



Green Roof Outfitters®



OWNER'S MAINTENANCE MANUAL

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1. INTRODUCTION

This reference guide is intended to be a practical manual used by building owners, homeowners, landscapers and in-house maintenance staff to properly maintain a vegetated green roof. This comprehensive information packet meets a broad range of maintenance objectives, however, some procedures may not be applicable to your roof. When possible, there is a list of alternate maintenance methods.

1.1 LOW MAINTENANCE, NOT NO MAINTENANCE

Sedums plants are the predominant plant of choice in green roofs due to their low maintenance attributes. They are low growing, rapidly maturing perennials which are resistant to most drought and temperature fluctuations. Although these hardy plants reside on rooftops, maintenance is necessary as they can fall prey to weeds, pests and diseases. A minimal amount safeguarding will protect the quality and longevity of the plants and the long term survival of the green roof project.

1.2 CUSTOM MAINTENANCE TO MEET ROOF USES

Green roofs are installed for various reasons. This may include the following:

- Lower energy bills
- Minimize storm-water run-off and rainwater pollutants
- Remove airborne pollutants and creating oxygen
- Mitigate the Heat Island Effect
- Obtain LEED Credits
- Create a gathering/natural park area on the roof of a building
- Reduce noise pollution on a building near an airport or construction
- Create aesthetics for increased work productivity and psychological wellness
- Green roof research
- Extend the life of the roof membrane

Building owners should consider their own objectives when choosing a maintenance plan. This guide is intended for optimal results and we encourage utilizing all recommendations.

1.3 CUSTOM MAINTENANCE MATERIALS TO MEET CUSTOMERS/OWNERS NEEDS

In each chapter we will recommend certain nutrients and supplements, but these applications may not be appropriate for every roof or scenario. Please confer with the building owner as to which materials are acceptable.

1.4 PREVENTIVE VERSUS REACTIVE MAINTENANCE MEASURES

As with any maintenance program, there are both preventive and reactive programs. We will outline a preventive program that minimizes cost and time in favor of the reactive approach.

2. ROOF MAINTENANCE SAFETY PROCEDURES

It is the responsibility of the building owner/homeowner/maintenance provider/etc. to ensure that precautionary measures are taken when maintaining the green roof.

Please refer to www.OSHA.gov to see the most up-to-date roof safety regulations.

3. GENERAL ROOF HOUSEKEEPING

There are some maintenance jobs that are not optional on green roofs because they affect the plants or the function of the roof. These are described in sections 3.1, 3.2 and 3.3:

3.1 DRAIN CLEANOUT

The primary cause of water pooling and flooding is clogged drains and gutters. We recommend cleaning out all gutters and drains at least once a month.

3.2 SWAMPS

There is a tendency for water to collect on flat roofs. These areas should be leveled before green roof installation as it causes problems for the plants and roof membrane. If the roof cannot be feasibly leveled, and the roofing membrane is able to handle the water, we suggest planting a more water tolerant plant in that area of the green roof. If standing water is seen on a roof several days after a heavy rain or if the plants are all dying in an area, it may be due to excessive water pooling.

3.3 LOOSE FLASHING

During the normal maintenance routine, the flashings on the roof should be checked and repaired if needed. This simple step could prevent the need for re-roofing or repairing a leak.

3.4 FALL/WINTER CLEAN-UP (OPTIONAL)

Once the green roof plants mature, most varieties will flower abundantly. This provides beautiful colors from the spring through the fall, but may leave unsightly flower stalks in the winter. If you are in a snowy region, then the snow tends to knock these stalks down, but if not, these stalks can be removed carefully with a string trimmer.

4. NUTRIENTS AND SUPPLEMENTS

Green roof plants use the rain and pollutants contained therein as a food source. However, before the green roof is fully established, the plants will need additional nutrition. Supplying the proper nutrition during the establishment period will enable the plants to grow more rapidly and fill in the green roof area. This slows weed growth, prevents wind and rain erosion and improves roof appearance.

