



Rooftop Gardening

There are many benefits of a rooftop garden beyond the fact that they can be quiet retreats. They add another dimension of green space to an urban scape without taking up an extensive area of land in densely populated places. In some European countries such as Switzerland, bylaws have been passed that new buildings must be designed to relocate the greenspace covered by the building to their roofs. Existing buildings must also comply with the bylaw by greening at least 20% of their rooftops.

These relatively simple changes to rooftops can greatly benefit our urban areas. Here are some examples of the advantages of rooftop gardens:

- Green roofs can help in the absorption of carbon dioxide and help reduce air pollution
- Storm water runoff, flooding and water pollution can be reduced
- The building and surrounding area's aesthetics will be enhanced and property value could be increased
- Economically, there are no additional land costs
- Temperatures around the building can be lowered in the summer
- A building can be further insulated from the cold in the winter
- The roof life can be extended by protecting it from various weather conditions
- Heating and cooling bills will be reduced
- The rooftop garden space can be used for food production

ROOFTOP GARDEN TYPES

There are two types of rooftop gardens and depending on the structural design of your roof, one might be preferable to the other. One is the extensive rooftop garden, often inaccessible and the other is the intensive rooftop garden, which is accessible to people.

1. Extensive rooftop gardens:

- Generally lightweight gardens
- Require little or no maintenance
- Vegetation acts like another layer of the roofing material and usually covers the entire roof
- Can be installed on both flat and sloped roofs
- Depending on climate and the amount of rainfall, can grow a variety of hardy grasses, wildflowers, mosses and sedums
- Use drought-tolerant plants that will go into hibernation if exposed to harsh conditions like wind and sun exposure and/or under-water
- Since they are not generally walked upon, guard rails, exit requirements and access need not be a concern. If they will be walked on, these aspects need to be considered. SEE

THINGS TO CONSIDER - ACCESS AND SAFETY

2. Intensive rooftop gardens:

- Allow for a more diverse plant selection such as perennial flowers, trees and shrubs (all of which can remain in containers over the winter) and the potential to grow food.
- Are subject to building and zoning codes, especially with respect to public safety issues, hence the need for proper exits, guard rails, and lighting.
- Generally installed on flat roofs with the vegetation either covering the entire area or in containers and raised beds.
- A stronger roof structure is required due to the added weight of people accessing the garden as well as higher soil and container weights, decking and trees all adding to the weight impact to the roof.
- More maintenance is required because of the greater variety of plants.
- Other considerations for an intensive rooftop garden include condition of roof, structural and weight capacity, access, cost, irrigation, and drainage.

THINGS TO CONSIDER

1. Weight capacity

The primary concern when thinking about starting up a rooftop garden is the weight bearing capacity of the roof. The best possible and most cost-effective scenario is to construct a rooftop garden when the roof needs to be replaced or is newly constructed.

- Before you even start designing your rooftop garden, consult with a structural engineer and if possible the building's architect regarding the weight bearing capacity of the roof. If you live in an apartment building, consult with the superintendent or owner to propose the idea.
- For the structural analysis of the roof, the architect and/or structural engineer will consider such factors as loading strength, condition of the waterproof membrane of the roof, and necessary safety provisions.
- Once the structural capacity has been determined, you will then know the type of garden that is best suited for your roof.
- Your first concern should be the weight bearing capacity of the roof. Most roofs are designed with an average loading strength of 40 lbs. per cubic foot. Wet soil weighs on average 100 lbs. per cubic foot.
- In order to reduce the soil weight, lighter soil varieties should be used such as perlite, vermiculite, peat moss and coconut husk fibre. SEE **WHAT YOU'LL NEED - SOIL**
- Find out where the building's structural columns are located, as they are able to support greater loads than other areas. Place the largest planters and containers at these locations and spread the smaller, lighter ones about equally. SEE **WHAT YOU'LL NEED - CONTAINERS**

- Since different plants require different soil depths depending on their root structure, find out how much soil each plant requires. Plants with shallow, spreading roots can grow in less soil depth than plants with longer (tap) roots. Do not use more soil than you need.

2. Exposure

The second and almost equally important concern to the weight capacity of your rooftop is the exposure to elements. Rooftop gardens are more susceptible to factors such as wind, sun and heat due to their height off the ground. The roof can actually be as much as 5oC hotter than the surrounding land. A four pronged approach is usually the best option to overcome these conditions.

- Choose **PLANTS** that have the ability to withstand harsh conditions, or provide them with **SHADE**.
- Provide a thick layer of mulch to insulate and shade the soil. This will minimise evaporation and keep the soil cooler .
- Install a drip irrigation system, on a timer, that will deliver steady moisture to each planting bed. Without this kind of irrigation, many planters, especially the smaller ones, may need watering twice a day. SEE **WHAT YOU'LL NEED - WATER**
- Choose your **CONTAINERS** with care. Although you might find that terra cotta pots look better than plastic containers, they are too porous to conserve water under rooftop conditions. Plastic pots seem to work a lot better

3. Wind and sun protection

Wind conditions on a roof can be dramatically different from those on ground level. Generally, the higher up you are, the stronger the wind. Combined with the increased sun and heat exposure on a rooftop, plants could have a hard time surviving unless some precautions are taken.

