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Call home gardening for enhancing food in the urban area

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Food is a basic need and essential for human beings. The COVID-19 pandemic challenges us with food and nutrition security, and thus resilient food system is necessary. Home gardening may improve our self-sufficiency and have a sustainable food system to cope with the challenging situation. There is no denying home gardening brings many benefits to human health, including physical, mental, and social. Nevertheless, the most significant challenges of home gardening, especially in urban areas, are the substrate properties, light intensity, and temperature. Therefore, further investigation should investigate the impact of food crop yield on a household level, especially in urban areas in different countries.

1. Introduction

COVID-19 continuously outbreaks across the world and brings death. The food security and nutrition of millions of people worldwide are threatened by the COVID-19 pandemic (Lal, 2020). Especially, urban people faced huge issues with food supply chain disconnection which led to hunger. It is not in line with SDG 2: Zero hungry. They are highly dependent on the rural people for food. Food insecurity brings a severe problem in developed and developing countries such as Latin America, Sub-Saharan Africa, the Caribbean, South Asia, and the Pacific region (Lal, 2020). Urbanization is growing more rapidly than in developed countries in the 21st century. The global urban population of 54% in 2020 is expected to be 60% by 2030 in this era of urbanization (UN/DESA, 2018).

Therefore, most people prone to undernourishment and malnourishment are in Asia and Africa, and COVID-19 worsens the previously severe problems of hunger (undernutrition) and hidden hunger (malnutrition) (Lal, 2020). Hidden hunger is lacking essential vitamins and minerals for human growth and development.

Before the COVID-19 pandemic, one out of eight people did not have adequate food even though more than enough calories were produced to meet basic dietary needs worldwide (Schipanski et al., 2016). Undernourished people have not decreased as unstable food-price volatility is greater in the least developed countries, notwithstanding global crop production. The global environmental change is mainly caused by agricultural activity and weakens productivity (Schipanski et al., 2016; Steffen et al., 2015). Concurrently, malnutrition and overconsumption are affected by the growing social and economic inequalities (Dixon et al., 2007; Schipanski et al., 2016). To tackle the intertwined worldwide challenges (e.g. limited energy and water resources, diet-related health problems, decreasing crop diversity, moves toward resource-inten-

sive diets, and persistent undernutrition), transformative and systemic solutions are needed (Schipanski et al., 2016).

Two-thirds of the world will be urbanized by 2030; 80% of them will be in low to middle-income countries. Yet, the cities are not well designed to provide sustainable sources of sufficient and nutritious food for a huge population. Food insecurity in 2020 was mainly due to the COVID-19 pandemic. The food price during the pandemic was not meet the demand of the growing population. Besides, the poor institutional support and weak infrastructure have worsened the problem. Thus, the reduction of food loss and food waste along the food supply chain would make the food systems more resilient and reinforce local agricultural capabilities through urban agriculture and home gardening (Lal, 2020). Therefore, the cooperation between government, city planners, and residents are vital to creating a high self-sufficiency level city.

Actions to manage or alleviate COVID-19 pandemics are now affecting world food supply chains. Lockdowns and mobility restrictions imposed by the government are, for instance, slowing harvests in some areas of the world. Millions of seasonal workers lose their source of income while also hindering the transport of food to markets. Thus, the subsequent loss of income and purchasing power has on people's food security, especially the poor (Béné, 2020). Due to COVID-19 severe outbreaks among workers, meat processing factories and food markets are being forced to close by the purchasing power in many places. Supply chain disruption and plummeting consumer demand as some farmers have been dumping milk or burying perishable produce. Consequently, urban people now strive to get fresh vegetables and fruits, dairy, fish, and meat (UN, 2020).

