



Impact of Climate Change on Fruit Crop Productivity and Farmers' Income in Ahilyanagar District

Dhokchaule C. G.¹ & Dr Jadhav K. D.²

^{1,2}Post Graduate Economics Research Center, Sangamner Nagarpalika Arts, D.J.Malpani Commerce and B.N.Sarda Science College, Sangamner, Maharashtra, India

Corresponding Author – Dhokchaule C. G.

DOI - 10.5281/zenodo.20474489

Abstract:

Fruit cultivation in Ahilyanagar District, Maharashtra, has long been a cornerstone of rural livelihoods, with pomegranate, grape, mango, and banana forming the backbone of the district's horticultural economy. Over the past two decades, however, farmers in this semi-arid region have witnessed a troubling shift—seasons that no longer follow familiar rhythms, rains that arrive too early or too late, and summers that push far beyond what the land and the crops can bear. This study examines the impact of these climatic changes on fruit crop productivity and the income of farming households in Ahilyanagar District. Primary data were collected through structured interviews with 120 fruit farmers across six talukas using stratified random sampling, and 20 years of meteorological and crop production data were drawn from the India Meteorological Department (IMD) and the Maharashtra State Horticulture Department. Analytical methods include descriptive statistics, Mann-Kendall trend tests, correlation analysis, and comparative income assessment. Findings reveal a decline of approximately 20 percent in pomegranate and grape yields between 2003–2010 and 2017–2023, accompanied by a fall of over 56 percent in real net farm income for pomegranate growers. Rising costs of pesticides, irrigation, and labor compound the income erosion caused by yield decline. The study further documents adaptation strategies being adopted by progressive farmers and draws on district-specific literature to contextualize findings within broader regional trends. Policy recommendations focus on expanding micro-irrigation, reforming crop insurance delivery, promoting climate-resilient varieties, and strengthening agro-meteorological advisory services tailored to the fruit-growing communities of Ahilyanagar.

Keywords: Climate Change, Fruit Crop Productivity, Farmers' Income, Ahilyanagar District, Maharashtra, Horticulture, Adaptation Strategies, Semi-Arid Agriculture

Introduction:

Agriculture is not merely an economic activity in rural India—it is a way of life, a cultural identity, and for millions of farming families, the only source of sustenance. Horticulture, and particularly fruit cultivation, has emerged over the past three decades as one of the more rewarding branches of farming, offering higher per-hectare returns compared to traditional food grain crops. Maharashtra, which ranks among India's leading horticultural states, has invested considerably in expanding fruit

cultivation, and Ahilyanagar District has grown into one of its most productive horticultural belts. Known for its pomegranate orchards, grape vineyards, and mango groves, the district supports the livelihoods of hundreds of thousands of farming households whose fortunes are tied directly to the health of their orchards.

Yet something has been changing, steadily and unmistakably, over the past two decades. Farmers who once had a reliable understanding of when to plant, when to irrigate, and when to expect rain now find themselves

navigating an increasingly unpredictable agricultural calendar. Temperatures during the critical March-to-May fruiting period have been climbing. Monsoons that once arrived in a measured sequence now either flood fields in concentrated bursts or fail to appear when crops need them most. Hailstorms—rare events in the memory of older farmers—have become alarmingly frequent in recent years, devastating orchards overnight. These are not isolated complaints; they represent a pattern of climate change that is quietly eroding the foundations of fruit farming in Ahilyanagar.

The consequences extend well beyond the field. When pomegranate yields fall because of bacterial blight triggered by erratic humidity, or when a late-January rain cracks and ruins a ready grape harvest, the loss is borne entirely by the farmer—often a smallholder already stretched thin by the high capital demands of horticulture. The resulting income shock drives indebtedness, reduces household welfare, and in severe cases, forces families to make painful choices about food, children's education, and the future of the farm itself.

Understanding this nexus between climate change and fruit farming income in Ahilyanagar is both urgent and necessary. While a body of literature has established the broad relationship between climate variability and agricultural productivity in India, district-level empirical studies that link meteorological trends, horticultural yield data, and farm income specifically for semi-arid inland Maharashtra remain scarce. This study addresses that gap. It seeks to trace how observable climatic changes have translated into measurable economic consequences for fruit growers in Ahilyanagar, and to identify what farmers are doing—and what policymakers must do—to navigate this challenging new reality.

