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The Necessity and Prospects for Novel Approaches in Horticultural Crop Production

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INTRODUCTION

Horticultural crops, including fruits, vegetables, ingredients for beverages and fragrances, herbal medicines, and ornamental plants, play a significant role in our daily lives. Horticultural crops now play a significant social role in shaping human culture, enhancing landscapes, and influencing human lifestyles, in addition to their economic significance in providing food as contemporary society progresses. As a result of this change in duties, horticultural workers have been motivated to produce more types and better products. This is becoming increasingly significant. It also motivates researchers in horticulture to conduct more useful work in order to enhance the functional applications of horticultural crops.

Nonetheless, the establishment of horticulture crops necessitates extensive manual labor that heavily relies on skilled personnel to accomplish tasks such as pruning branches, pruning flowers and fruit, picking fruit, and managing insect and pest infestations. Currently, horticultural crop production faces a number of obstacles. These issues arise from numerous underlying factors, including an escalating global population that is predominantly urban and consumes rather than produces our food supply, the heightened negative impact of environmental concerns that reduce crop yield and restrict the availability of arable land, challenges with resource utilization efficiency to limit chemical releases into the environment, and an increase in the utilization of pesticides, fungicides, bactericides, herbicides, and other chemical control agents. It is important to increase crop output without significantly increasing the amount of land, water, or fertilizer used. Horticultural researchers must prioritize the development of novel technologies to enhance orchard management decisions and significantly enhance horticultural output, in order to meet the forthcoming requirements and obstacles.

Hence, the primary objective of intelligent horticulture is to produce premium fruits, vegetables, and decorative crops by utilizing cutting-edge technology, tools, and systems to reduce the utilization of human force and enhance its efficacy.

The challenges encountered in the research and production of horticultural crops:

The number and quality of horticulture crops has increased a lot in the twenty-first century because agricultural technology has improved. Notwithstanding, these advancements still fall short of meeting the ever-increasing demands of the populace. According to estimates, the world population was estimated at 7 billion in 2020 and will reach 9 billion by 2050. Due to serious issues such as global warming, desertification, and environmental contamination, the availability of land for agriculture will decrease, rendering it increasingly challenging to ensure food supply and security. The issue of sustainability has become a significant concern for agriculture, as horticulture production is increasingly under increasing pressure. Horticultural crops present a number of unique challenges or issues when compared to the production of stable crops such as rice, wheat, maize etc.

Quality enhancement has become more important for the majority of horticultural crops because longer breeding cycles are needed and quality enhancement has become more important. Perennial fruit trees with long juvenile periods are frequently bred using conventional techniques such as mutation and crossing. Nonetheless, they frequently necessitate labor- and time-intensive cutting or grafting propagation in order to guarantee genetic stability or acquire superior characteristics. During the development of tea cultivars, for example, lines are initially chosen by hybridization or from natural populations, then they are reproduced by cutting, and the best lines are found after planting for three years. Typically, the process requires a duration exceeding 10 years. Horticultural crops possess crucial quality attributes, such as scent, taste, and color, as breeding targets, as these attributes have a significant impact on the crop's nutritional and economic worth. Breeding has been mostly about making things, but not considering how good they taste. Secondly, cultivating and overseeing horticultural crops presents a greater technical challenge. The most of them are perennials that have been regularly cultivated for many years, if not decades, and come in a variety of kinds.

Horticultural crops are thus more susceptible to pests and illnesses. The fundamental prerequisites for the growth and harvest of horticultural crops necessitate the utilization of greenhouses or other edifices. Therefore, it is evident that, in general, horticultural crops require additional effort and enhanced planting management. Since most horticultural commodities have a high rate of post-harvest loss, the majority of fruits, vegetables, and flowers must be stored fresh.

Need for new approaches in horticulture:

Horticulture is one of the best ways to increase land productivity, provide human nutrition security, and keep the farming community around the world happy. This is a well-known fact. The world's population is expected to reach 9 billion by the year 2050, with the bulk of that growth occurring in developing nations with severe malnutrition and ongoing food shortages. Due to the overexploitation of natural resources, this anticipated population growth will undoubtedly result in a decrease in the per capita availability of natural resources, which will ultimately increase hunger, poverty, and malnutrition as well as raise food costs. Therefore, it is imperative and imperative to address the prudent utilization of natural resources.

