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A SWITCH ON CLIMATE CHANGE ON HORTICULTURAL PRODUCTIVITY

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Abstract : The visible effects of global warming are now evident in various parts of the world, *With abnormal climate patterns impacting specific hydrological cycles due to Accelerated warming. Higher temperatures result in increased evaporation rates and Dry conditions in certain regions, alongside more frequent severe weather events. Scientists attribute much of the rapid warming observed in recent decades to human-Induced atmospheric changes, alongside some natural variations. The impacts of Climate change are intricate, affecting natural resources like agriculture directly and*
Indirectly. While agriculture could potentially benefit from higher atmospheric Carbon dioxide levels, which may enhance photosynthesis rates, several interacting
Factors complicate the situation. As warming levels increase, estimated monetary Impacts typically become negative, with studies factoring in worst- case scenarios
Projecting highly unfavorable outcomes. Additionally, perennial plants, particularly Fruit-bearing ones, face greater risk compared to annual or seasonal crops .

Key words: climate, productivity,, horticulture.

INTRODUCTION

Fruits , vegetables, flowers and ornamental plant growing in garden is known as horticulture. The Term horticulture come from the Latin word 'Hortus'meaning 'garden culture ' or ' a flower – filled Medow'. Traditional agriculture have only seasonal harvests, but horticulture produce crop Throughout the year. Horticulture science play a very important role in understanding the Environmental conservation and biological resources. Horticulture main focus is to improve Agricultural productivity and ensure food security to use different method like soil management, Pest control,crop breeding etc. The application of science in horticulture known as horticultural Technology (ISHS,2017). Horticulture is not just growing vegetables also include more no of plant For comfort and beauty (Paiva ,2018) . Horticulture also include various types of plant such as tree Nuts, fruits, edible flowers, aromatic and medicinal plants, cut flowers, vegetable etc. Some of the Horticultural plants produce secondary compound like honey,raw silk etc . Horticulture broadly Divided into food horticulture and ornamental horticulture (Ravichandran et al.,2014). TheInternational society for horticultural science (ISHS) has an important objective of the International society for horticultural science and scientific information. Originally horticulture Referred to enclosed production area. The main focuses of horticulture is the intensive cultivation Of plants for medicine, food, aesthetic pleasure and other agricultural activities.small farmers Facing many challenges in Horticultural production like costly inputs , low market awareness, Insecurity, limited extension services (Wasilwa L.,2008) .Horticultural crops are high-value crops that yield maximum returns for farmers. In India, the Availability of fruits and vegetables is essential for meeting the population's nutritional and Protective dietary requirements. Of the total horticultural production, 67% is used for local Consumption, 30% is lost post-harvest, 2% is exported, and 0.8% is processed. Additionally, the Need to bridge the gap between Horticultural production and consumption, with a focus on Reducing post harvest losses and expanding market opportunities. For fruit and vegetables growing Using less water and save money , so that these crops are more worth. For example strawberries , Almonds , and some vegetables grown in Spain that use less water. Scientist use sensors to decide When the plant need more nutrients.

The establishment of large hospitals where hundreds to thousands of patients are treated , it has created a serious problems of biomedical waste management. The seriousness of improper biomedical waste management was brought to the light during summer 1998. In India studies have been carried out at local / regional levels in various hospitals, indicate that roughly about 1-5 kg/bed/day to waste is generated. Among all health care personnel ,ward boys , sweepers, operation theatre & laboratory attendants have come into contact with biomedical waste during the process of segregation , collection, transport, storage & final disposal . The knowledge of medical , paramedical staff & ward boys , sweepers about the biomedical waste management is important to improve the biomedical waste management practices. The biomedical waste requiring special attention includes those that are potentially infectious , sharps ,example needle , scalpels , objects capable of puncturing the skin , also plastic ,pharmaceutical & chemically hazardous substances used in laboratories etc.

The INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC) indicate that different Environmental change like rising temperatures, drought, floods, desertification mainly affect on Agriculture (Pradeep Kumar T., 2008) .Because of cooperation between countries and modern Technology we avoid the food problem. Scientist are studying how to grow better crop on the Changing climate (Hirpo et al.,2019). Now a days increasing population is putting stress for crop Production for food security, recommended several studies to increase crop yield, rather than Clearing more land for food production (Malhotra s.k., 2017).The review underscore the Substantial ramifications of climate change variability on Horticultural out put , highlighting Concerns like terminal heat stress, water scarcity, and environmental pressure.It proposes solutions Like employing greenhouse technology and breeding crop varieties resilient to stress factors to Alleviate these challenges and maintain productivity. Agriculture contributes significantly to Greenhouse gas emissions, driving climate change , but Horticultural crop can help counter its Negative effects by offering improved carbon trading and serving as carbon sinks. One concerning Response to climate change is the shortened growing season,leading to reduce fruit and vegetables Production, impacting the growth of Horticultural crops due to heat stress and limited water Availability. Thus intervention focusing on climate -smart Horticulture are crucial, integrating Location specific and knowledge intensive approaches to enhance production under challenging Conditions (Saqib M. et al.,2022). Adaptation strategies tailored to specific crops, their sensitivity, And the local environment are essential considering the carbon sink potential of different Horticultural crops compared to annual field crops can aid in developing effective strategies to Address climate change related challenges.If agriculture is the primary source of green house gas Emissions leading to climate change , Horticultural crops play a significant role in mitigating it's Adverse effects by improving carbon trading and serving as carbon sinks . A notable physiological Responses to climate change is the shortened growing period , resulting in a clear decrease in fruits And vegetables production which negatively impacts the growth and development of Horticultural Crops due to heat stress and limited soil water availability.consequently interventions promoting Climate smart Horticulture are essential, integrating location specific and knowledge intensive Approaches to enhance production under challenging conditions .Tailored adaptation strategies for Different crops, considering their characteristics and sensitivity to environmental factors, are Necessary.Additionally assessing the carbon sink potential of various Horticultural crops Compared to annual field crops can aid in developing effective strategies to climate change.

3.1.climate change

The climate change, which is considered one of the most serious problems facing humanity.It Emphasizes the role of human activities, particularly the rapid increase is CO_2 emissions from Industry ,in driving global worming (Rahman et al.,2015). The projections for future temperatureAnd CO_2 concentration increase are concerning with potential impact including greater climate Variability and more extreme weather events . The climate of Earth is in a perpetual state of flux , reflecting the planetsdynamic nature. Changes in the fundamental elements affecting earths Climate can originate externally, from the oceans , atmosphere, and land system. For instance,an External change could involve shifts in the suns output, resulting in alterations in the amount of Solar radiation teaching earth. The consensus among scientist that 22ºc increase above per Industrial levels constitutes dangerous climate change. While natural cycles can cause fluctuations In global mean temperature, the rapid warming observed over the past so years is primarily Attributed to human activities, despite some skepticism. Factors such as milankovitch cycle can Cause significant temperature variation over long periods but their impact is gradual and not Responsible for the recent rapid warming.short term variations in solar radiation also influence Global temperature but their effects are relatively small compared to anthropogenic influences. Overall, it's the susceptibility of these natural factors to short term human influences that is of Particular concern in the climate change debate .

3.2 IMPACT OF CLIMATE CHANGE

For Impact of global warming on India include heightened temperatures resulting in increased Evaporation and longer heatwave, reduced winter rainfall leading to water scarcity, intensified Droughts affecting agriculture and coastal flooding due to sea level rise and stronger Cyclones.(Rehman et al.,2015). It also highlights health concerns like heat related stress and Vector borne disease, along with the broader implications for sustainable development. Climate Change is expected to worsen food shortages and infrastructure danage while changing crop yields And agricultural distribution patterns . In regions with higher latitude in Europe and North America, Agriculture may initially benefit from climate change . However, in most other areas especially Tropical regions already experiencing optimal temperature and water availability are expected to Reduce crop yield . According to reports by the IPCC in 2001 and 2007 , global surface Temperatures are projected to increase by varying degrees by the year 2100, depending on different Emissions scenario. The current rate of worming surfasses that observed in the 20th century and is Notable faster than the worming at the end of the last ice age . This acceleration is attributed to Increased carbon dioxide emissions and decreased sulfur emissions while global temperature Average are crucial, regional impacts are of greater concern , necessitating more detailed Assessment of regional warming trends continental interiors and northern hemisphere latitudes are Forecasted to experience the most pronounced warming while coastal areas and oceans are Expected to warm less. High latitudes in the north could experience warming several times faster Than the global average, with continental interiors warming up to twice as fast as surrounding Oceans . The cooling effects of the southern oceans and potential changes in ocean circulation in The north Atlantic may mitigate warming in these regions .The eastern tropical Pacific might see More warming compared to the western part , potentially leading to a shift towards more average Conditions.

