



Role of Weather Parameters on Cultivation of Indian Fruits: A Climatic View

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Article ID: 105

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1. Introduction

Horticulture sector has become one of the major drivers of economic growth as it is more remunerative than the agricultural sector (food grains mainly). Department of Agriculture, Cooperation and Farmers Welfare reported that the total horticulture production during 2018-19 in the country was estimated to be 313.85 million tonnes which is 0.69% higher than the horticulture production of 311.71 million tonnes in 2017-18. The area under horticulture crops has also increased to 25.49 million hectares in 2018-19 from 25.43 million hectares in 2017-18 (DAC&FW).

Global scale food and nutritional insecurity were caused by changing weather and climatic conditions in the 21st century due to food demand by increasing population (Kang *et al.*, 2009). Several studies have indicated that probability of occurring extreme weather events drastically would reduce food production in entire world. Increasing magnitude, intensity and frequency of extreme precipitation tends to reduce the crop yield which was confirmed by several research works (Min *et al.*, 2011).

2. Influence of various weather elements on fruit crops

2.1. Temperature

Temperature plays vital role in fruit production. Optimum temperature at atmospheric level influences different activities in plants like growth and development, respiration, photosynthesis, transpiration, uptake of nutrients and water and reproduction (Such as pollen viability, blossom fertilization fruit set etc.), carbohydrate and growth regulators balance, rate of maturation and senescence, and quality, yield and shelf life of the edible products. Both high and low temperatures are detrimental to fruit production where high temperature affects the growth functions, and low temperature stops physiological activities of the plant.

In warm winter areas, temperate fruits like apple, apricot, pear and plums are not considered suitable for tropical or subtropical regions because fruit trees fail to complete their physiological rest period due to insufficient chilling temperature, as a consequence of these bud remains dormant, and leave as well as blossoms do not appear on the trees in the following spring. Mango, chiku, papaya and banana are successfully grown in high temperature regions making them wonder fruits of tropical condition. Because of these, the minimum temperature should be at tolerable levels for tropical and sub-tropical fruits.



Optimum temperature range for most of the fruit tree crops are given below in temperature ranges.

| | |
|---------|------------------|
| Minimum | 4.5°C to 6.5°C |
| Optimum | 24°C to 27°C |
| Maximum | 29.5°C to 45.4°C |

2.2. Humidity (moisture) and frost

Amount of moisture needed to produce fruits is decided by the atmospheric humidity. In tropics hot, dry weather conditions accelerate lot of transpiration whereas, in temperate region, even though it is hot, the level is comparatively much smaller, hence, this region of humid belt need less amount of water for irrigation. High humidity combined with high temperature also promotes rapid growth which tends to boost up the yield as well as pests and diseases outbreak.

2.3. Rainfall

Rainfall is a vital factor for horticultural crops and rainfall pattern decides the selection of crops in any area of garden or orchard during establishment. Rains at the time of flowering is not suitable, because most of tropical fruit crops are sensitive.

3. Case Study – I

Swati *et al.* (2019) conducted a scientific investigation on influence of regional weather changes on major fruit production and productivity over Navsari district of Gujarat. Findings of their study revealed that the production and productivity of banana, mango, sapota and papaya have slight negative correlation with mean annual temperature (MAT) *i.e.*, > -50% (except the productivity of banana) whereas very weak negative and non-significant correlation with total annual Rainfall (TAR). With respect to productivity, correlation value was found to be ranged between -34 to -53% and -0.7 to -62% for both MAT and TAR, respectively (Table 1).

Table 1. Correlation of production, productivity with mean annual temperature and total annual rainfall for major fruits of the Navsari

| Crop | Mean Annual Temperature | | Total Annual Rainfall | |
|--------|-------------------------|--------------|-----------------------|--------------|
| | Production | Productivity | Production | Productivity |
| Banana | -50% | 33% | -37% | -3.9% |
| Mango | -53% | -61% | -34% | -0.7% |
| Sapota | -50% | -62% | -48% | -37% |
| Papaya | -52% | -56% | -49% | -53% |



4. Case Study – 2

DisketDolkar *et al.* (2018) conducted an experiment on impact of climatic factors on growth and quality of Kinnow mandarin. During the study period, plant height was positively influenced by optimum relative humidity whereas the stock girth and scion girth were positively favoured by both temperature gradients and relative humidity at a period from maximum fruit set to fruit harvest stage. Likely the maximum, minimum temperature and relative humidity did positively influence the plant growth and fruit quality. Acidity content of juice had a positive relation with the maximum and minimum temperature and evapotranspiration during ripening stage.

5. Case Study – 3

Abdus Sattar, a climate change expert at the Rajendra Prasad Central Agricultural University (RPCAU) at Pusa indicated that litchi has been affected by climatic variations more than any other summer fruit in India because litchi requires low humidity and occasional rain for proper growth and taste. In the recent years, trend of increasing rainfall and thunderstorm in the month of May affects the growth of litchi. He noticed that during earlier decades months of April and May, used to be very dry because of very low rainfall. Prevalence of dry westerly winds would mean low humidity during daytime. Litchi is very sensitive to temperature fluctuations, rainfall and humidity, thus, a delay in maturity period by 7-8 days when low temperature has prevailed for longer periods (Mohd Imran Khan, 2018).

Conclusion

From this paper, it can be concluded that the area, production and quality of fruit trees have been influenced by many weather parameters. Mostly plant growth and production correlate with major weather parameters like temperature, rainfall, windspeed and humidity. Hence, the study reveals that climate change and variability influence the fruit production and productivity both positive and negatively. The study needs to be conducted on a large scale and might be improvised when other climatic factors are taken inconsideration.

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