

Applicational study on the edible university landscape under COVID-19 epidemic circumstance

Abstract

All of universities or colleges have to solve the big challenges from the outbreak of COVID-19. Quarantining of Campus has been being the regular management policy, the activities of all students were restricted inside the campus. Under such status, campus landscape quality. In this study, the concept of Edible Landscape has been introduced into the campus planning and designing. The construction principles of healing, practicality, ecology, economy and adaptation to local conditions were illustrated, in the light of COVID-19 controlling and prevention. Furthermore, a construction strategy of edible landscape in assisting related teaching and researching activities, taking away negative emotions, and producing fresh and delicious fruits and vegetables, which can offset the shortcoming of traditional landscape of ornamental-value-centered. The construction principles and strategies of this paper put forward novel thinking and references to carry out the construction and development of campus landscape with ecology, healthy and effective traits, to the application of edible and pluralistic school landscape.

Keywords: Edible landscape, Quarantine of epidemic situation, Application study, Epidemic Prevention

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Research significance of edible landscapes

Development process of edible landscapes

The origin of edible landscapes can be traced back to the three kinds of Gardens (Yuan, You, Pu). It is written in The Book of Songs: "the animal farm is used to keep animals in captivity". It is also written in the *Shuo Wen*: "Yuan is the garden for planting fruit trees; Pu is the garden used for growing vegetables".¹In the late Eastern Zhou Dynasty, with the improvement of productivity level, the ornamental function of the garden gradually appeared, but still retained the function of production for a long time.² There is the *SanFuHuangTu*, which records the Shanglin Imperial Park of the Han Dynasty: "The grape palace is in the west of the Shanglin Imperial Park", means that exotic species such as grapes and lychees are grown inside Shanglin Imperial Park.³The forbidden garden of the Tang Dynasty was used as a production base to supply fruits and vegetables to the palace; peach, cherry and other fruit trees were more and more planted on both sides of the streets in Luoyang city. During the Song Dynasty, agricultural production techniques were advanced, and the fruit trees, medicine herbs were planted in the Royal Gardens, where it not only carrying on the ancient tradition as before but also add new content into it,⁴ which fulfilled the production functions of garden. During the Ming and Qing Dynasties, rice fields were reclaimed around the Summer Palace as the royal imperial fields, thus showing that the productive function of the gardens was gradually recognized and valued by the users.

The development of edible landscapes at domestic and abroad is similar and related to the level of social productivity. Early palace courtyards in ancient Egypt, medieval monastery courtyards and castle courtyards were mainly practical, with edible crops such as olive, apple and pear planted inside.⁴Allotments gardens emerged in England in the late 18th century to meet the needs of the urbanized population who lost their land due to the enclosure movement and industrialization.⁵ In the 19th century, German Schreber garden had been transformed into a now form that focus on the experience of farming cultivation and the spiritual needs of getting close to nature.⁶ Community gardens in the United States in the early 20th century were designed to provide

food and work for citizens in the context of the Great Depression, and from the 1990s to the 21st century, community gardens played a variety of roles in education, environmental protection, and ecological restoration.²

The data in the figure are from the China National Knowledge Infrastructure and Web of Science (WOS), publish time set to 2005-2022, retrieved May 28, 2022. The search was conducted with the themes of "edible landscape", "productive landscapes" and resulted in 332 valid documents. In the Proceedings of the core document database of WOS, 200 papers with high relevance were selected by using "edible landscape" and "productive landscape" as subject terms to form a foreign sample data base. Using Citespace's keyword path calculation method, the keyword analysis frequency of one slice per year was used to obtain the domestic and foreign keyword emergence analysis graphs in Figure1. From the graphs, it can be seen that edible landscapes, edible landscapes combined with rural revitalization and landscape design are the current domestic research hotspots and trends. Foreign research frontiers focus on ecosystem services, agricultural development, soil quality and community gardens.



Figure 1 Citation Burst Analysis of keyword in domestic literature.