3.3 CLIMATE CHANGE IN HORTICULTURAL CROPS

Variables The Horticulture sector has experienced significant progress due to advancement in technology Such as new cultivars and improved production system management.This progress is evident in The substantial increase in production and productivity, rising from 25 million tones in 2015-16.Despite encountering challenges, the horticultural sector is at a crucial stage of development And needs initiatives for sustainable growth. To achieve the target of 310 million tonnes by the end Of the plan, it is vital to focus on vertical growth through the adoption of new cultivars, efficient Water and nutrient management, effective plant health management, and strategies to minimize Post-harvest losses. This approach necessitates innovation and investment in research and Development,as well as the promotion of advanced technologies and best practices among farmers To sustain growth and address challenges like climate change,pest and resources Limitations.Achieving higher Horticultural production faces hurdles due to climate change Challenges such as altered seasons and extreme weather events like heavy rains , floods, Hailstorm,frost,heat, waves and droughts. These environmental shifts can leads to lower yield due To shortened growing season, reduced weather availability, and inadequate vernalization. To Accurately measure climate change effects on Horticultural crops, detailed data on crop Physiology, growth , development, quality, and productivity are necessary. Addressing these

Impacts requires a systematic approach to prepare the sector for climate change challenges.Temperature increase can affect respiration, photosynthesis, and the distribution of nutrients in Plants. Additionally, temperature shift can alter crop timing, flowering, fruiting and ripening. The Sensitivity of crops to temperature is influenced by their inherent traits and growth patterns. Crops With longer flowering periods tend to be less affected by heat stress compared to others. Temperature changes may not be consistent across day and night or between seasons , Especially in tropical regions where even minor warming can significantly reduce Yields. Conversely in higher latitudes , slight temperature rises might improve yields. However in developing countries, mainly in lower latitudes, further warming could Reduce productivity.The impact of climate change varies by region and crop type, Affecting different Horticultural sectors uniquely. Extreme weather events like Heatwaves and cold spell have been documented to cause significant harm to Numerous fruit crops. Temperature play a vital role in influencing flowering patterns In perennial crop like mango and guava. Mango specifically, tends to favor Vegetative growth more as temperatures rise , affecting the timing of flowering. Research suggests that later emerging panicles tend to have a higher percentage of Hermaphrodite flowers, which correlates with increased temperature. During peak Flowering times , high temperature, combined with low humidity and prolonged Sunshine, can lead to excessive transportation and dehydration in panicles, resulting In injury symptoms such as leaf scorching and twig die back are common in both Bearing and non- bearing mango plants under heat stress. Climate change Significantly affects mangoes, leading to altered flowering times, multiplereproductive flushes, inconsistent fruit ripening, irregular fruit setting, and the Conversion of reproductive buds into vegetative ones. Tracking these effects Frequently involves different organizations (Malhotra and s.k., 2017).

Year	Yield :Bushels per acre	Climate
1960	45-55	Blight
1970	60-80	Wet spring early frost
1980	65-100	Drought
1990	60-110	Drought
2000	85-115	Flood
2010	95-140	Un usual climate event
2020	100-150	Un usual climate event

