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GROWING BERRIES IN CONTAINERS - A NEW PERSPECTIVE FOR URBAN HORTICULTURE

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Abstract

Nowadays, the limitations of cultivated areas, climate changes and degraded soils move the crops in greenhouses or under plastic. Also the soil problems and the need for space efficiency place the plants into containers that can be more controlled in terms of mobility and substrate adequate quality for each crop. Another reason to have the containerized crops are the market demand for fresh products out of the season time. Berries are fruits with very high value and profitability. Therefore, one by one, crops like raspberry, blackberry, currants and blueberry are going to be cultivated in pots anywhere it is a space available, and mainly in the protected field. The present work is about present and further solutions for urban horticulture focusing on the berry crops as an alternative for the open field technologies.

Key words*: blueberry, raspberry, currant, blackberry, greenhouse, pots.*

INTRODUCTION

Urban agriculture (UA) has more and more an active role in the global challenges: urbanization and food security (COST Action Urban Agriculture Europe, 2015). It interferes between the need for a resilient and sustainable urban development and the design of a multifunctional urban landscape involving socio-economic aspects, citizens, ecology, biodiversity and other key factors.

In 1960, the global urban population was 34% of the total; today, 55% of the world's population lives in urban areas and continuously grow, expecting to increase to 68% by 2050 (UNDESA). Rapid deployment of rural areas in favour of urban ones combined with migration of mainly young people from rural to urban areas, boost the cities and transform them into metropolitan areas (Boto and Mofolo, 2018). This accelerated urbanisation disturbs and largely impact the eco-socio-environmental state of the cities. Demands for food and water are considerably increased.

A higher importance is given by FAO too, who has developed its own programme for urban and peri-urban horticulture (UPH) focusing on five directions: ensuring political and institutional commitment, secure land and water for horticulture, ensure product quality while protecting the environment, ensure participation by all stakeholders in the UPH sector, secure new markets for fruit and vegetables (FAO, 2019).

"Food miles" is the term for the distance food travels from where it is grown or raised to where it is consumed. Many people don't have access directly to local farms since more than 80% are living in urban areas. Trade-offs between place of production and place of consumption (Wakeland et al., 2012) lead to a burning need for urban farming in connection to many other advantages such as community engagement and well-being (Golden S., 2013), ecosystem services to urban areas, stakeholders and policy coherency etc.

Nova P. et al. (2018) reveal in their work the benefits of urban organic community gardens, with a sensitive impact on growing health and quality of life.

Urban green spaces can host animals and other plant species, that adapt to the typical urban environment and therefore increase the site biodiversity with bilateral beneficial services. UPH improve the ecosystem. Trees attract birds and provide energy saving insulation to buildings (Sumangla et al., 2013).

The scope of UA is described in his multifunctionality perspective (fig. 1).

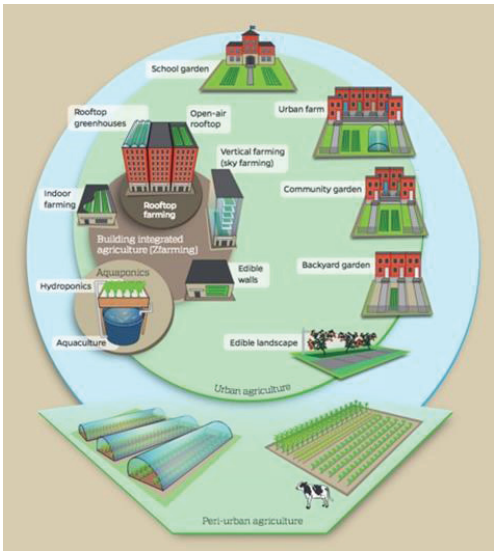

Fig. 1. Scope of Urban Agriculture. Source: Johns Hopkins Center for a Livable Future

Concept of circularity has now got closer through UPH, which gather inputs, production, processing, distribution and management of waste all along the value chain. It has a beneficial role in all regards. This sector has also a high potential of job creation and engagement of different social categories in the business.