The study pursues four specific aims: (i) to document and analyze climate trends in Ahilyanagar District over the period 2003–2023; (ii) to quantify the impact of these trends on yields of major fruit crops; (iii) to assess the resulting changes in farmers' income; and (iv) to evaluate existing adaptation strategies and recommend targeted policy interventions.

Study Area:

Ahilyanagar District occupies a prominent position in the geography of northern Maharashtra, lying between latitudes 18°13' N and 19°32' N, and longitudes 73°09' E and 75°05' E. With a total area of approximately 17,048 square kilometers, the district is divided into 14 talukas and shares its borders with Nashik to the north, Pune to the south, and Chhatrapati Sambhajnagar to the east. The rivers Pravara, Mula, and Sina traverse the district, and their basins support the agricultural activity that defines rural life here.

The climate is predominantly semi-arid. Mean annual rainfall ranges from 550 to 650 mm, concentrated in the southwest monsoon months of June through September. Summers are intense, with maximum temperatures regularly touching 42–43°C, while winters are mild with minimum temperatures around 10°C. The district's agro-ecological diversity—from the Sahyadri foothills in the west to the drier eastern plains—supports a variety of fruit crops across its different talukas. Pomegranate dominates in Sangamner, Akole, and Rahuri; grapes are cultivated primarily in Shirampur and Rahata; while mango and banana find favorable conditions in the more moisture-retentive lower river valley zones.

Fruit cultivation in Ahilyanagar is not a marginal activity—it is central to the district's agricultural economy. Nearly 2.5 lakh farming households derive their primary income from horticulture, and horticultural crops occupy close

to 35 percent of the total gross irrigated area. The district is among Maharashtra's top pomegranate producers and exports a significant share of its output to domestic and international markets, making climate-related disruptions here a matter of considerable economic consequence.

Review of Literature:

The scientific community has built a substantial body of evidence linking climate change to agricultural productivity losses globally. Lobell et al. (2011) demonstrated that climate trends reduced global maize and wheat yields by around 5 percent over the period 1980–2008, with the most severe impacts in regions already prone to heat and moisture stress. For the Indian context, Kumar and Parikh (2001) offered an early but influential econometric assessment showing that rising temperatures would adversely affect farm net revenues, particularly in semi-arid agricultural zones where adaptation options are limited.

The broader dimensions of climate-crop interactions across India were examined by BIRTHAL et al. (2014), who found significant negative impacts on productivity for rain-dependent crops and underscored the vulnerability of regions with erratic precipitation patterns. Tripathi et al. (2016) extended this perspective globally, offering a comprehensive review of how climate change is disrupting major food sources and calling urgently for region-specific adaptation research as a policy imperative.

Research specific to horticulture and climate change has grown more refined in recent years. The comprehensive review by Deori et al. (2024) examined the impact of climate change on fruit yield and quality across modern horticultural systems and highlighted the complex interplay between temperature anomalies, water availability, and post-harvest quality

deterioration—concerns directly relevant to the fruit crops of Ahilyanagar. Singh et al. (2013) documented the vulnerability of mango orchards to heat stress during flowering, finding a direct correlation between temperature anomalies and fruit set failure. Panse et al. (2019) showed how changing rainfall patterns in the Nashik region of Maharashtra adversely affected grape quality, a finding of direct comparative relevance for the Shrirampur belt of Ahilyanagar.

From the perspective of Ahilyanagar District specifically, the work of Sasane (2016) on drought severity assessment for the district provided important baseline evidence of intensifying climatic stress. Bansod and Pawar (2018) conducted a systematic trend analysis of rainfall and temperature data for the district, confirming a rising temperature trend alongside increased monsoon variability—findings that this study draws upon and updates. ICAR-NRCP (2020) documented the growing incidence of bacterial blight in pomegranate under altered humidity conditions, with crop losses ranging from 30 to 60 percent in severe years. Thorat et al. (2021) assessed the socio-economic vulnerability of pomegranate farmers in Ahmednagar to drought, finding that smaller landholders with limited irrigation access were disproportionately affected.

Taken together, these studies establish a strong contextual foundation for the present research while revealing a clear gap: no study has yet integrated meteorological trend data, crop-wise yield analysis, and farm income assessment specifically for the fruit farming communities of Ahilyanagar District. This study is designed to address that gap.

