

Systematic Approach to Choosing Sedums and Ice Plants (Stonecrops) for Extensive Greenroofs



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Table of Contents

	page
1. Forward and contact Information	2
2. Introduction	3
3. Stonecrop plant Origins and preferred climate	4
4. Stonecrop diseases	5
5. Problematic Climate Conditions	6
6. Man-made Problems	7
7. Systematic Approach	8
8. Recommended Species	9-13
9. About Carolina Stonecrops, Inc.	14

1- Forward

This short manual is sent to you by Carolina Stonecrops in the hope that it will allow you to understand the Stonecrops (sedums and ice plants) and how roof conditions can affect their disease resistance. If this systematic approach is used the plant choices will make the roof planting more robust and minimize maintenance. The manual discusses the interaction of plant species, diseases, climatic conditions and man-made conditions which have a major effect on the roof plantings. Use of this approach is most important south of the Mason Dixon line but detrimental climactic and man-made conditions exist to some extent throughout the US.

Choosing the best plant mix is not complicated and assures that the roof owner gets the most robust roof possible. The information contained in this manual comes from 8 years of growing rooted plugs and prevegetated modules in our zone 7 nursery. Feedback also comes from Capitol Greenroofs LLC who maintains greenroofs in the Washington, DC area.

The plant species recommended are common and readily available from most greenroof plant growers. Carolina Stonecrops simply hopes to have the opportunity to quote on your future greenroof and green wall projects.

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2- Introduction

Stonecrops have been the favored plant for extensive greenroofs for nearly 40 years in Europe and 20 years in the US. This is not by mistake as these plants are quite robust and survive well under most greenroof conditions. However the roof climate of most buildings challenges the plants especially during temperatures above 90 degrees F and droughts. However, not all Stonecrops have equal disease resistance and not all climates in the Eastern US are the same. Add to this the fact that most greenroofs are almost inaccessible, get minimal maintenance, little known “designer” species are often specified and use of fungicides are frowned upon and you have difficult conditions for plant survival. This short manual will briefly look at major diseases and discuss the effects of climatic conditions (both natural and man-made) on the viability of plants. A recommendation will be made on a systematic approach to choosing and planting Stonecrops to maximize disease resistance.

Although Stonecrops are the main plants discussed, the use of additional wild flowers and herbs when mixed in will have a beneficial effect.

3- Stonecrop Plant Origins

Many people think of the Stonecrops as desert plants because they have evolved a mechanism for rationing water and surviving dry periods. This process is called ***Crassulacean acid metabolism (CAM)*** and it allows the plant to break up the photosynthesis process into two separate parts. As a result, the plants breathe in carbon dioxide and breathe out oxygen only at night when temperatures are cooler thus preserving water.

They have evolved this mechanism because they originated in mountainous, low humidity areas of Northern Europe, Russia, Japan and South Africa. They do not originate in any deserts. Actually most of their areas of origin are high elevation and overall cooler climate than most of the US except for northern areas. In addition to the CAM mechanism some of the species have also additional cuticle layers in their leaves to minimize water loss.

As a result of their evolution they grow better in the cooler temperature of Spring and Fall and are dormant in Winter and semi-dormant in the highest temperatures of Summer. Keep this in mind, at temperature of 90 degrees or higher in summer these plants go somewhat dormant exactly at the time disease pathogens accelerate their growth.

4- Stonecrop Diseases

In western North Carolina, the Carolina Stonecrops nursery is in a hardiness zone 7 climate similar to most of the East Coast. The normal temperatures in summer are significantly higher than the Stonecrops would see in their natural environment of origin. As a result, when we first started growing, we saw outbreaks of two major families of disease pathogens which in the nursery we can now prevent. On a roof, the disease pressure will be significantly less than in a nursery primarily due to wind and dry conditions. However, knowing a little about the diseases can be helpful in minimizing and preventing them.

Diseases fall into two distinct categories- ***below ground and above ground***.

Below ground the major diseases are caused by water molds, most often pythium. This disease is caused by water born pseudo-funguses that exhibit their diseases by the common descriptive name of root rots. In the summer if a plant gets diseased, it starts to change to dormant winter colors (not good). When a sample plant is pulled up, its roots will be black or grey instead of a healthy white.

Too frequent watering by irrigation and/or rain is the likely cause of this disease. Although predominantly water born the spores of this disease seem to be everywhere. Drenching with the specific fungicides Banrot, Truban or Terrazole is effective at eliminating the disease it is more of a nursery cure than for roofs. The best preventative measure is to use irrigation only during droughts of more than a month duration or during the first year of roof establishment. At least once a month the roof soil should be allowed to completely dry out for several days if not longer.