- Use the sides of the plant's own container as a windshield for young plants by planting them several inches below the top of the pot.
- For larger plants in very sever conditions, you may have to build a windbreak or use hardier plants themselves as windbreaks. An outside row of tall sturdy plants, such as sunflowers or evergreens, or hardy vines on a trellis, can protect other more delicate plants.
- When selecting plants for a windbreak, look for plants with thick leaves with hairy or waxy surfaces. They loose less water to evaporation than thin, smooth leaves.
- Stake your plants using stronger and more numerous stakes than you would normally use on ground level. These will protect and support the more heavily laden plants. If the plant grows upright rather than in a spreading fashion, it will probably need some support.

4. Access and safety

Access and roof safety should be priority considerations when designing your rooftop garden. As well as physical access for people, there should be water access as well. If your only method

of getting to the roof is by ladder, you should think carefully about the task of carrying all the materials needed for building your garden as well as the repeated transportation of water to the roof.

If it is a public building, the Building Code will not allow ladder access for this intended use. In terms of safety, consider installing guard-rails at appropriate heights around the perimeter of the roof where there is garden access. These will not only protect the people visiting the rooftop garden, but will also shield the plants themselves.

5. Roof properties and drainage

Any excess water not absorbed by the plants should be drained into the existing drainage system with only a few slight modifications depending on the complexity of your garden.

Try to keep the flow of draining water free of obstructions (i.e. containers) so water does not build up on the roof and can reach drains and eaves troughs. Maintain a gravel ring and filter cloth layer around the roof drains and over flow scuppers.

WHAT YOU'LL NEED

1. Soil

- Lightweight soil. Due to the weight of soil, especially wet soil, it is best to use lighter soils such as perlite, vermiculite, peat moss, coconut husk fibre and rockwool pad (a Danish product that can completely replace soil without harming the plant)—these add bulk without jeopardising the stability of the plants.
- Fertilisers. If you use these types of soil, they need to be mixed with fertilisers, preferably organic ones, to ensure the survival of your plants.
- Minimum soil. Many plants do not need 12 inches of soil for healthy growth so use a minimum amount of soil as possible. Select plants that require less soil depth such as ones with shallow and spreading roots.

2. Water

- Water access. Water on the roof is ideal—i.e. a water tap.
- Water pressure. Moderate to high water pressure is preferable. If the water pressure is low, there may not be enough force to have a long drip system or soaker hose. In this case, several shorter hoses on separate zones would get water to all the plants.
- Drip irrigation system. This is an effective way to get a steady amount of moisture to your plants and can be put on a timer for efficiency and lower maintenance.

3. Plants

- Hardy or indigenous plants. Use plants of these varieties, as they are more capable of withstanding the harsh climate conditions of a rooftop such as sun, wind, rain fall, soil depth, shade and air pollution.

- **Roots.** Choose plants that have shallow root systems rather than ones that require higher soil depths making the container too heavy to be sustainable on a rooftop.
- **Growth conditions.** Consider where your plants have been grown prior to being planted on the roof and try and get plants that have been subjected to similar conditions.
- **Plants and garden types.** For an inaccessible/extensive garden, mixtures of grasses, mosses, sedums, sempervivums, festucas, and irises—plants native to drylands, tundra and alpine slopes are best suited for this rooftop environment. Accessible/intensive gardens can support just about any type of plant, provided that special protective precautions are taken for more sensitive plants such as using windbreaks and shading.
- **Windbreak plants.** Choose plants that have thick leaves with hairy or waxy surfaces as they tend to be stronger and lose less water to evaporation.

4. Containers

- **Appropriate containers.** Although terra cotta pots look good, they are too porous to conserve water under rooftop conditions. Plastic pots do a much better job.
- **Size.** Do not use anything smaller than 20 cm (8 inches) in diameter because there isn't enough soil mass relative to the exposed surface area in a small container to hold much moisture for very long.
- **Alternatives.** Plastic pails that restaurant food supplies come in (usually 3.5 gallons or 16L) are perfect for a single tomato, pepper or eggplant. Poke a few holes in the bottom, add an inch of gravel for drainage, covered by a filter cloth to prevent the soil from coming out the bottom. Fill it about 2/3 full with a light weight soil mix, leaving room for mulch, and you have a perfect rooftop garden plant container.
- **Larger planting beds.** You can build wooden planter boxes or adapt packing crates. To do this, line with plastic, cutting a few holes in the bottom for drainage, and also fit with insulation on the inside, especially if you are planting anything that will be over wintering on the roof, such as perennials, shrubs or trees. These plants can be damaged by repeated with thawing and re-freezing in the winter and the interior insulation helps to minimise the thawing of the soil.
- **Soil.** No matter what kind of container you use, do not fill it to the top with soil. The lower soil level will enable the plant to get some wind protection from the container itself, as well as leaving enough room for a generous layer of mulch (at least 1 inch).