Objectives of the Study:

The present study is guided by the following specific objectives:

1. To analyze the trends in temperature and rainfall in Ahilyanagar District over the period 2003–2023;
2. To assess the impact of observed climatic changes on yield levels of major fruit crops—pomegranate, grape, mango, banana, and sweet lime;
3. To estimate the change in net farm income of fruit growers attributable to climate-related productivity losses and associated cost increases;
4. (To identify the adaptation strategies currently adopted by farmers and to recommend policy measures for strengthening climate-resilient horticulture in Ahilyanagar District.

Research Methodology:

1. Data Sources and Sampling: This study employs a mixed-method design, combining field-level primary data with long-run secondary data. Primary data were collected during October–December 2023 through structured personal interview schedules administered to 120 fruit farmers across six talukas—Sangamner, Rahuri, Shirampur, Akole, Pathardi, and Newasa—selected through stratified random sampling based on principal fruit crop cultivated and landholding size category. The interview schedule captured crop-wise area and yield data, income and expenditure details, climate-related losses experienced over the past five seasons, and adaptation measures adopted by the household.

Secondary data on rainfall, temperature, and relative humidity were obtained from the India Meteorological Department, Pune (IMD, 2023). Crop production, area, and yield statistics were sourced from Maharashtra State Horticulture Department (2022) annual reports and the Government of Maharashtra's Directorate of Economics and Statistics (Government of Maharashtra, 2023). Market price data for the

principal fruit crops were collected from the records of the Agricultural Produce Market Committees (APMCs) at Rahuri and Sangamner. All monetary values were deflated to constant 2015–16 prices using the Consumer Price Index for agricultural laborers to ensure inter-temporal comparability.

2. Analytical Methods: Meteorological trend analysis was conducted using the Mann-Kendall non-parametric test, which is well-suited to detecting monotonic trends in time series data without requiring the assumption of normality and is robust to outliers—important qualities when working with rainfall data characterized by high inter-annual variability. Crop yield trend analysis was performed using ordinary least squares (OLS) regression with year as the explanatory variable. Farm income comparison was made between an early reference period (2003–2010) and a recent period (2017–2023). Pearson correlation coefficients were calculated to examine the statistical association between selected climatic parameters and crop yield indices. Primary survey data were processed and analyzed using SPSS Version 25.0.

Results and Discussion:

1. Climate Trends in Ahilyanagar District (2003–2023): The meteorological record for Ahilyanagar over the past two decades tells a story that farmers on the ground already know from lived experience. Building on the trend analysis pioneered by Bansod and Pawar (2018) and the drought severity assessments of Sasane (2016), the present analysis of IMD data confirms that warming and climatic disruption in the district have continued and intensified through the second decade of the study period.

Mean annual maximum temperature has risen by approximately 0.8°C over 20 years. The increase is most pronounced during the pre-monsoon months of March through May—

precisely the period during which critical phenological processes such as fruit development in pomegranate and grape maturation take place. The number of extreme heat days with maximum temperature exceeding 40°C increased from an average of 12 days per year in 2003–2010 to 21 days per year in 2017–2023. Minimum temperatures have also trended upward, with implications for crop water demand and pest activity during cooler months.

On the rainfall side, the picture is one of increasing variability rather than a simple linear decline. Total monsoon rainfall shows a moderate declining trend, falling from a period average of

628 mm in 2003–2010 to 574 mm in 2017–2023. More consequentially, the character of rainfall has changed: the number of rainy days has fallen from 52 to 41 per year on average, while the frequency of heavy rainfall events exceeding 65 mm per day has risen from 4.1 to 6.8 events per year. Rainfall is becoming concentrated in fewer, more intense episodes—a pattern that brings flooding and fungal disease risk when it rains, and prolonged moisture stress between events. Drought occurrence frequency in the district has risen from 22 percent of years in the early period to 38 percent in the recent period.

Table 1: Key Climatic Parameters – Period-wise Comparison for Ahilyanagar District

| Climatic Parameter | 2003–2010 | 2011–2016 | 2017–2023 | Trend |
|--------------------------------------|-----------|-----------|-----------|-----------------|
| Mean Annual Maximum Temp. (°C) | 35.4 | 36.1 | 36.9 | Rising (+0.8°C) |
| Mean Annual Minimum Temp. (°C) | 16.2 | 16.5 | 17.1 | Rising (+0.9°C) |
| Total Monsoon Rainfall (mm) | 628 | 601 | 574 | Declining |
| Number of Rainy Days / Year | 52 | 46 | 41 | Declining |
| Extreme Heat Days (>40°C) / Year | 12 | 16 | 21 | Rising |
| Heavy Rainfall Events (>65mm) / Year | 4.1 | 5.3 | 6.8 | Rising |
| Drought Occurrence Frequency (%) | 22% | 31% | 38% | Rising |

Source: India Meteorological Department, Pune (IMD, 2023); By Analysis.