Challenges of the epidemic on campus landscape and management

The new crown epidemic has brought great challenges to the management of universities around the world. The quarantining model

of campus management has achieved remarkable results in epidemic prevention and control, but some derivative problems have gradually emerged up in terms of college students.⁷ For example, long-term quarantining inevitably lead to teachers and students suffering from certain anxiety, depression and other psychological problems. Some district of high epidemic situation, has been shorting of living materials due to the quarantine. Under the attacking of the epidemic, the shortcomings of the traditional landscape of community and campus, monotonous, patterning, pay more attention on ornamental function and overlook production function has been surfacing gradually.

Edible Landscape was first proposed by landscape architect Robert Kourik in the 1980's as a way to create ornamental, productive, and edible landscapes using edible plants.⁸ Edible landscapes break out the traditional landscape design models, and introduced the tactics into campus landscape design can help solve these problems.

The importance of campus green space landscape

It is the unique feature that university students determine the risk of cross-infection on campus.⁹ Universities have been the vital units for epidemic prevention and control considering its high outbreak risk.¹⁰ Campus green space can eliminate noise to certain extent, beautify the environment, improve the local micro

climate that include amazing temperature, humidity and active ingredient releasing from trees and herbs, which provides a good platform to learn and communicate, and relax for teachers and students. Secondly, campus green landscape can enhance the physical and mental health of the people who use it through sensory stimulation, such as a good campus ecosystem, the pleasant sound of birdsong makes people happy, the unique smell of aromatic plants relaxes people, green plants can soothe the eyesight, and cobblestone paving can massage the muscles. By stimulating the five senses of hearing, smelling, seeing, touching and tasting, it achieves the positive effect in releasing stress, enhancing physical status and advancing the mental capability.

Principles of edible landscape in the background of epidemic conditions

Healing function

At present, most colleges and universities in China adopt closed loop management. Once the scope of travel activities has been restricting for a long time, students and teachers in school will have negative emotions inevitably such as loneliness and helplessness. Some studies show that college students possessing both physically and mentally health can create higher personal and social values when they enter into the workplace.¹¹ It is well-known matter that the psychological problems of college students are as the same important as the physical ones. Creating a picturesque and agreeable landscape is to provide a precondition to enhance the overall health status of students at university. The campus landscape must play positive and active roles in both healing function but also the traditional green volume index¹² during the epidemic situation. It has been a regular measure that fragrance plants application in campus, such as *Rosmarinus officinalis*, *Mentha canadensis* Linnaeus and *Ocimum basilicum*. The special ingredients of aromatic plants can better the investigated people through relaxing man's nerves by the effect of endorphin and enkephalin, and achieve a healing effect on health.¹³

Function of yielding food and agreeable experience

Edible landscapes are composed of edible plants, by which three functions of greening or beautification, ecological value and a transformed production function can come true.¹⁴ The edible landscape focus on its dynamic experience process, in which contains a series

of colorful and seasonal variation episodes, providing different visual and psychological feelings through stimulating inner metabolism of human body and yield healthy feedback. The edible landscape break through the limitations of traditional one and bring a new landscape experience for students and teachers, to avoid the aesthetic fatigue brought. In addition, the domestic epidemic may out break at any time, which put forward to higher requirements for urban green space, the production roles of urban landscape have been getting more and more attentions from different populations, especially people went through quarantine spell without sufficient supply of food, vegetables, fruits and other necessary items. Edible landscapes are productive compared to traditional landscapes, which should be attributed to regional features of selected plants with strong adaptabilities and unique advantages to meet the demands of low-carbon. So, edible landscape not only satisfy the demanding of five sense feeling (sight, touching, smelling, tasting, hearing), especially the tasting always aroused the agreeable and enjoyable feelings, but also yield many kinds of edible, fresh fruits and vegetables.¹⁵

Function of science teaching

Edible landscape can provide the necessities and preconditions for labor education as well as the practical teaching activities,¹⁶ scientific researching materials. The edible landscape provides preconditions for San Quan Yu Ren, which lies in the well combination of education both out-class or in-class, to commence a new campus living style to university students in New Era. By which capabilities of active observation driven by strong requirement for knowledges, reflections, mental management can be trained and get consciously or unconsciously as well as the pleasant feeling deriving participating in the build-up of. This method not only allow students to strengthen their knowledge learning in practice, but also helps students to establish a correct concept of labor, form labor habits, and improve their abilities of practicing and solving problem, which is in line with the trend of the development of the times.¹⁷