4.1 FERTILIZERS

Green roof plants do not require much fertilizer, but throughout the establishment period for newly planted plugs, they will need more nutrients than the rain can provide. A balanced slow release fertilizer that releases over a period of 3-12 months is best. Osmocote or Nutricote are examples of commercially available slow release fertilizers. Initially a 10-10-10 is good at supporting top growth, root growth and flowering (14-14-14 or similar can also be used). In the second and later years as the plants fill in and growth slows, the fertilizer ratio should be changed to more nitrogen (ex. 18-6-12) but still be of a slow release variety.

In addition to promoting growth, fertilizers also keep the plant healthy and more resistant to disease. If the green roof is to be used for aesthetic reasons, the fertilizer will keep the plants looking their best.

4.2 BIOLOGICALS

Most roof soils are comprised of a lightweight aggregate that is heated to very high temperatures (resulting in sterilization) and a small percentage of sterilized compost. Sterilization may cause the soil to be deficient in biologicals. Biological supplements such as compost teas, worm castings

and worm casting teas (ex. VermaPlex), biological nutrients (OMRI Nutricast) and mycorrhizal injections (Mycorrhizal Application, Inc.) may be required in some instances. If the plants are not growing after they been fertilized and treated with fungicide, biologicals may be worth consideration.

5. DISEASE PREVENTION AND TREATMENTS

Green roof plants are considered resistant to most diseases and pests problems; however, on occasion a disease or insect problem may arise.

5.1 POTENTIAL FUNGUS ISSUES

Sedums and ice plants are less susceptible to fungus infection than on-the-ground plants. However, fungus issues can still develop. There are three main fungi that cause green roof plant damage:

- Pythium, seen as damping off and root rot
- Rhizoctonia, also primarily root rot
- Fusarium seen as leaf wilt or spots

Prior to treatment, a professional should be consulted to properly diagnosis the issue. Without proper identification of the diseases and/or insect, one cannot properly treat the issue at hand. Our goal is to limit problems by utilizing a preventive maintenance program.

5.2 PREVENTATIVE TREATMENTS

There are several fungicides which can help protect your green roof plants:

Rhapsody or CEASE, is an organic fungicide and it is available from most agricultural chemical suppliers.

Chorothalonil is sold as Ortho Garden Disease Control, Daconil, and included in fungicides such as Initiate 720. They are available in most garden centers.

Chemical fungicides containing the following ingredients will also help control disease: Thiophanate Methyl, PCNB, Iprodione, Azoxystrobin, Fludioxonil and Flutolanil.

We strongly recommend consulting a professional horticulturist or landscaping supply store to help identify the issue prior to purchasing or applying any fungicides. Always follow ratio and safety guidelines when applying, or hire a professional to apply.

5.3 CURE OUTBREAKS

A preventive maintenance program will significantly reduce the risk of disease outbreak. Such outbreaks are usually not detected until the disease has progressed to a noticeable level. This usually happens after a period of several weeks of rains or periods of drought with very high temperatures

(over 90 degrees). It is best to have a professional diagnose the disease before starting a spray/drench application.

5.4 SAFE APPLICATION PRACTICES

Fungicide application, like application of insecticides and pesticides, should be done safely. Please read the entire label and follow all safety precautions.

6. PESTS

Most pests are controlled by the intense conditions of a green roof micro-climate, however some pests will surface as a result of over-irrigation.

6.1 ABOVE GROUND PESTS

Most pests will be seen during the green roof establishment period. Snails and slugs can be indicators of excess irrigation or excess rain and they will multiply in moist soil. The best solution is to decrease irrigation. The snails and slugs will die out once the irrigation or rains have become normal. In some circumstances, snail pellets may be needed.