2. Impact on Fruit Crop Yields: When climate changes, crops feel it first. The yield data for Ahilyanagar District reveal a consistent and troubling downward trend across all five major fruit crops studied, with the two flagship crops—pomegranate and grape—showing the steepest declines.

Pomegranate yields, which averaged 11.2 tonnes per hectare in the 2003–2010 period, fell to 8.9 tonnes per hectare in 2017–2023, a decline of 20.5 percent. This reduction is consistent with findings from ICAR-NRCP (2020) regarding the

rising incidence of bacterial blight (*Xanthomonas axonopodis* pv. *punicae*) under conditions of elevated humidity and erratic rainfall. Heat stress during the March-to-May fruiting period, when temperatures now frequently exceed the physiological optimum threshold of 38°C for pomegranate, compounds the disease pressure and affects fruit size and quality alongside total yield.

Grape yields in the district declined from 18.4 to 14.6 tonnes per hectare between the two comparison periods—a fall of 20.7 percent.

Paralleling the findings of Panse et al. (2019) for the Nashik region, survey respondents in Shirampur taluka reported intensified problems with downy mildew and berry cracking caused by untimely rains during the December–January ripening period, which are now occurring more frequently due to delayed monsoon withdrawal. For mango, the documented impact of heat stress on flowering—observed by Singh et al. (2013) for northern India—resonates with the experience of Ahilyanagar farmers, where dry spells during the November–December panicle initiation period and unpredictable late-season hailstorms have made mango yields increasingly volatile. Banana and sweet lime have experienced comparatively smaller but nonetheless significant declines

driven by water stress and temperature fluctuation during sensitive growth stages.

Pearson correlation analysis confirms statistically significant relationships between climatic parameters and crop yields: mean maximum temperature during March–May and pomegranate yield show a strong negative correlation ($r = -0.72$, $p < 0.01$), and the number of heavy rainfall events in November–January is significantly negatively associated with grape yield ($r = -0.68$, $p < 0.01$). These results provide quantitative support for the attribution of observed yield declines to climate change, as is broadly supported by Deori et al. (2024) and Tripathi et al. (2016) at global and national scales.

Table 2: Crop-wise Average Yield Comparison (Tonnes per Hectare), Ahilyanagar District

| Fruit Crop | Avg. Yield 2003–10 (t/ha) | Avg. Yield 2017–23 (t/ha) | % Change | Primary Stress Factor |
|-------------|---------------------------|---------------------------|----------|-------------------------------|
| Pomegranate | 11.2 | 8.9 | –20.5% | Bacterial Blight, Heat Stress |
| Grape | 18.4 | 14.6 | –20.7% | Untimely Rains, Downy Mildew |
| Mango | 7.8 | 6.7 | –14.1% | Dry Spell, Hailstorm Events |
| Banana | 42.5 | 37.9 | –10.8% | Water Stress, Hot Winds (Loo) |
| Sweet Lime | 10.3 | 8.8 | –14.6% | Temperature Fluctuation |

Source: Maharashtra State Horticulture Department (2022); Government of Maharashtra (2023); Primary Survey Data, 2023.

3. Economic Impact: Changes in Farmers' Income: A yield decline of 20 percent tells only part of the story. What makes the climate crisis particularly devastating for Ahilyanagar's fruit farmers is that falling incomes are accompanied by rising costs—the two jaws of an economic trap that squeezes farmers from both sides simultaneously.

Average gross returns from pomegranate cultivation declined from Rs. 2,24,000 per hectare in 2003–2010 to Rs. 1,86,000 per hectare in 2017–2023 (at constant 2015–16 prices), a

decline of 16.9 percent. At the same time, the total cost of cultivation increased sharply from Rs. 98,000 to Rs. 1,31,000 per hectare—a rise of 33.7 percent. This cost escalation is driven primarily by greater pesticide expenditure to manage climate-aggravated diseases (up 90.4 percent), higher irrigation costs as groundwater levels fall and pump hours increase (up 89.1 percent), and higher labor costs for disease management activities (up 50 percent).