Ecological function

As an important part of the urban green space system, campus green spaces play an important role in maintaining biodiversity and improving the quality of native habitats.¹⁸ The construction of edible landscapes can preserve the original topography of the site to the greatest extent. Productive plants not only effectively improve the microclimate environment, but also attract insects and birds to inhabit and reproduce, improve biodiversity, and create a stable campus ecological environment.¹⁹ For example, the rice field landscape of Shenyang Jianzhu University keeps some of the rice for birds to eat during the annual harvest in order to repay to nature.²⁰

Function of cultural transmission and inheritance

Campus is the main place for teachers and students in daily life, where campus culture can be illustrating vividly through the material carrier of campus landscape, can reflect the characteristics of a school culture and teaching atmosphere.²¹ The edible landscape has the background of Farming Culture, symbolizing hard work and perseverance, and combined with the slogan of "Hands in hands to fight the epidemic and overcome the difficulties together", it can inspire the students and teachers overcoming the epidemic.

Campus edible landscape creation strategy

The creation strategy focuses on three parts: plant selection, planting form and post-care management.

Plant selection

The aim of creating edible landscape is permeating regional features through proper plant design and other humanity design. So,

the selection of plants is vital important to build up the agreeable campus scene. Generally speaking, plant selection should be paid on planting site conditions, the ecological habits of plants.

Plants selection according to the planting site conditions

Plants should be selected according to the environment of the target site, which need to take the concrete status of temperature, sunshine,

moisture, wind and other biological factors into account altogether. Yangtze University locates in Jingzhou City, Hubei Province, where is a typical subtropical climate with four distinct seasons and abundant rainfall, and citrus plants grow well here. In addition, what and how we figure out the proper plants, the Table 1 offers some useful information (Table 1).

Table 1 Part of suitable growing conditions for edible plants

Name	Latin name	Temperature	Water	Growth habit
citrus	Citrus reticulata	Flower bud differentiation: 10-20°C	Air humidity: 70%-80%	Prefer warm and humid
	Blanco	Growth temperature: 13-37°C	Soil moisture: 60-80%	Does not tolerate low temperatures
Pomelo	Citrus maxima	Absolute low temperature: >-7°C	High water demand, not durable to flooding	Prefer warm and humid
	(Burm) Merr.	Growth temperature: 23-29°C	Air humidity: 75%-80%	Drought intolerant
loquat	Eriobotrya japonica	Growth temperature: 12-15°C	Air humidity: 70%-85%	Soil adaptability
	(Thunb.) Lindl.	> -5°C in winter	Soil moisture: >60%	Suitable for warm and moist
pomegranate	Punica granatum L.	Fruiting temperature: 12-18°C	Control watering	Hardy, drought tolerant, infertile, not tolerant of flooding
		Growth temperature: 15-20°C	It is better to be dry than wet	
Cucumber	Cucumis sativus L.	diurnal amplitude: 10-15°C	Air humidity: 60%-90%	Not tolerant to drought, not tolerant to flooding, requires a lot of water
		Growth temperature: 20-25°C	Soil moisture: 60-90%	
tomaoto	Lycopersicon esculentum	Flower bud differentiation: 20-30°C	Air humidity: 60%-80%	Temperature-loving vegetables, light-loving, short-day plants
		Growth temperature: 15-35°C	Soil moisture: 45-50%	

Plants selection according to seasonal changes

The most outstanding advantage of the deepening integration of ornamental fruit trees and landscaping lies in its distinctive seasonal changes, presenting different ornamental effects with the change of

seasons.²² It is necessary to fully understand the growth habits and ornamental characteristics of the plants to achieve an harmonious. About this point, Table 2 list different trees classified based on the four seasons.

