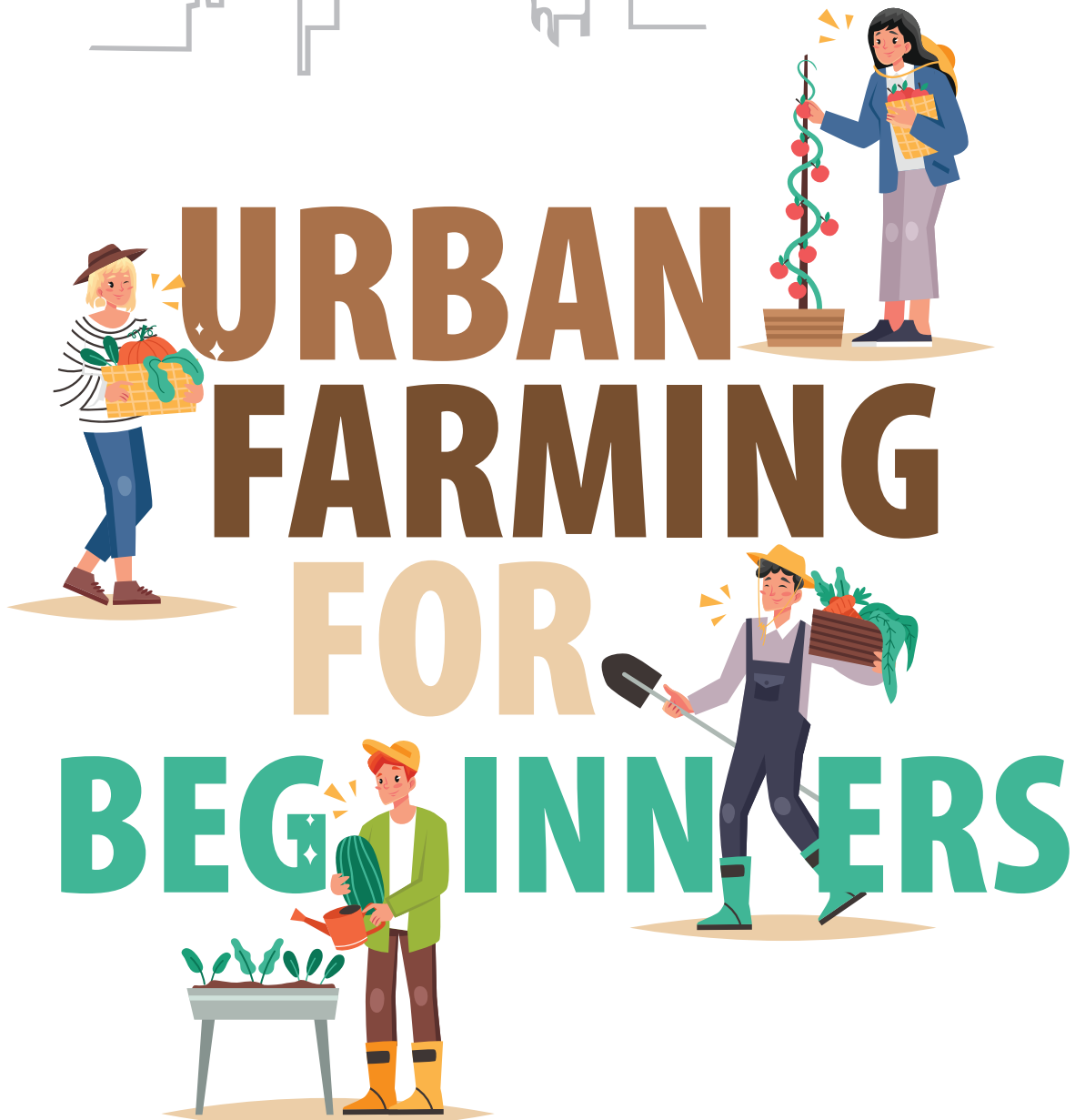




Urban
Farming
Education for
Sustainable
Future





Urban Farming Education for Sustainable Future

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 ЗА ЕВРОПСКИ ОБРАЗОВНИ
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CONTENT

Introduction to the training manual.....4
 Aims and scope.....7
 Structure.....8
 Organizing training course.....12

Chapter 1: Benefits of urban farming.....14
 1.1. Environmental.....14
 1.2. Social.....17
 1.3. Health-related.....20
 1.4. Economic.....24

Chapter 2: Organization, management and marketing strategy.....30
 2.1. Planning process.....30
 2.2. Market.....38
 2.3. Customers.....41
 2.4. Products.....42
 2.5. Distribution.....42
 2.6. Sales and pricings.....43
 2.7. Competition and promotion.....44

Chapter 3: Production practices and approaches.....48
 3.1. Physical resource needs.....48
 3.2. Human resource needs.....48
 3.3. Urban farming management49
 3.3.1. Going Organic?.....49
 3.3.2. Soil management: contamination, fertility, cultivation and fertilization..50
 3.3.3. Composting.....51
 3.3.4. Crop rotation.....51
 3.3.5. Collecting and storing seeds - hobby seed farming.....57
 3.3.6. Control of weeds, diseases, and harmful organisms.....61
 3.4. Formation and maintenance of urban gardens.....63
 3.4.1. Calendar and work planning.....63
 3.4.2. Cultivation and pre-sowing soil preparation.....66
 3.4.3. Sowing and planting.....67
 3.4.4. Care measures (hoeing, watering, feeding).....69
 3.4.5. Basic information on growing vegetables: leafy, root, tuber, legume, fruit, bulb, flower and stem vegetable.....69
 3.4.6. Harvesting and storage.....69

Chapter 4: Urban farming production systems.....76
 4.1. Ground-based outdoor urban farming.....76
 4.2. Vertical urban farming.....77
 4.2.1 Hydroponics.....78
 4.2.2. Aquaponics.....79
 4.2.3. Aeroponics.....81
 4.3. Rooftop farming.....82
 4.4. Landscaping and nurseries.....85
 4.5. Urban orchards.....87
 4.6. Urban livestock and beekeeping.....89
 4.7. Mushroom production (fungiculture).....90



Introduction

In a world increasingly characterized by urban sprawl and environmental challenges, the concept of urban farming has emerged as a vital bridge between our rural agricultural heritage and our urban present. The concept of urban farming stands as a beacon of hope and offers practical approaches to tackling present and future food supply challenges. Urban farming is more than just a trend; it represents a movement with the potential to transform the way we engage with food production, our communities, and the environment. This Beginners Guide to Urban Farming offers a unique perspective on this movement, one that draws inspiration from the Rural-to-Urban Transect characteristic of New Urbanism and the ecological transect concept advanced by the pioneering explorer and naturalist, Alexander Von Humboldt. By merging these two frameworks, we can better understand the essence of urban farming and how it enhances contemporary urban landscapes.

The Rural-to-Urban Transect: A New Framework for Urban Farming

New Urbanism, an urban planning and design approach, introduced the Rural-to-Urban Transect as a tool to assess and design the full spectrum of human environments, from rural to urban. This concept classifies areas along a continuum, recognizing that a city should offer a range of experiences and functions, much like the natural landscapes that Humboldt explored in his scientific journeys. New Urbanism seeks to create sustainable, vibrant, and walkable communities. Central to this approach is the concept of the Rural-to-Urban Transect, which helps us visualize the evolution of a community, from pristine wilderness (T1) to bustling city centers (T6). Each zone along this continuum possesses distinct characteristics that influence the way people live and interact within them.

T1: Natural Wilderness - In this initial zone, we find untouched landscapes, forests, and pristine ecosystems. Nature reigns supreme, untouched by human intervention.

T2: Rural Farmland - As we move closer to civilization, we encounter rural farmland. This is where traditional agriculture thrives, with large fields and open spaces dedicated to crop cultivation and livestock farming.

T3: Suburban Living - Suburbia represents the transition from rural to urban. Here, we see low-density housing, larger lots, and a mix of land uses, including gardens and community spaces.

T4: Urban Living - In the heart of the city, we find the densest urban environments, characterized by high-rise buildings, compact housing, and commercial centers. Green spaces are often limited, and the focus is on human activity.

T5: City Center - The city center is where commerce and culture converge. Skyscrapers and bustling streets define this zone. Here, the natural environment is secondary to human-made structures.

T6: Urban Core - This is the epitome of urban intensity. In this final zone, skyscrapers, heavy traffic, and the built environment dominate the landscape.

Now, how does urban farming fit within this transect, and how can it offer a harmonious blend of urban and rural influences within our cities?

Alexander Von Humboldt's Ecological Transect: Reframing Urban Farming

Alexander Von Humboldt, a pioneering explorer and naturalist, introduced the concept of the ecological transect. This method involved examining ecosystems along a linear path, revealing how various ecological factors change as one moves from one environment to another. It provides a way to understand the intricate connections between species, climate, and geography.

Through the perspective of Humboldt's ecological transect, we can explore how urban farming bridges the gap between rural and urban environments, effectively merging the best of both worlds. Just as Humboldt's ecological transect allowed us to understand the dynamics of natural ecosystems, urban farming enables us to integrate agroecology within urban settings.

Urban farming, could utilize Humboldt's framework, to initiate a symbiotic/synergic approach of practising agroecology within urban landscapes adding functional layers to the ecological/urban transect. Just as Humboldt recognized the interplay of ecosystems in nature, urban farming demonstrates how cities can integrate agricultural systems into their fabric. By doing so, we aim to achieve the following:

Biodiversity: Urban farms foster agrobiodiversity, mirroring Humboldt's emphasis on ecological diversity. A well-designed urban farm can create an optimal environment for pollinators, beneficial insects, and various plant species.

Local Ecosystems: Urban farms become miniature agroecosystems, drawing parallels with Humboldt's detailed studies of microclimates and their effects on flora and fauna. Understanding these local ecosystems is key to successful urban farming.

Climate Awareness: Humboldt's emphasis on climate's influence on ecosystems is mirrored in urban farming's adaptation to local weather patterns. Urban farmers consider microclimates in their planting strategies, using micro-environments like greenhouses and vertical gardens to optimize growing conditions.

Education and Advocacy: Just as Humboldt's work helped raise awareness about the interconnectedness of nature, urban farming serves as a powerful educational tool. It reconnects city dwellers with the origins of their food, raising awareness about environmental stewardship.

Urban Farming: A Nurturing Convergence

Urban farming, as seen through the lens of the Rural-to-Urban Transect and Humboldt's ecological transect, is the seamless integration of rural practices into the urban fabric, creating a bridge between agriculture and city life.

Rural Areas (T1-T3): These are the zones closest to the countryside, characterized by open fields, agriculture, and lower population density. In the context of urban farming, rural areas represent the origins of agricultural practices, often inspiring the movement to bring farming back into cities. This might also serve to reenact the historical correlation between agriculture and human settlement. In the 'T2: Rural Farmland' section of the Rural-to-Urban Transect, traditional agriculture is the dominant feature. As we journey through this transect, urban farming becomes the embodiment of this rural heritage. It brings the practices, principles, and benefits of rural farming into the heart of the city.



In the 'T3: Suburban Living' zone, the suburbs become the ideal backdrop for community gardens, where residents can connect with the land, grow their own food, and foster a sense of rural simplicity within an urban environment.

Suburban Areas (T4-T5): Suburban zones blend the rural and urban environments. These areas provide the opportunity to bridge the gaps between conventional agriculture, agroecology and urban farming. Suburban dwellers can embrace sustainable practices, engage in community gardening, and support local food production. Within these zones community-supported agriculture (CSA) initiatives become the embodiment of urban agroecology. These practices enable city dwellers to maintain their stewardship of the land, sovereignty of food production, and nurture resilient communities.

Urban Areas (T6-T7): As we progress through the transect into denser urban zones, urban farming continues to play a vital role. Urban cores are where most people reside, and here, urban farming can be challenging due to limited space and different land uses. However, creative approaches such as rooftop gardens, community plots, and vertical farming are essential in realizing the potential for urban agriculture within dense city centers.

Downtown Areas (T7-T8): Downtown areas represent the most intensive urban environment. While it may seem counterintuitive, even in these bustling districts, innovative urban farmers find niches for growing food, such as microgreens, aquaponics, or cultivating edible plants in small spaces.

Urban farming, therefore, encapsulates the essence of the Rural-to-Urban Transect and Humboldt's ecological transect by reimagining our urban landscapes and breathing life into the spaces between buildings, on rooftops, and along sidewalks. It bridges the divide between rural and urban, offering city residents the chance to experience the abundance of nurturing crops, tending to livestock, and fostering a connection to the natural world. Urban farming, when approached holistically, transcends the boundaries of traditional agriculture, offering a unique opportunity for people in all types of environments to reconnect with the land and explore the intricate relationships between humans, food, and the environment.

Throughout this guide, we will delve into the practical aspects of urban farming, including site selection, plant care, sustainability, and community engagement. We will examine how each aspect aligns with the Rural-to-Urban Transect, taking inspiration from Humboldt's ecological insights. By the end, you will be equipped with the knowledge and inspiration to start your urban farming operation, contributing to a nurturing, interconnected, and resilient urban landscape. This Beginners Guide to Urban Farming will provide you with practical insights on how to embrace urban farming, regardless of your urban setting. We will explore everything from balcony gardens to community farming initiatives, empowering you to become a part of this transformative movement.

Aims and Scope of This Guide

The journey you are about to embark on through this Beginners Guide to Urban Farming is multifaceted, and it aims to provide you with a comprehensive understanding of urban farming, from its fundamental concepts to its real-world application. Our guide's scope encompasses a wide range of topics and practical advice, designed to cater to beginners and seasoned urban farmers alike.

1. Understanding the Basics: We start by immersing you in the foundational principles of urban farming. You will learn about site selection, soil quality, and the various types of urban farming practices available, including container gardening, vertical farming, hydroponics, and more. Whether you have a small balcony or a larger piece of land, you will discover how to maximize your available space to cultivate a thriving urban farm.

2. Plant Selection and Care: One of the most exciting aspects of urban farming is selecting and nurturing your crops. We will guide you in choosing the best plants for your space, be it vegetables, herbs, or small fruits. You'll also learn the essential techniques for planting, maintenance, and pest control to ensure a bountiful harvest.

3. Embracing Sustainability: Sustainability is at the core of urban farming. We delve into the world of eco-friendly farming practices, including organic gardening, water conservation, and integrated pest management. By implementing these sustainable techniques, you'll not only reduce your environmental footprint but also create a healthier, more resilient urban ecosystem.

4. Expanding Possibilities: Urban farming isn't limited to just plants. We explore the world of urban livestock and beekeeping, discussing the benefits and considerations of raising chickens, bees, and other small livestock. This section provides a glimpse into the fascinating world of animal husbandry within an urban setting.

5. Fostering Community Engagement: Building a vibrant and supportive community around your urban farm is vital for its success. We offer insights into how you can connect with like-minded individuals, participate in community gardening initiatives, and even consider selling your surplus produce through community-supported agriculture (CSA) programs.

6. Troubleshooting and Problem-Solving: Every farmer faces challenges, and we are here to help you overcome them. From identifying and managing pests and diseases to addressing weather-related problems, we provide practical solutions to keep your urban farm flourishing.

7. Harvesting and Preserving: Learning when and how to harvest your crops at their peak of freshness is a vital skill. We also introduce various methods of food preservation, allowing you to enjoy your homegrown produce year-round and reduce food waste.

8. Beyond Your Farm: Our guide extends beyond the boundaries of your personal urban farm. We delve into the larger world of urban farming, exploring local food movements, farmers' markets, and the role of urban agriculture in building a more sustainable and resilient urban future.



Our aim is to equip you with the knowledge and practical skills needed to not only start but also sustain a successful urban farming journey. Whether you live in a bustling metropolis or a small town, our guide is tailored to accommodate a variety of urban settings. It encourages you to embrace the transformative power of urban farming and become an active participant in the movement toward healthier, more sustainable urban communities.

By the time you complete this guide, you will be well-prepared to create your own urban oasis, engage with your community, and make a positive impact on the environment. Urban farming isn't just a hobby; it's a transformative way of life that connects you to your food, your community, and the natural world. Join us on this exciting journey as we sow the seeds of change and cultivate a more sustainable and fulfilling urban future together.

Navigating Your Farm Through The Urban Landscape: Guide's Structure

This guide is designed to be your roadmap to successful urban farming, structured in a way that encourages learning and growth. We'll take you through a step-by-step process, starting with the basics and gradually progressing to more advanced techniques.

In this foundational section, you'll discover the world of urban farming and delve into the benefits it offers for individuals, communities, and the environment. We will explore the concept of the rural-to-urban transect and learn how to adapt urban farming practices to different contexts.

Part 1: Planting the Seeds of Urban Farming

Chapter 1: Benefits of Urban Farming

- 1.1. Environmental Benefits
 - * Explore the positive impact on air quality, carbon footprint, biodiversity, water usage, soil health, and waste reduction.
- 1.2. Social Benefits
 - * Discover how urban farming increases access to fresh food, strengthens communities, promotes mental and physical well-being, provides educational opportunities, celebrates cultural diversity, and reduces crime rates.
- 1.3. Health-related Benefits
 - * Understand the link between urban farming and access to nutritious food, increased physical activity, reduced stress and anxiety, improved mental health, increased exposure to sunlight, and reduced risk of chronic diseases.
- 1.4. Economic Benefits:
 - * Learn about increased food security and resilience, job creation, increased property values, boosted local economies, reduced healthcare costs, and diversification of local food systems.

Chapter 2: Laying the Foundation for Your Urban Farm

- 2.1. The Planning Process
 - * Develop a framework for identifying your goals, resources, location, growing method, layout, and crop selection.
- 2.2. Understanding Your Market
 - * Analyze target markets, trends, regulations, and customer preferences.
- 2.3. Building Relationships with Your Customers
 - * Implement strategies for attracting and retaining customers through excellent service and engagement.
- 2.4. Cultivating a Diverse Product Portfolio
 - * Explore the selection, diversification, and maintenance of high-quality products.
- 2.5. Optimizing Distribution Channels
 - * Choose the right channels for getting your products to customers and establish strong relationships with distributors.
- 2.6. Pricing Strategies and Sales Techniques
 - * Develop effective pricing models and implement successful sales strategies to secure your market position.
- 2.7. Facing the Competition and Promoting Your Urban Farm
 - * Analyze your competition and develop effective marketing and promotion strategies to stand out.

Part 2: Nurturing Your Urban Farm

Chapter 3: Cultivating Success: Production Practices and Approaches

- 3.1. Resource Management
 - * Choose the right tools, equipment, structures, and navigate permits and licenses.
- 3.2. Building a Skilled Team
 - * Recruit, train, and manage volunteers and employees for optimal efficiency.
- 3.3. Crop Management from Seed to Harvest
 - * Select seeds and plants, nurture them through their lifecycle, harvest efficiently, and store produce for optimal quality.
- 3.4. Embracing Organic Practices
 - * Understand the principles and benefits of organic farming and implement them in your urban farm.
- 3.5. Soil Management Fundamentals
 - * Test and understand your soil, build fertility, control contamination, and implement sustainable practices.



- 3.6. Safeguarding Your Crops from Pests and Diseases
 - * Identify and prevent pests and diseases through effective management methods.
- 3.7. Water Management Strategies
 - * Conserve and manage water resources efficiently using appropriate irrigation systems.
- 3.8. Saving Seeds for the Future
 - * Learn hand-pollination techniques, collect, store, and test seeds for future planting.
- 3.9. Maximizing Soil Health with Crop Rotation
 - * Plan and implement effective crop rotations to enhance soil health and productivity.
- 3.10. Harnessing the Power of Cover Crops
 - * Select and plant cover crops, manage their growth, and reap the benefits for soil health.
- 3.11. Composting for Sustainable Growth
 - * Set up and maintain a compost bin, process your organic waste, and utilize compost for soil enrichment.
- 3.12. Harvest, Post-harvest Storage, and Food Safety
 - * Implement proper harvest techniques, ensure optimal storage conditions, and maintain food safety practices.

Part 3: Exploring Diverse Urban Farming Systems

Chapter 4: A World of Possibilities

- 4.1. Ground-based Outdoor Urban Farming
 - * Dive into raised beds, container gardening, in-ground gardening, and vertical gardening techniques.
- 4.2. Indoor Farming: Hydroponics and Aquaponics
 - * Understand the principles of these systems, learn how to set them up and maintain them, and explore their challenges and opportunities.
- 4.3. Rooftop Farming: Transforming Your Rooftop into a Green Oasis
 - * Assess your rooftop's suitability, select appropriate crops and growing methods, and build your rooftop garden.
- 4.4. Integrating Urban Farming into Landscaping and Nurseries
 - * Edible landscaping: Discover the principles of using edible plants in landscaping design, selecting appropriate species, and maintaining your edible landscape.
 - * Nurseries dedicated to urban farming: Explore how nurseries can adapt their offerings and services to cater to urban farmers, including providing seedlings, starter kits, and educational resources.

- * Community-supported agriculture (CSA) and farm shares: Learn how nurseries can participate in CSA programs and offer farm shares to connect with local communities and provide fresh produce.

- 4.5. Urban Orchards: Cultivating Fruitful Abundance
 - * Choosing the right location and fruit trees: Understand the factors to consider for successful orchard establishment and select suitable fruit trees based on climate and space constraints.
 - * Care and maintenance of your urban orchard: Learn about pruning, pest management, watering, and fertilization practices specific to urban orchards.
 - * Harvesting and utilizing your bounty: Explore harvesting techniques, post-harvest handling, and creative ways to utilize your fruit harvest.
- 4.6. Urban Livestock and Beekeeping
 - * Raising small livestock in cities: Learn about the considerations and regulations surrounding raising chickens, rabbits, bees, and other small animals in urban environments.
 - * Beekeeping in your urban oasis: Discover the fascinating world of beekeeping, explore hive management techniques, and reap the benefits of honey production and pollination.
- 4.7. Mushroom Production (Fungiculture)
 - * Growing mushrooms indoors: Learn about the basic principles of mushroom cultivation, choose suitable varieties, and establish your indoor mushroom farm.
 - * Log-grown mushrooms: Understand the process of growing mushrooms on logs, choose appropriate species, and utilize this low-maintenance method.
 - * Benefits and challenges of urban mushroom production: Explore the environmental, economic, and health benefits of growing mushrooms in cities, as well as potential challenges to address.