With a good harvest of food grains in 2019 in India and most staple foods being adequate, staple grains in global markets stay robust during the pandemic. Despite that, food security and nutrition remain highly vulnerable to disruption as most of the world's population takes its food from local markets. Food supply chains were disrupted and rose in panic buying en masse and hoarding of food by consumers during lockdown periods and causing more severe disruption, reducing food availability in the market. As the policies to contain the virus result in food production, processing, and transport being weakened. For instance, the time input for cultivating season was delayed due to transportation and market disruption, affecting yield and farmer income. Also, the movement restriction policy makes a workforce shortage. Furthermore, reducing the overall food demand and food-related services like restaurants due to the social distancing policies and illnesses brings up job, income, and livelihood losses (UN, 2020).

As a cost-saving measure, many households shift to inferior goods (i.e., shelf-stable goods for industrialized countries or less processed and more nutritious food). Food accessibility is challenging with high levels of unemployment, loss of income, and rising food costs. Without big-scale organized action, the functioning and sustainability of food systems were disrupted by the effect of COVID-19, mitigation measures, and the emerging global recession which bring severe health and nutrition for more than half a century (UN, 2020).

Furthermore, HLPE-FSN (2020) recommended improving local food products such as home gardens to enhance food resilience, minimize food waste and avoid overbuying to ensure equitable access to food for all community members. The government should provide food production, handling, and processing guidelines to prevent catching and spreading COVID-19. Globe food prices increased which stays at a 10-year peak. This situation also alarms us about the importance of food security. Therefore, food security can be strengthened by home gardening.

1.1 Food security

1.1.1 Concept of food nutrition and security

FAO (1996) defined food security in the publication of the World Food Summit - Plan of Action - Rome 1996 as follows.

"Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life."

Based on the following definition, 4 main dimensions of food security can be identified, which are (1) physical availability of food, (2) physical and economic get

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to the food, (3) food consumption, and (4) sustaining the stability of the other three dimensions (FAO, 2008; Maxwell & Smith, 1992). Food availability directs to the supplies of food security which defined the food production level, food supply levels, and net trade (FAO, 2008).

Adequate food supply at the household, national and worldwide levels corresponds to incomes, expenses, prices, and markets in achieving food security targets (FAO, 2008). However, adequate food supply also needs to look at the individual level since the body is a healthy individual. It should be looked at the individual level as in a household; many factors will also affect "sufficiency" such as eating preferences. Feeding practices, food preparation, diet variety, and inter-household distribution of food determined good biological utilization of food consumed (FAO, 2008).

Adequate food intake daily maintains the nutritional status. Sufficient calorie intake is not enough for an active and healthy lifestyle but also for protein, micronutrients, food quality, and safety (Maxwell & Smith, 1992). However, it is affected by adverse weather conditions, economic factors (e.g. rising food prices and unemployment), or political instability (e.g. conflict and war) (FAO, 2008). Typically, food security is defined as 2 typical types of food insecurity which are chronic food insecurity and transitory food insecurity. Chronic food insecurity is food not accessible food for the long term which is more than 6 months due to financial problems. Transitory food insecurity is short term food not accessible due to household income, food prices, and domestic food production. Sadly, nutritional standards in Malaysia were 14.1% below the world average, even though Malaysia's food affordability was in 25 category ranks compared to 113 countries The food security index in Thailand was ranked 51 over 113 countries as the micronutrient availability was 24.2% below the world average (The Economist Group, 2017).

Low sensitivity and high resilience of the environment and food supply system are crucial to maintaining our health and active lifestyle. Many agencies have risen since the 1940s, such as FAO and UNICEF (Maxwell & Smith, 1992). Overall, Singapore was ranked 20 on the food security index, however, the category of natural resources and resilience ranking was 53. Besides, Malaysia's sensitivity to natural resources and resilience was 24.4% far below the world average (The Economist Group, 2017). During the COVID-19 pandemic and lockdown, Malaysian also launched the White Flag Campaign or #benderaputih in June 2021 (Rodzi, 2021). The flying of the white flag showed the need for food. University students also created an online app, the Sambal SOS app, to help people to fast access the nearby food bank. This also showed that Malaysia has a highly sensitive and low resilience food system under environmental stress. The action is just an intermediated support and not sustaining.

