) are best for achieving higher flowering percent and quality fruit production in pomegranate. Pomegranate may be trained as multi-stemmed tree or single stemmed tree. Generally 3 to 4 stems are retained to avoid damage due to stem borer and remaining shoots are removed, this will give a bush form look to the tree. At initial years, pomegranate plants are generally trained by open centre system. Light pruning is done after withholding of irrigation and 15 -20 days before starting of new *bahar*. Use of 10 per cent Bordeaux paste is done on pruned parts of plants to avoid fungal attack.

In dry areas *mrigbahar* is regulated for qualitative crop production. For regulating of crop in dry areas, withholding of irrigation is done in April-May. Subsequently light pruning and spraying the mixer of 1000-2000 ppm ethrel and 0.5 per cent diammonium phosphate is followed. Flowering takes place in June - July. This gives good quality fruits in November-December. For getting good quality yield 60 to 80 fruits should be retained on single plant.

#### **4. Insect-pests and diseases management**

Crop regulation is good system to manage the insect-pests and diseases. Use of defoliant induces leaf falls from 50 to 100 per cent depending upon concentration of defoliant used for crop regulation. The fallen leaves should be collected and burnt so that insect-pests and diseases may be destroyed up to some extent. Therefore, it helps to escape the crop from outbreak of insect-pests and diseases and also reduce usage of insecticides.

**Table 1: Advantages and disadvantages of different bahars in pomegranate**

Bahar	Advantages	Disadvantages
<i>Ambebahar</i> (February-March)	i. Attractive fruit colour ii. Fruits suitable for export iii. Low incidence of insect pests and diseases	i. More required irrigation facilities. ii. Low production
<i>Mrigbahar</i> (June-July)	i. Less requirement of irrigation. ii. Suitable for arid regions. iii. Most suitable environment.	i. Flowering and development of fruit coincides with the weather conditions ii. Not suitable where more disease infestation
<i>Hastabahar</i> (October-November)	i. Attractive fruits with dark brown colour ii. High prices due to limited availability	i. Low flowers and fruits production

### 5. Physiological disorder

In dry areas fruit cracking, sun scorching, browning of arils *etc.* are major physiological disorders in pomegranate. Crop regulation is an appropriate practice for avoiding these disorders. For control of fruit cracking, selecting a suitable bahar along with foliar spray of gibberellic acid (20ppm) and boron (0.2%) are followed. Sun scorching in the plants and fruits should be avoided with use of 30-35 per cent shade net and butter paper, respectively. Harvesting of pomegranate fruits must be done at appropriate time to avoid the browning of arils.

#### Floristic and biological factors affected by the crop regulation in pomegranate

- Selection of any bahar : *Ambe*, *Mrig* and *Hasta bahar*
- Time and duration of the flower initiation: One to three times and for how long
- Types of flowers : Three types of male, bisexual and intermediate flowers
- Nature of the flowers initiation: Flowering on both new and old branches
- Flower sex ratio : Crop regulation increase number of hermaphrodite flowers
- Pollination : Low or high temperature at flowering time affects pollination
- Production of fruits : Crop regulation reduces the fruit dropping and increases the yield.

Crop regulation is an effective and advanced management practice for obtaining higher yield with good quality fruit production. Availability of irrigation, pests and diseases infestation, market demand, use of germplasm and climatic conditions are play major role in crop regulation. It requires an intensive care and work for its operation. In addition to this, crop regulation is more effective to control of physiological disorders *i.e.* fruit cracking, sun scorching, browning of arils.

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