By understanding the diverse urban farming systems available, you can choose the approach that best suits your resources, interests, and goals. Whether you have a small balcony or a spacious rooftop, you can cultivate your own urban farm and contribute to a more sustainable and vibrant future.

How to Organize a Training Course: Empowering Urban Farmers

Organizing a training course is a powerful way to empower individuals interested in urban farming, helping them acquire the knowledge and skills needed to become successful urban farmers. Whether you're a seasoned urban farmer looking to share your expertise or someone passionate about fostering a community of urban growers, this "How-to" section will guide you through the process of organizing a training course as a follow-up to the Beginners Guide to Urban Farming.

1. Define Your Objectives:

Start by clarifying your course's objectives. What do you want participants to learn? Determine whether it's a general urban farming course or if you'd like to focus on specific aspects, such as vertical gardening, organic practices, or beekeeping.

2. Identify Your Target Audience:

Consider the knowledge and experience level of your intended participants. Are you targeting complete beginners, or is your course designed for more advanced urban farmers? Understanding your audience will help tailor the course content.

3. Plan Your Curriculum:

Develop a detailed curriculum outlining the topics you intend to cover. Refer to the Beginners Guide to Urban Farming for inspiration and structure your content accordingly. Ensure a logical flow of information, starting with the basics and progressing to more advanced concepts.

4. Choose a Suitable Location:

Select a venue for the training course. Depending on the scale and format, you can host it in community centers, gardens, or even online through webinars. Ensure the venue has the necessary facilities, such as seating, projectors, and access to practical gardening areas if required.

5. Set a Schedule:

Determine the course duration and schedule. Urban farming courses can range from a single day to several weeks. Be mindful of participants' availability and consider offering flexibility for those with busy schedules.

6. Secure Resources:

Gather the necessary resources, including course materials, handouts, and any equipment required for hands-on activities. Consider collaborating with local suppliers for seeds, soil, and gardening tools.

7. Enlist Knowledgeable Instructors:

If you're not the sole instructor, recruit experts in urban farming, horticulture, or related fields. Having diverse perspectives and experiences will enrich the learning experience.

8. Promote Your Course:

Use various channels to promote your training course. Create a website or social media pages dedicated to the course, send emails to potential participants, and reach out to local gardening clubs or community organizations. Networking can be an effective way to reach a broader audience.

9. Registration and Fees:

Set up a registration process to collect participant information. Determine if your course will be free or if there will be a registration fee to cover expenses. Offering scholarships or discounts can make the course more accessible.

10. Engage Participants:

During the course, foster a participatory and interactive learning environment. Encourage questions, discussions, and hands-on activities. Practical experience is often the most valuable part of the training.

11. Feedback and Improvement:

After the course, collect feedback from participants to understand what worked well and where there is room for improvement. Use this information to refine your course for future sessions.

12. Encourage Continued Learning:

Provide participants with resources and references for further learning. Encourage them to stay engaged with the urban farming community, whether through local gardening clubs, online forums, or social media groups.

13. Build a Community:

Creating a community around your training course is a powerful way to support participants in their urban farming journey. Consider hosting regular meet-ups, workshops, or online forums where participants can connect and share their experiences.

Organizing a training course is a fulfilling endeavor that can help spread the knowledge and passion for urban farming. It empowers individuals to become self-reliant and make a positive impact on their communities and the environment. As you embark on this journey of education and community-building, remember that the more people you empower, the stronger and more sustainable our urban farming movement becomes.



CHAPTER 1

1.1 Agroecology in The City: The Environmental Benefits of Urban Farming

In the bustling heart of cities, a quiet revolution is taking root – urban farming. This practice that transforms city spaces into productive agricultural zones, involves growing crops and raising livestock within urban environments, offering a multitude of environmental benefits beyond simply providing fresh food. One of the most impactful aspects of urban farming lies in its potential to address critical environmental challenges faced by modern cities. As urbanization continues to grow, it is crucial to recognize and leverage these benefits to mitigate the impact of cities on the planet. In this comprehensive exploration, we will delve into the environmental advantages of urban farming, shedding light on its role in fostering a healthier and more agroecologically responsible urban future.

Sustainable Land Use:

One of the primary environmental benefits of urban farming is its promotion of sustainable land use within cities. In many urban areas, vacant lots, brownfields, and abandoned spaces remain unused, contributing to urban blight and environmental degradation. Urban farming revitalizes these areas, converting them into productive and green spaces. By repurposing these parcels for agricultural purposes, urban farming minimizes urban sprawl, preserving valuable natural lands from further development.

Ecological Footprint Reduction and Carbon Sequestration:

The current food distribution system relies heavily on long-distance transportation of produce, consuming substantial energy resources, and contributing significantly to greenhouse gas emissions. Urban farming, however offers a local alternative - it plays a significant role in shortening food supply chains, thus reducing the concept of “food miles.” By growing food closer to where it is consumed, urban farms significantly reduce the need for transportation, minimizing the ecological footprint and mitigating climate change. This proximity means fewer food miles, lower carbon emissions associated with transportation, and fresher produce for urban dwellers. Moreover plants and soil play crucial roles in carbon sequestration, capturing and storing carbon dioxide from the atmosphere. Urban farming increases the presence of vegetation and soil ecosystems within cities, thereby enhancing carbon sequestration. This is particularly valuable in the fight against climate change, as the sequestered carbon helps offset the carbon emissions associated with urban living.

Air Quality Improvement:

Cities are often plagued by air pollution, posing significant health risks to residents. Plants are natural air purifiers, and urban farming increases the presence of vegetation within cities, leading to improved air quality. Through the process of photosynthesis, plants absorb carbon dioxide and release oxygen, reducing the concentration of harmful pollutants in the atmosphere. In densely populated urban areas where air pollution is a prevalent concern, urban farms act as green lungs that help cleanse the air, making it safer and healthier for residents. The increased vegetation cover provided by urban farms also helps to release oxygen, further improving air quality and creating a healthier environment for all.



Rooftop garden

Source: <https://www.nytimes.com/2009/06/17/dining/17roof.html>

Biodiversity Enhancement:

Urbanization has led to habitat loss and fragmentation, causing a decline in biodiversity. Urban farms can significantly contribute to enhancing urban biodiversity - acting as corridors and refuges - they provide vital habitat for pollinators like bees and butterflies, as well as birds, small mammals, and other wildlife. This increased agrobiodiversity contributes to a healthier ecosystem, promoting natural pest control and pollination, which are essential for sustainable food production. In essence, urban farms help counteract the loss of biodiversity in urban environments.

Efficient Water Management:

Traditional agriculture often uses vast amounts of water, particularly in arid regions. Urban farming, on the other hand, can employ water-efficient techniques like drip irrigation and vertical farming, significantly reducing water usage. Additionally, capturing rainwater and utilizing greywater can further contribute to water conservation in urban environments.

Urban areas are notorious for their impermeable surfaces, which can lead to issues like flooding and runoff pollution. Urban farming, particularly when designed with permeable surfaces and rainwater collection systems, helps manage stormwater. Green rooftops and rain gardens, often integrated into urban farms, absorb and filter rainwater, mitigating the adverse effects of heavy rains and contributing to better water management in cities.

Improved Soil Health:

Urban soils are often compacted and depleted of nutrients. Urban farming practices like composting, cover cropping, and no-till gardening help to improve soil health, increasing its fertility, water retention and carbon sequestration capacity. This leads to healthier plants, increased yields, and reduced reliance on chemical fertilizers and pesticides.



Compost bin

Waste Reduction:

Contemporary food systems generate significant amounts of food waste that ends up in landfills, releasing methane, a potent greenhouse gas. Urban farming encourages responsible waste management through practices like composting and reduction of non-biodegradable materials usage. Additionally, organic waste generated from urban farms and food scraps from households and restaurants can be composted to create nutrient-rich soil, closing the loop on resource use. This reduces the amount of organic waste sent to landfills, decreasing methane emissions, a potent greenhouse gas.

Energy Efficiency:

Urban farms, especially those incorporating sustainable practices like vertical farming and hydroponics, often require less energy than traditional rural farming. Controlled environments, efficient irrigation systems, and the proximity of urban farms to consumers result in energy savings and reduced reliance on fossil fuels for agriculture. Furthermore the production of heat and methane during some composting processes could be utilized as energy resource, leading towards a closed loop agroecosystem.

Reduction in Pesticide Use:

Urban farming encourages the use of organic and sustainable farming practices, reducing the reliance on synthetic pesticides and herbicides. This leads to less chemical runoff into water systems and fewer harmful impacts on non-target species.

Increased Greenery:

Simply put, urban farming brings more greenery into cities. Beyond the tangible benefits of food production, this increased green space enhances aesthetics, promotes relaxation, and contributes to the overall well-being of city residents.

Conclusion:

Urban farming is more than just a trend; it's a transformative practice that addresses various environmental challenges facing our increasingly urbanized world. Urban farming is not just about growing food; it's about cultivating a more sustainable and resilient future for our cities. By recognizing and harnessing the environmental benefits of urban farming, cities can become more sustainable, resilient, and harmonious environments, fostering a healthier future for both people and the planet. By embracing its environmental benefits, we can reduce our carbon footprint, improve air quality, protect agrobiodiversity, conserve water, improve soil health, and reduce waste. With each urban farm that flourishes, we take a step closer to a more livable future for all. In the following chapters, we will continue to explore the many facets of urban farming and how it could enhance our communities and individual lives.

1.2 Nurturing A Resilient Community: The Social Benefits of Urban Farming

In the food deserts of modern cities, where social connections can feel fleeting and a sense of community can be elusive, urban farming emerges as a vibrant movement embedded in social interaction and shared purpose. Urban farming operations, encompassing everything from rooftop gardens and community plots to windowsill herb boxes, offer a surprising array of social benefits that extend far beyond the joy of harvesting fresh produce. From community building to education and empowerment, urban farming serves as a catalyst for positive social change in our urban environments. This chapter delves into the multifaceted social benefits of urban farming, shedding light on how it brings people together, enriches their lives, and contributes to the fabric of society.

Community Building:

Urban farming serves as a natural gathering point for communities. It provides a physical space for people of diverse backgrounds and ages to come together, fostering a sense of belonging and community. It brings neighbors together to work, share, and learn about the cultivation of food. Community gardens, allotments, and shared green spaces become hubs for interaction, fostering a sense of belonging and cooperation. These shared spaces encourage collaboration, conversation, and the exchange of knowledge, creating a strong social fabric within urban neighborhoods. Urban farmers often collaborate, support each other, and celebrate the collective effort, strengthening the bonds that tie the community together.



Enhancing Food Access and Security:

In many urban areas, residents, particularly in low-income neighborhoods, may lack access to fresh and affordable produce, leading to food deserts. Urban farms play a crucial role in addressing food insecurity, particularly in underserved communities with limited access to fresh, healthy food. Urban farming initiatives often target these underserved communities. By providing local sources of nutritious produce, urban farms empower individuals and families to make healthier food choices and contribute to a more equitable food system. Moreover, residents involved in urban farming mitigate food insecurity and help alleviate the consequences of inadequate nutrition. It is a powerful tool in the fight against hunger and unequal access to healthy and fresh food.

Maintaining Mental and Physical Well-being:

Spending time outdoors in nature and engaging in gardening activities has been shown to have numerous benefits for mental and physical health. Urban farming provides opportunities for physical activity, reducing stress and anxiety while improving mood and cognitive function. The act of nurturing life and witnessing the rewards of one's labor can also build confidence and enhance self-esteem.



The presence of green spaces in the urban environment offers both aesthetic and psychological benefits. Urban farms create pleasing and calming landscapes that enhance the overall well-being of city residents. These green spaces, whether community gardens, rooftop farms, or small backyard plots, are sanctuaries in the urban hustle and bustle. Gardening also offers therapeutic benefits, reducing stress and promoting mental health. The act of nurturing plants and connecting with nature provides solace, helping individuals find peace in their surroundings.

Education and Empowerment:

Urban farms serve as living classrooms, offering hands-on learning experiences about food production, sustainability, and environmental responsibility. These learning opportunities are particularly valuable for children, who can develop a deeper understanding of where their food comes from and the importance of environmental stewardship.

Urban farming offers unparalleled educational conditions. Educational programs, workshops, and school initiatives centered around urban farming empower individuals with valuable knowledge about sustainable environmental practices, nutrition, and the entire food production process, from planting seeds to harvesting crops. Learning to grow your food is an essential life skill that contributes to a deeper understanding of the food system and encourages conscious consumption.

Cultivating Cultural Diversity:

Urban farms can be a space for different cultures to come together, share traditional food practices, and celebrate their heritage. This exchange of knowledge and traditions enriches the cultural fabric of cities and fosters mutual understanding and respect between diverse communities.

Urban farming often reconnects urban communities with their agricultural roots. It revives traditions of growing food locally and encourages a cultural shift towards appreciating fresh, seasonal, and locally sourced produce. This connection to food traditions fosters a sense of cultural identity and encourages cultural exchange among urban residents.

Sense of Ownership:

When people participate in urban farming, whether through individual plots or community gardens, they develop a sense of ownership and responsibility for their environment. This sense of ownership extends beyond the farm itself to the surrounding community. Urban farmers are more likely to take pride in their neighborhoods and contribute to efforts that enhance their surroundings. Urban farms offer a platform for individuals and communities to take control of their food systems and their health. By growing their own food and sharing resources, individuals gain autonomy and develop valuable skills related to food production, nutrition, and community building.

Inter-generational Bonds:

Urban farming provides a unique opportunity for inter-generational interaction. Grandparents, parents, and children can work together in the garden, sharing knowledge and values across generations. This strengthens family bonds and instills a deep appreciation for the land and its resources.

Community Resilience:

Communities with a strong presence of urban farming tend to be more resilient in the face of challenges. These communities have established networks and support systems that can be mobilized in times of need. Whether it's organizing community events, sharing resources, or providing mutual assistance, urban farming communities are well-positioned to weather crises and adapt to changing circumstances.

Local Economy and Entrepreneurship:

Urban farming can stimulate the local economy and entrepreneurship. Farmers' markets, food cooperatives, and small businesses related to urban farming, such as the sale of honey, handmade crafts, or value-added products like jams and sauces, offer opportunities for economic growth. This encourages individuals to explore entrepreneurship and strengthen the local economy.

Civic Engagement:

Participating in urban farming often translates into increased civic engagement. Urban farmers are more likely to be involved in community activities, advocate for sustainable practices, and engage in local policy decisions. Their commitment to environmental stewardship and community well-being creates a more vibrant and participatory urban landscape.

Conclusion:

The social benefits of urban farming are undeniable. Urban farming is a vehicle for positive social change, it brings people together, enhances their quality of life, and empowers them to take an active role in shaping their communities. Engaging in urban farming makes individuals and communities stronger, improves food security, promotes well-being, creates educational opportunities, and celebrates cultural diversity. As we strive to create more resilient and equitable cities, urban farming stands as a powerful tool for nurturing not just plants, but also the social fabric that binds us together. From fostering community cohesion to promoting health and well-being, urban farming is a catalyst for building stronger, more resilient, and harmonious societies. In the subsequent chapters, we will continue to explore the facets of urban farming, highlighting its positive influences on individual lives and communities.

1. 3 From Soil Biota to Human Microbiome: The Health and Wellness Benefits of Urban Farming

Urban farming goes beyond producing fresh food in the city; it has a profound impact on individual health and well-being. In this chapter, we will explore the diverse health and wellness benefits of urban farming. From access to fresh, healthy food to physical activity and stress reduction, urban farming is a practice that enriches the lives of urban dwellers, nurturing not only their bodies but cultivating a worldview of mutual aid. Urban farming offers a unique opportunity to be outdoors, all while reaping a multitude of physical and mental health benefits from the cultivation of nourishing crops. In the midst of bustling cityscapes, these agricultural havens offer much more than just fresh produce; they provide a pathway to a healthier and more fulfilling life.

Food Security:

Urban farming can enhance food security and even strive for food sovereignty. By growing their food or participating in community gardens, urban residents become less vulnerable to external factors that can disrupt food supply chains. In times of crisis or shortages, urban farmers can rely on their gardens for a steady source of fresh produce, helping to secure their access to nutritious food.



Access to Fresh Food:

Urban farming empowers individuals to grow their own fresh produce or access locally grown food. This direct access to farm-fresh ingredients ensures that urban dwellers can incorporate nutrient-rich fruits, vegetables, and herbs into their diets. By reducing the reliance on processed or packaged foods, urban farmers enjoy a healthier diet that is rich in vitamins, minerals, and antioxidants, leading to improved overall health and well-being.

Reduction in Food Contaminants:

When you grow your food or purchase locally grown produce, you have greater control over the food production process. This control results in a reduced risk of exposure to harmful pesticides, herbicides, and contaminants that are commonly found in conventionally grown produce. By minimizing your intake of these harmful chemicals, you can help protect your health and the health of your family.

Better Dietary Choices:

Urban farming provides individuals with a more profound understanding of where their food comes from and how their food is produced. This knowledge leads to more informed dietary choices. Urban farmers are more likely to prioritize fresh, seasonal, and locally sourced produce, which are healthier and more nutritious options. This conscious approach to food selection benefits overall health.



With access to a variety of fresh fruits and vegetables, urban farmers are more inclined to diversify their diets and consequently the diets of their customers. Consuming a diet rich in fruits and vegetables offers a diversity of nutrients - this contributing to enhanced diet quality with numerous health benefits, including reducing the risk of chronic diseases, improving gut health, and boosting the immune system. Urban farming empowers individuals to make healthy food choices and contribute to a more sustainable food system.

Increased Physical Activity:

Gardening involves a range of physical activities like digging, planting, watering, weeding, and harvesting, all providing an excellent way to stay active and improve overall fitness.



Regular physical activity strengthens muscles and bones, improves cardiovascular health, and reduces the risk of chronic diseases like diabetes and heart disease. In today's increasingly sedentary lifestyles, urban farming presents an engaging and enjoyable way to incorporate necessary physical activity into daily routines.

Better Weight Management:

The physical activity involved in urban farming can help with weight management. Regular gardening and outdoor work burn calories, promote muscle strength, and improve metabolism, contributing to maintaining a healthy weight. This active lifestyle helps counteract the sedentary behaviors associated with urban living.

Improved Mental Health:

Spending time outdoors while gardening has a profound impact on mental well-being. In the midst of urban chaos, urban farming provides a sanctuary where people can escape daily pressures and find relaxation. It also encourages mindfulness, promoting psychological well-being and reducing the negative impacts of stress. Urban farms provide a respite from the stress and noise of city life, allowing individuals to reconnect with nature and experience its calming and restorative effects.

Studies have shown that exposure to certain types of soil microbiota, such as *Mycobacterium vaccae*, promotes the production of serotonin, reduces stress hormones, improves mood, and reduces symptoms of anxiety and depression. The act of nurturing plants and witnessing the fruits of one's labor can also boost self-esteem and provide a sense of accomplishment and purpose. Harvesting fruits and vegetables triggers the natural mechanism of dopamine production in the body, which has a role in controlling memory, mood, sleep, learning, concentration and overall effects ranging from satisfaction and motivation to pleasure.



Gardening has been proven to have therapeutic effects on mental well-being, there is a wide range of horticultural therapy applications tailored for specific needs and disorders. The therapeutic aspects of urban farming, including the exposure to outdoor spaces with lush vegetation and the satisfaction of nurturing plants, have a positive impact on mental health. The repetitive motions of gardening, the fragrance of flowers and herbs, and the beauty of nurturing plants, and witnessing their growth all contribute to reducing stress levels. Gardening can help reduce symptoms of anxiety and depression, promote relaxation, and enhance overall emotional well-being.



Increased Social Interaction:

Urban farms and community gardens are vibrant social hubs where individuals from diverse backgrounds come together to share their love for gardening, food, and nature. These interactions foster a sense of community and belonging, tackling feelings of isolation and loneliness.



Sharing knowledge, tips, and experiences with fellow urban farmers creates a supportive network and strengthens social bonds. This sense of connection and belonging is crucial for mental well-being and overall happiness in building resilient communities.

Enhanced Connection with Nature:

Urban farming reconnects individuals with the outdoors, fostering a deeper appreciation for the natural environment. It encourages a sense of responsibility for the land, promotes sustainable practices, and reinforces a relation of stewardship toward nature. This connection with nature has profound effects on mental and emotional well-being.

Conclusion:

Urban farming is a practice that nurtures health and wellness on multiple levels. It provides access to fresh, healthy food, encourages physical activity, reduces stress, and promotes mental well-being. By practicing urban farming, individuals not only improve their own health but also contribute to the creation of healthier, more resilient urban communities in synergy with the environment. So, grab your gardening tools, step outside, and embrace the transformative potential of urban farming on your health and well-being.

1.4 Sowing the Seeds of Prosperity: The Economic Benefits of Urban Farming

Urban farming offers a vast array of economic benefits that extend far beyond the individual gains of harvesting fresh produce. In this chapter, we will explore the diverse economic benefits of urban farming, ranging from income generation to entrepreneurship opportunities, job creation, and cost savings. From creating green jobs and boosting local economies to enabling sustainably functional food systems, developing resilient

communities, and enhancing property values, these urban farms might provide means of quietly transforming the harsh economic landscapes of cities. Urban farming's economic contributions not only provide financial advantages but also play a crucial role in building a regenerative and resilient urban future.

Income Generation:

One of the most direct economic benefits of urban farming is the potential for income generation. Urban farmers can generate revenue by selling their surplus produce. Farmers' markets, local restaurants, and community-supported agriculture (CSA) programs are common outlets for selling fresh produce. This income can serve as an additional source of financial stability for urban farmers and their families.