1.1.2 Concerns about food and nutrition insecurity

The food system is typically operated under challenging conditions, such as inadequate infrastructures (e.g., road conditions, power accessibility, irrigation, and wholesale markets) leading to economic and geographic isolation, lack of access to services (e.g., training, credit, supplies), little opportunity to develop business, and high dependence on weather conditions especially in middle and low-income countries (>6.5 billion people), small-scale food producers, suppliers and logistic (Béné, 2020). The food supply cool chain is a vital concern during transportation. What if the food is transported safely but without proper storage conditions? The food is properly rotten, wasted, and even not arrived at the consumer level.

Furthermore, the effect of shocks and stressors are the current issues that directly reflect the inability of the local food systems to respond and recover rapidly. Actors involved in local food supply chains (e.g., food producers, merchants, shippers, etc.) are severely affected by local or mesoscale shocks (e.g. drought, flood) or stressors (e.g. local insecurity, corruption, seasonal road inaccessibility) and hence prevent most of them from operating efficiently. Economic and physical troubles of food supply operations resulted in food losses, food shortages, or price volatility in urban and rural areas for chronic and acute hunger and malnutrition the immediate and continuing consequences (Béné, 2020).

Not only that, uncontrollable factors such as weather and soil weathering are also bringing a drastic effect on our food and nutrition security. Soil quality also plays a vital role to produce nutritious food for us. Soil nutrition status can be indirectly reflected in the plant nutrient. Finding a sustainable way to enrich the soil

status for the next food growing is important. In the household aspect, food preparation and plate waste are always the best sources of soil amendment. However, the attitude toward food waste should be avoided to improve our food security.

Conflict and war between Russia and Ukraine lead to global food insecurity. Both Russia and Ukraine are the big wheat and sunflower oil production countries. This brought another panic buying after the COVID-19 pandemic. A country like Malaysia which is highly dependent on imported food will reduce its self-sufficiency level, increase currency outflow, and increase its carbon footprint. Carbon footprint is the total amount of greenhouse gases such as carbon dioxide and methane generated by an individual during their activity such as transportation. The seed bank is also playing a vital role to ensure our food and nutritional security. It is preferable to have a seed bank in each country to cope with unpredictable disasters including the COVID-19 pandemic.

1.2 Food resilience and sustainability

System resilience is the capacity of the system to withstand and adapt to disturbances, shocks, and external pressures such as unpredictable and not accounted risk over time by fulfilling its basic structure, processes, and functions, and offering its services or desirable results (Schipanski et al., 2016; Tendall et al., 2015). In addition, resilient systems have the buffering capacity that enhances their ability to adapt to changes, learn from past mistakes, and recover from shocks (Schipanski et al., 2016).

Generally, sustainability is the capability to achieve today's targets without negotiating the future to reach them. In contrast, resilience is the dynamic capacity to continue to achieve goals despite disturbances and shocks (Tendall et al., 2015). Therefore, resilience and sustainability are related concepts (Maleksaeidi & Karami, 2013). One of the requirements to preserve resilience is sustainability which reveals maintaining the capacity of a system to operate in the future.

Regardless of disturbances, resilience denotes the capacity to continue providing a function over time. Hence, sustainability is the measure of system performance, while resilience is a way to achieve it during times of disturbance (Tendall et al., 2015). Food system vulnerabilities could be reduced by applying resilience thinking to agriculture at multiple time scales, as well as continuing stresses, occasional shocks, and unexpected shocks (Schipanski et al., 2016). Continuing stresses are long term changes in food demand, for instance, shifting human diets and climate change. Whereas occasional shocks are short term alterations of food demand such as price volatility. Unexpected shocks occur under unforeseen conditions such as catastrophic weather events.