The global agriculture is currently under significant threat from climate change. Throughout the past century, the surface temperatures of the earth have experienced a significant rise, with agriculture being the

sector most adversely affected. The increase in temperature has a negative impact on agricultural output because it increases the rate of respiration, shortens the duration between crops, hastens crop maturity, and accelerates ripening. Climate change is the primary cause and trigger of numerous climatic extremes, such as droughts, floods, tropical cyclones, heavy precipitation events, hot extremes, and heat waves, which have a detrimental impact on agriculture.

Precision farming, which involves the management of resources in time and space for horticulture, is a crucial high-tech intervention required to maximize resource utilization. The objective of technology infusion is to enhance crop productivity per unit of inputs by optimally utilizing the readily available resources. Only the utilization of contemporary high-tech applications and precise farming techniques would render this feasible. These technologies must be widely used and implemented in order to increase agricultural output and return to farmers. The challenges listed above and their expected role in guaranteeing food and nutritional security for humanity require a collection of high-tech cultivation techniques and postharvest management of horticultural crops.

The prospects for new approaches to horticulture:

Until recently, farmers' ability to choose among a variety of technologies was largely influenced by the need to boost output, profits, and productivity. The primary obstacles were a dearth of funds, a dearth of technological proficiency, and market hazards, which were safeguarded by government measures in numerous nations' policies. The aim of agricultural policies was to boost production, so "good policy practices" were usually straightforward and focused on boosting output. The aim of agricultural and horticultural research and extension programs could be to boost the production of small farms. Currently, agriculture must attain a multitude of objectives, including achieving international competitiveness, producing superior agricultural products, and achieving sustainability objectives. Agricultural producers desire prompt access to innovative technologies in order to maintain their competitiveness. Farmers are currently confronted with both increased prospects and increased constraints. They have to be successful and follow environmental guidelines and regulations.

Consumers may also encounter an overwhelming amount of information from numerous government and business sources, thereby rendering the selection of suitable technology more challenging. Farmers are required to modify their management and production practices in response to agricultural regulations that consider environmental factors. The uncertainty could be even greater in future events. The forthcoming policy environment may also be uncertain, particularly in light of support, trade, and obstacles posed by the agro-food sector. The adoption of farming technology necessitates financial support. Nonetheless, it takes time for the advantages to manifest, and farmers may be hesitant to make investments in an uncertain setting with additional restrictions, where a portion of the advantages are beneficial to society.

For boosting development and productivity, technological advancement has been the foundation. With the advancement of novel technologies, research exerts an impact on the efficacy of agricultural systems. If these technologies prove to be suitable for the requirements of farmers, they will be swiftly implemented. To solve the problems facing the horticultural industries, it's important to come up with new ideas. For farmers, producers, and enterprises to become more productive, they will require new concepts, technology, and methods. They will also enhance the industry's resilience and environmental sustainability. Fruits and vegetables help prevent hunger, lack of essential nutrients, and overeating. They are important because they create jobs

and create new markets. Because horticultural crops are often high-value crops, they contribute to wealth generation. It is believed that the growth of horticulture will greatly benefit from advances made in basic research and new technologies, such as multi-omics technique, gene editing, big data mining, cloud computing, and novel sensor instruments.

Conclusion:

Horticultural crops provide us with food, drinks, and decorative items. It is noteworthy that, as a result of remarkable technological advancements and highly beneficial collaborative efforts, significant program-based advancements and achievements have been achieved in the domain of horticulture research. Population growth, the rapid depletion of land resources, and the dangers posed by pests and illnesses are increasing. In light of these facts, the future of horticultural research will revolve around the selection of superior varieties, effective prevention and management of pests and diseases, and sustaining quality and yield to satisfy human requirements while safeguarding the environment. Researchers should enhance the post-harvest storage and processing procedures for horticulture goods, enhance cultivation and management practices, and invent the utilization of genetic resources.

Before adopting this revolutionary technology, we must overcome the obstacles related to the preservation and characterization of the natural genetic variety of horticulture crops. The implementation of multi-disciplinary techniques and contemporary biology and AI technologies will prove to be efficacious in addressing horticulture issues. This approach involves highlighting the distinctive characteristics and significance of horticultural crops and summarizing the major obstacles anticipated in the future horticultural production process, including breeding, planting management, harvesting, and post-harvest procedures. Researchers should strive to achieve the sustainable advancement of smart horticulture, which holds significant potential for future horticultural output. Additionally, they should closely link horticultural products with market consumption.