Entrepreneurial Opportunities:

Urban farming often leads to entrepreneurship opportunities. As urban farmers become more proficient, they may explore value-added products or services related to farming. This can include creating homemade jams, sauces, pickles, or other food products, as well as selling handmade crafts or products such as honey or beeswax candles. These entrepreneurial endeavors not only contribute to personal income but also stimulate economic growth within the community.

Beyond traditional roles, urban farming fosters entrepreneurship. From local farmers markets and CSA programs to innovative start-ups focused on aquaponics or vertical farming, the opportunities for creative ventures abound, offering new avenues for income generation and economic growth.

Job Creation:

The expansion of urban farming initiatives creates job opportunities in various capacities. These jobs contribute to a thriving urban economy and create opportunities for individuals of varying skill levels. Urban farms require diverse skillsets ranging from farmers, gardeners, distributors, and entrepreneurs to farm managers, agricultural educators, and agricultural technicians. Additionally, farmers' markets, gardening supply stores, and local businesses supporting urban farming rely on a significant workforce for their operations. This rate of job creation contributes to local economic development and provides employment opportunities within the community.

Resilient Local Economies:

Urban farming encourages localized economic investment and contributes significantly to the economic vitality of local communities. By encouraging the production and consumption of locally grown food, they bolster the economic health of the immediate area. As urban residents become more involved in urban farming activities, they are more likely to support local businesses by purchasing gardening supplies, equipment, and services, thus creating a ripple effect that stimulates economic activity throughout the city. Money spent on urban farming activities tends to circulate within the local community, rather than being sent to distant corporations. This strengthens local businesses and enhances economic resilience.



Additionally, urban farms could attract tourists and residents seeking vibrant communities with access to fresh, local food. This increases foot traffic and siphons the spending power of visitors to local sites, thus further contributing to the economic growth of the surrounding area.

Reduced Food Expenses:

Growing your own food through urban farming can lead to significant cost savings on grocery bills. By producing a portion of your food supply, you reduce the need to purchase expensive, out-of-season produce from supermarkets. This not only lowers your food expenses but also enables you to enjoy fresh, locally grown produce at a fraction of the cost of store-bought items.

Cost Savings on Transport:

Urban farming can reduce transportation expenses associated with food distribution. Traditional food supply chains often involve long-distance transportation of produce from rural farms to urban markets. By growing food within the city, urban farming reduces the distance and, consequently, the cost of food transportation. This contributes to overall cost savings in the food industry.

Functional Food Systems and Increased Food Security:

Urban farming enhances food security by reducing reliance on external food supply chains. In times of crisis, when traditional food distribution networks may be disrupted, urban farmers are better positioned to secure their access to fresh produce. This increased food security is an economic benefit, safeguarding against potential shortages and rising food prices.

Urban farms provide local sources of fresh, nutritious food, promoting a more diversified and sustainable food system. By reducing reliance on long-distance transportation and large-scale industrial agriculture, urban farms contribute to food security, particularly in underserved communities with limited access to healthy food options.

This increased food security not only improves the health and well-being of individuals but also reduces healthcare costs associated with diet-related illnesses.

Reduced Healthcare Costs and Increased Public Health:

A diet rich in fresh produce is associated with better health outcomes, reduced incidence of chronic diseases, and a lower burden on healthcare systems. The health benefits associated with urban farming, such as increased physical activity, improved mental well-being, and access to nutritious food, translate into reduced healthcare costs for individuals and communities while alleviating financial strain on healthcare institutions.



Additionally, urban farms promote environmental sustainability and agroecology by reducing air pollution, improving water and soil management, and supporting agrobiodiversity. This, in turn, contributes to better public health outcomes, eventually.

Enhanced Property Values:

Studies have shown that properties located near urban farms tend to have higher property values. This can be attributed to several factors, including improved aesthetics, reduced crime rates, and increased access to green spaces. Property owners who embrace urban farming may have the opportunity to generate additional income by renting out garden spaces or rooftops to urban farmers. This diversification of income streams can be financially beneficial for property owners while promoting urban farming initiatives.



As urban farms become more prevalent and integrated into the fabric of cities, their positive impact on property values is likely to continue, further incentivizing their de-



velopment and contributing to the overall economic well-being of communities. Nonetheless, it must be noted that rising property values tend to lead to gentrification of neighborhoods which might have an adverse effect on the capacity for inclusiveness of the communities in the long run.

Conclusion:

The economic benefits of urban farming are evident and extend beyond the individual level, making it a powerful force for building economic resilience within communities. By generating income, fostering entrepreneurship, creating jobs, and contributing to local economic development, urban farming not only enriches the lives of those involved but also helps build stronger and more resilient urban economies. Besides boosting local economies, enhancing property values, and reducing healthcare costs, urban farming aims at food security and perhaps food sovereignty. Urban farming might be also setting the foundations of Local Exchange Trading Systems (LETS), introducing circular economy or even degrowth as a concept. As we strive to build thriving and functional cities, urban farming might presents itself as a powerful tool for economic rethinking, offering alternative models for our communities to regenerate in the future. In the following chapters, we will continue to explore the various facets of urban farming and its positive influences on individuals, communities, and the environment.

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CHAPTER 2

Organization, management and marketing strategy

This chapter is primarily of interest to urban farmers planning to enter the market, i.e. farming for profit as a full or part-time job.

2.1. Planning process



Planning process (www.canva.com)

Step one: Exploring the legal environment

The planning process for an urban farm is, in its essence, no different than planning process for any other business and, first of all, it takes patience to research the legal environment in which the farm will produce and sell the produces. This step may be the least attractive to an enthusiast farmer impatient to start planting and even a bit discouraging to a visionary farmer pioneering change to create a more sustainable food system in an environment and climate friendly city. However, this step is essential in order to avoid the loss of money and labour investment.

Before deciding the business model (profit or non-profit) and the method of production, it is advised to become well acquainted with the national legislation regarding farming and food safety and also the city regulations, especially if the farm is planned to include animal husbandry. It is not always easy for a beginner to find all relevant laws, bylaws and other regulations and to understand them in full. Therefore, after the search for information on the official internet pages of the ministry responsible for agriculture, exploring the official gazette and relevant laws and regulations, the next step is to find a local office, agency or other official advisory body in the matter of agriculture and get informed there about the options. It is strongly advised not to avoid the above suggested preparatory homework in order to be able to ask the right questions.

The farmer-to-be needs to confront their idea with the legal possibilities. Will the method of production be ground-based outdoor farming? Or the method will be different, like hydroponic cultivation or aquaponic growing system? Or mix of some of them? What about the rooftop farming? Conditions for farm registration may vary from country to country; the registration possibilities may depend, for example, on the economic value of the farm, so it is necessary to clear the matter before proceeding with further plans. If the farm is to be registered in one of the EU countries, the relevant answers can be found by asking in the offices of the national paying agency in agriculture which each European Union member state must have established. In the non-EU countries, the prospective farmer should contact the national body responsible for registering farms to seek advice instead.

Step two: Deciding the business model

Even before taking this step, the future farmer will probably have an idea of their farm's business model and know whether they prefer a profit or non-profit business model.

Profit is calculated as income minus expenses at the annual base. This means that at the end of the year from the sum of income generated by selling different products (or services if the farm offers any) will be subtracted all the expenses associated with the inputs necessary for production (for example land preparation, compost, seeds and seedlings, labour, machinery, structures, cost of distribution and promotion ...).¹ The result, if positive is – profit, otherwise there is loss.

Non-profit organizations, such as associations, calculate the same way their surplus of income over expenses, but if the result is positive – it is not called “profit”. The reason behind it is that, while profit organizations distribute profit among the business owners or shareholders, the non-profit organizations are prohibited by law to distribute this surplus to their founders. They can use this surplus only to invest in the production (for example to buy new machinery or tools, to pay expenses such as land lease, or water expenses, to increase salaries of the employees...)

If the farmer's choice is to go with non-profit business model, it is of paramount importance to check with the national regulation what distribution channels are permitted by law and what are other possible restrictions concerning selling farm products for a non-profit organization.

Step three: Deciding the method

Different methods of agricultural production systems, such as ground-based outdoor urban farming, hydroponic or aquaponic urban farming or rooftop farming are explained in the Chapter 4, as well as different branches of agriculture such as mushroom production, livestock or beekeeping.

Deciding what to produce and what production system to apply should not simply be the result of a farmer's inclination and/or the “know-how”, even if the existent “know-how” of the farmer can result in having less expenses on education or labour.

1 Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p. 33



Three most important factors in deciding the production system method are:

- capacity of the urban farm
- market’s demands
- capacities for distribution

Finding enough space for production in the urban environment is most certainly one of the greatest challenges, especially if the preferred option is ground-based production. Options of creating vertical gardens and roof gardens may be also taken into consideration. According to estimations, rooftop gardening can lower the ambient temperature of a building and can save up to 14,5 % of its annual energy consumption². However, before opting for it, the farmer should carefully exam the costs of structural reconstruction and the water drainage system.

Step four: Making a farm (garden) plan

Since the space on the urban farm is very limited, the farmer must approach making a farm plan meticulously, especially if the chosen method is ground-based outdoor urban farming in which case it will actually be the garden planning.

The purpose of the garden plan is to ensure that the crops will be placed in the right places, especially garden beds that cannot be moved or may need to be rotated. The availability of light, crop rotation, companion planting, succession planting, and the possibility of season extension are among the other factors to consider.

According to a quite famous urban farmer Curtis Stone³ “succession planting can be one of the most difficult aspects of farming because it involves understanding your market demand, changes in day length and temperature from season to season, what you can expect your crops to yield and how long you expect to harvest them“. The difficulty stands in the need to have the idea, as precise as possible, of the demand for every particular crop on a weekly basis which determines the requested yield and therefore the quantity of planting. Nevertheless, it is worth an effort to calculate, because succession plantings is a way to achieve a consistent harvest and stable income.

It may be difficult for the farmer to do a very precise calculation for the first year of production, but taking notes on the demand during every year should improve the precision of the calculation. Taking notes on demands is most useful for planning, even if the farmer sells processed produce or the production system is different than ground-based outdoor production.

Crop planning is an important strategy to manage market risks, enabling the farmer to take advantage of the opportunities offered by the lower supply of fresh, local vegetables in the early spring, late fall, and winter⁴. Crop planning should take into account crop rotation, which can reduce the risk of pests and diseases.

² CityZen project (2022), Cityzen handbook: Urban farming policies and practices, CityZen project, p.5. (https://projects2014-2020.interre-geurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1659019357.pdf)

³ Curtis Stone (2016) The urban farmer – Growing food for profit on leased and borrowed land, New Society Publishers, Gabriola Island, p.337-338 (https://ia800100.us.archive.org/7/items/TheUrbanFarmerGrowingFoodCurtisAllenStone_201712/The%20Urban%20Farmer_%20Growing%20Food%20-%20Curtis%20Allen%20Stone.pdf)

⁴ Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p.24

There are different methods for season extension of different crops used by urban farmers. While greenhouses are a quite expensive option (and may not be in accordance with urban zoning plans), there is a possibility to combine outdoor and indoor production, or to create so-called “low tunnels” or “high tunnels”. Low tunnels are created by “laying the inexpensive row cover cloth over small metal hoops“, while high tunnels „are usually made of less expensive materials with flexible plastic coverings, in-ground or raised beds (as opposed to bench-top production), and passive heating and cooling such as row covers and roll-up sides“⁵.

Step five: Defining a target market

The next step for urban farmers involves answering who they will sell their produce to and how they will reach their target customers.

It is paramount to determine with precision urban farm’s market, which of course depends on who the targeted customers are. Urban farm will be competing with big supermarkets, specialized grocery shops, peri-urban and rural farms. Urban farm cannot compete with any of them at the level of the price because supermarket chains buy large quantities and peri-urban and rural farms are most certainly larger and therefore can produce more and sell it for a lower price. That is why it is important to find out what would the targeted customers be willing to pay. The easiest way to find out is to research the prices for the similar products and then to think what added value our product has.

Some of the possible micro-targeted markets for urban farmers could be reached through specialized shops, green markets, farmers markets, or direct delivery from the farm to customers’ homes.

Specialised shops

One possible option for urban farmer is to sell to specialized grocery shops. Such specialized shops would probably want to ascertain that the farm’s production meets their standards and they generally tend to sell organic produce. The economic reason for that is that small grocery shops also cannot compete with the supermarkets. To justify their price, they need to offer “something more”, some added value, being it the eco-label, a short chain of delivery or both.

Green market

In some cities, the popular way to sell farm’s own produce is the green market. Before opting for this type of direct sale, urban farmer should consider the costs of the stand and the shopping habits of the customers. It would be good to do a small research among the other sellers, and customers if possible, to know what kind of products customers come here to buy and which hours are most busy. If urban farming is not farmers “day job”, then it would not be an option to do the selling on their own. If thinking about according with someone else to sell the farm’s produce, urban farmer should inquire what type of seller is allowed to re-sell their produce. Generally, it would be permitted to a trading company but not to other farm owners.

⁵ Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p.24



Farmer's market

The farmer's market is another popular way to sell the produce. Farmer's market differs from the "green market" because, as its name says – only farmers can sell the produce. Farmer's markets might be less time consuming than green markets, because the farmer is not expected to be at the stand every day, being it that the market days are one or two during the week, or that farmers rotate.



Farmers' market in Zadar County, Zadar, Croatia (author: M. Mikulić)

From farm to fork

The newest method of selling agricultural produces is delivering them directly to customers' home. Although it existed before COVID-19, particularly in larger cities, it is now becoming more and more popular, especially with the rise of delivering services. Urban farmer should try to do at least a small research among the possible customers, for example by publishing a poll on social networks. This method of delivery permits urban farmers to deliver after their "day job" and to accord the time of the delivery with the customers.

Step six: Calculate expenses

Before starting a farm urban farmer should calculate expenses and put them in relation with the realistically expected income and thus understand if the farm they are starting is financially sustainable. This should be done, not only before starting the business, but also for every successive year. It is important to calculate the profit to understand if the profit meets farmers' expectations.

According to Stone,⁶ many businesses, farms included, "fail in their first couple of years, and one of the main reasons is that they go in with too many overhead expenses". He advises against keeping operating under credit and considers essential to keep the costs low, especially the overhead expenses.

⁶ Curtis Stone (2016) The urban farmer – Growing food for profit on leased and borrowed land, New Society Publishers, Gabriola Island, p.74 (https://ia800100.us.archive.org/7/items/TheUrbanFarmerGrowingFoodCurtisAllenStone_201712/The%20Urban%20Farmer_%20Growing%20Food%20-%20Curtis%20Allen%20Stone.pdf)

The farmer should start by calculating the fixed expenses like the annual price of the lease of agricultural land or loan repayment rates, the cost of the water, the cost of the storage, the cost of seeds or seedlings, compost, plant nutrition or other inputs in the non-agricultural production as well as taxes and contributions. It is equally important to calculate, as precisely as possible, the variable expenses such as the labour and distribution costs. While doing the calculation, the farmer must bear in mind the way amortization cost is calculated. If a farmer needs to purchase equipment or structures, the entire cost of it is not subtracted in the year of purchase. Just the value of amortization will be registered as expense for any given year (reduction in value of the asset at a given time). This is important to remember when doing a cash flow.

Fully aware that municipal water for irrigation can be expensive, experts warn against collecting rainwater from the roof which „makes a lot of sense financially and environmentally, but makes food safety scientists nervous because of potential risks of contamination if rooftops or other surfaces exposed to birds and rodents are used for rainwater collection“. They suggest to instead apply "collected rainwater using drip irrigation or another precise method to the soil surface, so that it does not contact the edible portion of crops"⁷.

The cost of storage, mentioned among the cost to calculate, may need a further explanation to a person new in the farming business. Not just any spare room (farmer's own or rented) can be used as a storage for the reasons of food safety management. The farmer needs to learn about storage needs of every particular crop on the farm and then calculate expenses according to the price of getting the needed conditions in the storage(s).

Step seven: Calculating cash flow

The farmer should not only be able to calculate farm's income and expenses and therefore the profit on the annual base, but also keep in mind that the farm's cash flow during the whole year remains non-interrupted. Well-planned cash flow will allow the urban farmer to provide for the necessary monthly payments or expenses such as labour force or taxes and contributions.

This is especially important if the farmer is launching a farm, not as a part-time job, but as the primary source of income.

For the cash flow to be accurate, it is important to plan sales channels and to be aware of the cashback time. Direct sales have an immediate cashback, but selling, for example, to specialised shop may not have, and the farmer might wait for the cashback.

The simplest definition of the cash flow is that it is concerned with planning inflows and outflows of money during the year in order for the business enterprise, in this case - the farm, to be solvent at all times. It is advisable to calculate the cash flow on monthly bases for all months during which the production will have expenses and incomes. It is equally important to monitor the realization of the planned cash flow on a monthly basis.

⁷ Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p.27



It may be important to note that the cash flow is not concerned with the calculation of income and profit; it simply takes into account only the “real” money that is inflowing and outflowing from the business. Inflow is not the same as income. Income is exclusively related to the selling products the farm has made. Therefore, the money from the loan has to be put into the cash flow even if it is clearly not income. Also, the equipment paid for in the certain year will be present in the cash flow with its full price, but in the profit calculation only a determined amortization sum will be expressed on the side of expenses.

Cash flow prediction directs farmer to plan as precisely and as realistically as possible, not only outflows but also the inflows as it is needed to predict when and how much of the products and at which price will be sold. Therefore, making a cash flow prediction can also help with the decision on the type of production (or the combination thereof) the farm will engage, and also to develop farm (garden) plan, both in relation with the expected income deriving throughout the year.

If the farmer is planning to have diverse production, to combine for example production of flowers and vegetables with having a few beehives, it is good to do the cash flow calculation for each production. After a few years, it will transpire which production is profitable, which results in near zero income, and which one generate losses. Diverse production is, of course, strongly advised, not only for ecological reasons, but also for economic reasons, especially if the farm opted for ground-based outdoor farming. For a number of reasons, like climate, pests or diseases, certain crops may give reduced yield or no yield at all in a given season. Therefore, it is advised to plant different cultures which ripen during different months.

Step eight: Some basic questions for the farm manager (evaluation)

Experts in the field of urban farming⁸ strongly suggest that a farmer should often think about several questions regarding the management and try to assess if the land, labour, structures and equipment are used in the most efficient manner. If the farm is operating on borrowed money, they should also evaluate if the money is acquired in the most favourable terms and does the borrowed money when the interest is paid contributes to financial sustainability or not. The farm should produce a profit or the surplus of income over expenses (in the case its business model is non-profit) and the farmer needs also to evaluate if that profit is enough – does it meet their (realistic) expectations and permit to reinvest in the development of the farm. It is also suggested that a farmer needs to re-evaluate their marketing strategies, business relations and inquire about possible new technologies that might make the production more efficient.

Step nine: Business plan

After careful consideration of all the steps, questions and examples mentioned in this chapter, urban farmer should write a business plan. It is therefore suggested to first finish reading this entire chapter and then come back to actually write a business plan. If a loan is needed, the financial institution may require a more complex business plan, but for the farmer alone, the following example should suffice.

⁸ Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p. 37

Urban farm is a small enterprise, and the business plan should be simple and clear, written on no more than two or three pages. If the farmer-to-be have done what was so far suggested in this chapter, writing this simple business plan should be just summarizing the previously gotten information.

The main elements of the business plan are:

The executive summary. This should include a short presentation of the business idea, in this case the urban farm’s vision and mission. Vision statement expresses farmer’s vision for the future of the farm with the farmer’s own values incorporated into the statement. These values can be environmental, economic, societal or others. Mission statement describes the farm’s purpose and expectations customers may have from the farm.

Description of the business and products. This section should provide with the detailed explanation of the products produced by the urban farm, their business model, and the method(s) of production.

Market analysis. It includes description of targeted customers, sales channels, and it shows an understanding of the competition.

Organization structure. In this section it is explained who beside the farmer will be included in the business (the farmer should think about all the aspects of business and needed know-how; farming, distributing (selling), promoting, accounting....)

Marketing plan. It explains farmer’s strategy in selling, including pricing, distribution strategy and promotion. (For more details, see the section 2.2. Marketing plan)

Funding and financial projections. In this section, the capital to be invested in the farm should be assessed, including the eventual need for loans or getting funds otherwise (for example by fundraising). The purpose is to have a clear calculation on how much money is needed to start the farm, but also when and how this investment will pay-off. Profit or surplus of income over expenses (with the cash flow projection added) has to be calculated. Projections should be calculated for at least 3 years ahead.

If the farm is non-profit, then crowdfunding could be an option. It is less likely that people would donate money to a profit oriented farm, but not impossible if a farmer has a really inspirational vision and mission.

Before the investment, and especially prior to deciding to take a loan, farmer-to-be should inquire about the eventual possibilities of getting co-financing or to be otherwise supported by different national, foreign, EU or local funds. As stated by the Directorate-General for Environment “at EU level, urban agriculture does not directly benefit from the support of the Common Agricultural Policy, but organic farming principles defined in the EU regulation on organic production and specific technologies can be used to grow produce in the cities. It also interplays with the EU’s Farm to Fork Strategy, which aims to accelerate the transition to a sustainable food system. There are also examples of policy making at national and city-level, and an acknowledgement of the growing importance of governing such food systems”⁹.

⁹ “Science for Environment Policy”: European Commission DG Environment News Alert Service, edited by the Science Communication Unit, The University of the West of England, Bristol https://environment.ec.europa.eu/news/more-consistent-policy-support-needed-urban-agriculture-flourish-2023-10-04_en



Step 10: Registering the farm

The registration of the farm is done only after the farmer has successfully completed all the previous steps, and can confidently claim that the farm will operate with profit (or create the surplus of income over expenses in the case of non-profits). At the registration office, farmer should ask information regarding further legal responsibilities, such as registering at the tax office or other possible registries required by the national regulations.

2.2. Market

A market is an environment in which the exchange of goods or services between buyers and sellers occur. To take part in this large environment of customers in search for farming produce, urban farmer has to define the market niche, that is to find customers recognizing the values that their produces represent and willing to buy it for a requested price. The marketing plan is a tool for an urban farmer to target the desired market niche.

