Exploration into Development Pattern of Contemporary Urban Agriculture under Urbanization

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Abstract. Urban agriculture, as a new industry related to city closely, is significant to solve the issues arising from urbanization and realize the sustainable development. Following the logic introduction of the origin and revolution of urban agriculture, this paper summarized the main problems existing in the contemporary urban agriculture development in China. Based on the urban agricultural development experience under the context of urbanization, it puts forward a new development pattern of urban agriculture for China cities.

Introduction

A series of issues are faced by the city under the rapid development of urbanization, including decline of natural environment quality, population expansion, environmental pollution, and land shortage and traffic congestion. For the cities and the surrounding rural areas, the increasingly prominent problems also are reflected in imbalance between social and economic development, division of natural and agricultural landscape, city sprawl, and loss in agricultural land and labor in suburb. The relationship between city and agriculture therefore becomes the focus of attention for scholars both at home and abroad again.

In western city planning system, the famous Garden City model put forward by Howard, advocated that city vitality should be combined with the tranquil and healthy natural environment in rural areas to further constitute modern pattern of city development. In this model, city is divided into different functional area by annular greenbelt and the limit of development scope is preset for each area. The administration, culture and business group match with the peripheral industry and farmland. This pattern was highly fascinated after World War II and three generations of new cities were built in UK guided by this pattern. However, city expansion finally led to the unlimited sprawl of city scope with the growth of population and the rise of economic level. In the development of contemporary city, city Greenland was encroached and divided, showing the pattern of fragmentation, either in metropolitan area, megalopolis or metropolitan region. And industries including agriculture also get further away from urban residents, which improve the life cost and have impact on daily lives and public recreational activities for city residents.

Modern urban agriculture emerged in this context. The supply for vegetables and other agricultural necessities is improved both in convenience and food security. Additionally, urban agriculture serves as a kind of cultural and recreational activity with strong participation. And it can promote the communication and exchanges of social public, eliminate social isolation and build harmonious relationship among different groups.

A commonly perspective calls for that the development of urban agriculture is beneficial to coordinate and cope with the problems faced in the current development of majority cities, which is significant to break urban-rural dual structure and achieve sustainable urban development. The combination of urban agriculture and city planning is especially vital to the effective development of urban agriculture. The main problems existing in the contemporary agriculture are summarized following the logic introduction of the origin and revolution of urban agriculture. The pattern of urban agriculture, which suits national condition of China, is ultimately put forward drawing from the theories and practical experience of city planning under the context of urbanization.
Concept, Origin and Development of Urban Agriculture

Concept and Origin

Urban agriculture, as a new pattern of agriculture, theoretically originates in Japan and some European cities with highly urbanization. Urban agriculture was firstly mentioned in Agricultural Economic Geography by Japanese scholar, Aojisi Shiro in 1935 [1]. During 1950s-1960s, urban agriculture drew attention from American experts widely. And Alan Kniss, an American agricultural economic expert, clearly put forward the concept of urban agriculture in book Japanese Agricultural Pattern in 1977 [2]. The subsequent international practice of urban agriculture develops rapidly. According to The Council on Agriculture, Science and Technology (CAST), urban agriculture is defined as the agricultural activities within city, which consists of production, manufacturing, marketing and consumption. It also includes offering recreational activities, commercial vitality, individual and community health and welfare, landscape beauty, environmental protection and regulation for the city [3].

The proposal and development of urban agriculture is a dynamic process. Schrebergarten pattern firstly emerged in German in 1919. During World War II, to alleviate food shortage from the war and strengthen city independence, Food and Drug Administration (FDA) in U.S launched national victory garden plan and established a considerable amount of urban farms (Fig. 1). The participant was up to 5,500,000 and fruit production for only one year reached 9,000,000 lbs., accounting for 44% of agricultural production in U.S. after the war, urban agriculture drew attention and as a significant way to deal with a series of urban issues bringing from rapid urbanization and industrialization.

![Figure 1. Urban farm during World War II](source: Wikipedia).

The formation of urban agriculture differs in historical period and direct reason in different countries under various political and economic systems, but the ultimate cause is the same, which is the rapid development of urbanization [4]. To the point of Canadian expert, Christopher R. Bryant, the agricultural behavior for surrounding areas of the cities gradually attracted wide attention from geographers, urban planners and decision-makers due to the large concentration of the population within the city and the various requirements for the surrounding areas.