The arithmetic is stark: net income from pomegranate cultivation fell from Rs. 1,26,000 to

just Rs. 55,000 per hectare in real terms—a reduction of 56.3 percent. For a smallholder farmer with two hectares, this translates to an annual income loss of over Rs. 1.4 lakh—a loss that, when it occurs year after year, dismantles any prospect of household financial security. These findings align with and extend the vulnerability analysis of Thorat et al. (2021), which identified the compound economic fragility of pomegranate farmers in this district under drought-stressed conditions. Birthal et al. (2014) similarly warned that smallholder farmers in rain-deficit zones would experience disproportionate income erosion under climate stress, a prediction that the present data confirm with striking precision.

The human consequences are visible in the survey data. Among 120 respondent farmers, 68 percent reported taking formal or informal loans specifically for crop loss recovery during at least three of the past five years. Only 41 percent had enrolled in the Pradhan Mantri Fasal Bima Yojana (PMFBY), and of those, 62 percent reported unsatisfactory experiences with claim settlement timeliness or adequacy. Beyond farm finances, 23 percent of surveyed families reported reducing household consumption expenditure due to crop losses, and 18 percent had withdrawn children from higher education. These are not statistics about farming—they are statistics about lives being reshaped by a changing climate.

Table 3: Farm Economics for Pomegranate Cultivation – Period-wise Comparison (Rs./Ha at 2015–16 Prices)

| Economic Parameter | 2003–2010 (Avg.) | 2017–2023 (Avg.) | Change (%) |
|------------------------------------|------------------|------------------|------------|
| Gross Returns (Rs./ha) | 2,24,000 | 1,86,000 | –16.9% |
| Total Cost of Cultivation (Rs./ha) | 98,000 | 1,31,000 | +33.7% |
| Net Farm Income (Rs./ha) | 1,26,000 | 55,000 | –56.3% |
| Pesticide Cost (Rs./ha) | 12,500 | 23,800 | +90.4% |
| Irrigation Cost (Rs./ha) | 9,200 | 17,400 | +89.1% |
| Labor Cost (Rs./ha) | 21,000 | 31,500 | +50.0% |
| Crop Loss Incidence (%) | 18% | 34% | +88.9% |
| Farmers Availing Crop Loans (%) | 48% | 71% | +47.9% |

Source: Primary Survey Data, 2023; APMC Price Records, Rahuri and Sangamner; By Calculations.

Adaptation Strategies Adopted by Farmers:

Farmers in Ahilyanagar are not passive recipients of climate misfortune. Across the district, a growing number of cultivators are experimenting with and adopting strategies that reflect a practical, ground-level understanding of how farming must change. These adaptations are as varied as the farmers themselves—some driven by necessity, others by opportunity, and many by a combination of both.

The most widespread adaptation has been the expansion of drip irrigation. Among surveyed pomegranate farmers, 58 percent now use drip systems, compared to an estimated 22 percent two decades ago. Beyond the obvious benefit of water conservation—reducing farm water use by 35–40 percent—drip irrigation also reduces the humidity around the root zone and foliage, which helps moderate the bacterial blight incidence documented by ICAR-NRCP (2020). The state government's subsidy scheme for micro-irrigation

has been a critical enabler for medium-scale farmers, though uptake remains low among those with holdings below one hectare.

Varietal adaptation has also been observed. Several farmers in Sangamner taluka have shifted to blight-tolerant pomegranate varieties, including 'Bhagwa,' and a few progressive farmers are trialling heat-tolerant selections recommended by Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri. In the grape belt of Shrirampur, shade net cultivation has been adopted by a small but growing number of farmers to moderate temperature extremes during berry development and reduce evapotranspiration. Crop diversification—introducing dragon fruit, papaya, or custard apple alongside traditional crops—has been adopted by some as an income hedging strategy against total crop failure.

On the information side, the use of weather-based advisories through the Kisan Suvidha mobile application and the Gramin Krishi Mausam Seva (GKMS) system has increased among educated younger farmers. Market-side adaptations—linkages with cold chain facilities, direct marketing to modern retail, and engagement with export agencies through the Maharashtra State Agricultural Marketing Board—have helped some farmers stabilize income despite yield reductions. Farmer Producer Organizations (FPOs) active in Rahata and Newasa talukas have facilitated collective input procurement, technical training, and access to institutional credit, demonstrating the value of institutional networks in building climate resilience.