Marketing plan

The marketing plan was initially composed of four elements, so-called four Ps; product, price, place and promotion, but these elements expanded to include people, processes and physical evidence. They represent different areas of focus (also called marketing mix) in creating a marketing plan.



Marketing plan (www.canva.com)

1.Product

The first and most important step is to really know and understand the product that is to be put on the market. It is crucial to describe what makes the product “unique or special, who will buy them, and how much you will sell them for”. The product should be described in terms of what it does for the customer and it is important to clearly communicate the benefits for the customer¹⁰. In essence, describing a product must answer to the most crucial question; why would a customer prefer this product to a competitor’s. The farmer has to avoid any medical claim about the product in order not to break a law.

This also means that it is not nearly enough to determine that the product, for example, is the strawberries. There are different varieties of strawberries; some sweeter than others, some smaller, but maybe more tasteful and aromatic than the bigger ones. A farm can, of course, produce different types of strawberries and see which customers will prefer. But, whatever their size or taste, urban farm’s product is not just strawberries. Competition in selling them is without doubt present. The farmer must convince the customer that their strawberries will meet their expectations better than those of the competition’s. For a product that does meet their quality expectation, the customers will be prepared to pay a little more than for the conventionally grown produce in the supermarket, but it is the farmer’s job to convince the customers that the quality of their produce is better. In the case of strawberries, the short chain of delivery can be a good reason to claim better quality.

It is also important that the product is visually appealing and the choice of packaging can be of great importance. If the farm made publicly known that its mission is rooted in environmental reasons, then the packaging has to be in line with that statement, and the farmer has to choose eco-friendly or re-usable packaging. If the farmer is delivering directly to the customers, it will be easy to re-collect the reusable packaging and doing it will communicate to customers that this farm is serious about protecting the environment and that this is not just another greenwashing strategy.

The quality of a product can be tasted, but just to a certain degree, so it is important to support the claim of the quality. Is it organic and labelled as such? Does the chosen method of production help the soil? There are methods of regenerative agriculture which can help to increase the amount of organic matter in the soil, and if the farmer is applying those, they should say so. If the farm is, for example, producing honey, it is not just the honey that the customer purchases. By purchasing the honey coming from an urban farm, the customer is also doing a service to the eco-system by supporting the bee preservation and by stating that, farmer can make the customer feel as an active participant in the environmental protection.

2.Price

If the farmer has done a realistic estimation of the cost of production and the desired profit, in this step they should decide the price taking into consideration that for certain products the profit could be bigger than for the others. The research on prices for the same or similar products should be easy to do by for example visiting specialised stores or other longer existing urban farms web sites or posts on social networks. If they have

¹⁰ Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p.50 - 52

been present in the market for a few years, then it is realistic to assume that their pricing was accepted by the customers. Giving discounts for a larger quantity of products purchased or in particular occasions can be a good marketing strategy, but in that case the farmer needs to calculate the margin of price that still leads to profit at the end of the year.

(The pricing is discussed in more detail under section 2.6. Sales and pricings)

3. Place

The farmer has to determine the place or the channels through which farm's products are going to be sold. When choosing a place or a channel, the farmer needs to take into consideration the quantity of products that should be sold and the distance of the farm from the place. If the chosen channel is direct delivery, the cost of it and the consumption of time needs to be carefully evaluated. The farmer might research if there are already existing websites through which some of the produce could be sold online and under which terms.

If the farmer wants to sell online directly from the farm's web shop, it is necessary to consult the legal terms in their country relative to this type of selling and also to find a way of receiving the payment online.

4. Promotion

Assuming that in the prior steps the farmer determined the market niche and gained knowledge who their customers are, and through which media channels can be reached, in this step the farmer is deciding on how to use those promotion (media) channels and how much money the farm can afford to spend on the promotion.

The farmer should also look for some free of charge promoting methods like a billboard on the farm, using social networks and creating a web page on their own using some free of charge online templates.

(Promotion is discussed in more detail under section 2.7. Competition and promotion)

5. People

Urban farms are small enterprises, and besides the farmer, not very many people will be involved in interaction with customers. If the chosen method of sales channel is direct delivery to customers, the farmer or other farm's employee doing the delivery (or selling at the green market) will be the key person presenting the products to customers and it is absolutely necessary that this person has good communication skills and is well informed about the products and the farm.

If the products are being sold through the intermediaries, for example in specialised shops, then it would be important that the sales person in the shop is educated about the products and able to answer the customers' questions.

One of most important communication channels today is social networks. The farm's administrator of the social networks profiles and pages will have responsibility to not only present the products and the farm's story, but also to communicate to potential customers. Potential customers will use social networks to ask a wide range of ques-

tions and their impression of the farm as a brand and its products will be largely formed by the administrator's ability to answer those questions in a satisfying way and reasonably fast.

6. Processes

Defining processes "behind the scenes" help in creating the customer friendly experience. Urban farmer should define the steps necessary to create positive customers' experience from the first enquiry to receiving a product, giving a review of the product afterwards and if necessary - returning the product. If the products are delivered (not purchased in the specialised shop, green market or the farmers' market) the main questions that need to be answered are: how long does it take to respond to an enquiry about products and how long will it take for the customer to receive ordered product. Regardless the channel through which the products are purchased, the farmer also has to provide an answer regarding where customers can leave their reviews of the products and what is the procedure for returning the product if the customer is unsatisfied with its quality.

7. Physical evidence

Physical evidence is everything that provides tangible cue of the quality of the farm's product. It is especially important for inspiring new customers. In the case of the urban farm, it is tidiness of the farm and physical places where the product are sold. It transpires from the content on the web page and social network, the logo, brochures, business cards, even the invoice, from the packaging and the uniform of the salesperson or delivery person.

2.3. Customers

In this chapter different possible market niches were already mentioned as well as channels to reach the customers. However, the urban farmer has to realistically evaluate the market and identify the profile of potential customers or clients (who function as an intermediary between the farm and the final customer), such as specialised shops or even restaurants, smoothie and salad bars.

For an urban farm, there would be three markets to deal with; consumers' market – individuals and households buying the products for themselves, retailers such as specialised shops and restaurants.

To identify potential individual customers, the farmer should make a demographic profile including age, education, income but also their societal and environmental values. To identify potential clients among specialised shops or restaurants and other catering facilities, the farmer applies the same logic and define the potential client among businesses that have compatible values such as selling local produce with as less as CO2 footprint as possible, or creating menus using local and seasonal produces.

Restaurants as very sensitive clients which is perfectly understandable because their reputation depends on the quality of food they serve. Experts in the field of urban farming give useful tips on how to deal with the chefs – starting from bringing two samples of each product on the first meeting



and not charging them, being eloquent and clear about the way they are grown, leaving a business contact information, being clear about the quantity of products available in each week during the season, giving precise information regarding the storage and shelf life¹¹.

Instead of opting to directly work with the customers, urban farmer may choose to find the clients among the processors. Selling to processors can represent less risk for the urban farmer but also less profit, since generally the processors aspect lower prices while demanding “stringent quality”¹².

Another possibility is to join the cooperative and to benefit from the fact that the cooperative has a professional person to deal in forming prices, sales, and finding a market. However, before joining the cooperative, urban farmer should be informed about the expected price range for their produce and calculate if this can bring a satisfactory profit. On the other hand, cooperatives have greater probability to get contracts with supermarket chains or grocery shop chains since they can offer larger quantity of products than a single farmer¹³.

2.4. Products

Describing a product was thoroughly discussed in the section 2.2. Market. When launching a new product farmer should repeat the describing process for that specific product.

Before launching a new product, it’s crucial to determine how it responds to customers’ demands at the moment. The answer may be simply offering a particular agricultural produce a little bit longer than the competition (season extension). In other case, it may be about recognising the right moment and respond to a general demand. The farmer will probably notice that some produce gains popularity in a determined time span; suddenly there are a lot of media articles about the benefits of that produce, a lot of recipes on how to use it, and the demand gets higher. In such cases, the farmer could benefit from this situation (which can be seen as a result of bigger market players’ communication strategy) and offer their version of this product.

If the produce the farmer wants to introduce to the market is generally unknown, for example a type of vegetable that is not commonly consummated in the region, it would be useful to test its reception before starting a larger production. Markets and farmers’ markets offer a good opportunity for testing products. Otherwise, the farmer could organize a small presentation on the farm or at the specialized shop. If the farmer delivers directly to customers, it could be a great opportunity to offer it to regular customers as a free sample or at a discount.

2.5. Distribution

Distribution plan regards setting up distribution channels for the farm’s produce. The basic knowledge the farmer has to acquire before writing it is to know where the customers are located and how to reach them in the manner that conserves produce’s

¹¹ Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p. 56 -57.

¹² Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p.57.

¹³ Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p.58

quality. Therefore, the farmer must have thorough knowledge of every produce’s storage needs, shelf life and the packaging that permits it to keep its freshness.

It is clear that distribution plan is in close relation to the planning of sales channels, because some of the produce needs to be delivered soon after harvesting while others can be stored for a longer time span before delivering. Shelf life of certain produces will also be different and has to be taken into consideration.

It is strongly suggested to consider those questions before choosing sales channels for every particular produce so that the harvesting time and the quantity to be harvested at one moment can be planned in advance.

The farmer can make a list of the produces that need to be delivered soon after harvesting (the same day or within a few days) and consider which sales channels are adequate for delivering them, and create another one where the produces with longer storage possibilities and shelf life will be listed and chose different sales channels for them.

2.6. Sales and pricings

Sales plan is directly dependent on the production (farm or garden) plan discussed under the section 2.1. Planning process. It consists in describing how long each produce will be available to customers and the estimation of the sales volume for the given produce.

Pricing is a sensitive process since the price for each product must fall between two points: what the customer is willing to pay and the point at which farmer starts losing money¹⁴.

It is paramount for the farmer to know the cost of production for every produce and also to know how much the competitors are charging for the similar produces. However, the experts warn that charging a little less than the competition is not necessarily a guarantee for success and that selling at the lowest price could even create the opposite effect¹⁵. The reason for it stands in the fact that customers buying from the urban farmer would be willing to pay a little more for a produce with an added value. In this case, the added value is the fact that the urban farm contributes to greening the city, preserving pollinators, shortening the chains of supply and generally positively contributing to environmental restoration. If those elements of the added value have been clearly communicated to customers, the farmer should not hesitate to include this added value in the pricing strategy. Also, if the products are delivered directly to customers’ home, this needs to be included in the pricing.

Promotional pricing that requires a farmer to lose money for a short period should be used with caution. It can be a calculated loss at the beginning of the enterprise in order to attract customers, or at the times when the farm is introducing a new product.

¹⁴ Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p. 52

¹⁵ Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p. 52



2.7. Competition and promotion

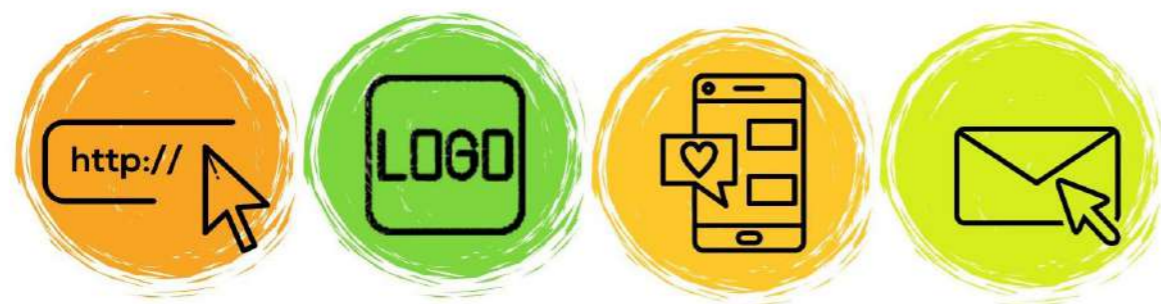
According to the experts¹⁶, there are three types of competitors to take into consideration; competitors selling similar products, those competing for the same customers and future competitors.

The farmer should realistically examine the advantages and disadvantages of their products in comparison to the competition's, (for example: who offers a better price for the similar quality, whose produces are more accessible, how well the competitors are already established in the market) but also try to predict competitors' response (could they offer lower prices, improve their distribution, invest more in the promotion....).

Promotion

The promotion includes all activities of communication with the customers and potential customers regarding the products the farm wants to sell. It is a combination of all branding activities along with advertising, communications through web site, social media, other online media and print media, as well as demonstrations, handing out coupons and similar activities with the intention to initiate or boost sales¹⁷.

Once when the farm's mission has been established to reflect the values of the farm, the products have been described and the target customers identified, the farmer can start planning the promotion. According to the habits of the targeted customers, the farmer needs to choose the promotion channels (newspaper, news portals, social networks and which ones, live promotions, flyers, newsletters, or combination of some of them).



Basics of promotion (www.canva.com)

Equally important is defining the message(s). The farmer should decide what message will have the greatest success in communicating the farm's values and the products' quality. The questions to consider when creating the message are: to what societal and environmental benefits the farm is contributing, is the production organic and /or local, is the product's quality superior because of the production practice or some other characteristic? The main message has to be short, clear and memorable.

¹⁶ Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p. 52

¹⁷ Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p. 60

Web site

Regardless of who the target customers are, and what sales channels the farmer uses, it is essential that the farm's presence online is not limited to social networks. In other words, the farm must have a web site and publish content regularly. If farmers themselves are not a type of person who likes to write, select pictures and administrate a web page, they can ask a family member or a friend to do it.

The experts in the field states that "a website is the cornerstone for a farm's online presence. Not having a website is like not have a phone number."¹⁸

The website is a promotional tool that has to be used to tell the story about the urban farm, the products, and the story of the urban farmers themselves. The best advice that can be given here is; tell your story because that's what people want to know! Tell why did you become the urban farmer. Was it to relax after the office job? Was it to do a step to help mitigating climate changes? Was it because you always wanted a garden? Perhaps the farm happened as something almost accidentally and fun; were you challenged by a friend to do it?

In telling the story, the photograph is paramount. Put your picture on your website, let the customers meet – you, the farmer! It may feel uncomfortable for some people, but in the today's social network culture, not putting out the picture makes the farmer as "not quite a real person" in the eye of the customer.

Not every product may have an interesting story, but if the farm is, for example, producing strawberries, it is advisable to put some recipes (and the photos) with the strawberries on the website and then also share it on social networks. The recipe can also be in a video form.

The web site should also contain solid factual information about the farm's production and products, such as ingredients data of the processed product or description of the production method if the produce is a vegetable or fruit. The production method is of interest to customers and part of the farm's branding, especially if the farmer is producing according to organic, biodynamic or permacultural principles. Even if that is not the case, this is a good place to tell the customers about the philosophy of growing and producing food the farmer is following.

The language used should be easy to understand for people who don't know anything about agricultural production and the web site visually appealing to the target audience and the font used easy to read. It should have a desktop and mobile version, be easy to navigate and have social media icons and newsletter sign-up button at the visible position on the homepage¹⁹.

Logo

The farmer can develop a logo around most important product, the one planned to be the farm's bestseller. If the farm is the first urban farm in the city, the farmer could play with that idea for the logo. Regardless of the choice, the rule for the logo remains; the simpler – the better. The reason for this is not aesthetic but practical; during the course

¹⁸ Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p. 56

¹⁹ Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p. 62



of years, it will be applied to various materials.

To start with, it should be applied on the website, social media, business card, products and packaging. Time passing, the farmer might want to apply the logo on different promo items such as textile bags, cups, t-shirts, hats, pens. If possible, promotional items should include the website address which can be in the form of QR code.

It is good to have a logo designed in colour and also in black and white because colour logo might not look good on every material and item. If particular colour is part of the branding of the farm, then it should be represented in the logo.

Social media

Developing authentic, fun and professional voice on social networks is a serious work. If the farmer is not a “social media person”, it is advisable to find someone else to do it. It is not easy to make the user stop scrolling and give the attention to the farm’s post. That’s why it is important to post visual content such as photos, videos or infographic. The farm’s followers would want to be updated about what’s happening on the farm. Did the lettuce sprout out? Is this the first zucchini flower this season? Are the strawberries for tomorrow’s delivery been just picked? These are photos and videos to be shared.

Photos and videos must look good, be eye catching, but that does not mean that all of them must be done by professionals. However, the farmer or the other person administering social networks, should have basic knowledge of editing photos and video using online tools. There are a number of online tools free of charge that can be easily used. One of the easiest free tools to edit photos is Lrfan view. Canva is one of the tools (base use is free) easily used to edit a video, giving it a title, adding music or voice and subtitles or to create an infographic and offers templates specifically designed for different social networks.

Posting on social networks should be regular and the content can be different; sometimes it will be about a product or it will be some farm news, and another time it can be growing tip or recipe. It is important to respond to fans (and haters) in a timely, positive fashion²⁰.

Newsletter

Some customers might like to receive the news about the products available in a newsletter. It is good to ask them. Also, it is important to have a newsletter subscribe button on the web site.

Differently than social media post, a newsletter is personal. There are different user friendly and free online tools to create a newsletter, such as Mailchimp. To be interesting, newsletter should not just be the list of products the farm can deliver and the farmer might want to add recipes using some of the farm’s products. The newsletter should not be long. It is advisable to use links that lead to more information on the subject or more recipes published on the web site.

²⁰ Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p. 62

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Neith Little, Kim Rush Lynch, Dale Johnson, Nicole Cook, Ginger Myers (2019) From Surviving to Thriving: Strategies for Urban Farm Success, University of Maryland Extension, p. 24, 27, 33, 37, 50 – 52, 56 -58, 60, 62

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CHAPTER 3

Production practices and approaches

3.1. Physical resource needs

In urban agriculture, physical resources include land, buildings and equipment necessary for the production and sale of raw materials, semi-finished and final products. For urban agriculture, it is necessary to ensure the availability of resources, such as water, electricity and the impacts that the farm can have on the environment (eg generation and disposal of the resulting waste). It is also necessary to have a plan regarding the availability of land areas that are planned for urban agriculture in the coming period. In this regard, it is necessary to regulate the planned areas in Contracts on the purchase or lease of land. It is also necessary to determine whether there are known or potential environmental problems on the farm that will require assessment or the introduction of cleanup measures on the farm or whether specific agricultural techniques are needed to solve them. If there are physical obstacles on the farm, e.g. remaining foundations or floor slabs need to be removed in order to carry out production. For successful production in urban agriculture, it is necessary to have accommodation facilities (buildings, houses and other auxiliary facilities). Water and electricity are most often used from the buildings, and there are usually compost bins next to the buildings in their shadow. The facilities store machinery and equipment, such as mini tiller cultivator, vehicles, refrigerators, etc., as well as tools, such as shovels, hoes, rakes, hand seed drills, etc. Various types of raw materials are stored in the facilities, such as fertilizer, compost, commercial plant nutrition and plant protection products, seeds, seedlings, mulch, boxes, crates, straw bags, sacks, bags, labels, etc. Since urban agriculture is located in urban areas where average air and soil temperatures are higher, in such conditions it is necessary to provide an irrigation system and accompanying equipment for the same.

3.2. Human resource needs

One of the critical issues for engaging in urban agriculture is the availability of the human labor required to manage the farm. Estimates of the number and types of workers needed can be made by identifying the specific tasks performed daily on the farm, including administrative and management responsibilities, and estimating the number of hours per month for each task. These tasks can be grouped by skill or experience and the estimated total number of hours for each group. For example, tasks can be grouped into operational, administrative, marketing and finance. Before and during production on urban farms, it is desirable that urban farmers be educated through various types of education. On the other hand, if there is a lack of seasonal human labor, urban farms often employ volunteers, part-time workers, full-time workers, in some cases the lack of labor is “covered” by third-party services or some other combination.



One of the educations related to the application of different bioagrotechnical measures (photo Ugrenovic, 2022)

3.3. Urban farming management

3.3.1. Going Organic?

Organic practices and methods have a special place in dealing with urban agriculture, they are very important in urban environments, primarily due to limited land resources, especially in densely populated cities. Organic methods are accepted by urban farmers because they exclude synthetic agents (synthetic fertilizers, pesticides, additives,...) that can contribute to soil and water contamination. In addition, raw materials and products obtained from organic crops/plantations are healthier than conventional raw materials. Great attention is paid to the cultivation of the soil using compost, cover crops, means for the protection and nutrition of plants based on minerals and biological raw materials. There are also Lists of plant protection products and Lists of plant nutrition and soil conditioners that can be used in organic production, a significant part of which is manufactured organic fertilizers based on compost, manure, vermicompost (the product of the composting process of the red Californian earthworm) and the similar, are updated by Working group of Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia is still in 2017. Diseases and pests of plants are controlled by using crop rotation, resistant varieties, different types of cultivation, and biological control of diseases and pests. Animal health is maintained by healthy food, adequate shelter, access to the outdoors and preventive health plans. They often have a higher market price, which is important for urban farmers who want to increase the profits obtained from small plots of land. In the Republic of Serbia, organic production is legally regulated and subject to control and certification. Based on the Law on Organic Production, in 2023, the Ministry of Agriculture authorized six control organizations for certification and control in organic production. After the conclusion of the contract between the producer and the authorized control organization, the organic producer has several obligations:



To apply organic production methods and use permitted means during production and processing, which is regulated in the Annex to the Rulebook on Control and Certification in Organic Production and Organic Production Methods.

Every year, he must inform the control organization about the dynamics of production, and within the deadline set by this organization.

To keep records on production in accordance with the instructions of the control organization, as well as to enable the control organization to perform controls through access to premises, production units and all documents and records on organic production.