Table 2 A list of seasonal changes in some fruit trees

Spring	Summer	Autumn	Winter
<i>Malus pumila</i>	<i>Punica granatum.</i>	<i>Crataegus pinnatifida</i>	<i>Citrus reticulata</i>
<i>Prunus cerasifera</i>	<i>Atropurpurea</i>	<i>Diospyros</i>	<i>Citrus sinensis</i>
<i>Malus spectabilis</i>	<i>Litchichinensis</i>	kaki Thunb.	<i>Citrus maxima</i>
<i>Prunus spp.</i>	<i>Mangifera indica</i>	<i>Pyrus spp</i>	<i>Citrus × limon</i>
	<i>Eriobotrya japonica</i>	<i>Ziziphus jujuba</i>	(Linnaeus) Osbeck

The edible landscape should be planted after thinking through the morphology, color, ecological habits and flowering period of plants, to create a multilayer plant community that have enjoyable scenery in different seasons. Considering plant ecological habits, the understory space of trees should be planted love-shadow species or shadow-

tolerable ones, the upper-layer is suitable for sunlight-loving trees. the scientific combination of trees, shrubs and grasses makes full use of the vertical space, and maximize the ecological benefits per unit land. To some places with higher utilization, plant design should consider the plants with function of repelling mosquitoes, such as *Dalmatian chrysanthemum*, *Tulbaghiaviolacea*, *Mirabilis jalapa*.



Figure 2 Citation Burst Analysis of keyword in foreign literature.

Edible landscape presentation

The planting form is determined by the site nature, and make decisions about the construction points considering the features of season and site conditions following the principle of humanization and the users' needs. Secondly, in the light of local situation, to carry out landscape planning and designing, a principle must keep in mind, respecting the original landform. For example, in the area of teaching and office, the outdoor planting and roof garden can effectively absorb sound and reduce noise to maintain a quiet environment. The recreational activity area focuses on human participation, using edible plant materials to create flower beds and border, and organizing interest activities such as One-Meter Vegetable Garden to attract people to enter and make the land space active again (Figure 3).

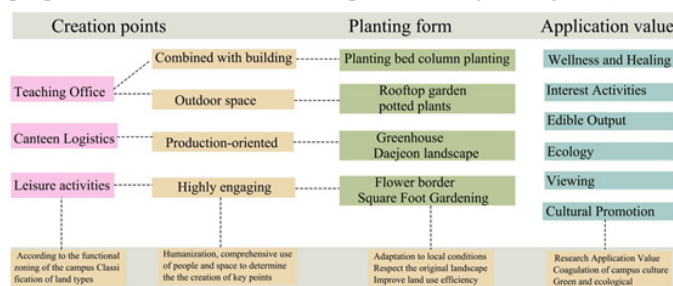


Figure 3 Plant configuration forms for different land types.

Operations Management Strategy

Focus on overall planning and optimization of student training programs: Edibility was the primary function of landscape gardening in the early development stages, and ornamentation has been put at the important rank following the society development and advancement of people's living level. In recent years, edible campus landscapes have again received a lot of attention from the industry. *Eriobotrya japonica*, *Citrus reticulata* Blanco, *Prunus persica*, *Armeniaca vulgaris*, *Prunus salicina*, *Osmanthus fragrans* and other plants, the campus has long been a popular area for students to pick *Eriobotrya japonica*, climb over the fence to pick oranges sharing them with their classmates, and bring out their own pickled flowers of *Osmanthus fragrans* to classmates, all of which area fond memory. In the meantime, personal safety needs to be thought ahead by setting up safety warning signs and removing fences around the fruit.

In the new era, for the edible landscape of the campus, overall planning and designing, taking into account the geographical characteristics of the school and covering the discipline situation is the same important as growing fruits and vegetables. At the same time, it consider deeply the multi-need of students that to combine moral, intellectual, physical, aesthetic and labor comprehensive development,

and makes the edible landscape become an open attraction scenery to attract the participation of all teachers and students.²³ In response to this situation, schools should publish relevant rules and regulations to put labor classes into a mandatory project every semester. Thus, edible landscapes are considered as a new model to be incorporated into the overall landscape planning of the campus, which can meet the needs of campus teachers and students to observe and experience the process of plant growth and development, to enjoy the perception and experience joy of harvesting, and the perceptual experience of landscape art.²⁴