Tendall et al. (2015) suggested a food system resilience explanation that acknowledges the significance of the time dimension in resilience and highlights that resilience appears at the various levels of the food system (i.e., from individuals to national food systems) and global webs of value chains as follows.

"Food system resilience is the capacity over time of a food system and its units at multiple levels, to provide sufficient, appropriate and accessible food to all, in the face of various and even unforeseen disturbances."
A resilient food system excludes the threat of enhancing systems' resilience that produces undesirable outcomes, such as food and nutrition insecurity and environmental degradation. According to Tendall et al. (2015), food availability, accessibility, utilization, and stability over time reflect the importance of resilience for food security.

One of the significant inventions of Thailand's sufficiency economic physiology is to meet SDG goals and benefit the Thai people and even the country (Jitsuchon, 2019; Mongsawad, 2010). The physiology was rooted in Buddhism ideas and looped with three main concepts such as resilience, moderation, and reasonable with morality (action) and knowledge (application) (Jitsuchon, 2019; Mongsawad, 2010, p. 123). The physiology encourages people to shift their growth pattern from mono-cropping or cash cropping to integrated farming to food self-sufficiency. The New Theory of Agriculture encouraged Thai people to divide their land into rice production, vegetable and fruit production, water reservoir, and residential area (Mongsawad, 2010). The surplus food could be traded and further expanded to other products. This encouragement also keeps the Thai people away from poverty and food resilient, thus meeting SDG 1: No poverty

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and SDG 2: Zero hunger.

The concept could be utilized in different rural and urban areas and even countries. However, this theory is just limited to landed housing with a large area of the backyard. People living in tall buildings with limited space may also rely on the resources of those people. Hence, they may apply the part of the theory. For instance, use the window and balcony as microgreens, vegetables (e.g., leafy vegetables, including Chinese chives and bak choy, and fruit vegetables such as cucumber and eggplant), and short-term fruit production (e.g., tomato) space. Rainwater harvest for food production and cleaning purposes to reduce economic stress can partly improve food resilience and indirectly reduce the urban poor.

Besides Thailand, the Malaysian government also incentivizes a program to encourage people to have urban farming. For example, Selangor's government has hydroponic, household conventional cultivation, and community garden (Dewan Negeri Selangor, 2020). Universities like Universiti Putra Malaysia also held farming techniques and tips online (ITAFoS, 2021). However, the incentive is not fully immersed in the community.

To form a whole food system resilience-building process, four accessible entry points are (1) national or regional food systems, (2) individual food value chains ranging from local to global levels (3) individual interests and aspirations, and (4) tackling issues of gender equity, and social justice that shape access to all food system components (Schipanski et al., 2016). Considering these entry points are who is introducing, leading, and supporting the process, who is involved, the goals of the process, and the major issues in the food system of interest. The process then integrates two other levels in further steps, no matter which entry point is selected to capture cross-scale interactions and success in food systems (Tendall et al., 2015).

1.3 Home gardening

1.3.1 Home gardening enhanced food and nutrition security

Most adult Malaysians suffering food insecurity (Ahmad et al., 2020). Home gardening can contribute to food security (SDG 2: Zero hungry) if sound garden planning. It works well in the backyard garden, balcony garden, and kitchen garden. Rationally, food security ensures home gardening by providing an adequate food stock that allows direct food access daily, especially in Bangladesh (Bushamuka et al., 2005; Galhena et al., 2013; Schreinemachers et al., 2016). Home gardening could be done in small spots of homestead land, the edges of a field, vacant lots, roadsides, or containers. Therefore, impoverished, landless, or near landless people could practise nearly no economic resources by using locally available planting materials, "live" fencing, green manures, and local pest control methods.