The way of doing UPH embrace various forms such as micro-gardens inside city and in peripheries, hydroponic gardens, green rooftops or terraces, soilless cultures. It applies for vegetables, berries, fruit trees and ornamentals too.

Crops are managed using traditional practices but nowadays are quite high-tech innovative in order to answer to specific requirements. The systems have to be intensive, high-yielding and year-round productive with same or different species (De Bon et al, 2015).

Some risks associated with the production inside urban areas are given by environmental pollution (industry, traffic) and presence of heavy metals. Water can also contain various contaminants increasing the possibility to retain residuals in plants.

In this regard, a solution could be cultivation inside the plastic tunnels or greenhouses.

Among all the facades of urban farming and landscaping it is obvious that education in this emerging sector is mandatory.

Citizen science has a key role together with the high innovative research supported by dedicated national or international funding programmes. The stakeholder engagements and public involvement in scientific work, under the professional coordination create a smooth and sustainable synergy in the future UPH.

In the present paper we are exploring the pathways of different berry crops integration into the UPH concept and how it deals with the specific bottlenecks of urban areas.

MATERIALS AND METHODS

In order to map and survey the topic of alternative berry crop management in relation to urban horticulture and future cultivation techniques, a relevant number of recent publications and research conducted in different field trials and experimental plots all over the World were consulted. Famous databases such as Scopus, Science direct, Clarivate, CABI, Google Scholar, ResearchGate and so on provided the scientific support of the present overview performed. FAO, UNDESA and other organization were analyzed.

RESULTS AND DISCUSSIONS

There are several possibilities to cultivate berries. The most extensive system is outdoor in the field using the natural soil as growing substrate. The plant density was gradually increased for a higher productivity and in many cases plant architecture was also reshaped to obtain a better quality for fruits and easy management of manual works (Asanica, 2017).

Beyond these limits of growing berries, for smart land use and valorisation of tiny plots or underutilised and degraded soils, an innovative solution was released: the pot culture.

This option is a perfect way to naturalise cities in a socio-economic perspective addressing to the need of supplying healthy and nutritious food to the people living inside urban or peri-urban areas.

Berry fruits such as blueberry, raspberry, blackberry, currants, gooseberry, chokeberry, honeysuckle are very attractive for urban consumers and plays an important role in a healthy diet. Due to the smaller habit and

superficial root development of these species, the growing system in different containers became feasible and open a new horizon for super-intensive systems outdoor, indoor, within or outside urban and peri-urban areas.

Type of pots

The major difference between pots used in the nurseries and the ones used for growing berries is that in the second case, the plants need to grow and bear fruits several years in the same volume of recipe (Pinto et al., 2017). Therefore, the material has to be UV resistant, to resist in hot and cold conditions during all year-round and to be easy handle by workers in case of relocation or rearrangements.

The common and convenient use of pots are made from solid plastic (fig 2).

Fig. 2. Plastic pots of 65 l volume used for blueberry crop (Dambovita, 2018)

Sometimes, breathable bag-pots (fig 3) manufactured organically or from polyester are designed for growing ornamentals, vegetables or berries with the inconvenience of instability and substrate cracking.

Fig 3. Blueberry crop in bag-pots (Bilcesti, 2014)

A very important feature to keep in mind for potted crops is the drainage. As long as the roots will grow faster and occupy the entire volume of the container, a good aeration and drainage has to be provided. In order to prevent waterlogging from the bottom of the pot due to some unexpected flood or bad surface inclination, the containers could be placed on different supporting materials for few centimetres' elevation.

The shape of the pots is normally round with the higher diameter at the top-edge of the recipe. In urban horticulture and also in greenhouses, each square meter is very costly and valuable. In this respect, to make it more efficient, the plants can be grown in square pots (fig. 4) which are linear distributed along the row and collects more units/linear meter.