3.3.2. Soil management: contamination, fertility, cultivation and fertilization

Land represents one of the most important natural resources, an invaluable good that is slowly formed, and in the process of destruction it is quickly destroyed! In urban agriculture, land has added value because there is little of it for food production, and its utilization is high. In a short period of time, urban farmers produce a large amount of food on a small area, which further depletes nutrients and deteriorates the soil structure, and land management in urban very important to agriculture. One of the possible problems of urban farmers is the contamination of urban soils, primarily by heavy metals and, to a lesser extent, contamination by pesticides. Exposure to heavy metals has long been recognized as a danger to human health. The soil of urban farmers often contains elevated levels of cadmium (Cd), lead (Pb), mercury (Hg), chromium (Cr), nickel (Ni), mostly from inherited sources, which is one of the obstacles to practicing urban agriculture. The capacity of urban farmers to access, understand and act on scientific data related to soil contamination is also variable. A large part of urban farmers, however, has an awareness of the use of the latest scientific data related to soil contamination and the analytics that are carried out in this regard. In addition, knowledge about the content of organic matter (primarily humus) in the soil is very important for adequate soil management, without which there would be no life on earth, and in this case, no urban agricultural production. In addition to organic matter, soil consists of mineral particles, water and air and is a living environment for plants, animals and microorganisms. Land is limited in surface area, and by nature a destructible asset. It is formed slowly, and in the process of destruction it is quickly destroyed. Soil quality implies a combination of several of its properties: physical properties (mechanical composition, compaction), water-air regime (retention properties, water permeability, air capacity...), chemical properties (soil fertility, content of dangerous and harmful substances...), microbiological properties (abundance and activity of certain groups of microorganisms), etc. These features should not be considered separately, as they are often interdependent. In this regard, from time to time it is necessary to first of all control the fertility of the soil, which the majority of urban farmers know, but also analyzes that improve the other properties of the soil.

In order for soil management to be more efficient in the conditions of urban agriculture, we must first of all fertilize the soil. Organic fertilizers such as: manure, compost, vermicompost, green manure, sedge, peat, wood ash, plant preparations and other permitted waste organic materials created as side products in urban agriculture are usually used for this purpose. Since in urban areas fertilization with manure and grain is almost omitted, urban producers mostly use compost, followed by green manure, in

some cases vermicompost, and lately more and more preparations based on medicinal and other plants.



The above-ground part of comfrey is full of potassium (photo Filipovic, 2023)

The good thing is that, for example, in the Republic of Serbia, urban farmers use fertilizers that are on the List of plant nutrients and soil conditioners that can be used in organic production, and a significant part of which is manufactured organic fertilizers that are based on compost, manure, earthworms and the like, which updated by the Working Group for preparation and annual updating of the Ministry of Agriculture, Water Management and Forestry of the Republic of Serbia. Producers can find a list of permitted fertilizers and soil conditioners in the Annex to the Rulebook on Control and Certification in Organic Production and Organic Production Methods ("Official Gazette of the RS", No. 95 of July 3, 2020, 24 of March 19, 2021) or its Annex (Annex 1) in which the list of permitted means for plant nutrition and soil conditioners in organic production is given. To conclude, by applying organic production methods, the quality, i.e. the level of fertility of the soil used in urban agriculture is protected, preserved and increased. This combination is valuable because, although they are not certified, urban producers use organic methods that greatly contribute to an adequate approach to land management. in urban areas.

3.3.3. Composting

In urban production, composting is one method that is widely used for the production of high-quality organic fertilizer - compost. Compost is an organic fertilizer and soil improver produced by controlled biooxidative decomposition of various mixtures composed of various plant residues, sometimes mixed with organic fertilizers and/or animal residues, and contains limited amounts of mineral substances. As in organic production and in urban agriculture, composting is recommended as a bioagrotechnical measure primarily for the treatment of waste generated in the production of plants and from the household, but also for the control of weeds, pests and diseases. A large number of videos, newspaper articles, brochures promote urban composting, as a measure that promotes the principle of "zero waste", i.e. production without waste. Composting breaks down organic matter with the help of microorganisms. Plant residues originating from urban gardens and from urban roofs are most often composted,



but in some cases waste from the household (kitchen) or some urban processing is added. Vegetable, fruit, leaves, stalks, grass clippings, straw, ashes, parts of food, etc. are most often composted. Care should be taken to ensure that rhizome weeds, weed plants with mature seeds, walnut leaves, and above-ground parts of white wormwood, sage, ambrosia, diseased plants and other household industrial waste do not enter the compost. Recently, urban farmers are increasingly applying fast or hot composting, so-called Berkeley Method, which compared to classic composting, is a much faster process, and “mature” compost is obtained in an average of 14 to 21 days, according to most sources in 18 days. All waste is added after the compost pile (mass) is established and as a result, the microorganisms that break down (mineralize) the organic matter in the pile work much faster. That kind of approach makes the crowd warm! Hence the name “warm or hot composting”. Such high temperatures (about 70 °C) affect the destruction (sterilization) of the compost mass, so that the negative impact of the presence of germinating weed seeds and the presence of pathogens and pests is greatly reduced. As for the volume of compost in fast composting, it remains the same, while in classic composting, it is only 30% of the original volume at the end of composting. With the fast composting method, during those 18 days it is necessary to invest more work, but in return the output product - compost, with its quality, meets all the necessary technical and market requirements.

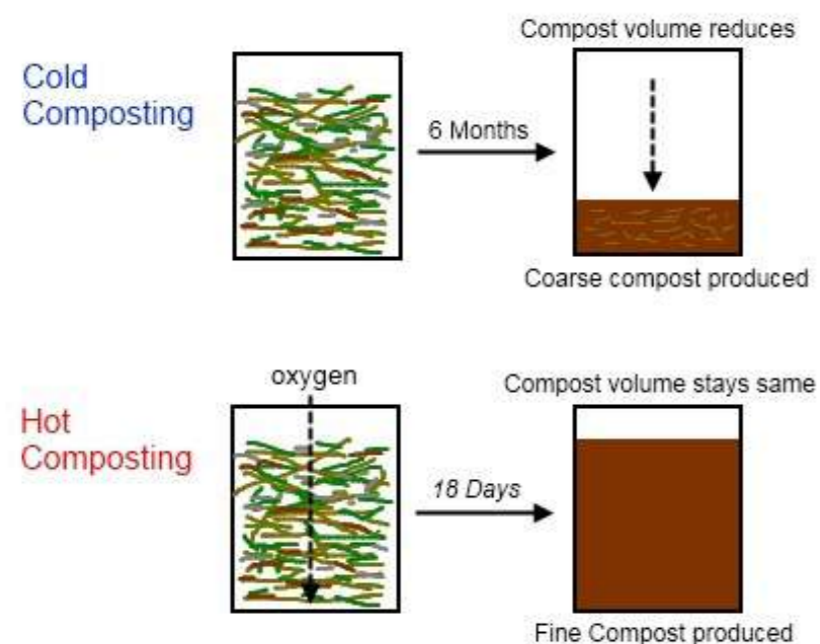
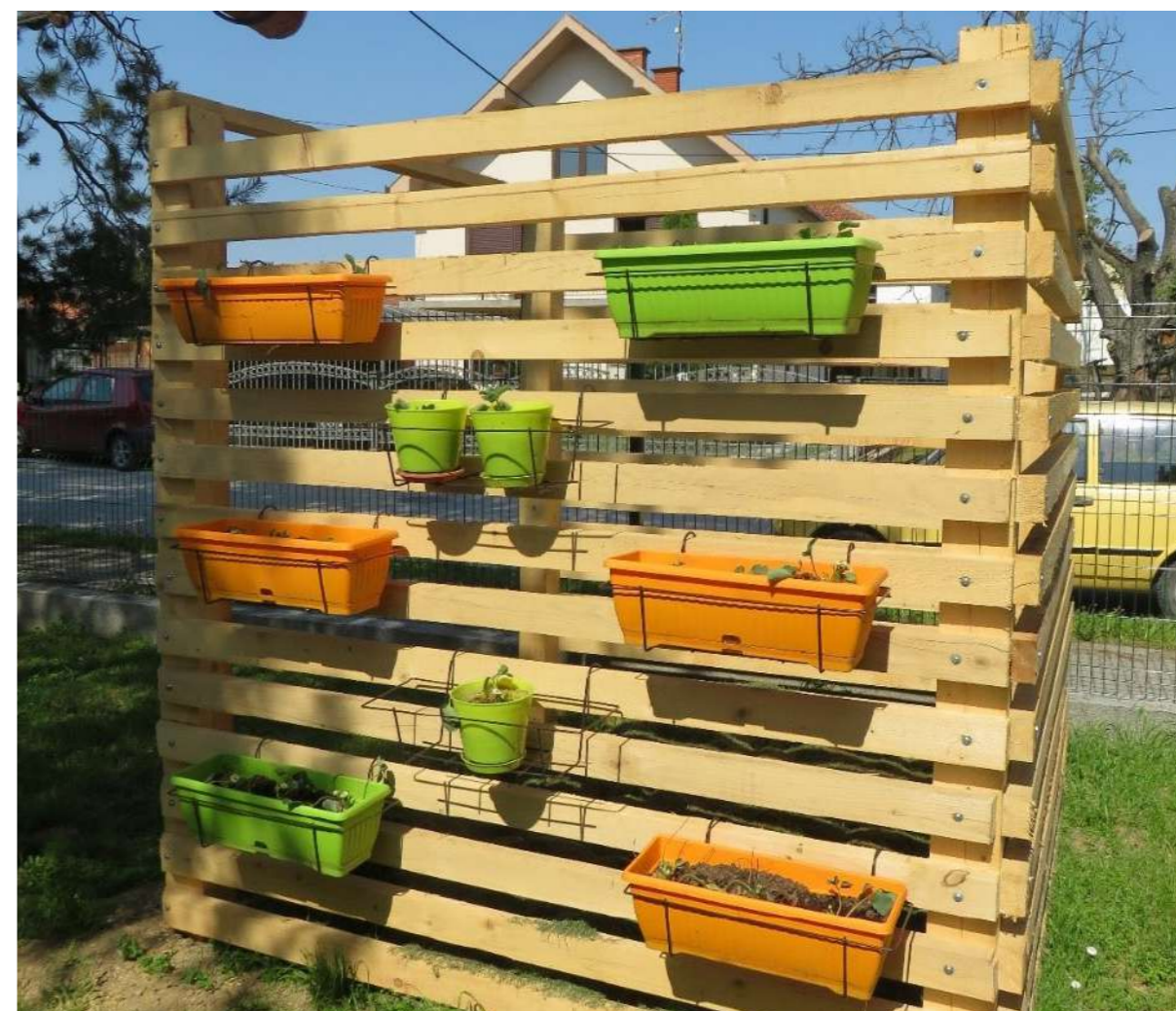


Illustration of the cold (classic) composting method and the warm (fast) composting method (source: Atchley, 2013).

In order to obtain quality compost, it is necessary to take into account the relationship between carbon (C), which is a source of energy, and nitrogen (N), which is the basic element of plant nutrition. That ratio should be C:N = 25:1 to 30:1, which means that there is one part of nitrogen for every 25 parts of carbon. With an extremely high C/N ratio, there is little nitrogen, with a low ratio there is a lot of nitrogen, which can be harmful. When producing compost, it is most important to maintain the ratio of carbon (C – brown waste) and nitrogen (N – green waste). Carbon is contained in hay, straw, corn stalks, leaves, and the like, while most nitrogen is found in green and yellow-green

plant waste (above-ground parts of legumes, carrots, potatoes, grass, etc.). Compost with a high carbon content is yellow or brown in color, dry and lumpy, and compost with a high nitrogen content is greenish in color, moist, and sometimes muddy. In order for the process of mineralization, i.e. obtaining mature compost to take place even more successfully, it is necessary to add an inoculant (eg microbiological fertilizers, etc.) or teas based on medicinal plants (chamomile, valerian, dandelion, yarrow, nettle,...).

Composting in a compost pile is done in a place protected from wind and strong sun with accessible access in different weather conditions. The dimensions of the compost pile are different, which primarily depends on the amount of compost material and the purpose of the obtained compost.



Composter built within project “ABC of Better Me” implemented by the National Association for organic production “Serbia Organica” and Novak Djokovic Foundation (photo: Filipovic, 2018)

Before starting composting, for faster decomposition and ripening, it is necessary to chop coarse material to a size no larger than 5.0 cm. After that, the mass is prepared: if it is dry, it needs to be moistened or vice versa, dried with some of the structural materials. The first phase is the so-called the mesophilic phase, which lasts for several



days and ends at around 40 °C. In the second or thermophilic phase, the decomposition of the ingested material is intensified, due to biochemical reactions, the temperature (in the middle of the mass) reaches 70 °C and more degrees, which in total lasts about 1-1.5 months (in some cases even more). After that period, it is necessary to mix the mass and cover it again several times during decomposition, all for the sake of “restoring” microflora activity. In that period, fungi, bacteria and collembola are the most active, and after “cooling” in the phase of the same name (i.e. the ripening phase) at a temperature of around 25 °C, that “role” is taken over by earthworms and other insects. In some cases, the end of decomposition can be after six months, however, the best compost is obtained after a year, when the mass is completely “ripened”.

Compost care measures include mixing, watering, health monitoring and storage during composting. In appearance, compost is very similar to burnt manure, due to its crumbly structure, dark-brown color, uniform mass and pleasant smell of forest soil. The content of active substances is similar to well-burnt manure, it usually contains nitrogen 0.3-0.5%, phosphorus 0.2%, potassium 0.2-0.3% and calcium around 0.6%, which varies depending on from the content of composted raw materials. Before use, it is preferable to disinfect the compost. In recent times, the so-called herbal teas (purchased or homemade) that are used as activators of the composting process. Certain microbiological, biodynamic and homeopathic preparations can also be used for this purpose.

The purpose of this high-quality organic fertilizer is multiple, it is most often used as a substrate in nurseries, vegetable growing, flower growing, mushroom growing, etc. For fertilization, it is used immediately before sowing or planting, in quantities of 3 - 6 kg/m², with an effect of up to three years. Compost is not introduced deep into the soil, but at the surface (up to 5 cm deep). Compost is particularly suitable for preparing substrate mixtures, preparing the seed layer, picking seedlings and as a “covering layer” of seeds.

Be careful and pay attention to the most common defects in composting!!!

Symptoms	Problem	Solution
Compost has an unpleasant smell The middle of the pile is dry	Lack of oxygen Lack of water	Dig through the pile When turning over, pour water over the mass
The pile is warm and moist only in the middle	The pile is small	Increase it by adding fresh cold material
The pile is moist, with a sweet smell, but the mass is cold	Lack of nitrogen	Add material rich in nitrogen (freshly cut grass, etc.)

3.3.4. Crop rotation

Crop rotation is a planned system of plant production in which the composition and ratio of areas under crops is constant for a long time. Plant species alternate in time and space in a fixed order. If organic methods are applied, crop rotation is given great importance, because it is seen as an important phytosanitary measure that reduces the occurrence of plant diseases, pests and weeds. In urban agriculture on small areas, there is a more intensive change of crops in time and space. The largest number of plant species on urban farms are vegetable species, primarily because they are used

fresh for food, but also later as raw material for processing. The purpose of vegetable crop rotation in urban agriculture is to, as part of other bioagrotechnical measures, maintain and eventually increase yields, but also the quality of the desired raw material over a long period of time. Vegetable production in crop rotation is a mandatory measure in urban production and represents one of the most significant preventive and bioagrotechnical measures in this type of production.

Vegetable crop rotation has great biological importance:

- maintains the nitrogen balance in the soil,
- reduces weediness and the number of pests,
- stabilizes active substances in the soil,
- reduces leaching of nutritious elements and
- contributes to the maintenance of soil microbiological activity.

If plant species that have a greater need for nitrogen are produced (cabbage, potatoes, gourds/ pumpkins and fruit vegetables), then the crop rotation should include at least 25% of legumes with a vegetation period longer than 3 months (high varieties of green beans, broad beans, lentils as well as subsequent crops). In practice, the composition and size of the crop rotation depends on a large number of factors: whether urban vegetable production is intended for own use, market or some other type of sale (a large number of species, varieties and varieties) or processing on the farm, whether or not the vegetables are raw materials for processing industry or the producer is engaged in the production of vegetable seeds.

Cultivation of vegetables in monoculture and fatigue of the soil have a long-term effect on the reduction of yields, which is reflected in the profitability of the farm. Inadequate crop rotation in urban vegetable growing, in the long term, contributes to stronger weediness of production areas, which is due to a poor selection of species (some types of vegetation, with their green mass, cover the soil less well) and due to the presence of rhizome weeds. For this reason, there is an additional investment in many hours of mechanical and manual work on areas where there are a lot of weeds. When growing vegetables in urban agriculture, multi-field crop rotation as a bioagrotechnical measure additionally contributes to the economic stability of the producer, because the risk associated with the production of only one or a smaller number of crops is reduced (due to the sowing of low-quality seeds, bad weather conditions, failures during the cultivation itself, if the market is saturated with a certain with the type of vegetable, the purchase price is low, etc.)

When planning future urban agricultural production and selecting species, the producer adjusts the crop rotation to the available resources on the urban farm (sowing and harvesting periods must fit into the optimal schedule for the use of natural and human resources on the farm). It is important for the urban producer to use land resources rationally, and to feed both the soil and the plant in a balanced way.

The backbone of the planned urban production and crop rotation should be the species that are needed by the household, the species that are in demand on the market and that the urban producer knows well technologically (he has enough knowledge



and experience). For the selected species, the urban producer should have appropriate equipment and comply with the requirements in sowing/planting, harvesting, washing, sorting, packing, etc., sufficient labor on the farm and that the production fits into the planned income budget of the farm, and promises economic profitability.

Each producer plans a crop rotation in accordance with agro-ecological conditions, soil characteristics, irrigation possibilities and set production goals. Creating an optimal crop rotation in the conditions of urban agriculture with all elements such as: crop rotation (temporal change of crops), field rotation (change of crops within a field with one or more beds) and resting the soil is not at all simple, because you need to choose the type, variety, fertilization, tillage, sowing and planting dates, ripening time, etc.

The vegetable crop rotation plan in the conditions of urban agriculture cannot be taken from another producer or copied, but is fully adapted to the conditions of each individual urban producer, i.e. the land he cultivates in relation to the set production plan, the quality of the soil and its ability to store nutrients, the possibility of suppressing harmful organisms (weeds, diseases and pests), as well as the availability of water, labor and machinery.

Vegetable species are classified into groups on several grounds, including resistance to monoculture cultivation and soil fatigue:

- very low sensitivity to monoculture: leek, celery, lettuce and pepper;
- medium sensitivity: tomato, cauliflower, cabbage, carrot, cucumber, onion and pea,
- high sensitivity: parsley, beetroot.

Cabbage plants (eg cabbage, cauliflower, broccoli, Chinese cabbage), spinach, beetroot, Swiss chard and beans are the most sensitive to soil fatigue, and salad and fruit vegetables (tomato, pepper) are much less or almost not at all.

Vegetables are also divided according to their requirements for organic fertilizers. For organic vegetable growing, the specific application of a pure vegetable crop rotation with the rotation of three groups of vegetables is:

- Group I in the crop rotation - species that are abundantly fertilized with manure or compost (2-6 kg/m²): pepper, potato, pumpkins, late cabbage, kale, broccoli, cauliflower, Brussels sprouts, tomato, eggplant, cucumber, sweet corn, celery, leek, melon and watermelon;
- Group II in crop rotation - species with lower requirements for manure or compost (1.5-2.5 kg/m²), and use the prolonged effect of manure decomposition (organic fertilizers adversely affect the quality of the product): carrot, parsley, parsnip, early cabbage, kohlrabi, onion, garlic, lettuce, spinach, Swiss chard, beetroot, radish, radishes (conditionally);
- Group III in the crop rotation - species that enrich the soil with nitrogen and species that are not fertilized with manure or compost: peas, green beans, beans, broad beans, various salads, lamb salad, argula, radishes, parsley, chicory, endivia...).

3.3.5. Collecting and storing seeds - hobby seed farming

Dealing with urban agriculture can be completed in a very interesting way by collecting and saving seeds of old varieties and using such seeds for sowing. That activity will bring a lot of benefits and joy to urban producers. As one of the goals of sustainable development is the preservation of biodiversity in urban agriculture, priority is given to the use of native and domesticated, old varieties. Their great diversity enriches agriculture and contributes to the easier establishment of production. Local crops are particularly important because during cultivation, they adapted over time to the existing ecological conditions (climate, soil), to biotic factors (pests, disease) and to local technologies. However, old varieties are often not available to organic food producers, and their maintenance on the farm is complex and risky due to the influence of external factors. Urban farmers as small producers can be engaged in the preservation and maintenance of local plant populations and the exchange of their seeds. This type of preservation and maintenance is called *in situ* or *on-farm* conservation and is gaining more and more importance in the world. An urban producer can produce seeds on his own land, however, it is known that many plant diseases and weeds are transmitted by seeds, so special attention must be paid to the health status, purity and germination of such seeds, but also to preserving the identity of the variety he grows.

Species and variety

Self-collection and preparation of seeds is not a miracle. In the villages of Serbia, even today, many traditional producers take care not to run out of favorite and reliable varieties of beans, peppers, corn or types of flowers, which are not commercially available.

Since the concepts of species and varieties will be constantly repeated and many laymen do not distinguish between these two concepts, we will explain the difference with a simple example:

For example, a **species** is a bean, and there are many **varieties** of beans: Tetovac, Gradištanac, Trešnjevac and a number of others. The species are also: green beans, beets, peppers, cabbage, and the varieties of peppers are: moravska kapija (Moravian gate), somborka, kurtovka, bugarka (bulgarka), etc...



The use of domestic and domesticated and old varieties in urban agriculture contributes to the preservation of biodiversity (photo Ugrenovic, 2019)



The species is determined by the scientific name, so the entire plant world is classified into classes, orders, families, genera and species. This division enables people from all over the world to communicate professionally with each other. With that division, each plant species received a “surname” and “name”, that is, the name of the genus and species. For example: onion belongs to the genus *Allium*, and to the species *cepa*, garlic also belongs to the genus *Allium*, but to the species *sativum*. Most of these scientific names are of Latin or Greek origin. Domestic (indigenous, domesticated, old) varieties usually have a folk name, which they got in the area where they were created during a long-term process of adaptation to local conditions.