Development Pattern and Trend of Foreign Urban Agriculture

New Forms of Urban Agriculture (NFUA), featured as multi-functionality, have gained wide attention from scholars. NFUA can be divided into three types: urban farm, allotment garden and agricultural park. Urban farms, as the basic form of urban and multi-functional agriculture [5], provide cooperation relationship for farms and communities to reach direct connection between food production and consumption, reducing food distance. Urban farms are usually operated in the community supported-agriculture model with the scale ranging from 5,000 to 20,000 m². City waste material is recycled for production, which is valuable to improve city environment, offer social education and increase employment and maintain social equity [6]. The minimized scale of
Allotment gardens range from 50-100 m² to 200-400 m² and the maximized scale can reach 5,000 m² [7]. These aim at offering garden-oriented activities with participation for children, senior citizens and the unemployed. Agricultural Park, as a creative kind of agroforestry managing pattern, combines the agricultural production (mainly the organic plant) with rural landscape conservation and management of natural resource with the objective to offer the production and leisure and conservation for the cities, using large area of farm land. Land use for agricultural park is flexible and it ranges from 10 to 10,000 Ha in France. The above three types are all widely applied in city area in European cities, especially Mediterranean area. Other patterns of new form of urban agricultural also emerged under other geographical background and demands of planning scale, such as domestic gardens and educational or social farms [8].

The primary characteristic of urban agriculture lies in the organic whole constituted by its mutual connection with city economy, society and ecological system [9]. It’s therefore necessary and crucial to analyze the relationship between agriculture and city from the perspective of urban planning. International experience and trend indicates that it’s one of the important ways to achieve city sustainable development through integrating urban agriculture into urban planning. In Japan, rural areas were gradually declining during 1960s-70s due to the advance of rapid urbanization. And government began to conduct a series of reform policies of agricultural land to support agricultural development. Layout of urban agriculture was gradually constituted in the distribution of spot or patch in Tokyo, Osaka and Nagoya metropolitan region. Various managing forms were displayed depending on the perfect system of urban agriculture and industry, such as citizen farm, agricultural park, accommodation in the farm and natural resting and health-keeping villages. In some capitals of developing countries, urban agriculture is also integrated into master plan or plan of city development. La Habana, the capital of Cuba, promulgated the first cooperation plan of urban agriculture in the world in March, 1993. And the department of urban planning and urban agriculture also amended relevant laws to the convenience of the urban agricultural construction for unused city land. Additionally the special research agent of urban agriculture was set up to offer specific service and technical support [10].

The development of urban agriculture was blocked because of higher land value and development density in city built up area. Andre Viljoen, an American architect, proposed to integrate continuous productive urban landscapes into strategies of urban design to further form open productive layout of spatial network within the city, ultimately connecting to the rural areas [11]. This theory plays an important role in directing organic accordance with urban green space for urban agriculture, reducing maintenance cost of city green and decreasing the farmland occupation by city construction. Upper Bieslandse polder (Fig. 2) in Netherlands locates at the peripheral area of eastern cities in Delft, covering 35 hectares. Footpath was planned around polder for walking, cycling, horse riding and sightseeing. The function of land use consisted of dairy agriculture, recreation, nature (re)development, natural water treatment, wildlife habitat and social education [12]. Large social demand was satisfied with less land by planners. The government extended the lease of its land and supported the subsidies to the farmers of the land management along with groups of environmental conservation, which was the model to combine land uses with integration of policies among different organizations at different levels.

![Figure 2. Upper Bieslandse polder](source: Multifunctional Land Use: An Opportunity for Promoting Urban Agriculture in Europe).
The development of three-dimensional urban agriculture, which includes city farms depending on high-rise buildings and small-scale roof planting, increasingly becomes the hot spot to compensate urban agricultural land and construct ecological city. This three-dimensional urban agriculture is effective to improve environment of city buildings, alleviate heat island effect and establish ecological cycle economy of urban agriculture. According to the design project (Fig. 3) of Central Theater District proposed by Gordon Graff, a Canadian architect, this building is total 58 floors and 7,400m$^2$ planting area are suggested based on 2,508m$^2$ base area, which can offer food supply for 35,000 people [13].

Figure 3. Design project of Central Theater in Toronto City (source:http://www.treehugger.com/green-food/more-detail-on-gordon-graffs-skyfarm.html).

Conditions, Problems and Focus of Urban Agriculture Development in China

Development Condition

Urban agriculture mainly originated from the development of suburban agriculture in China. In 1980s, State Council proposed to implement the construction of Vegetable Basket Project in order to guarantee the supply of urban non-staple foodstuffs and part foodstuffs and stable price and residential life, which triggered the construction rush of suburban agriculture [14]. The constraint of suburban agriculture was revealed gradually, such as hard definition of spatial district and partial emphasis on economic benefit and disconnection with city development.