6.2 BELOW GROUND PESTS

Mealy bugs, sow bugs and centipedes have been found in green roof plants. They can be treated during fungus spraying with additions of liquid seven. They rarely have a detrimental effect on the plants. If the plants aren't doing well, first check for fungus and then look at the roots of a plant. Mealy bugs show up as white areas, and sow bugs and centipedes are easily seen. A worst case scenario would require an application of liquid seven. Please note that liquid seven will kill bees so we do not recommend using while plants are flowering.

7. WEEDS

Like any garden, weeds are the biggest maintenance requirement. Roofs, due to their elevated position, are less susceptible to weed infestation but they are not totally immune. Some weeds have enormous root structures and can survive in extreme conditions found on rooftops.

7.1 PREVENTION

Although we want to avoid treating the roof with chemicals, one method of minimizing weeds is to treat the area with a pre-emergent herbicide. Please be sure to read the label and follow instructions.

7.2 REMOVAL

During the first year, weeds should be pulled and removed at least every 2 weeks. They are much easier to pull after a rain and before their roots get too deep. Weeds thrive in mid to late summer, and many will go to seed after only a few weeks growth. Every effort must be made to remove the weeds before they go to seed.

8. IRRIGATION

Poor irrigation and moisture management is the leading cause of damage to green roof plants. This is done by either ignoring irrigation during periods of extreme drought or more frequently, by over watering. Green roof plants are naturally drought tolerant, but they need periodical water to keep them healthy and growing well, especially during the first year when they are becoming established.

8.1 DIFFERENT FROM OTHER PLANTS

Green roof plants differ from other plants in their photosynthesis process. Under conditions of sufficient water, they run photosynthesis in one step: they absorb carbon dioxide, water and sunlight, and give off oxygen during daylight hours. However, during periods of water deficiency,

they shift the photosynthesis process into 2 steps: 1) reaction of carbon dioxide with water and sunlight during the day, and 2) expulsion of oxygen and uptake of carbon dioxide during the night.

By doing this, the stoma (breathing holes) are only open during the cooler nights, thus conserving water. The key point is that this capability still requires water but not as much as a normal plant.

Another item to note is that they cannot tolerate having roots immersed in water for days at a time. Dry period are necessary for their health.

8.2 RECOMMENDED IRRIGATION

Proper irrigation depends on soil depth, humidity, age of the plants and temperature. For 4 inch deep soil, here's the recommendations during spring/summer/fall, and a watering is considered a rain event or you manually soaking them with water: 1) Newly planted plugs: water every other day for first week, then twice a week for next 2 weeks and then once a week for next 2 weeks. Make sure they get water at least every other week from then on to look good. 2) Established plants/sedum mats: water twice a week for first 3 weeks, then once a week for next 2 weeks. Make sure they get water about once every two weeks after that to always look good.

More frequent watering will make the plants grow slightly faster but will also make them more susceptible to diseases.

Established plants can get by with water every month as a minimum, but will not look as good as those that get it at least once every couple weeks.

We can't stress enough --- OVERWATERING KILLS PLANTS!

9. PLANT FILL-IN AND REPLACEMENT

As the green roof grows in, there will most likely be some areas where the plants die out or just don't fill in fast enough. In these areas, try to define and correct problems such as "swamps", dense shade or fungus. If there are no obvious problems and the areas are small, these areas can be improved by taking cuttings off bigger plants and partially burying the cuttings in the soil of the bare areas. If a larger area needs work, the best solution is to purchase assorted bulk cuttings or plugs, and plant them in those areas. Remember if you don't try to cover an open area, nature will do so with weeds.

10. SUMMARY

YEAR 1

- For newly planted plugs, weed every month or as needed to keep them in check
- For established plants/sedum mats, weed quarterly or as needed
- Apply slow-release fertilizer (for newly planted plugs) in spring and fill in plants as needed
- Clean debris & leaves from around modules and drains quarterly
- Irrigate as recommended above, except if rain occurs

YEAR 2

- Weed quarterly or as needed to keep them in check
- Apply slow-release fertilizer in spring and fill in plants as needed
- Clean debris & leaves from around modules and drains quarterly
- Irrigate as recommended above, except if rain occurs