Crossbreeding and insemination

We emphasized the importance of old varieties, and the secret of their preservation is precisely related to cross-breeding. The species are not related enough and rarely interbreed. For example: a pumpkin cannot be crossed with a carrot, and it will be easy to cross two different varieties of pumpkin, or two different varieties of carrots, when they flower at the same time and are close to each other. In nature, cross-breeding takes place constantly and spontaneously, and thus new varieties of the same species are created. However, in home seed production, the spontaneously created variety through uncontrolled crossing has certain disadvantages. because we cannot know what kind of seed plants we will get by sowing in the following years.

Preservation of old varieties is not an end in itself, it means preservation of valuable hereditary traits, which can come in very handy for urban farmers. They often have tolerance to diseases and pests, so they are easier to grow, or some specific characteristics: color, smell, taste, which are interesting for consumers. In order for all of this to happen, it is necessary to ensure that the seeds of old varieties grow into plants with the same characteristics as the parents. There are plant species where every beginner in home seed growing will be able to successfully grow different varieties (of the same species), without major unpleasant surprises (bean, tomato, pepper). We call those species self-pollinating, because in them pollination takes place within a single flower. Pollination of those other, cross-pollinated cultivated plant species depends on whether the pestle one plant to get pollen flowers of other plants, of the same species. Pollen is carried by the wind and pollinating insects: bees, bumblebees, wasps, flies, butterflies, etc... If we want to grow more varieties of the same species, or a neighbor nearby has a new variety, in order to preserve our old variety, we must apply insulation.



Phacelia is cross-pollinating entomophilous plant (photo Ugrenovic, 2020)

Isolation

If we have, for example, three different varieties of onion (cross-pollinating plant) that bloom at the same time, there is a high probability that there will be uncontrolled crossing and insemination, so we will not get what we expect from the collected seeds. In such a situation, it is easiest to sow a different onion variety every year. It's called time isolation. Varieties that do not bloom at the same time during one year, early and late varieties, are isolated in time.

By sowing different varieties (of the same species) at a certain distance, we ensure spatial isolation. This will be feasible in vegetable gardens only with self-pollinating plants, because they do not need to be sown or planted at great distances from each other. This primarily refers to bean, tomato, pepper. If we have a small vegetable garden, but we still want to grow different varieties (of the same species) at the same time, we will have to use bags for pollination control.

On the flowers of the plants that we want to protect from the visit of insects, before the flowers open, we put and fasten a white, air- and light-permeable bag: paper, or a mosquito net. Every morning on warm and sunny days, we remove several bags and use a brush to transfer pollen from the flowers of one plant to the flowers of another plant. Best in a certain order, then we go back and repeat the same procedure in the opposite direction and so with each flower twice. Thus, we can be relatively sure that the flowers of one plant are pollinated by the pollen of another. Finally, we put the bag back on and fasten it to the stem. We do the whole procedure until the flowering has passed and only then can we remove the bags. It is important to mark the “selected” flowers beforehand, so that there is no confusion when collecting the seeds.

Notes:

We must always select as many plants as possible, whose flowers we want to protect from uncontrolled pollination and from which we collect seeds.

We cannot use mosquito nets for plants that are pollinated by the wind (beetroot, chard, spinach, corn, etc.), since they have very fine pollen, which passes through even the smallest pores.

Selection

Each of us can do selection in our own garden. If we observe many cultivated plants of the same species (one population), we will notice that they differ somewhat even in a smaller space in the same climatic and soil conditions. For example: according to the size, shape, color of the fruit, vitality, some are attacked by plant diseases, while others are healthy. Each plant has different genes and hereditary traits (good or bad) that are passed on to offspring. The selection process becomes much simpler when we get to know and learn to observe plants. For taking seeds, we select those individuals that have the characteristics we care about (vitality, lush growth, healthy leaves, beautiful and tasty fruits, resistance to diseases, resistance to drought, low temperatures...), and the appearance of the plant must be typical for variety.

The purpose of selection is to preserve and improve traits. For example: in the case of vegetables, it is the taste and appearance of leaves or fruits, in the case of flowers, the beauty of the flowers, in the case of medicinal plants, the aromaticity, etc. In this work,



the most important thing in the crop of a certain variety is to prevent atypical individuals from blooming and transferring some of their negative characteristics to the plants selected for seed collection. Such atypical plants should be removed from the crop before flowering. Also, in order to maintain genetic variability, we must not take seeds from only one or two of the most beautiful plants of a certain population, in order to avoid “inbreeding”. The rule is “the more plants the better”, not less than ten (eg we would have to take corn seeds from at least 200 plants).

Collection, cleaning and storage of seeds

Seeds should be collected in dry and warm weather from weed-free and healthy crops. In order to ensure the maximum vitality and germination of the seeds, the fruits should be left to fully ripen on the plant, and if this is not possible, the whole plants should be pulled out of the ground and left together with the fruits in a shady place, so that they fully ripen. The seed obtained in this way should be mechanically cleaned from various admixtures, seeds of weed species, as well as from empty, undersized and diseased seeds. The exposed seeds should be packed, labeled and stored in a dry, dark and cool place.

Dry cleaning - Seeds in husks, pods, pods, of various hardness and shapes, must first be freed from those shells, by threshing in a larger container. Then, by gradually sieving, through sieves with different opening diameters, impurities are separated: dry parts of the plant, empty, undersized and diseased grains and weed seeds. In some species, this procedure will go quickly and easily, in others it will be difficult.

Sifting is an ancient procedure for separating seeds from various impurities. The seeds are thrown into the air from a shallow, wide container on a windy day, and since they are heavier than the admixtures, they fall back into the container, and the wind carries away the admixtures. It is painstaking work, and better solutions are sifting through appropriate sieves. For small quantities of seeds, sometimes it is enough to blow off the dry impurities, in order to obtain clean seeds.

Wet cleaning - Seeds that ripen in the juicy flesh of the fruit (tomatoes, cucumbers, melons, watermelons) are subject to wet cleaning. Such seeds should be exposed to fermentation, which takes place in overripe fruits, boiling occurs, and the flesh of the fruits gradually decomposes. During these processes, the compounds created destroy pathogenic bacteria and fungi. Smaller fruits, e.g. tomatoes, should be crushed and left to ferment for several days, and larger ones (cucumbers, pumpkins, zucchini) should be cut in half, the seeds should be scraped with a spoon along with the meat and pulp and left to ferment. Then, by washing, the seeds are separated from the meat and pulp. The mixture is diluted with a lot of water and mixed well, the seeds fall to the bottom, and the lighter part remains on the surface. That layer is carefully removed from the pulp, and a larger amount of water is added again. At this stage of washing, the seeds can be seen at the bottom of the container, so that the excess water can be poured off. At the end, the seeds are spread out on a sufficiently thick sieve and washed with running water.

Drying - It is important to dry the seeds quickly, so that they do not germinate and are not attacked by pathogens. During wet cleaning, the seed should be placed on a thicker cotton cloth before drying, so that it absorbs as much water as possible from it. Then the seeds are spread in a thin layer on a hard, glass, porcelain, ceramic or metal sub-

strate. During drying, the temperature should not exceed 35 °C, it is most suitable in a shady place, and not exposed to direct sunlight.

Storage - The two biggest enemies of stored seeds are: high temperature and humid air. Seeds stored in an area with large and frequent temperature changes will quickly lose their germination. Moisture is harmful because it favors the development of microorganisms and thus significantly reduces the quality of the seeds.

It is best to pack completely dry seeds in glass or metal containers with tight screw-on lids. After packaging, each container should be marked with a label (name of plant species, variety, year of production, etc.). The containers are placed in a cooler room where the temperature and air humidity are as uniform as possible.

3.3.6. Control of weeds, diseases, and harmful organisms

Weed control - In the system of urban plant production, weed control is based on preventive action, hygiene of production areas and their maintenance without weed seeds and organs for vegetative propagation.

Weeds are plant species that over time have adapted to cultivated plants and agro-technical measures, which have been applied for a long time, so it can be said that they are not accidental companions of cultivated plants. On the other hand, they compete with crops for space, light and nutrients, and thus can significantly reduce the yield of cultivated plants. In addition, they can have a negative effect on the quality of the products obtained, because they can often be poisonous, such as the very common *Datura stramonium*. Because of all this, it is very important to recognize weeds, especially the poisonous ones, if the urban producer is not sure whether the weed is non-poisonous or poisonous, it is best to get information from a weed expert - a herbologist, thus removing any doubt as to what kind of weed it is. Urban farmers also use plant recognition applications, but as such they are not secure enough and quite often plants can be replaced, poisonous with non-poisonous and vice versa!

Proper crop rotation, mulching, as well as tillage without overturning, can significantly reduce the number of weeds on production areas, however, in the agro-ecological conditions of Serbia, the use of human labor for hoeing and weeding cannot be avoided. In the world, intensive work is being done on the development of bioherbicides and mechanization, for the most efficient destruction of weeds, because the success of the weed control solution largely depends on the success of plant production in the cultivation system without synthetic herbicides.

Flower protection belts (flower strips) - represent belts made of biologically active plants, which surround or cross agricultural areas. The intensification of agriculture in recent decades has had an extremely negative impact on biodiversity. Inappropriate use of pesticides and other synthetic agents has affected the loss of honey bees and other beneficial insects. The loss of natural pollinator communities can cause dramatic changes in ecosystems and biodiversity. In the further development of agro-ecological measures that will be applied in ecological production systems, and above all in organic production, different floral protective belts will have a special importance in the protection of certain plant species and agro-ecosystems. Their role can be multiple: preservation of biodiversity, protection from soil and water pollution, protection of soil from erosion, biocontrol of pests and others.



Flower belts are often established, which fulfill their function by providing habitats and feeding grounds for many beneficial organisms. They are established along or within fields, with mixtures of annuals that bloom at different times. In the flowering stage with a large amount of nectar, they attract insects, and insects attract birds. In order for these belts to bloom as long as possible, they are based on mixtures of different flowers (eg white mustard, phacelia, buckwheat, dill,...). One of the frequently and successfully applied solutions is the use of perennial fennel.



The use of perennial fennel in flower strips (photo: Ugrenovic, 2017)

As part of bioagrotechnical measures, flower belts are formed on urban farms and crops are combined using friend plants. In urban agriculture, the protective belt is formed from flower, medicinal and aromatic plant species. They have the function of attracting beneficial insects (pollinators, predators), that is, they can be trap plants for diseases and pests, as part of the measures used in biological protection. They are sown and planted as borders and make good habitats for beneficial insects such as: sunflower, lavender, breckland thyme, mint, dill, fennel, buckwheat, nasturtium, pot marigold, marigold, and for the habitats of beneficial birds, they are hawthorn, barberry, elderberry, ivy and yew. Buffer flower belts zones are also being erected around roads and other polluters and all facilities that threaten the environment in any way. Such zones in agriculture contribute to protection against soil erosion by wind and pollutants. They can be used to protect water from pesticides, and most often they consist of perennial shrubby and woody vegetation.

The establishment of floral protective belts with herbs, in addition to biological justification, can also economically justify the use of this method. The demand for products from these plants in fresh and dry state has been constantly increasing for the last fifteen years, especially since this production is carried out to a significant extent according to the principles of organic production. The greatest demand is for parsley, basil, coriander, breckland thyme and thyme.

3.4. Formation and maintenance of urban gardens

3.4.1. Calendar and work planning

In order to successfully plan and implement the planned production, every urban farmer should adhere to the work calendar and perform the planned activities according to it. The calendar of works in which works in urban vegetable growing for some of the more common types of vegetables grown in our country are presented is shown in the next part. It is a generally useful reminder for all agricultural producers, in this case for urban producers.

January:

- Procurement of materials for the upcoming production year: seeds, plant nutrition and plant protection products, tools, accessories, spare parts and more.
- Preparation of warm beds and tunnels.
- Sowing peppers, tomatoes, cucumbers and lettuce in beds.
- Care of plants in the bed.
- Control of vegetables in the trap and in the basement.
- Examination of seed germination.

February:

- Sowing in beds of tomatoes, peppers, cabbage and kohlrabi and other plants for early field production.
- Seedling care in the bed: airing, watering, feeding and protection.
- Picking tomatoes and peppers sown in January.
- Preparing the garden for early sowing.
- Application of certain mechanical and biological measures on areas for the production of onions and peas.
- In favorable weather conditions, planting onions and garlic and sowing spinach, lettuce, radish, peas, carrots, parsley and parsnips.

March:

- Sowing spinach, lettuce, radishes, peas, carrots, parsley and parsnips.
- Planting potatoes, lettuce, cabbage, kale, kohlrabi and horseradish.
- Construction and preparation of warm beds and sowing of peppers, tomatoes, blue eggplant, celery and cabbage for the production of seedlings.

April:

- Destruction of weeds by mechanical means, on the surfaces where tomatoes, peppers, beans and green beans will be sown.
- Suppression of weeds in sprouted onions, peas and other vegetables.
- Care of tomato, pepper and eggplant seedlings in the bed.
- Seedling preparation, ventilation and temperature reduction in greenhouses for outdoor planting.
- Completing the sowing of onions, peas and carrots.
- Direct sowing of peppers at the beginning, tomatoes in half, and cucumbers, squash, beans, green beans and sweet corn in the third decade of April.



- Planting potatoes, cabbage, cauliflower and kohlrabi.
- Harvesting lettuce, spinach, radishes and spring onions.
- Collection and production of natural preparations based on plants for the protection and strengthening of plants.

May:

- Mechanical weed control and weeding in sprouted vegetables.
- Protection of tomatoes, potatoes, cucumbers and cabbage from blight and other diseases.
- Monitoring the development of potato blight and spraying when the larvae hatch.
- Feeding, watering and hoeing of crops.
- Sowing beans, cucumbers, watermelons, melons, sweet corn...
- Planting peppers, tomatoes, cucumbers, watermelons, melons, eggplants, celery, medicinal and herbs.
- Harvesting kale, lettuce, spinach, peas and picking carrots and new potatoes.
- Collection and production of natural preparations based on plants for the protection and strengthening of plants.

June:

- Hoeing and weeding, especially after watering or rain.
- Feeding fruitful vegetables with foliar preparations based on iron (Fe) and boron (B).
- Continue protecting tomatoes, cucumbers, onions and cabbage from blight and other diseases. Protect peppers from bacterial spotting of leaves and fruit, wilting, blight, fruit tip rot and aphids.
- Protect watermelons from fusarium wilt.
- Feeding plants.
- Harvesting cabbage, kale, cauliflower, kohlrabi, lettuce, spinach, radishes, spring onions and early carrots.
- Soil preparation and sowing of radishes, lettuce, green beans, beets, parsley, parsnips and leeks.
- Sowing cabbage. Weeds are being weeded, vegetables need to be watered more and more.
- Collection and production of natural preparations based on plants for the protection and strengthening of plants.

July:

- Hoeing and weeding, especially after watering or rain.
- Protection of peppers, tomatoes, cucumbers, watermelon and potatoes from diseases and pests that appeared in the previous month.
- Protect beans and green beans from bacteria, and cabbage for autumn production from blight and blight.
- Feeding and watering crops.
- Tomatoes, peppers and cucumbers are harvested, onions and potatoes are taken out.

- Sowing broad beans, gherkins and radish.
- Cabbage, kale, cauliflower and late tomatoes are planted.
- Collection and production of natural preparations based on plants for the protection and strengthening of plants.

August:

- Crop care in the field.
- Vegetables are protected from the same diseases and pests as in the previous month.
- The rule is to pick the ripe fruits first, and then feed and protect the plants.
- Pay attention to the selection of permitted preparations.
- Plants from the second sowing, such as green beans, gherkins and cabbage should be protected from blight.
- Picking onions and harvesting peppers, tomatoes, eggplant, lettuce, watermelons and melons.
- Sowing lettuce, spinach, radish, radish and silver onion for the production of seedlings.
- Collection and production of natural preparations based on plants for the protection and strengthening of plants.

September:

- Protection is the same as in August. Use preparations from the list of permitted means for organic production or those produced on the farm.
- Care of lettuce and onion seedlings in an open bed.
- Take care of the plants in the garden and protect them from early frosts.
- Harvesting green beans, gherkins, tomatoes, peppers, and other autumn vegetables. Extracting potatoes.
- Gradual sowing of radish, spinach and lettuce every 7-10 days.
- Land cultivation.
- Collection and production of natural preparations based on plants for the protection and strengthening of plants.

October:

- Autumn fertilization is done with burnt manure, compost or some other organic and/or permitted mineral fertilizer.
- Autumn tillage is being carried out.
- Lettuce, white, black and silver onions are planted.
- Autumn sowing of spinach and winter varieties of peas.
- Put the tomatoes to ripen and the cauliflower to ripen.
- Take out root vegetables and store them in the trap or in the basement.
- Harvesting cabbage, cauliflower, horseradish and radish.
- Collection of organic matter from production plots and from the garden for composting purposes.
- Collection and production of natural preparations based on plants for the protection and strengthening of plants.



November:

- Autumn fertilization is done with burnt manure, compost or some other organic and/or permitted mineral fertilizer.
- Autumn tillage is being carried out.
- Harvesting late cabbage, Brussels sprouts and extracting celery, leeks, carrots, parsley, parsnips and horseradish.
- Trapping (storage) of vegetables.
- Pull up all plant remains of cultivated and weedy plants, take them out of the garden and compost them.
- Late autumn tillage.
- Collection of organic matter from production plots and from the garden for composting purposes.
- Collection and production of natural preparations based on plants for the protection and strengthening of plants.

December:

- Autumn fertilization is done with burnt manure, compost or some other organic and/or permitted mineral fertilizer.
- Autumn tillage is being carried out.
- Procurement of materials for the upcoming production year: seeds, plant nutrition and plant protection products, tools, accessories, spare parts and more.
- Visit the crops in the field - lettuce, spinach, onions.
- Control the bruised carrot, parsley, beet...
- Preparation of land for beds.
- Repair of the tool for saving hot beds.
- Sowing lettuce, onions and peppers for early production.

3.4.2. Cultivation and pre-sowing soil preparation

Tillage in urban agriculture is highly specific. Due to the small and fragmented plots, mini tiller cultivator (due to easier manipulation on a small surface) and hand tools, such as a shovel, hoe and rake, are most often used to turn and shred the soil for sowing and planting. However, a part of urban farmers, in addition to standard processing, introduced the so-called conservation treatment that reduces the risk of soil degradation, keeping a lot of harvest residues on the surface as mulch. In that case, the soil is not dug up, that is, it is not turned over. If weeds develop on the cover, they are mowed before flowering and the soil is covered with them so that they gradually decompose. The goal of pre-sowing preparation is to create hard beds with a crushed - crumbly, loose and flat surface layer of soil. In this way, the hard substrate enables good contact between seeds and soil moisture, and the loose layer allows the seedlings to easily reach the soil surface. This allows us to achieve fast and uniform germination and emergence of seeds. Depending on the agroecological conditions and the choice of cultivated species, it depends on which processing system will be applied. The correct selection of the basic tillage system and pre-sowing/pre-seeding soil preparation has the greatest effect on weed control, faster and uniform sprouting and rooting of plants, easier care of crops and plantings during the growing season, etc.



Shredding of soil for sowing and planting (photo Filipovic, 2015)

3.4.3. Sowing and planting

In urban agriculture, direct sowing of seeds, planting with seedlings (classical or grafted), planting of planting material (onion by sets, tubers, shoots, stolons, cuttings, division of shoots and root heads) or created reserves are used to establish certain plant species. substances for growing up and promoting the growth of plant organs used in food (cauliflower, onion, leek, radicchio), and in recent times rooting is done by tissue culture (the so-called meristem method). High quality declared seeds are used for sowing. In domestic urban agriculture, seeds from own production are mostly used, or seeds are procured from other urban producers. However, most of the seeds used for sowing or planting are bought on the domestic and/or foreign market.

Direct sowing of seeds in the conditions of urban agriculture is mostly done manually or with mini planters for vegetables. The time of sowing is adapted to each species individually and also to the purpose. So we can sow certain species during the entire production year. Sowing is done in rows or in two-, three-, four- or multi-row ribbons (strips). At the same time, the distance between the rows is narrower (10-30 cm), and between the ribbons is wider (35-70 cm). In this way, a track is obtained from which care measures are taken in the rows. Sowing in houses is characteristic for cucumber, watermelon, melon, pumpkins, potatoes. 2-5 seeds, or potato tubers, are sown in the house, depending on the species, and after sprouting, the plants are thinned and one to two are left in the house. Very large and large seeds (pumpkin, green beans, peas, watermelon, cucumber, melon, beetroot, spinach, parsnip) are sown at a depth of 3-4 cm, medium large seeds (cabbage, tomato, pepper, onion) at a depth of 2- 3 cm, and small and very small seeds (carrot, parsley, lettuce, celery) at a depth of 0.5 to 1.0 cm. It is sown deeper on lighter soils, and shallower on heavier ones. One of the organic methods used in urban agriculture is the sowing of mixed crops as one of the good ways to protect plants.



Seedlings can be produced outdoors (cold beds) and in a protected area (glass and plastic greenhouses, warm beds). There are several ways of sowing seeds for the production of seedlings, and the most common are direct sowing in beds and sowing in containers. The production of seedlings in containers is extremely reliable, but it is expensive, so it is used less. This type of seedling is a little more difficult to sow by machine. There is also the production of seedlings in hydroponics. It is expensive and less reliable, so it is rarely used in wider practice. The quality of seedlings depends on favorable microclimatic conditions for growth and development that must be monitored daily (temperature, humidity, light), nutrient substrate, seed quality, accuracy of sowing and fertilizing. The production of quality seedlings is the most important link in the chain of production of vegetables, tobacco, flowers, medicinal, aromatic and spice plants, because the yield and quality of the crop directly depends on the quality of the seedlings produced. Sowing time is a very important factor for the production of quality seedlings. The most favorable sowing time for the production of seedlings of heat-loving species (tomato, pepper, cucumber, basil,...) in a protected area, it is best to sow in the second half of February. On the other hand, for the production of cabbage seedlings and a large number of perennial medicinal plant species, it is best to sow in cold beds during the months of May, June, July or August, depending on the selected species. Depending on the type and method of care, seedlings contribute to planting 30-60 days after germination. The plants should be firm, healthy, with at least four normally developed leaves, a well-developed root system and a quality and well-formed elastic stem.



