Impact of Climate Change on Horticulture Sector of District Shimla, Himachal Pradesh

A Brief Introduction

Introduction

Horticulture is the science, art, as well as business of cultivating vegetables, fruits, flowers, ornamental plants, and herbs. The horticulture sector in India has emerged as an important sector for the diversification of agriculture. At present, this sector contributes to the country's economy in a great manner through increased productivity, enhancing exports apart from providing household nutritional security and precious raw material for various processing and ancillary industries.

Key features of Horticulture are-

- ⇒ The horticulture sector in India renders more opportunities in the sphere of employment across primary, secondary as well tertiary sectors of agriculture.
- ⇒ This sector has become one of the major drivers of growth as it is more remunerative than the agriculture sector (food grains mainly).
- ⇒ Water utilization is very low, minimizing the risk of crop failure and it can be done on smaller farms.
- ⇒ The horticulture sector enables the population to eat a diverse and balanced diet for a healthy lifestyle.

Impact of Climate Change on Horticulture Sector

Climate Change, defined as climate variability induced by direct or indirect anthropogenic activities in addition to natural climate variations causing alterations in composition of global atmosphere observed over comparable time periods has observed manifestation in the horticulture sector through two parameters-erratic precipitation (rains and snowfall), and uncertain spells of temperature rise that has unpredictable impact on fruit crop productivity.

Climatic Variations

Higher variability in temperature and rainfall parameters observed during pre flowering period as compared to flowering and fruit setting period from 1990 to 2016.

Flowering period

Maximum temperature increased by *0.02*℃ per year from 1990 to 2016.

Pre-Flowering period

Maximum temperature and Diurnal temperature increased by *0.01*℃ per year from 1990 to 2016.

Fruit-setting period

Maximum temperature increased by *0.04*℃ per year from 1990-2016.

Higher anomalies in maximum and minimum temperature reported during all three phonological stages indicating a warming trend.

Climate Change Impact and Phenological Stages

Phenological Stage	Climate Change Impact
Pre-flowering	• Flowering bud initiation is extremely sensitive to temperature variations from extreme high to low –growing season temperatures.
Flowering	• Soil moisture variations are driven by changing temperatures also decide the flowering time and seed germination • Moderate winds during the flowering stage enable better fruit setting; however harsh winds accompanied by heavy rains at low temperatures hinder appropriate flowering
Fruit Setting	• Orchards deep-seated in the valley have better fruit setting as compared to plantations on windward sides • Spring frost can either destroy flower sexual organ or completely damage blossom with impacts on fruit-set
Fruit Development	• Hailstorms anytime during the fruit development stage are catastrophic. • Excessive rain and fog near maturity lead to poor fruit quality. • Extreme and sudden hailstorms lead to spotting and fruit drop.

Fruit Crop Productivity

Acreage under apple cultivation increased from 18,887 ha in 1980 to 39,728 ha in 2015 (an increase of 110.34 percent) and the production surged from 73,521 MT to 48, 2388 MT (1980-2015). Whereas the productivity of apple increased from 3.89 percent to 12.14 percent (1980-2015). Nonetheless, the productivity of Apple did not register any statistically significant variations, with minimum productivity of 2.50 t ha^{-1} in 1994 and a maximum of 17.4 t ha^{-1} in 2010 thereafter declining to 12.14 t ha^{-1} by 2016.

For other temperate fruits, the composite acreage increased by 58.25 percent (2,494 ha in 1980 to 3,947 ha in 2015), the total production surged by 9.90 percent (811 MT in 1980 to 8,187 MT in 2015), and productivity increased from 0.33 to 2.07 t ha^{-1} in past 35 years.

The composite area under dry fruits i.e., Almond, Walnut, Picanut, increased by 153.76 percent from 718 ha to 2041 ha till 2001, thereafter declined to 1822 ha by the end of 2015. While, productivity showed an increasing trend in moving from 0.22 t ha^{-1} in 2015.

Climate Crop Juxtaposition

Among all the fruits crop, **Apple** was found to be most vulnerable to the impact of climatic variability at all three phonological stages while **Pear** was least vulnerable. A highly significant correlation between climate variability and productivity was observed during the pre-flowering stages, with a predominant impact on the productivity of the Apple crop.

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