A diversity of fresh foods that enhance the quantity and quality of nutrients available to the family could be provided. More than 50% of their food supply, such as secondary staples food as taro, cassava, and sweet potato, are obtained from home gardening. The home garden significantly increased by 16.5 g per person per day in vegetable production, vegetable consumption, and micronutrient supply (Schreinemachers et al., 2016). A substantial percentage of the suggested dietary allowance for protein (10 to 20%), calcium (20%), iron (20%), vitamin A (80%), and ascorbic acid (100%) will be provided from a tiny mixed vegetable garden (AVRDC, 1985; Galhena et al., 2013; Marsh, 1998). In contrast, no significant correlation between a home garden and food security was found in the Philippines (Cabalda et al., 2011).

The food variety in a meal is also important for us to improve our appetites and physical and mental health. If space is allowed, different types of vegetables and fruits should be planted. For instance, leafy vegetables (Brassica rapa), root crops (potato), and fruit crops (cucumber, tomato, melon) are providing different types of nutrients. To cope with this sudden pandemic, growing fast-growing crops such as Ipomoea spp., amaranth, and Brassica rapa is preferable.

1.3.2 Home gardening as an alternate income

During this COVID-19 pandemic, Malaysia's household income declined by around 10% from 2019 to 2020 (Department of Statistics Malaysia Official Portal, 2021). Home gardening is the primary source of additional income for poor town and countryside

households worldwide (Abdoellah et al., 2020). During periods of stress from the family household (e.g., long term unemployment, harvest failure, the preharvest lean season, health or other disabilities suffered by the farmer or family members) and market (e.g. economic disruption caused by war), the home garden may become the principal source of income and household food (Marsh, 1998). The home gardener has generated income from part of their production and thus reducing poverty in Bangladesh (Bushamuka et al., 2005). The supplementary income allowed the poorer to purchase other nutrient sources such as meat. It will have become the alternative source of income to cope with this pandemic as most people suffer economic issues.

1.3.3 Home gardening shifts the food preference

Food preference in humans is usually determined by flavour. Sour and bitter tastes are commonly found in vegetables which are vital for a balanced diet. In this scenario, children tend to eat fewer vegetables and not meet the level of nutrition recommendation. With the physical and social environment, children increased twice their willingness to try new foods and were more likely to eat vegetables and fruits that emerged from the Stephanie Alexander Kitchen Garden Program than in the comparison group (Gibbs et al., 2013). In the future, children's dietary diet may switch to a more healthy diet to reduce the prevalence of obesity and overweight among children. In addition, children's preferences may switch to homegrown and locally produced vegetables with the accessibility of gardening (Gibbs et al., 2013).

By using a minimum of 10 g consumption for each food group or applying the all-inclusive dietary diversity score, children from families with gardens had higher dietary diversity scores. They were significantly more likely to eat vegetables more frequently than children who lived in families without a garden. Possessing a home garden was linked positively with the child's diet diversity and vegetable consumption frequency. Furthermore, families without gardens may benefit from raising gardens to enhance diet quality (Cabalda et al., 2011). Children are more excited to accept and enjoy new food and are not choosy, thus less plate waste, which fulfils SDG 12 (sustainable consumption and production).

1.3.4 Home gardening empowers women

Gender inequality still happens even in highly educated urban people (SDG 5: Gender equality). Women are the ones who should stay home to do house chores and men should earn money. Formerly, women in Bangladesh need to have a son or age for decision-making power (Bushamuka et al., 2005). With gender inequality, women also face mental stress (Carmen, Russo, & Miller, 1981). Home gardening can be the medicine to relieve their stress.

Home gardening allows the whole family, especially women and children, to produce their own cheapest and safer nutrient-rich food from seed to cooked food just beyond their eyes (SDG 3: Good health and well-being). Home gardening empowered women as model farmers by sharing their experience and knowledge (Blakstad et al., 2020). Involving the income generation gardening activity and contributing economically to the household improves women's self-esteem and decision-making power in Bangladesh (Bushamuka et al., 2005). Hence, women can sell their surplus vegetables and cooked food to their neighbourhood to earn extra income and contribute to the home economy (SDG 1: No poverty and 8: Decent work and economic growth).