To create a campus edible landscape painting by students and faculties: Edible landscape belongs to the category of productive function of landscape, and edible campus landscape has an important role in practicing the new era of labor class. Colleges and universities are the convergence of national culture, expertise and skills. With the national goal of Carbon Peaking and Carbon Neutrality Goals as their responsibility, they can create beautiful and edible campus landscapes through innovation and entrepreneurship projects, competitions and other diversified forms, giving full play to their professional strengths and the talents of teachers and students, and using them for innovation. Henan Agricultural University and other productive landscape break through the traditional Sightseeing Experience, combined with campus characteristics to create teaching, research practice base, which let teachers and students to participate in, to achieve a win-win result of scientific research, labor practice and output harvest.²⁵ According to the professional characteristics of each faculty, each faculty creates a special garden complying with the overall campus planning. This model has the following advantages: (1) non-agricultural students have the opportunity to participate in the construction of campus greening and beautification, enhancing the sense of belonging and accomplishment to students; (2) Cross-disciplinary and co-integration development is achieved, stimulating the creativity of student groups and cultivating teamwork skills.(3) Joint efforts are made to build edible cultural landscapes on campus, effectively experiencing the "flowers in spring and fruits in autumn. (4) To cooperatively build edible cultural landscapes on campus, to experience the changes of seasonal landscape, and to create a good atmosphere for the overall development students.

Explore Win-Win Campus Landscape and Promote Farming Culture: The obvious feature of plant is lively changing following the season alternation. To some plants or crops, the most attractive spell only keep several days, especially to annual plants. In landscape fields, it is possible to build a plant community with blossom in three-seasons even full year by arranging different kinds of species, which can overcome the drawbacks of single plant application. For example, the Rice Campus of Shenyang Jianzhu University, rice (*Oryza sativa*) has the advantages of low cost and quick results, but there is no scenery to enjoy after the harvest. If carry out crop landscape, crop rotation is a ideal select, which do help to create a lasting campus landscape.²⁶ Therice fields in rotation with *Astragalus sinicus* can achieve both the purpose of self-fertilize the fields of *Oryza sativa* in Yangtze University, and the effect of spring flowers attracts countless teachers and students to stop, watch and take photos (Figure 4). In addition, there is a rotation model of *Triticum aestivum*-*Zea mays*-*Brassica napus*. The crop campus landscape is more suitable for agricultural colleges and universities, in which can meet the scientific research needs of teachers and students, and create a unique campus landscape. Considering that the labor course will be commenced in all the Chinese schools and universities, non-agricultural colleges and universities can set up diversified campus landscapes, so that students can better understand and experience Chinese Farming Culture, and cultivate a tough character of hard working.

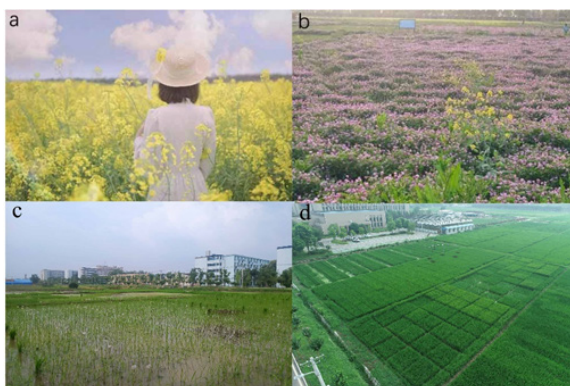


Figure 4 Rice field landscape of Yangtze University West Campus.

Conclusions

Edible landscape originated from ancient Farming Civilization. We have to publicize and inherit the elite Farming Civilization Culture Wealth of our Nation, to nurture new generations to form the right values. There are some advantages to popularize it, and the summarized goodness as follow:

Firstly, edible landscape is an important part of landscape production function, with which campus landscape can yield much more benefits, such as Five Sense Design is good at keeping physical and mental health, especially tasting sense can only be come true through edible landscape application. Meanwhile, it can provide various fruits, food and other edible things, equals to enhance land utilization efficiency.

Secondly, edible landscape is a carrier of propagating Farming Culture, by which students have the chance to experience the annual cycle of different campus edible plants and anticipate the real cultivation, by which make students realize that any living necessities is made up of many physical and intelligence working, cherish happy life, and set up strong view of life.

Thirdly, to build edible landscape may become one way of implementing San Quan Yu Ren. Most of the schools can try to set up a slice of edible landscape or garden to enrich campus living.

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Conflict of interest

The author declares that there has no conflict of interest to publish this manuscript.

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