Fruit crops

The passage underscores how extreme weather occurrences like heatwaves and cold snaps pose a Significant threat to fruit crops such as mangoes and guavas. It underscores the impact of Temperature fluctuations on mango flowering, noting that warmer temperatures can intensify a Preference for vegetative growth and alter flowering timelines. Moreover, it points out the Detrimental effects of high temperatures, including dehydration damage to panicles, leaf scorching, And twig mortality. Climate change exacerbates these challenges, leading to irregularities in Flowering, fruit ripening, and abnormal fruit formation(Malthor ,2017). In guava farming, there's a notable uptick in pest and disease occurrence due to hot and humid Weather conditions. The increaseing temperature and shifting climate patterns are having notable Effect on fruit crops, causing problems such as increased pest presence, decreased yields, and early Ripening . Farmers are encountering difficulties in adjusting their farming methods to these Evolving conditions , affecting decision on which crops to grow and how to manages will be Essential for the sustainability of fruit cultivation. Temperature greatly influences the growth Growth rate of fruit as shown by the use of bunch covers , which are throught to boost growth by Providing warmth. Warmer temperatures , usually around 31-32ºc, can speed up the maturation of Bananas , leading to shorter bunch development periods. However, excessively high temperatures Above 38ºc along with intense sunlight,can cause sunburn damage to exposed fruits and result in Bunches becoming choked . Despite grapes originally coming from temperate regions, adjustmentin production methods,such as adopting a two purning and one crop system, have allowed them to Adapt to tropical climates, with climate change,there are expected alterations in the availability of

Growing degree days temperature, potentially harvesting phenological process .vineyards facing Extreme temperatures , like 42ºc may struggle to harness radiant energy due to enzyme and Chlorophyll degradation surpassing photosynthesis ratios.In wine grapes, the development of Anthocyanins is affected by temperature fluctuations between day and night, with a greater range Fostering better development. Identifying suitable grape varieties and regions is crucial for Producing high-quality fruit. Extended periods of excessive heat often lead to delayed fruit Maturation and reduced quality. Different grape varieties have varying tolerances to temperature Changes. Typically, the best temperatures for shoot and root growth, measured 28 days after

Temperature treatments, are 20°C for Semillon, Cabernet Sauvignon, and Cynthiana, while Pinot Noir and Chardonnay thrive at 30°C. European varieties are noted to have higher tolerance to high

Temperatures compared to American cultivars, potentially making them suitable for wine

Production in hotter regions. Valencia and novel orange varieties showed a consistent decrease in Acid percentage as effective heat units increased suggesting an inverse correlation between Temperature and acid /brix ratios.In the case of grapevine, bananas , mangoes and other important Horticultural crops adjusting varietal choices may become necessary to adapt to changing climate Conditions.

3. 1 Mango crop

Climate change presents significant obstacles for mango cultivation, affecting key agronomic Processes such as photosynthesis, vegetative and reproductive growth, and fruit quality. Despite The absence of a dedicated mango crop model hindering accurate predictions, potential adaptation Measures include selecting suitable cultivars and rootstocks, as well as refining cultural practices. Creating a mango crop model could enhance our ability to comprehend and address the impacts of Climate change on mango production.

The challenges posed by climate change for mango cultivation are evident, impacting vital Agronomic processes including photosynthesis, vegetative and reproductive development, and fruit Quality. Though the absence of a specific mango crop model complicates predictions, potential Adaptation strategies include selecting appropriate cultivars and rootstocks, as well as refining Cultural practices. The creation of a mango crop model could improve our understanding and Management of climate change effects on mango production.(Legave et al.,2013).

- In photosynthesis

  Temperature, light, and CO2 levels are crucial elements that influence photosynthesis, and an Anticipated elevation in these factors is likely to benefit the process. The effects are balanced as They enhance both photosynthetic assimilation and respiratory losses. However, extreme Temperatures (>45°C) or high light intensities can cause damage to the photosynthesis Machinery.While mango trees are adapted to dry environments and can endure water stress and High evaporative demand, an anticipated increase in drought and vapor pressure deficit (VPD) Would negatively affect photosynthesis due to the rapid closure of stomata in mango trees when Climatic demand rises.Flooding is expected to increase in regions with more intense and frequent Rainfall and decrease in drier regions. In both scenarios, the impact on mango photosynthesis is

Likely negative. Despite mangoes being moderately flood-tolerant, flooding leads to a swift Reduction in transpiration, stomatal conductance, and maximum photosynthetic assimilation. The Reduction in flooding occurrences corresponds to an increase in drought, as mentioned earlier.