Jiusheng Yu et al. from Shanghai Academy of Agricultural Sciences began to translate foreign works on urban agriculture. And Shanghai, Beijing and Shenzhen et al. clearly proposed to accelerate the transformation from suburban agriculture to urban agriculture. In 1994, Shanghai pioneered to list urban agricultural development into the ninth five-year plan and objectives outline of city development. Following by Shanghai Agricultural Layout Plan (2009-2020), compiling methods of urban plan is combined with agricultural planning to fully match with Shanghai Master Plan of Land Use (2006-2020). Suburb agriculture of Shanghai City is divided into five districts and three industries. The former consists of Sandao production district of green quality agricultural product, Hangzhou Bay production district of Beian crop, vegetables and special fruits, Sanshui agricultural district at Upper Reaches of Huangpu River, north Shanghai production district of outer suburban vegetables and crop facilities and development district of urban garden agriculture around the city which is the mosaic wedge agriculture, tending to offer urban areas ecological protection and leisure space. Three industries cover security industry, industry of local advantages and specials and service industry. Suburb agricultural production land is distributed in concentration and is dominated by function of agricultural production according to circumstances, supplemented by ecological leisure sight-seeing agriculture. This plan emphasizes the organic combination between production types and morphology and layout, realizing comprehensive layout of district and group agricultural production [15].

According to Beijing Construction and Development Plan of New Village during the period of 11th five-year Plan, urban modern agricultural layout is optimized to form five urban agricultural circles, including urban development circle, suburban agricultural development circle, outer suburban plain agricultural development circle, mountain ecological health-keeping development
circle and cooperation agricultural development circle with other cities around Beijing. The core development direction for urban development circle, formed by urban and partial suburban area, is landscape and exhibition agriculture, including urban Greenland, garden landscape and exhibition of agricultural product; The core development direction for suburban agricultural development circle, formed by the combined urban-rural area within six-ring road, is modern agricultural park and leisure sight-seeing agriculture; outer suburban plain agricultural development circle focuses on scale and professional production of bulk agricultural product; the construction of ecological project and the special agriculture is the key direction for mountain ecological health-keeping development circle, including cultivation of special agricultural product, folk tourism in mountain area and ecological leisure; the planned direction for cooperation agricultural development circle with other cities around Beijing is to strengthen urban ecological protection [16].

**Main Issues and Focus**

The development of urban agriculture in China has taken into account of production, ecology, economy, society and culture. The regulation and control of urban agriculture is also enhanced during recent years. However, China is in the rapid period of urbanization with gradual expansion of urban region. Urban agriculture is lower in its economic competition comparing with other construction activities of other cities and the main obstacle is the limit of land use. China should strengthen the macro regulation and control of the urban agriculture and accelerate to incorporate the industrial economy of urban agriculture into urban economic and social development. The plan of spatial layout of urban agriculture should be taken into account into urban master plan. The embedded and fragmented bottom-to-up urban agricultural activities are legalized in the form of law. Urban agriculture in the fringe area pays attention to the leisure and sight-seeing with single development pattern and highly-frequent bottleneck of development. New urban agriculture with multifunction in foreign countries should be drew to realize the development to local conditions.

Another point is that the suburban area is large in China and the connection between urban agriculture with circle layout and urban transportation is still weak even featured as strong system and convenient management, which calls for strengthening comprehensive layout of urban agriculture and the connection among each urban agricultural circle, linear corridors and key districts and also perfect the industrial system of urban agriculture.

**Exploration into New Pattern**

The layout of circle is applied to urban agriculture depending on general layout and location characteristics of the city for the sake of allocating land resources rationally under urbanization. Transportation, agriculture belt or water system is used to enhance linear connection between primary districts and each circle to perfect the integrated network structure of urban agricultural layout. In consideration of different land use value and spatial structure features of each circle, outer suburb circle is dominated by the function of production and ecology, production and leisure are for suburb circle. The embedded layout for urban core area deploys abandoned space, reserved land for development and green land in residential area for urban agricultural activities to accommodate the high plot ratio and population density within this circle. Primarily, the urban agricultural parks that organically combine agricultural production, agricultural landscape, consumption of agricultural product, leisure experience and social education, can compensate and mitigate the contradictory between construction and non-construction land within the city. Additionally, roof plant, balcony plant and other vertical plant are adopted within the built-up area to develop three-dimensional urban agriculture to therefore realize large-scale operation of urban agriculture in limit land. It’s suggested to plant in glasshouses with the aim to prevent the influence on safety production of agricultural product from air pollutant. Beyond that, the glasshouses that integrate production and leisure with public activities are beneficial to constitute urban landscape.
Conclusions

Urban agriculture is a new kind of industry and lifestyle with broad prospect. The research and practice are pushed on under the system of urban planning after incorporating urban agriculture into urbanization framework, which is conducive to sustainable development of eco-cities and significant to coordinate development between urban and rural space. The government should strengthen the policy support to urban agricultural land use and comprehensive land utilization. The transformation into urban agricultural land with composite function from non-construction land including traditional farmland and forestry land should additionally be speeded up. The functional types and layout of urban agriculture should be combined organically based on general layout and location characteristic of each city, to plan and constitute network layout of urban agriculture combined by point, line and surface. The perfect industrial structure of urban agriculture is cooperated to promote the sustainable development in the process of urbanization.

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