Different types of organically certified basil seedlings (photo Filipovic, 2016)

A large number of cultivated species are produced from seedlings. The advantages are in shortened vegetation, and the increase after planting is uniform. It is extremely important for seedlings that they are not overgrown, and the age depends on the crops we grow, as well as the growing season.

Table 1. Characteristics of standard seedlings of different vegetable species

Species	Age (days)	Number of leaves
Cabbage	30-55	4-8
Tomato	30-60	5-9
Cucumber	15-26	2-5
Celery	45-50	4-6
Salad	20-35	4-5
Pepper	30-60	6-8

For some vegetable species, such as pepper, tomato, melon, cucumber, and eggplant, the extension of the nursery period affects the shortening of the period until fruiting, so it is often used by vegetable growers in a protected area, especially in heated facilities. Thus, more tours are provided: e.g. in our country, the cucumber bears fruit in 30 days, and thus the vegetation is shortened to 15 days. Before planting, seedlings must be watered for 10-14 days, reducing watering and reducing heat by opening or ventilating the building. In this way, the plant adapts to the conditions of the external environment.

Planting of seedlings is done manually on smaller areas - with planters, and on larger areas mechanically - with planters. Do the planting in the evening, when there is no wind. Before and after planting, be sure to water. The time and method of planting depends on the cultivated species and the purpose for which the species is cultivated. Planting can be done on bare or mulched soil, at a depth suitable for the species.

3.4.4. Care measures (hoeing, watering, feeding)

During the growing season, the following care measures are most often used for the selected plant species: inter-row cultivation, hoeing, mulching, watering, fertilizing with solid and liquid fertilizers, protection against diseases, pests and weeds, and filling empty spaces during seedling production. There are also several special bioagrotechnical measures, which are mainly characteristic for production in a protected area: picking, grafting, tempering, additional lighting, use of beds of different heights and widths, fertigation, frost protection, mulching, application of agrotexiles and shading. In some vegetable species, some specific agrotechnical measures are also applied, such as: in tomatoes - cutting the stems, guiding the plants, removing leaves, threshing (decapping or breaking the tops), staking, in cucumbers - pinching, in pepper - pruning, in celery, asparagus, radicchio - blanching, for cauliflower, leeks, Brussels sprouts, radicchio - ripening.

3.4.5. Basic information on growing vegetables: leafy, root, tuber, legume, fruit, bulb, flower and stem vegetable

About 70 types of vegetables and spice plants are produced in our country, of which about 35 types are economically important, while the rest are grown in certain localities on small areas. The spread of a larger number of species in production in our country is limited by specific biological requirements and tradition.

The division of vegetable species can be done in different ways, depending on which common characteristic is taken as the basic criterion. Classifications are most often



applied on the following basis: 1. botanical characteristics, 2. optimal growing temperature, 3. edible part of the plant, 4. development cycle. Vegetable plants can also be classified based on other criteria such as tolerance to soil acidity (pH), salt concentration in the soil solution, development of the root system, etc.

One of the classifications is the division based on the organs used in nutrition. In vegetable species, different plant organs are used for nutrition, from roots to flowers and seeds. Depending on which part of the plant is used as food, vegetable species are divided into:

Leafy vegetables: spinach, chard, New Zealand spinach, lettuce, endive, radicchio, celeriac, Swiss chard, cabbage, kale, Brussels sprouts, Chinese cabbage, Beijing cabbage, argula, dill, parsley, celery, basil, chives, marjoram, cardamom, greens, sorrel.

Root and tuber vegetables: carrot, parsley, parsnip, beetroot, celery, radish, turnip, peach, horseradish, black root, white root, potato, sweet potato, chicory.

Legumes: peas, green beans, beans, kidney beans, lentils, lima beans and other legumes.

Fruity vegetables: tomato, pepper, eggplant, physalis, watermelon, cantaloupe, squash, pumpkin, butternut squash, zucchini, cucumber, gourd, loofah, okra, sweet corn.

Bulbous vegetables: onions, garlic, leeks, chives, shallots, spring onions.

Flowering vegetables: cauliflower, broccoli, artichoke.

Stem vegetables and vegetables from which the stem is used: asparagus, kohlrabi, celeriac, rhubarb.

Mushrooms.

Depending on ecological conditions and dietary traditions, the representation of certain types of vegetables in production varies. In our country, fruiting vegetables (especially peppers), bulbous vegetables (especially onions) and leafy vegetables (cabbage) dominate, but there is a pronounced tendency to spread leafy vegetables (salads), followed by groups where flowers are used for nutrition (cauliflower, broccoli). Fruiting vegetables (tomatoes) and legumes (especially peas and green beans) are dominant for industrial production and processing.

Leafy vegetables - the largest number of species belong to annual plant species. They prefer cooler and more humid growing conditions. The largest number of species from this group is propagated by direct sowing. The cabbage family (Brassicaceae) and goosefoot (Chenopodiaceae) have the most representatives.

Root and tuber vegetables - the largest number of species belong to biennial plant species, which form vegetative organs in the first year and generative organs in the second. Cooler and more humid growing conditions suit them better. Half of the representatives of this group of plants are established by direct sowing and the other half by planting planting material (seedlings, tubers, cuttings, division of root heads). The families Apiaceae and Brassicaceae have the most representatives.

Leguminous vegetables - almost all cultivated species from this group of plants belong to annual plant species. It is best grown in warmer and more humid regions. All types of legumes are based on direct sowing, primarily due to the high energy of germination. All representatives of this group belong to one family, the leguminous family (Fabaceae).

Fruiting vegetables - the largest number of species belong to annual plant species. The representatives of this group of plants require a lot of heat and sun, and they are big consumers of water. They are mainly propagated through seedlings, and a smaller part also by direct sowing. About 90% of fruiting vegetables are found in two families, the Solanaceae family and the Cucurbitaceae family.

Bulbous vegetables - the largest number of species from this group of plants belong to annual plant species, only a few are perennial. They tolerate somewhat colder growing conditions in more humid regions. The method of production of bulbous vegetables is related to the biological properties of the variety, ecological conditions and tradition in production. In this group of vegetables, the following are distinguished: spring onion production, planted by sets, bulb production. The production of bulbs can be direct from seeds, from seedlings and by sets. All representatives of this group belong to one family, the onion family (Alliaceae).

Flowering vegetables – a heterogeneous group in which, according to their life cycle, there are annual, biennial and perennial plant species. Depending on the family, the needs for growing conditions also differ. For example. Cauliflower and broccoli grow well in conditions of moderate temperature and sufficient moisture in the soil and air. At high air temperatures above 28 °C, the heads remain small, loose, unsightly and as such lose their market value. Artichoke, on the other hand, requires higher temperatures and a good supply of soil moisture. All species are propagated by seedlings. Cauliflower and broccoli belong to the cabbage family (Brassicaceae) and artichokes to the Asteraceae family.

Stem vegetables and vegetables from which the stem is used - a heterogeneous group in which, according to their life cycle, there are annual, biennial and perennial plant species. As for growing conditions, all species require moderate temperatures and a more humid climate. According to the method of propagation, asparagus is based on direct sowing, kohlrabi and celeriac via seedlings and rhubarb via rhizomes with 2-3 buds that are removed from two- or three-year-old plants. Asparagus belongs to the asparagus family (Asparagaceae), kohlrabi belongs to the cabbage family (Brassicaceae), celery ribs belong to the parsley family (Apiaceae) and rhubarb belongs to the smartweed/buckwheat family (Polygonaceae).

Mushrooms - belong to a special group of vegetables, for the cultivation of which basements, barns, abandoned tunnels and all other spaces with thick walls can be maintained where the temperature and humidity required for the cultivation of these mushrooms can be maintained. For example. for mushroom cultivation in the first stage of mushroom cultivation - when the mycelium of the mushroom grows in the compost, constant temperatures in the range of 22 to 25 °C and relative air humidity of 90 to 95% are necessary. In the second phase - the phase of fruiting, i.e. the growth of the fruiting bodies of the mushroom, it is necessary to ensure the temperature at the level of 17 to 18 °C, and the relative humidity should be slightly lower than 95%.



3.4.6. Harvesting and storage

Complete success in growing vegetables depends on timely harvesting. Considering the method of use, vegetables are harvested at the most suitable maturity. Harvesting can be at technological, transport and physiological botanical maturity. A delay in harvesting means stopping the further growth of the plant, reducing yield and quality. This is especially pronounced in species that have gradual ripening (cucumber, pepper, tomato) of fruits on the plant. Harvesting can be one-time or repeated. Most species bear fruit, or form heads gradually. This is why harvesting on multiple occasions enables longer use of vegetables and ensures quality and a higher yield. Only certain vegetables (bean, onions, potato) are harvested or taken out once. It is extremely important that during the harvest, hygiene must be at a high level (accessible toilets, places to wash hands, gloves...), crates and packaging must be clean and must not come into contact with the ground during harvesting. With root and tuber vegetables, extraction occurs in the technological phase, which is most often in the autumn period, while with bulbous vegetables it is earlier, at the end of July to mid-August in the phase of physiological maturity (formed sprout and closed succulent leaf at the moment when 50% of the plants lie down). According to the method of harvesting in the conditions of urban agriculture, it is usually manual, rarely by machine. Manual is applied on small plots and machine on large plots. Hand harvesting can be done by cutting, tearing, plucking or extracting with special turnip forks. This is done on moderately moist soil, so that the root remains as clean as possible.

After picking, vegetables should be cooled quickly (put in the shade, canopy, basement) and washed with cold water. Unusable plants are discarded by sorting, vegetables are cleaned and used in the household or placed on the market. Only healthy, undamaged and ripe vegetables can be stored. After harvesting, the life processes in vegetables continue, albeit at a lower intensity. It breathes and releases heat and carbon dioxide, water evaporates from it, which leads to weight loss and quality reduction. Some vegetables have the ability to grow (cauliflower) or ripen (tomato, melon). All these processes are more pronounced if the temperature is higher or the vegetables are not ripe enough. That is why all storage methods, from those in the household to storage in state-of-the-art warehouses and refrigerators, rely on the regulation of storage conditions.

Peeled vegetables for the market are stored (washing is mandatory for root and tuber vegetables) and packed in ties, crates or net bags. The length of storage depends on the type (onions are better stored than tomatoes), variety (hot onion varieties are better stored than sweet ones), production method (watery fruits are worse stored) and storage conditions, above all, temperature, air humidity and the presence of oxygen. On average, vegetables are stored for the longest time at a temperature of 0 to 4 °C and a relative humidity of 90 to 100%.

Table 2. Storage conditions for certain vegetable species

Serial number	Vegetable type	Air temperature (°C)	Relative humidity (%)	Storage time (day(s), month(s), week(s))
1.	Artichoke	0-1	95-100	3-7 weeks
2.	Asparagus	0-2	95-100	2-4 weeks
3.	Garlic	0	70	6-8 months
4.	Green beans	7	95-100	1 week
5.	Broccoli	0-1	95-100	1-2 weeks
6.	Pumpkin	10-13	60-70	2-5 months
7.	Celery	0-1	90-100	3-5 months
8.	Onion - young	0-1	95-100	1-3 weeks
9.	Onion - old	-1-0	65-80	4-6 months
10.	Beetroot	0-1	95-100	4-6 months
11.	Melon	7-10	85-90	1-4 weeks
12.	Peas	0-1	90-100	1-3 weeks
13.	Cauliflower	0-1	95-100	2-5 weeks
14.	Kohlrabi	0-1	95-100	2-4 weeks
15.	Brussels sprouts	0-1	90-95	2-4 weeks
16.	Cucumber	4,5-10	90-100	1-2 weeks
17.	Potato	4-10	90-100	3-5 months
18.	Sweet corn	0-1	95-100	6-8 days
19.	Cabbage	0-1	95-100	3-6 months
20.	Watermelon	3-12	85-90	2-3 weeks
21.	Dill	0-1	95	1-2 weeks
22.	Carrot	0-1	95-100	6-8 months
23.	Pepper	5-10	90-95	3-5 weeks
24.	Tomato	2-15	85-90	2-4 weeks
25.	Parsnip	0-1	95-100	2-6 months
26.	Beans	7-8	95-100	1-2 weeks
27.	Parsley - leafy	0-1	95-100	1-2 months
28.	Parsley - root	0-1	90-100	2-6 months
29.	Eggplant	5-12	90-95	1-2 weeks
30.	Mushrooms	0-1	90	5 days
31.	Leeks	0-1	95-100	1-3 months
32.	Radish	0-1	90-95	4-5 months
33.	Radishes	0-1	95-100	1-4 weeks
34.	Sweet potato	13-16	85-90	4-7 months
35.	Spinach	0-1	95-100	1-2 weeks
36.	Zucchini	8-12	85-95	1-2 weeks
37.	Lettuce	0-1	90-100	1-4 weeks

Carrots and garlic can be stored for a maximum of eight months, onions, beetroot and



cabbage for six months, celery and potatoes for 3-5 months, cauliflower, peppers and tomatoes for 30 to 40 days, lettuce, green beans and semi-ripe tomatoes for 3-4 weeks, cucumber, melon, peas and watermelon for 1-3 weeks, green beans and sweet corn for a week, and mushrooms for 5 days.

Vegetables mostly consist of water, which is lost during storage, so it is very important to control and regulate the humidity in addition to the temperature in the refrigerator. High humidity in the cold room is needed to retain water in the vegetables. In addition to ordinary ones, there are also cold stores with a controlled atmosphere in which the levels of oxygen, carbon dioxide and nitrogen are regulated. In refrigerators with a controlled atmosphere, vegetables “sleep” in a way, and thus stay fresh longer. Vegetables can also be stored in the basement, pantry, attic or in a special storage room, which is the safest and best way. Regardless of where vegetables are stored, they should be protected from freezing, and in the room and layer of vegetables, constant air flow should be allowed. Onions and garlic are best stored wrapped in wreaths or in net bags, and they should be stacked so that air flows between them and inside them.

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CHAPTER 4

Urban farming production systems

Agriculture is the cultivation of crops or the husbandry of livestock in pure or integrated crop/animal production systems for the main purpose of food production, but also for the provision of biomass for material and energetic use.

The world’s population will reach 10 billion by 2050. With the growth of the population, human habitation patterns have also changed. In 2008, the population of cities exceeded the populations of rural areas for the first time in history. This trend will only become more pronounced in the years to come—in fact the United Nations predicts that by 2030, nearly 5 billion people will be living in cities, mostly in Asia and Africa. With population on the rise, taking advantage of unused urban space will create an important source of food—especially when it comes to fresh fruits and vegetables.²¹

In urban agriculture a farm might use multiple methods to grow crops and raise livestock. However, urban agriculture production systems can be broadly categorized as:

- Ground-based outdoor urban farming
- Vertical Urban Farming
- Rooftop farming
- Landscaping and nursery businesses
- Urban livestock production
- Mushroom production (fungiculture)

Across all production systems, the types of crops and livestock that fit most easily into an urban agriculture business are ones that are physically small, thrive in small spaces and challenging growing conditions, and have fast life cycles. The last point is important to maximize the amount of income or food produced per square meter. Slower growing crops or livestock can be important parts of an urban agriculture system, but their slow life cycles mean that they consume more space and time per unit of food produced than faster-growing crops and livestock.²²

4.1. Ground-based outdoor urban farming

Urban community agriculture often occurs on empty land - private or public - or in areas such as squares, parks, schools. Some municipalities offer fiscal and legal incentives for the use of public, private and rural urban land for agriculture. Increasingly, city halls have been adopting this practice to meet a demand from the communities and offer a differential to improve the quality of life in the city, contributing to the urban requalification, the environment and health.²³

21 <https://www.freightfarms.com/urban-farming>
 22 <https://extension.umd.edu/resource/chapter-1-urban-production-systems>
 23 <https://www.archdaily.com/916757/urban-farming-food-production-in-community-parks-and-private-gardens>



Picture 1: Urban Garden “Garden for Druzba”, Sofia, Bulgaria
 Source: Own photo, Bulgarian School of Politics “Dimitry Panitza”

4.2. Vertical urban farming

In contrast to traditional horizontal farming, vertical farming is a method in which crops are grown on top of each other. Thus, vertical farming saves space and allows for more plants to be grown per square meter.

Vertical farming refers to the system of cultivating crops in vertically stacked layers, instead of a single surface, like a greenhouse or field. Generally, cultivators incorporate these into vertical structures, such as shipping barrels, skyscrapers, used warehouses, and abandoned mine shafts.

Here are the four primary factors affecting vertical farming:

Layout: As already mentioned, farmers cultivate crops on tower-like structures to maximize food production while limiting resource usage.

Light: Cultivators use a combination of artificial and natural light, along with technologies like rotating beds to ensure optimum lighting efficiency.

Sustainability: Vertical farming intends to minimize the exhaustion of natural resources. As a result, this farming technique recycles irrigation water to minimize usage by up to 95%. At the same time, farming indoors requires negligible agrochemicals, thereby saving more resources.

Growing medium: Vertical farming uses soilless agriculture, such as aquaponics, aeroponics, and hydroponics. Cultivators also commonly use coconut husks and peat moss as growing mediums.²⁴

24 <https://www.cropin.com/vertical-farming>



4.2.1. Hydroponics

Hydroponic farming is an intriguing alternative to traditional soil-based agriculture. It involves nurturing plants in nutrient-rich water solutions instead of soil, providing them with all the essential nutrients they need to grow. As a result, plants flourish more quickly and efficiently. This soil-less approach to farming can be employed to grow a diverse array of crops, from vibrant leafy greens to delectable fruit-bearing plants.²⁵



Picture 2: Hydroponic farm

Source: <https://www.urbinati.com/en/hydroponic-culture-vertical-farming/>

Hydroponics can contribute to enhance urban farming activities in areas where access of citizens to land is limited, or where climate conditions are not favourable for farming outside of greenhouses. It is a farming alternative to some crops with many advantages. Looking at the water footprint of traditional agriculture, which is nowadays responsible for 75 % of the world consumption, hydroponic crops need 50 % to 90 % less water. The technology can also be a solution for soil scarcity in many urban areas, mainly in big cities, where finding an open space to cultivate is not easy. It is more versatile to be used in vertical allotments, increasing efficiency in the use of available space.

Japan is at the forefront of this technology. For some years, hydroponics has been used, both in abandoned spaces as well as for the creation of vegetable producing companies. Many cities have unused spaces (closed factories or shops, or buildings that no longer have residential use) that could be reconverted to promote urban agriculture and offer local and zero kilometre products. Additionally, hydroponics gives the opportunity to increase the production period. It is possible to harvest during the whole year thanks to the use of solar lamps, avoiding the seasonality of traditional crops.

Other benefits include lower impact of pest and diseases in hydroponic crops and the lack of need to use fertilizers obtaining faster growth rates than traditional crops. As these systems do not produce weeds, there is no need to eliminate them and working hours required for its cultivation are reduced.

²⁵ <https://getgrowee.com/hydroponic-farming-vs-vertical-farming/>

Of course, some disadvantages of this technology also need to be mentioned, for example a higher energy consumption is required for automatic watering and artificial light production. Hydroponic systems are not appropriate for all kinds of vegetables and they need a higher economical investment in comparison with traditional crops. However, these kind of crops are a very good solution for cities or places with limited space availability. It should also be said that the circularity and sustainability of hydroponic cultivation can be increased when hydroponics is combined with aquaculture, giving place to what is known as aquaponics.²⁶

4.2.2. Aquaponics

Aquaponics is a food production system that couples aquaculture (raising aquatic animals such as fish, crayfish, snails or prawns in tanks) with hydroponics (cultivating plants in water) whereby the nutrient-rich aquaculture water is fed to hydroponically grown plants.

As existing hydroponic and aquaculture farming techniques form the basis of all aquaponic systems, the size, complexity, and types of foods grown in an aquaponic system can vary as much as any system found in either distinct farming discipline.

Aquaponics is a food production system that aims higher sustainability by integrating advantages gained from aquaculture and hydroponic production. Aquaponics aims to mimic the biological process that happens in the natural environment in a controlled production system. As it can be applied to small scales, aquaponics is considered an important alternative for urban regions, which have low availability of agricultural land and water resources. Furthermore, the advantage is that it is located close to final consumers.²⁷



Picture 3: Aquaponics system

Source: <https://frontporchne.com/article/aquaponics-taking-root-urban-farm/>

²⁶ <https://projects2014-2020.interregeurope.eu/cityzen/news/news-article/11981/hydroponics-and-its-role-in-urban-agriculture/>

²⁷ Luiz H. David, Sara M. Pinho, Feni Agostinho, Jesaias I. Costa, Maria Célia Portella, Karel J. Keesman, Fabiana Garcia, Sustainability of urban aquaponics farms: An emergy point of view, Journal of Cleaner Production, Volume 331, 2022, 129896, ISSN 0959-6526, <https://doi.org/10.1016/j.jclepro.2021.129896>.

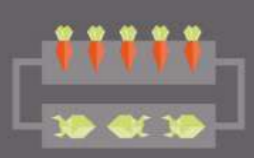


When you think of aquaponics, you might imagine a cutting-edge, modern farm. This can be true, but aquaponic systems have actually been around for thousands of years! Aquaponics offer a sustainable way to grow fish and vegetables in the same system without the need for chemicals, pesticides or even energy from fossil fuels.

A typical modern aquaponics structure includes a network of pipes connecting a fish tank, a water pump, and a plant bed where vegetables can be planted in gravel as water is pumped through it.

There are three main components in a closed-loop aquaponics system:


Use Your Fish Tank to Grow Herbs & Vegetables




Aquaponics grows herbs and vegetables without soil through a close-looped system with the following 3 key components:

- 1. Fish**


Tilapia is the favoured fish for aquaponics farmers because they're a hardy species that grows well in recirculating water. The fish's waste supplies the nutrients for plants to grow without soil!


- 2. Plants**


Leafy greens and herbs (like lettuce and basil) are well-adapted to growing in aquaponics system because they don't require a lot of nutritional input to thrive.