3.2 In vegetative growth

For Assuming adequate nutrient and water availability, higher temperatures are expected to accelerate Mango tree growth, resulting in shorter intervals between successive vegetative flushes and the Development of growth units and leaves. Additionally, elevated temperatures may postpone or Prevent growth cessation at the onset of winter. The impact of high temperature on the size of Growth units and leaves is uncertain. Whiley et al. (1989) found that trees grown at 30/25°C (day/night temperature) had leaves three times larger than those grown at 20/15°C. However, Dambreville et al. (2013) did not detect a significant temperature effect on leaf size within the Daily temperature range of 20-28°C, suggesting a possible cultivar-dependent response.

- In flowering and fruit set

  The initiation of flowers in mango trees is primarily influenced by cool temperatures. Therefore, Increasing temperatures would likely have an adverse impact on floral initiation. However, in Regions where temperatures are particularly cool during flowering, rising temperatures could Improve pollen viability and fruit set. Temperature also has a negative effect on the size of flower Clusters (Dambreville et al., 2013) and the number of flowers per cluster (Sukhvibul et al., 1999).Furthermore, floral initiation requires mature leaves to be exposed to light, indicating that Higher levels of light intensity could have a beneficial effect on mango flowering.

- In fruit growth

  Elevated temperatures are anticipated to have a favorable impact on mango fruit growth, Potentially speeding up the process. For instance, in Australia, the estimated time for mango fruit Development reduced by 12-16 days (7-8%) due to a 1.5°C rise in winter temperatures over the Past 45 years (Olesen, 2011). Additionally, higher temperatures could improve fruit quality by Triggering the production of secondary compounds, some of which offer nutritional Benefits.Increased light intensity is known to enhance the skin color of colored mango cultivars (Léchaudel et al., 2013). While excessive light might induce stress, similar to high temperatures, It could also enhance fruit quality. Moreover, greater light intensity may positively influence fruit Size by enhancing photosynthesis.

- In fruit growth and quality

  Increased levels of CO2 can boost photosynthesis, potentially enhancing fruit quality. Fruits grown Under higher CO2 concentrations tend to have a greater dry mass, particularly in the pulp.The Impacts of drought on fruit quality are varied and well-documented in orchards without irrigation. While drought typically reduces fruit size, it can also improve fruit quality, particularly in terms Of dry matter content and sugar concentration. IN summary, this review of how climatic factors Affect key aspects of mango production highlights the challenge of predicting climate change's Effects on mango cultivation with current knowledge. Individual factors may have mixed effects,and interactions between them are important. Optimal values for climatic factors in relation to Specific processes are often unknown, making it difficult to determine positive thresholds. Additionally, the cultivar and tree's phenological stage can alter the relationships between climatic Factors and these key processes.We will suggest ways to address these knowledge gaps and better Predict the impacts of climate change on mango cultivation. Nonetheless, based on existing Knowledge and regional climate change predictions, we can infer the likely future of mango Cultivation in specific regions, as outlined in the following section.

- In fruit cultivation

  It would be challenging to analyze and outline the anticipated impacts of climate change on mango Production and cultivation across all the regions where mangoes are grown. To demonstrate the Methodology, we've opted to focus on two specific cases with differing climate predictions: South Asia and the Caribbean Islands. Climate projections for these regions are sourced from Christensen Et al. (2007).

3.3 In peach crop

The study examines how climate change factors impact the water status, photosynthetic rate, and metabolic regulation in peach plants grafted onto two different Prunus rootstocks alongside the Catherina peach cultivar. It delves into the effects of elevated CO2 levels, temperature changes, and drought stress on various physiological, biochemical, and molecular aspects of the plants. The research underscores the adaptability and flexibility of these plant genotypes, providing valuable implications for maintaining sustainable peach production in the face of climate change adversities.At day 23 of the experiment, one mature leaf (specifically, the fifth fully grown leaf) from each of the four replicate plants was analyzed for stem water potential (Stems). To prevent transpiration and ensure equilibrium with Stems, the leaves were enclosed in plastic envelopes covered with aluminum foil for 30 minutes before measurement. Using a Schölander-type pressure chamber (PMS instrument, Corvallis, OR, USA), midday Stems was determined (Jimenez et al.,2020)

