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Urban Agriculture and Biotechnology: Collaboration for Sustainability in the Future

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Abstract

The demand for food is rising quickly along with the world's population. There won't be as much land available for traditional agriculture in urban areas due to the growing population in the upcoming decades. In a sustainable manner, urban agriculture can contribute to supplying the increasing demand for food. The practice of growing food in urban areas is known as urban agriculture. It can be done in alleyways, on vacant lots, on balconies, and even on rooftops. Fruits, vegetables, and herbs are just a few of the crops that can be produced through urban agriculture. It can also lessen stormwater runoff, boost employment, and enhance air quality. Urban agriculture can become more sustainable and efficient with the application of biotechnology. Crops resistant to can be developed using biotechnological tools.

Keywords: Biodegradation; Agriculture; Crops

Introduction

With the use of biotechnological tools, crops with greater yields, increased drought and heat tolerance, and resistance to pests and diseases can be developed. Crops' nutritional value can also be increased through the application of biotechnology. The necessity and significance of urban agriculture, biotechnology, and genome editing in supplying the increasing demand for food in urban areas are covered in this review article. It also talks about how biotechnology can help make urban agriculture more sustainable [1-3].

Methodology

Approximately 2.5 billion people on the planet make their living from agriculture. A number of factors, including urbanization, climate change, and population growth worldwide, have combined to negatively impact food security, livelihoods, and agricultural productivity. The production of nutrient-dense, high-yielding cultivars that satiate animal and human appetites is urgently needed. The agriculture sector has experienced a notable increase in disasters over the past three decades, accounting for 17% damage (D), 31% losses (L), and 25% (DL) globally, resulting in yearly economic losses of approximately $100 billion USD (FAO, 2016). In addition, the supply of fresh water is predicted to drop by 50% by 2050 due to climate change, while the demand for water for agriculture is predicted to double [4,5].

Just 2% and 14% of the world's population, respectively, called towns home in 1800 and 1900; by 2020, that number had risen to 55%, and by 2050, it is predicted to surpass 70%. Finding creative and more sustainable ways to meet growing food demands while still preserving biodiversity is therefore one of humanity's most urgent challenges.

According to West et al. (2014), one of the main causes of environmental degradation in the world is current agricultural practices, particularly those connected to large-scale industrial farming systems. These practices lead to degraded soils and water bodies because of overuse of fertilizers and pesticides, high greenhouse gas emissions, and a significant loss of biodiversity. Conversely, urban agriculture on a moderate scale makes a substantial contribution [6,7].

On the other hand, urban agriculture on a moderate scale makes a substantial contribution to global nutrition, and it is generally preferable to industrial agriculture in terms of certain environmental services, such as the preservation of healthy soils with minimal artificial inputs. The Sustainable Development Goals (SDGs) are being used to identify pertinent research areas for the future and to improve understanding of the relative benefits, risks, and trade-offs of various pest-control strategies used in urban agriculture (UNGA, 2015). According to the UN system, developing nations will account for 68% of the global population by 2050, when urbanization will be at its fastest (Nations, 2018). As more people move from rural to urban areas, there is a growing need for food, and producing it in cities and peri-urban areas is one practical way to meet this demand while also lowering environmental stress and warming the planet.

Thus, low-income households in developing nations support agricultural output and financial gains (Orsini et al., 2013, Thornton, 2008). Future metropolitan agriculture extension has the potential to provide health and environmental services worth $80–160 billion yearly, according to a study by Clinton et al. [2018]. Without a doubt, one of the most promising opportunities for addressing the need of society for increased global crop production to end hunger and malnutrition is found in plant biotechnology (Rana et al., 2020). Enhancing urban agriculture attributes is credited with many biotechnology advancements (Buiatti et al., 2013). We have covered these developments in the current review, which helps urban agriculture by increasing crop productivity and nutritional value while minimizing environmental damage [8-10].

Results

Similarly, we've talked about the potential consequences and ways to support urban agriculture practices in the future by utilizing cutting-edge biotechnology tools like genome editing and omics techniques.

Previously, urban agriculture was only a recreational hobby practiced by people all over the world. However, it has evolved into a

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new way to use land resources to meet the ever-increasing demand for food in urban areas. Small-scale urban agriculture includes backyard and kitchen gardens; medium-scale urban agriculture includes community gardens; and large-scale urban agriculture includes rooftop warehouses or warehouse-based indoor plant factories, vertical farming, and greenhouse farming.

Techniques for indoor cultivation hold promise for overcoming the drawbacks of traditional agriculture as well as the difficulties posed by rapid urbanization. According to Stewart et al. (2013), the urban agriculture system guarantees a workable and promising solution for the biggest problems the community is facing in the twenty-first century with regard to food production. The ideal temperature, humidity, CO_2, and air circulation for the plants are all partially controlled in protected cultivation.

Discussion

According to Reinhardt and Kuhlemeier (2002), plant architecture is made up of both its subterranean components (roots and their temporal, spatial distribution in the soil) and above-ground components (branches, leaves, and flowers; their pattern, positions, sizes, and shapes). Plant architecture forms the basis of most traditional taxonomy and classification systems for plants. Over the past three decades, the field of plant architecture research has grown and become its own independent scientific discipline. When it comes to above-ground plants.

Plant genome editing, or GE, has become a potent tool for achieving desired features. There are several ways to induce genome editing (GE), including CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) with CRISPR-associated protein Cas9 (CRISPR-Cas9), zinc finger nucleases, and transcriptional activator like effector nucleases (TALENs) (Gaj et al., 2013, Vats et al., 2022). Numerous traits related to biotic and abiotic stress have been effectively developed in agricultural and model plants.

Food-borne illnesses are caused by a variety of microorganisms, chemicals, and pollutants found in improperly processed plants. Among these, food allergies are becoming a growing concern for the general public as well as the industry. According to the Food Allergy and Anaphylaxis Network, one in every thirteen children in the US has a food allergy, and 4% of Americans suffer from food allergies.

Conclusion

According to studies, the prevalence of allergies in children has increased by more than 50%.Urban agriculture faces limitations in plant growth because of the lack of sunlight, which forces people to grow plants indoors and in urban areas (Yeh and Chung, 2009). In order to boost output indoors, artificial lighting is taken into consideration. Light-emitting diode (LED) technology has recently advanced, and this holds great promise for improving plant growth and creating more sustainable systems in smart agriculture.The idea of meeting current needs without sacrificing the capacity of future generations to meet their own needs is the foundation of agricultural sustainability. Thus, preserving natural and human resources over the long term is just as important as achieving short-term financial success.

Urban agriculture is crucial to the production of sustainable food in this regard. Urban agriculture controls local climate conditions, air quality, and water resources.

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