Fig. 4. Reshaped pots for a better use of space. Raspberry potted culture (Switzerland, 2019)

Type of trellising

In the same direction concerning land use efficiency or better valorisation of a limited urban space, growing systems have evolved into vertical training systems of plants stems. But this can be done only supporting them with wires or by individual holders (fig. 5).

Fig. 5. Red currants grown in greenhouse – wire and bamboo trellising for vertical training of cordons (Belgium, 2018)

For top roof cultivation or windy terraces, trellising is imperative due to the fact that the aerial part is heavier than the pots and could be taken down.

Species like raspberry of blackberry that issue more canes from the pots during the vegetative season needs a double wire system (fig. 6) and a supporting net for the lateral fruiting shoots for a convenient fruit picking.

Fig. 6. Blackberry in greenhouse – two wire system with supporting net (Belgium, 2018)

Moreover, in a project named "Innoberry" conducted at UASVM Bucharest, for the first-time blueberry grown in 65 l containers has been conducted with one or more vertical cordons using a single row of wires and individual bamboo sticks to maintain them upright.

Fig. 7. Blueberry – individual support for vertical cordons and 4 wire in a single plan for trellising (Bucharest. 2018)

Type of protection

In order to become more independent and to avoid climatic unbalances that could affect the normal development of berries, a couple of protective systems have been designed and applied. For instance, outdoor berry crops need protection against hail and or birds (fig. 8)

Fig. 8. Blueberry in containers under hail net with a double wire supporting system (Switzerland, 2019)

More control can be achieved by bringing pots under high-tunnels (Kathleen, 2009; Bielinski, 2012), where water and nutrition is entirely calculated and applied according to the fertigation programme (fig. 9). The microclimate condition is obtained (Retamal-Salgado, 2015) and enlarge the harvest season in both directions, earlier and late yield for the same varieties (Carey et al., 2009).

A wide range of high tunnels construction types can be used for this purpose (Both et al., 2019).

Fig. 9 Gooseberry crop under high-tunnel (Belgium,2018)

Similar protection can be assured by plasticulture (Imanishi, 2016). Classic solars represent an easy option for growers that aim to protect and/or advance the production. For berries, suitable solars are the ones larger and higher in order to permit a good ventilation and enough place for vertical growth of the canes (fig 10).

Fig. 10. Raspberry and blackberry in a plastic solar (Bucharest, 2019)

The most expensive protection is given by greenhouses where, in most of the cases, for berry crops, the light, temperature, water and nutrition are fully controlled by devices and sensors. In modern high-tech greenhouses, recirculating system for water and nutrients (fig. 11) is successfully applied in berry crops as well as for common vegetables.

Fig. 11. Potted blueberries in the recirculating system for water and nutrients (Belgium, 2018)

Another great advantage of potted crops is the capability of easy relocation and reintegration of abandoned places (fig 12) into production cycle. In the near future, a lot of unsuitable lands or plots for other purposes inside the urban and peri-urban areas can be transformed in production units as urban farms including the berry species as a very promising crops for fresh consumption.

Fig. 12. Potted blueberries in the old unutilized greenhouse (Orlando, USA, 2016)

CONCLUSIONS

Several advantages of growing berry fruits in pots under protected areas can be underlined:

- Extend the ripening period in both ways: earlier or beyond last regular production in the field with an economic rationale
- Better control of environmental factors, avoiding frost, birds' damages, hail or acid rains
- Water and nutrient uptake efficiency with proper volume adjusted to plant needs.
- More precise tuning of crop technology
- Outstanding utilization of small surfaces with or without soil background
- Mobility of plants and relocation of crop and yield in space and time
- Utilization of contaminated soils or industrial decommissioned areas as solid support for growing
- Best control of pest and diseases, easy to remove or replant any of affected plant
- Producing food inside the city and involve community in horticultural activities (educational and socio-ecological role)

Inconveniences:

- Higher cost of investment
- Specialized labour and high-tech technology to be applied
- Pollution in the urban areas as pathway to contaminate the yield

- Heavy structure and complexity of system use

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