3.4In cucumber and watermelon

This Research aims to evaluate climate change's impact on watermelon and cucumber production, Including yield, cropping patterns, and overall output. This study seeks to understand how climateVariations affect these crops, offering insights into adaptation strategies and potential Consequences for consumers and producers alike.The study explored how cucumber plants Respond to different greenhouse conditions, particularly examining the effects of temporary Shading during summer. Shading levels ranged from 90% to no shading, and various physiological Cucumber plant parameters were assessed. Results indicated that the 90% shading level created a Less stressful growth environment for cucumber crops compared to lower shading levels or no Shading at all.A separate investigation, the impact of climate change on watermelon and cucumber Farming in Hormozgan province was analyzed, aiming to predict long-term trends from 2025 to 2100. Utilizing data collected from 2003 to 2017 and projected weather scenarios, the study Forecasted crop yields, cropping patterns, and overall production. Findings revealed diverse effects Of climate factors on cucumber and watermelon crops, with temperature positively affectingcucumbers but negatively impacting watermelons. Rainfall showed negative effects on cucumbers In some scenarios but had direct impacts overall.Other factors like humidity had mixed effects. The study concluded that overall welfare is anticipated to decline in the future, with producers Facing greater losses compared to consumers (paroon et al.,2019).

3.4.1 In vegetables crop

Plants' growth and development hinge on both non-living (abiotic) and living (biotic) elements. Abiotic factors encompass physical surroundings, while biotic factors involve animals, insects, And diseases. Every plant has specific environmental needs for optimal growth and yield. When Conditions align with these requirements, crops thrive with minimal adjustments. However, Adverse environmental conditions can stress plants, leading to reduced yields. In such instances, Altering the environment, such as through greenhouse cultivation, can help meet crop needs.The vegetable category encompasses a wide range of crops, making it challenging to summarize How climate change might impact their growth and yields. Limited research exists on this topic, And the diverse characteristics of different varieties further complicate predictions. Studies, like Pete & Wolfe (2000), suggest that increased CO2 levels could benefit most crops, provided Temperature limitations are absent. However, forecasting the effects of rising temperatures is more Complex. Certain vegetables, such as tomatoes and peppers, are highly sensitive to excessive heat During critical growth stages, which can disrupt pollen function and flowering. Conversely, Warmer temperatures might improve seed germination rates in some crops, especially those sown Directly in cooler seasons.Moreover, high temperatures and long days can induce premature Flowering in crops like lettuce and spinach, reducing produce quality. While some varieties are Less susceptible to premature flowering, known as "bolting," adapting to these changes may Necessitate shifting production areas. Breeding for heat tolerance in vegetable crops is complex Due to varietal differences and the multifaceted genetic control of various growth factors affected By high temperatures. Additionally, high temperatures can heighten susceptibility to certain Diseases, leading to secondary effects on crop health.Most plants perform best within a limited temperature range, with the extreme limits being freezing Temperatures at around 32ºF (0ºC) and heat-induced mortality at approximately 105ºF (40ºC). Each Crop variety has its optimal temperature range for growth and development, known as the optimum Air temperature range. Typically, this range falls between 55 and 75ºF (12 and 24ºC), ensuring the Highest efficiency. Crops, particularly vegetables, are often categorized based on their temperature Preferences, whether they thrive in cooler or warmer conditions. These preferences are usually Determined by nighttime temperatures, with crops requiring temperatures below 65ºF (18ºC) Classified as cool-season varieties (Abou hussian and S.D ,2012).

1.In potato

The study evaluates how climate change might affect global potato production by using modeling And climate data. It predicts a rise in temperature ranging from 2.1 to 3.2°C with potential yield Reductions of 18% to 32% (without adaptation) and 9% to 18% (with adaptation). In regions withhigher latitudes, adjustments in planting schedules and crop varieties could lessen negative Impacts, while in lower latitudes, the consequences may be more severe. Introducing heat-tolerant Potato varieties could potentially help mitigate the challenges posed by global warming in tropical Areas(Hijmans and R.J, 2003). In our modeling approach, after determining the planting date and Crop cycle length, climate change impacts on maximum yields are driven by two key factors: one Related to CO2, which enhances biological efficiency, and another related to radiation (Rs) Absorption and conversion. While the direct changes in radiation are not highly significant, future Climate impacts on radiation are mainly due to shortened crop cycles, leading to reduced Rs Absorption by the canopy and potentially lower maximum yields. Figure 4 illustrates the effect of Increased CO2 on yields, showing mean yields (both maximum and actual) for the reference period (1961-1990) at two locations (Azangaro and Puno) based on CO2 levels. As CO2 concentrations Rise from 370 ppm (the reference level) to 550 ppm (the model's upper limit), mean yields during The reference period increase by 27% for S. tuberosum in Puno and by 28% for S. juzepczukii in Azangaro, reflecting a significant increase.(Sanabria J.and Hllomme J.p,2013).

