Urban agriculture: a sustainable added value for smart cities

Pr M. Haïssam Jijakli
Urban agricuture Research Centre (C-CAU), Gembloux Agro-Bio Tech, Université de Liège, E-mail : mh.jijakli@ulg.ac.be, Site : *www.agriculture-urbaine.be*

The world is facing a number of serious problems of which population rise, climate change, soil degradation, water scarcity and food security are among the most important. the global population now exceeds 7.2 billion and is growing rapidly. In that context, the focus on food security and resiliency in the cities is particularly relevant because it is expected to reach 9.6 billion around 2050 with more than 75 to 80 % living in urban areas (UN, 2013). Urban population growth requires an increasing demand for animal protein (Alexandratos and Bruinsma, 2012). Nevertheless, the future of conventional farming, including intensive animal protein production, to meet this demand is challenged by rising energy and oil costs, climate change and pollution. Resource limitations including the decrease of arable surfaces and fertilizer resources (mainly N and P), constrained freshwater supplies, soil degradation and soil nutrient depletion will also add to these challenges (Bindraban et al., 2012; Klinger and Naylor, 2012). This alerts researchers to the necessity to compensate existing sustainability deficits in agricultural food systems.

Urban agriculture will help to meet the future challenges mentioned above. Urban agriculture consists in growing plants, raising animals, transforming and distributing them in and around the city. Thus, the most appropriate systems are those who will take advantage of the proximity of resources and consumers. They must offer fresh produce with high value-added, (e.a. fruits, vegetables, livestock of small size). Urban agriculture already produces more than 1/3 of food consumed worldwide, and is currently concentrated in developing countries. In addition to his nurturing function, urban agriculture offers many other benefits based on the 3 pillars of sustainable development. These social, ecological and economic benefits will be exposed.

The Urban Agriculture Research Center (C-CAU) is actively involved in the deployment of urban agriculture accompanying public institutions, and real estate sector (building promotors, building enterprises, architects and landscape architects) in the design, study and realisation of projects incorporating urban agriculture. These advising activities will allow the acceleration of cities changes by touching all of the key players. Some cases of study will be presented and will concern both public institutions, and real estate sector.

Finally, the C-CAU is developing also innovative systems to produce plants (and fish's) in urban environnement. These systems are based on soil but also soiless techniques like hydroponics and aquaponics. Hydroponic culture is characterized by a soilless production of plants which grow thanks to water and soluble nutrients. Aquaponics is a closed-loop that combines elements of recirculating aquaculture (fish rearing) and hydroponics. The water from the fish tanks is enriched in plant nutrients thanks to bacteria converting fish excrements. That water is used for plant growth and purified by them before going back to the fish tanks. Both technics preserve natural resources in comparison with conventional agriculture and are well adapted to the cities. A first hydroponic system was developed in our laboratory and will be soon commercialized. This is a hydroponic shelf able to produce in monoculture 4 lettuces per week or in polyculture 2 lettuces, one basil per week and 5 other different aromatic plants while occupying only 0,25 m2. The design of the shelf allows its integration in any part of a home. Aquaponic systems are also under development. PAFF BOX (for Plant and Fishing farming in a container) is an aquaponics system able to produce in a closed loop fish and vegetable. It

is composed of a container and a greenhouse on the top. We have also build an decoupled aquaponics system : The system is composed of a RAS system (Recirculating aquaponics system) and an hydroponic system located 100 meters from the RAS. Both RAS and hydroponic can be connected or disconnected to create a decoupled aquaponics system. These systems and their advantage of uses will be presented.

References

Alexandratos, N., & Bruinsma, J. (2012). WORLD AGRICULTURE TOWARDS 2030 / 2050 The 2012 Revision, (12).

Bindraban, P. S., van der Velde, M., Ye, L., van den Berg, M., Materechera, S., Kiba, D. I., … van Lynden, G. (2012). Assessing the impact of soil degradation on food production. Current Opinion in Environmental Sustainability.

Klinger, D., & Naylor, R. (2012). Searching for Solutions in Aquaculture: Charting a Sustainable Course. Annual Review of Environment and Resources, Vol 37, 37, 247–+. doi:10.1146/annurev-environ-021111-161531

UN. (2013). Human development report 2013. doi:ISBN: 978-92-1-126340-4