Besides, women also can have a gardening and cooking community to enrich their life. Thus, their life would not be only for their family. They can enlarge their social circle. Women should live for themselves and not others. The government may play a vital role here. Free gardening and cooking online and offline classes should be provided. Time-to-time consultation can be provided whenever they are facing any problems. This may also decrease the chances of being scolded by their husband and not reduce their excitement about gardening and cooking.

1.3.5 Home gardening improved gardening creativity

With the limited spaces in the household areas, gardeners are creative with the garden. They are using any recyclable and reusable container as a growing pot. Also, they are forming a beautiful balcony, kitchen, and even windows. Students in agriculture-related fields such as Universiti Putra Malaysia and Universiti

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Malaysia Sabah were growing some vegetables with farmyard manure during this pandemic. For instance, students from Universiti Putra Malaysia were growing vegetable towers and composting them in the middle of the tower. This project could be brought to the communities, especially urban people.

Gardening creativity is not only limited to home gardeners but also gardening tools and equipment suppliers. They also launched some user-friendly gardening tools for gardeners. For example, the auto watering systems and lighting systems. This tool allows the gardener to understand the principle to grow plants. Also, gardeners with budget considerations are more prone to learn the market available and modify it with recyclable and reusable materials. This also would trigger their knowledge enhancement and share with the community online. Hence, they may influence people around the globe.

1.4 Challenge of home gardening in an urban area

Most areas are urbanized, and thus food growing has just remained on the balcony and kitchen. However, it still has some issues such as soil properties and light to be a concern. Therefore, further study should be carried out to understand the effect of crop yield further.

1.4.1 Urban soil quality

The urban soil is formed during the urbanization process by anthropogenic activity and is hence closely related to the geographic bounds of the process. Urbanization contaminates the soil with anthropic solids such as wood metal, asphalt, glass, masonry, and plastic and creates particular soil problems such as soil compaction, consequently impeding root growth. Urban soil is a material more than 50 cm thick of non-agricultural and manmade surface layer produced by filling, mixing, or contamination of land surface in suburban and urban areas (Craul, 1985). The non-urban area does have highly disturbed land and is associated with soil material, such as strip-mine spoil banks. In contrast, soil-forming processes occur naturally with ice, gravity, wind, water, and heat.

Urban soil such as Hong Kong, Japan, Germany, the USA, the UK, Russia, and Australia has dumped materials (Jim, 1998; Tiller, 1992). When the soil is removed, stockpiled, respreads, translocation, and hence the mixing of soil material occurs, allowing the exposure of subsoil and eroding the soil. To backfill drains and foundation walls or construct berms, urban soil is filled by dumping and spreading soil material over an existing surface to raise it to a higher level. The soil structure has been modified and destroyed by reducing pore space, especially macro pores and thus leading to compaction. Besides, the frequency of structure-enhancing wet-dry cycles was lowered and subjected to water surface traffic, leading to compaction (Craul, 1985). The presence of a surface crust on bare soil tends to be water-repellent and damages the vegetation. Furthermore, soil reaction (soil pH) was modified and usually elevated.

Insufficient organic matter and clay colloids in urban soil reduce the cation exchange capacity, contributing to nutrient exchange sites. As a result, the soil has low cation holding capacity and an inability to keep nutrients for plant growth. Nutrient ion quickly leaches during heavy rainfall as ions fail to find a foothold on the colloidal surface. For tropical soil, exchangeable calcium (Ca), magnesium (Mg) and sodium (Na) are below the low rating threshold. In urban heat islands, elevated temperatures in an urban area also affect nutrient and water cycling and thus affect vegetative growth (Schatz & Kucharik, 2016). Organic matter is correlated with the base saturation percentage (Jim, 1998).