Policy Recommendations:

The findings of this study point toward several concrete areas where policy action can make a meaningful difference for fruit farmers in Ahilyanagar District. The World Bank (2022) has argued that climate-smart agricultural investments

in South Asia must be simultaneously targeted and scalable—a principle that guides the following recommendations:

Expand Micro-Irrigation Coverage to Smallholders: While drip irrigation has demonstrably reduced input costs and disease incidence, its adoption remains concentrated among medium and large holders. Subsidy schemes must be restructured to specifically target farmers below two hectares, with simplified application processes and on-ground implementation support through agricultural assistants.

Reform Crop Insurance Delivery Under PMFBY: Given that 62 percent of enrolled farmers reported dissatisfaction with claim settlement, insurance reform is urgent. Technology-based loss assessment through satellite imagery, automatic weather stations, and drone surveys should replace manual inspection to eliminate delays. Block-level awareness campaigns in Marathi, specifically targeting women farmers and marginal holders, must accompany any structural reforms.

Accelerate Dissemination of Climate-Resilient Varieties: MPKV, Rahuri—the agricultural university closest to the district—should intensify on-farm demonstration trials of heat-tolerant, blight-resistant pomegranate selections and disease-tolerant grape varieties. Subsidized distribution of certified planting material through the Maharashtra Horticulture Development Corporation can accelerate farm-level adoption.

Establish Block-Level Agro-Meteorological Stations: The current network of weather monitoring stations is insufficient to capture the micro-climatic variation across Ahilyanagar's 14 talukas. Automatic weather stations at the block level, feeding into real-time, Marathi-language pest and disease advisories disseminated via SMS and community radio, would significantly

improve farmers' ability to take timely protective action.

Invest in Post-Harvest Infrastructure and Market Linkages: Cold storage facilities and processing units for pomegranate-derived products such as arils, juice, and anardana powder can stabilize farm income by reducing post-harvest losses and adding value. MSAMB should be supported with enhanced budgetary allocation to facilitate export linkages for Ahilyanagar fruit, and GI-tag recognition for local pomegranate varieties should be pursued.

Strengthen Farmer Producer Organizations (FPOs): The success of FPOs in Rahata and Newasa demonstrates their potential as vehicles for climate adaptation. State support in the form of equity grants, management capacity building, and market intelligence provision would enable FPOs to more effectively aggregate, process, and market fruit produce while delivering climate information and input services to their member farmers.

Conclusion:

The evidence assembled in this study makes clear that climate change is not an abstract future threat for the fruit farmers of Ahilyanagar District—it is a present and deepening reality. Over the past two decades, rising temperatures, intensifying heat events, shifting rainfall patterns, and growing drought frequency have combined to reduce pomegranate and grape yields by over 20 percent, while simultaneously pushing input costs upward. The result, for many smallholder farming households, is a net income from pomegranate cultivation that has fallen by more than half in real terms. These findings extend and concretize the district-level vulnerability identified by Bansod and Pawar (2018), Sasane (2016), and Thorat et al. (2021) and place Ahilyanagar within the broader pattern of climate-driven agricultural

stress documented across South Asia by BIRTHAL et al. (2014) and the World Bank (2022).

What gives cause for cautious optimism is that farmers in Ahilyanagar have not stood still. Drip irrigation, varietal diversification, shade net cultivation, and market linkage development represent real and active adaptations. But these efforts, largely self-financed and uneven in their reach, cannot substitute for the systemic policy response that the scale and urgency of the challenge demands. Expanded micro-irrigation support, meaningful crop insurance reform, climate-resilient variety dissemination, improved weather advisory systems, and stronger institutional infrastructure for farmers—particularly through FPOs—are not optional enhancements; they are essential investments in the viability of Ahilyanagar's horticultural economy.

Future research should explore the gender-differentiated dimensions of climate impact, given that women farmers often bear disproportionate burdens of crop failure within households. The economics of index-based insurance products for horticulture, the role of agroforestry in building microclimate resilience within orchards, and the long-term trajectory of groundwater depletion under increasing irrigation demand are all areas warranting deeper investigation. The present study hopes to contribute to the growing evidence base that must inform both the policies of today and the research priorities of tomorrow—for the sake of the farmers who tend Ahilyanagar's orchards, and for the communities whose livelihoods depend on them.

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