2.In onion , carrot and beetroots

The investigation utilized controlled- environment cabinets to explore how different levels of CO2 Concentrations and temperatures affect beetroot, carrot, and bulb onion plants. Polynomial models Were employed to forecast alterations in plant dry weight and fresh weight yields resulting from Climate change, suggesting potential benefits for bulb onion cultivation in Britain under warmer Conditions (Wurr et al.,1998).

The research emphasizes the substantial influence of unpredictable precipitation on onion Cultivation in Maharashtra, impacting both kharif and rabi crops. The harm inflicted by unforeseen Rains underscores the necessity for farmers to embrace methods such as planting seedlings on Elevated beds and employing drip or sprinkler irrigation to reduce risks linked to water stagnation And diseases transmitted through the soil (Gadge et al.,2012).These research works underscore the Notable repercussions of climate change on water supplies, agricultural output, and pest Distribution in dry regions such as Iran and India. Grasping these consequences is pivotal for Policymakers to formulate efficient measures for mitigating and adapting to sustain agricultural Systems (karuppiha et al.,2023).

3.In tomato

Tomatoes, part of the Solanaceae family, hold substantial economic value worldwide, with annual Production surpassing 90 billion USD. It is considered the second most important vegetable after Potatoes in many regions. Global tomato productivity has increased by around 300% over the last Four decades. In Nepal, Lycopersicum esculentum is a major commercial crop, ranking third in Both cultivated area and productivity. The vegetable sector, including tomato farming, contributes Significantly to Nepal's Agricultural Gross Domestic Product (AGDP), making up 17% of it. As Of the fiscal year 2018/19, tomato cultivation in Nepal spans approximately 22,566 hectares, with An average yield of 18 tons per hectare. Plastic house tomato farming offers notably higher profits, Around 700 USD per ropani of land (roughly 1400 USD per hectare), compared to traditional open-Field method (Bhandari et al.,2021).The text emphasizes the global importance of tomatoes, theirsusceptibility to climate change, and the difficulties posed by pests like the two-spotted spider Mite. It also discusses the significance of using biological methods, such as the predatory mite P. Persimilis, to control these pests. The study utilizes CLIMEX, a model for species distribution, to Evaluate how climate change affects tomatoes, the two-spotted spider mite, and P. persimilis in
Agricultural regions(Litskas et al.,2019).

I. CONCLUSION

The Earth's atmosphere has seen a 20% rise in carbon dioxide, the primary greenhouse gas, since 1950, leading to global warming as CO2 levels increase.To construct and uphold a sustainable Society, it's crucial to safeguard the functioning natural systems that sustain us. Renewable Resources like forests, biodiversity, soils, and freshwater need to be managed to maintain their Long-term productivity while respecting their ability to regenerate. Enhancing agricultural Practices is crucial for future sustainability, as significant improvements are necessary to meet the Food needs of the growing global population. Addressing the environmental issues associated with Agriculture—such as soil fertility loss, erosion, aquifer depletion, and pollution of soil, water, and Air—requires a variety of approaches. Strategies to combat topsoil loss, prevent land degradation, Conserve water and energy, and reduce the use of agricultural chemicals are vital. Furthermore, Cultivating perennial horticultural plants, which are more vulnerable, can help mitigate the effects Of climate change by absorbing more radiation compared to annual or seasonal crops.To deal with The problems caused by climate change in gardening, we need to do a few things. We should take Care of the land by using methods that conserve it, like not disturbing it too much and using clean Energy. It's also important to protect forests and water sources. We should create new kinds of Plants that can handle hot weather and pests, and use modern gardening methods. And we need to Be smart about how we use the land.

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