Lead (Pb) persists in the soil once lodged, mainly from the combustion of leaded petrol in transportation and transferred to the soil through wet or dry deposition (Jim, 1998). Due to controlled Pb fuel combustion, the concentration of Pb has been reducing over the last few decades in the environment. Over 126% decline in Pb concentrations in 2012 compared to 1941 was shown in bio-monitoring studies; however, the concentrations of nickel (Ni), cadmium (Cd), and chromium (Cr) content in 2012 were increased by 13, 10, and 16 times, respectively (Rodríguez Martín et al., 2015).

1.4.2 Lighting issues

Urban canyon shading is an important factor for urban plant growth since the plant is light-demanding. Shading and low light intensity affected plant growth

and development. For instance, shading affected plant photoperiod interruption, stomata conductance rate, carbon assimilation, flowering, leaf size, density, and colour in woody and herbaceous plants (Gebert et al., 2019; Jeong et al., 2009; Neverauskas, 1988; Vendrame et al., 2004). Deep shade significantly affects the plant morphology even though it can survive (Stanton et al., 2010). The low light intensity happened especially for the residents living in between tall buildings on a lower floor.

Light conditions and plants to be chosen are modulated by the face of a balcony garden (Bal & Pal, 2020) to reduce plants suffering from environmental stress. In the northern hemisphere, south-facing balconies are received direct sun rays for the more significant part of the day if there are no obstacles like adjacent buildings or big trees. In contrast, north-facing ones do not want such necessary sunlight. As a result, east-facing balconies receive fairly intense sunlight from morning to noon, whereas west-facing one receives total afternoon sun rays.

Plant tolerant to photoperiod would be more suitable for urban home gardening, such as Basella alba and Basella rubra. Therefore, the better option to grow vegetables in a tall building would be indoor farming with artificial lighting. Nonetheless, it would be increasing the home gardening cost for lighting. Home gardening should not be stressed in plant and human mental health and economy. Home gardening should treat mental health, especially in this pandemic that restricts movement.

On the other side, an urban area is also serious in light pollution. Prolonged light quantity significantly improved plant morphology and physiology (Neverauskas, 1988). However, the light quality and quantity varied from place to place (Kjelgren, 1995), and hence it was not easy to estimate the effect of the plant.

1.4.3 Urban heat island

Furthermore, anthropogenic land surface medication in urban induces the urban heat island effect. It significantly increased the evapotranspiration demand and eventually may impact the water, carbon, and energy cycle within the area (Zipper et al., 2017). It also affects the growing season, including the start, end, and total growing season, and eventually affects our food security (Schatz & Kucharik, 2016), especially growing in urban areas. Therefore, landscape planning and designing with urban green space are crucial to cooling space (Xiao et al., 2018).

In short, the challenge of home gardening in an urban area significantly affects plant growth and development. However, the government, urban landscape designers, environmentalists, and agriculturists could improve plant performance.

1.4.4 Food source variability limitation

Plant-based food is limited to leafy vegetables such as spinach and amaranth, fruit crops such as tomatoes and eggplants, and rooting crops such as carrots and potatoes. Fruit tree such as apple is not able to grow in apartment area due to the need for space and the supporting structure of the sky-scraping building. No livestock rearing is allowed in most of the sky-scraping housing areas such as apartments and condominiums. The policy is to take care of the well-being of the human being with a comfy home.

2. Conclusions and Recommendations

Food is our need, yet it is vulnerable to stress. The COVID-19 pandemic alarms us of the importance of a resilient food system as this event bring the most significant impact on our food security. Between, home gardening brings benefits such as food and nutrition sources, alternative income, improve food experience, empowerment of women, and gardening creativity. There are limitations for the urban home gardener. The urban area is limited by soil quality, lighting issues, temperature, and food source variation. Even though this pandemic ended, the next disaster may be coming and challenge our food system. To cope with the now and then situation and have a sustainable food system, home gardening may be the solution for us to improve our self-sufficiency level. Home gardening provided food and nutrient source for health. Government should play a vital role in policy and education as the Thailand king did.

Conflict of interest

The authors declare no conflict of interest.

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