- 3. Bacteria**

These naturally-occurring bacteria act as a "biological filter" that breaks down the ammonia from fish waste into nitrites and nitrates (essential nutrients for plant growth).



So, aquaponics is actually a symbiotic arrangement where fish, bacteria and plants are able to mutually benefit while providing for each other.



Fish

Tilapia is the favoured fish for aquaponics farmers because they're a hardy species that grows well in recirculating water.

Plants

Leafy greens and herbs (like lettuce and basil) are well-adapted to growing in aquaponics systems because they don't require a lot of nutritional input to thrive.

Bacteria

These naturally occurring bacteria act as a "biological filter" that breaks down the ammonia from fish waste into nitrites and nitrates (essential nutrients for plant growth).²⁸

Picture 4: How to Grow Herbs and Vegetables in Your Fish

Source: <https://www.foodunfolded.com/article/aquaponics-sustainable-urban-farming>

4.2.3. Aeroponics

A new-age farming practice called aeroponics has the ability to make a large impact in impoverished communities due to its resource-conserving practices and high output potential. Aeroponics is a soilless model that utilizes a sprayer system to apply nutrient-rich water to a suspended root structure. Aeroponics differs from its sister methods, aquaponics and hydroponics, by growing root systems without direct contact with water. The applied spray is concentrated with essential macro- and micronutrients, typically provided from purchased chemicals but does not require pesticides. Producers have the ability to control the entire growing environment by keeping the setup in an enclosed space and climate-controlled.²⁹



Picture 6: Aeroponics Farming

Source: <https://www.gulfagriculture.com/vertical-aeroponics-farming-sustainable-viable-profitable-future-of-farming/>

²⁸ <https://www.foodunfolded.com/article/aquaponics-sustainable-urban-farming>

²⁹ <https://www.eli.org/vibrant-environment-blog/aeroponics-sustainable-solution-urban-agriculture>



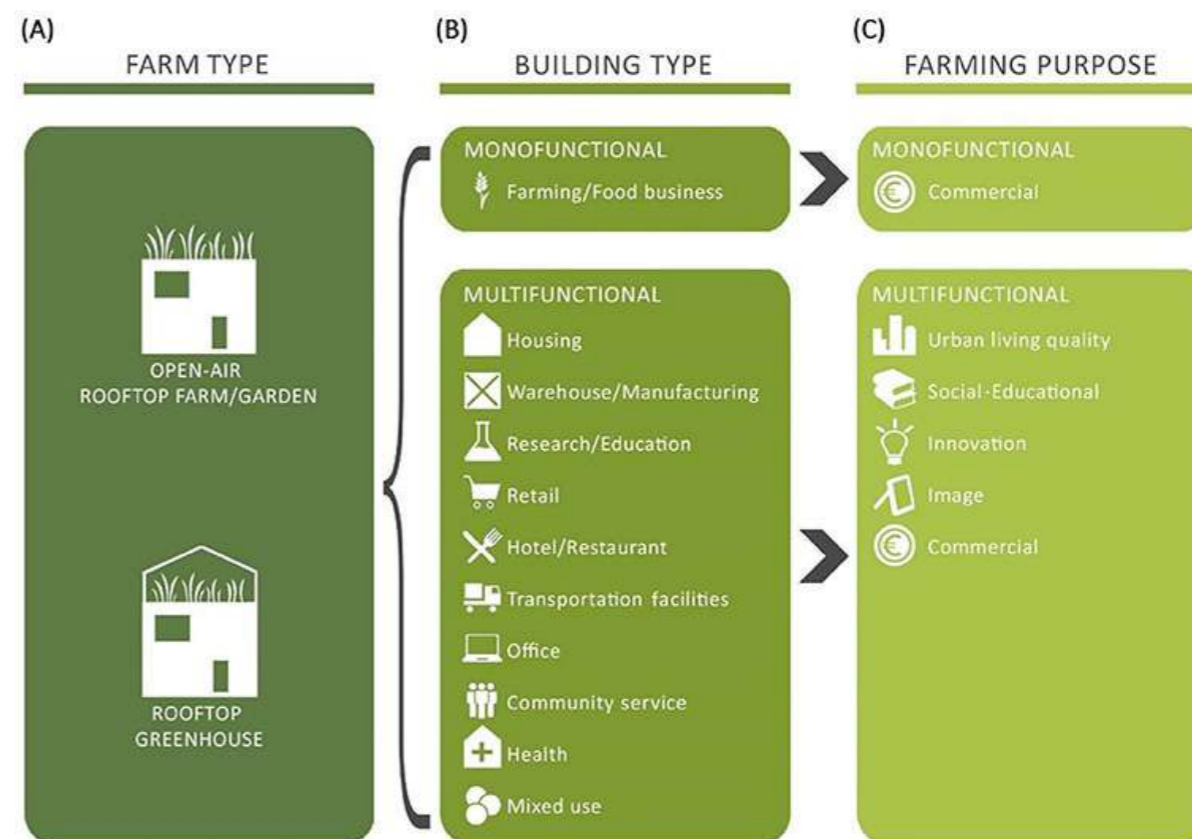
4.3. Rooftop farming

We can classify rooftop agriculture in various ways. First, we can distinguish two types of farming: rooftop greenhouses, which are rooftop farms with protective structures covering them, and open-air rooftop farms, which do not have protective structures. Rooftop greenhouses protect crops from conditions like cold and wind, and they allow cultivation during the winter. However, open-air rooftop farms are easier to construct and less expensive. For this reason, open-air rooftop farms can be used in places where there is less money to spend on urban agriculture.

The buildings used for rooftop agriculture can be of two types. Buildings can be monofunctional, which means they are used only for plant cultivation. In this kind of building, plants can be grown inside, too. Multifunctional buildings have more than one function. These buildings can be houses, supermarkets, schools, or hospitals, and the rooftops are the only cultivated part. Any type of building with a flat rooftop can be used for rooftop agriculture, but there are important considerations. For example, engineers must ensure that the added weight on the roof is safe for the building, and emergency exits, and protective railings must be present, for the safety of those using these gardens.

Rooftop farms can be created for various purposes. There are five main objectives of rooftop cultivation. Some rooftop farms are created to improve urban living quality, such as to give people a place to relax and enjoy nature. Others are created for social-educational purposes, such as to help different groups of people interact with each other, or to teach people about gardening. Some rooftop agriculture is established for innovation, in which they create new technologies. Sometimes rooftop agriculture is used to improve the image of a building, making it more beautiful. Lastly, commercial rooftop farms are those created to make a profit.³⁰

³⁰ <https://kids.frontiersin.org/articles/10.3389/frym.2022.701756>



Picture 7: Rooftop agriculture classification

Source: <https://kids.frontiersin.org/articles/10.3389/frym.2022.701756>

Besides helping meet the growing demand for food production, rooftop farms offer the following benefits:

Enhance the urban landscape (and human well-being). By cultivating lettuces, kale, arugula, and other crops, rooftop farms literally make cities greener. And studies have found that exposure to nature and vegetation provides an array of psychological benefits, from decreased anxiety to increased productivity.

Make cities more eco-friendly. Bare roofs in cities absorb and then radiate heat — a phenomenon known as the “heat island effect.” This increases energy usage and contributes to the poor air quality that often plagues big cities. But rooftop farms help cool buildings, ultimately reducing carbon emissions. And by growing food in the communities they serve, rooftop farmers lessen the environmental impact of food transportation, as well.

Increase the availability of real, healthy food. When farmers grow inside — or better yet, on top of — the concrete jungles and food deserts that many of us inhabit, more people have access to fresh, wholesome, and affordable food. And because it travels fewer food miles, hyper-local produce is often healthier and tastier, too.³¹

³¹ <https://www.agritecture.com/blog/2018/3/14/why-rooftop-farming-is-the-best-solution-for-smart-urban-agriculture>



A good example is the Nature Urbaine project. It is located on the top of a major exhibition complex in the south of Paris and is really a farm with a difference. It is the largest of its type in Europe. Extending over 14,000 square meters, the project is aiming to become a model for sustainable production.

The COVID-19 pandemic disrupted many aspects of daily life and Paris authorities are hoping to make a permanent shift to more fruit and vegetable production sites in the heart of the city. The city-farm project on the rooftop provides a chance for people to rent spaces to produce their own fruit and vegetables.

Sophie Hardy, director of the Urbaine project states that the project is based on the genuine willingness to put some sense back to the city and bring nature back in a city that pushed nature away for so many years.

The Paris authorities are trying to grow greener models of sustainability through projects like this. But a farm in a city runs the risk of plant growth being affected by the toxic fumes of road traffic. Emissions of nitrogen dioxide have more than doubled in the French capital since the end of lockdown in mid-May.

“With some plants, where the root system is protected, the plant doesn’t absorb the pollution. As for the produce grown in the water system, we check that pollution stays low. We still advise people to wash the vegetables before eating it, but we conform to pollution thresholds”, says Camille Billiemaz, a vegetable production manager at Nature Urbaine.

During lockdown, this urban farm had an agreement with the local authority to deliver vegetable baskets to online customers. And while the rooftop may not yet be crowded with amateur farmers, there is an enthusiasm for local shopping at the heart of French cuisine. Weekly markets are a tradition across France, with many people still preferring to shop there rather than at big chain stores.

“The sense of community at Nature Urbaine is a positive aspect. But there are economic and cultural challenges for projects like this. Urban farms are quite expensive to build, so local communities are not really able to pay for it. There are also problems linked to the fact that the majority of the population is disconnected from nature. And you can’t respect what you don’t know. But we hope people will change their consumer habits.”, says Frederic Madre, a biodiversity researcher³²

32 <https://newseu.cgtn.com/news/2020-07-13/Europe-s-largest-rooftop-farm-gets-growing-again-after-lockdown-S608xV1WZG/index.html>



Picture 8: The Nature Urbaine Project, Paris

Source: <https://newseu.cgtn.com/news/2020-07-13/Europe-s-largest-rooftop-farm-gets-growing-again-after-lockdown-S608xV1WZG/index.html>

4.4. Landscaping and nurseries

Densely populated areas are changing, and more complicated landscapes in which green or open spaces are considered to be of incalculable value for the well-being of people and wildlife are being developed. Urban landscapes play a crucial role in supporting municipal “ecological and social” systems. In urban areas, city parks, private gardens and street green space supply essential ecosystem services. The availability of green spaces impacts the qualities of the environment, such as air and water purification, wind and noise filtering or microclimate stabilization. Parks and gardens play a key role in supporting biodiversity and other important ecosystem services. These urban landscapes enhance the migration of fauna to large cities, leading to maintaining or improving urban biodiversity. As a result, they can bridge the gap between natural environment, biodiversity and the residents of urban areas. Beside important environmental benefits, the existence of natural ecosystems, such as urban parks and forests, green belts and their components (i.e. trees and water), improve the standards of life in many ways and provide social and psychological services, which are very important for the liveability of modern cities and the well-being of urban residents. At the neighborhood level, green spaces help provide restoration from stress, improving mental health for adults; they also pave the way for children’s physical and mental development. Green space also potentially enhances feelings of social protection and safety, increases social communication and the attractiveness of the city and promotes it as a landmark for tourists, increasing property values and tax revenues. People who are living in a greener environment report lower levels of fear, fewer bad manners, less hostile and violent behavior and feelings of insecurity associated with vandalism and less fear of crime in abandoned places.³³

33 Behdad Alizadeh, James Hitchmough, (2019) “A review of urban landscape adaptation to the challenge of climate change”, International Journal of Climate Change Strategies and Management, Vol. 11 Issue: 2, pp.178-194, <https://doi.org/10.1108/IJCCSM-10-2017-0179>



Picture 9: Urban Green Space, Sofia, Bulgaria
 Source: <https://air.sofia.bg/bg/article/255360-sazdavame-novi-tsvetni-resheniya-i-figuri-v-zeleni-prostranstva-na-sofiya-kaza-zamkmetat-desislava-bileva>



Picture 10: Botanical Garden of the University of Wrocław, Wrocław, Poland
 Source: Own photo, Bulgarian School of Politics "Dimitry Panitza"

A plant nursery is a place where plants will be propagated and grown up to a desired age by providing them with optimum growing conditions. Thereafter plants will be internally used or supplied to farmers or other users or resellers. Plant nursery covers the growing activity from seed including germination, budding, and grafting till the level of ready plant for transplantation. Besides internal usage by the farmers, commercial farms will take up these activities and supply plants such as vegetables, fruits, ornamental and medicinal plants, etc. Compared with direct sowing of seeds, a nursery saves considerable time for crops growing and also enables plants to endure open field conditions.



Picture 11: Plant Nursery, Sofia, Bulgaria
 Source: <https://homegardentt.com/%d0%b3%d1%80%d0%b0%d0%b4%d0%b8%d0%bd%d1%81%d0%ba%d0%b8-%d1%86%d0%b5%d0%bd%d1%82%d1%8a%d1%80/>

4.5. Urban orchards

An urban orchard is a fruit orchard located on a private or public owned residential property, designed to be shared with the community. The plants and trees are owned and maintained by the homeowner (or tenant), and the food grown is to be harvested and enjoyed by anyone who wants it or needs it. Orchards have provided mankind a sustainable reoccurring food source for millennia. The idea of planting a plot of trees once and reap an annual crop for hundreds of years is the most energy efficient way to farm.

If you go back 100 years orchards were much more common place across the countryside. Combine harvesters and diesel fuelled agricultural machines were just starting to make their mark on the landscape. Thousands of miles of hedgerows were removed to create larger expansive fields for extensive monocultures.

Not only do orchards provide a sustainable food source, orchard produce is some of the healthiest foods we can eat lacking in the unhealthy modern diet. Apples, pears, plums, damsons, quinces, meddlers, hazel nuts and sweet chestnuts are just some of the delights orchards can bring! Most modern cities have huge potential for urban food



production using orchards with most trees barely over 4 metres fitting snugly into the urban fabric.

Another benefit of urban orchards is they can be integrated into other elements of the urban farm. Chicken enclosures can double up as fruit cages with small orchards being fed by the fertility of the chicken manure. The heat island effect of cities allows us to be more ambitious with the species of orchard we grow. There is much evidence to suggest trees help cool the city in summer and help retain heat in the winter as well as help improve air quality. It is clear that urban orchards have a rightful place in our towns and cities.

When planning an orchard on an urban farm you must take a few things into consideration. What kind of fruit and nuts do you want to grow? Does your urban farm have the correct conditions? Will they grow well? Remember that it's easy to get carried away filling up space with new fruit trees but remember each tree requires space to thrive so try to think forward into the future and visualise your urban farm in 5 years time. Do you want to create a wild forest garden type of orchard? If you do then you must try to layer the planting so it catches the sun's rays as efficiently as possible.³⁴

The goal of an urban orchard project is to challenge norms and expectations about what private residential yards are to be used for, and to provide access to fresh, locally grown food for neighbors and strangers.

There are countless benefits to transforming basic turf-grass lawns into beautiful food producing gathering places. Here are a just few of the reasons:

Urban orchards produce healthy, local + delicious food. Creating a space to grow fruits free for the taking is a simple way to encourage people to eat more nutrient-dense fruit and less processed, unhealthy food.

It's a WAY Better Use of Resources! Turf-grass lawns do not only use tremendous resources (water, chemicals, etc.), but they also take up space that could otherwise be used to grow food. Turf-grass serves no purpose beyond a pleasing aesthetic. Urban orchards provide the aesthetic appeal and so much more!

Urban orchards create a sense of place in a neighborhood. Many neighborhoods lack nearby parks, or other spaces for neighbors to meet, gather and build community. Without these open spaces for connections and relationship building, neighbors might never have a chance to connect and become neighbors in the truer sense. The urban orchard allows homeowners to unlock their yard to become an asset for everyone in a community to come together and enjoy fresh food.

Urban orchards create an outdoor classroom for food skills education. What better place to teach people about food than the place it's grown? An urban orchard creates an outdoor classroom right in the heart of neighborhoods for hands-on learning about food from tree to table.³⁵

³⁴ <https://www.the-urban-farmer.co.uk/urban-orchards.html>

³⁵ <http://foodofthenorth.com/urban-orchard>



Picture 12: Urban Orchard

Source: <https://www.urbangreenup.eu/solutions/urban-orchards.kl>

4.6. Urban livestock and beekeeping

Many urban agriculture projects involve raising animals for eggs, dairy, meat, and honey. While fresh eggs, honey and other products can be some of the greatest pleasures of urban agriculture, they can also bring challenges with neighbors, who may not appreciate the sounds and smells of animals, or may be fearful of bees or allergic to bee stings. Animal agriculture seems to be the area of urban farming where community conflict is most likely to arise. It's important to check your city's zoning codes to determine what animals are allowed, and under what conditions. It's also wise to befriend your neighbors and be generous in sharing the fruits of your labor. If you work to minimize noise and smells, follow applicable laws, and cultivate open communication with neighbors, this will go a long way towards making your animal agriculture project a success.

Managing animals appropriately and ethically is also critical. Before adding animals to an urban agriculture project, it's imperative to learn all you can about their needs, and consider in advance what you will do when the animals' productivity is at an end. Recent reports suggest that urban animal shelters and animal rescue organizations are beginning to see an increase in unwanted backyard chickens and other backyard livestock. Adding animals to urban agriculture, whether a backyard farm or a community project, requires special consideration and planning.³⁶

³⁶ https://ucanr.edu/sites/UrbanAg/Production/Animals_and_Bees/



Picture 13: Urban Beekeeping in Sofia, Bulgaria
 Source: Own photo, Bulgarian School of Politics “Dimitry Panitza”

4.7. Mushroom production (fungiculture)

One crop that has emerged as a popular choice for urban farms is mushrooms. Not only are mushrooms highly nutritious, but they are also a sustainable food source that can be grown using waste products and require minimal resources. As a result, many urban farms are choosing to grow and sell mushrooms as a way to promote sustainable agriculture and provide fresh, local food to their communities.

Mushrooms are a sustainable food source for several reasons. First, they are highly efficient at converting waste products into food. Unlike traditional crops, which require large amounts of land, water, and other resources to grow, mushrooms can be cultivated in a controlled indoor environment using waste products like sawdust, straw, and agricultural byproducts. This means that they can be grown using materials that would otherwise go to waste, reducing the amount of waste sent to landfills and minimizing the environmental impact associated with food production.

Second, mushrooms have a short growth cycle, with some varieties taking just a few weeks to mature. This means that they can be grown year-round, providing a consistent source of fresh, local food even in areas with harsh climates. Moreover, because mushrooms grow in a controlled indoor environment, they are less susceptible to weather-related crop failures, reducing the risk associated with traditional farming practices.

Gourmet mushrooms are highly nutritious and offer a range of health benefits. They are a rich source of protein, fiber, vitamins, and minerals, making them an excellent addition to any diet. Furthermore, many mushroom varieties contain compounds like beta-glucans and polysaccharides that have been shown to boost the immune system, improve gut health, and reduce inflammation.

Mushrooms also require fewer resources to grow than traditional crops, making them

a more environmentally friendly choice. They require minimal water and can be grown in small spaces, making them an excellent crop for urban farming. Additionally, because they are grown indoors, they require fewer pesticides and herbicides than traditional crops, reducing the environmental impact associated with agriculture.

Finally, mushrooms can be used to remediate contaminated soil and water. Some varieties of mushrooms have been shown to break down harmful chemicals and toxins, making them a valuable tool in environmental clean-up efforts.³⁷



Picture 14: Urban Mushroom Farming
 Source: <https://www.milkwood.net/2016/05/30/growing-mushrooms-city/>

Setting up a mushroom cultivation project in an urban area can be a challenging but rewarding experience. There are several key factors to consider when planning a project, including the type of mushrooms to grow, the space required, and the resources and equipment needed.

The first step in setting up a mushroom cultivation project is to determine the type of mushrooms to grow. There are many different types of mushrooms that can be cultivated, each with its own unique flavor and nutritional profile. Some of the most popular types of mushrooms for cultivation include oyster, and button mushrooms.

Oyster and button mushrooms are some of the most resilient mushrooms you can grow. This is why they make excellent candidates for urban growing. They can withstand minor temperature swings, while also growing big and strong. They can also resist contamination quite well.

³⁷ <https://rrcultivation.com/blogs/mn/why-mushrooms-are-the-future-of-sustainable-agriculture>



Picture 15: Oyster

Source: <https://botanika.bg/article/gubena-gradina-v-gradski-usloviia-273>

Once the type of mushrooms has been determined, the next step is to assess the space required for the project. This will depend on the scale of the project, but it is important to ensure that there is enough space for the equipment, containers, and growing medium. **If you are simply growing on a terrace, rooftop, or porch, you only need basic materials!** This will include standard gardening supplies, a large pot to sterilize mushroom substrates, and some mushroom spores.

Once you have the basic supplies, simply monitor the weather outside to make sure your water content in your mushroom substrates isn't too high due to rain or humidity. If you are growing indoors, you can worry less about these factors. Simply mist your substrates/mushrooms a couple of times daily, and your mushrooms will grow.

Urban agriculture mushroom cultivation can present several challenges, including limited space, environmental control, and access to resources. However, with the right approach, these challenges can be overcome and a successful mushroom cultivation project can be established.

One of the biggest challenges faced by urban agriculture mushroom cultivation is limited space. This can be addressed by using containers and stacking systems to maximize the growing area. **Mushrooms are a great candidate for vertical farming.**

Another challenge faced by urban agriculture mushroom cultivation is the control of environmental factors such as temperature and humidity. If you live in a city with long winters, unfortunately growing mushrooms outside may be difficult. **If you do want to grow outside, you may need to wait for summer/spring to arrive.**

You can grow mushrooms indoors in an urban setting. You can very simply use a closet or basement as a grow space and follow all the normal steps of growing mushrooms at home. The important steps include sterilizing your grow medium, and supplying ample water/humidity.

The future of urban agriculture mushroom cultivation is bright, as the demand for locally grown, sustainable, and nutritious food continues to grow. As more people become interested in growing their own food, the demand for mushroom growing will increase.³⁸

³⁸ <https://mushroomgrowing.org/mushroom-cultivation-urban-agriculture/>



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