Above ground diseases are typically true fungus pathogens of the rhizactonia family. They normally appear during high humidity/temperature periods of May through September in zone 7. The disease is seen descriptively as leaf rot, stem rot and crown rot and to a slight extent as underground rots. This disease is best medicated by a drench of Banrot (a systemic) or foliar spray of Chlorothalonil (Daconil). However the choice of plants discussed shortly will minimize this disease.

Both above ground and below ground pathogens are assisted by moisture/humidity and high temperature (90 degrees F+). Therefore they tend to be summer problems especially in the South. Preventive measures consist of 1- providing a random mix of different height plants for partial shade. 2- using mixed plant species that grow in an open 3D network which encourages drying out of moisture from rain or evening dews.

5. Problematic Climate Conditions

Previously I mentioned that the diseases were enabled by moisture/humidity and temperatures above 90 degrees F. In addition to that the Stonecrops tend to go somewhat dormant (lower their defences) at high temperatures. In order to better understand the problem lets consider each.

- Moisture/high humidity can manifest in several ways. High humidity can cause afternoon thunderstorms and heavy dews that remain in and on the plants throughout the night and most of the following day. This serves to feed the growth of the fungal pathogens and germination of fungus spores. The high humidity can also cause breathing/growth problems for some species of Stonecrops. For example, Sedum acre and Delosperma 'Kelaides' are almost impossible to grow on the East Coast because of the humidity.
- High temperatures (90 degrees F+) cause a double effect on Stonecrops because the plants go somewhat dormant and less defensive at the same time pathogens are accelerating growth and germination. Even though these plants tend to like full sunlight, the heat of the sun can cause problems and some partial shade can help the heat problem.

6. Man-made Problems

As if a greenroof doesn't already have enough problems to deal with we often add to them with the following:

- **Automatic irrigation-** In the name of TLC automatic irrigation is often a part of most greenroofs. If a greenroof is planted with cuttings or rooted plugs, irrigation is mandatory for the first year. Also irrigation is also helpful during periods of long term drought on an established roof. However, where irrigation goes wrong is when it is **automated and forgotten**. The plant roots need to have a totally dry period at least monthly to dry out and minimize water mold pathogens, especially during periods of high temperature. *(One major fallacy is that plants can benefit during periods of high temperature with extra water like normal plants. Wrong, CAM mechanism does not need extra water under these conditions)*. With a auto irrigation system and periodic rains the soil is kept wet continuously. More greenroofs die due to over-irrigation than drought. As a grower I hate to supply plants to a roof that has been lost due to over-irrigation because the pathogens are already there in force and awaiting new plants to dine on. If a roof is lost either partial or in total due to over-irrigation, a drench of Banrot, Trueban or Terrazole is necessary before replanting.
- **Monocultures or designs-** Stonecrops come in lots of assorted plant colors and shapes and flower colors. Because of this there is a huge temptation to make a big design or to go with a one or two species plant palette. For example, one university wanted to use plants of its school colors in its greenroof. A design or monocultures is problematic from a disease perspective because 1- the plants of one species tend to grow very tight and hold water as discussed previously and 2- plants of few species do not offer the opportunity for partial shading to minimize heat buildup.

7. Systematic Approach

Finally, after considering the diseases and climatic and/or man-made problems, how then should we design a robust, disease resistant and low maintenance roof plant palette?

The following factor should be considered in order:

1. **Hardiness (winter kill) zone-** Assure that all plant species that you pick will survive the winters lowest temperature for you area. Although Stonecrops are cold weather plants each species has its limit. Also factor in that very high roofs may go into the next colder hardiness zone.
2. **Varying height and shape plants-** Choose 6-12 species of varying height and shape species to use bearing in mind that the tallest may only be 6 inches high. This mixture should be planted randomly so that the taller will provide shade and heat relief for the middle and lower height species. More importantly, the partial shade will cause the lower species to grow less compact (more leggy) creating a 3D growth that is open for rapid moisture escape during the day. If possible, when using plugs, use more than the usual 2 per square foot so that the roof fills in faster and plants can form the 3D network sooner.
3. **Robust species only-** Avoid the temptation to add unusual or unproven species. A greenroof, like the proverbial chain is only as disease resistant as its weakest link. If just one of the species is more disease prone it will serve as a disease nucleation and propagation site for the entire roof. Unusual species should be tested in a nursery nearby the roof first before specifying them on roofs.
4. **Non-Stonecrops-** Add some proven non-stonecrops species to the palette for variety, self sowing and disease resistance. Two excellent examples are *Allium Schoenoprasum* (chives) and *Talinum calycinum*. Both have been proven and are readily available as seeds or rooted plugs.
5. **Ask a grower-** Surprisingly I am seldom consulted by specifiers of greenroof plants despite spending 7 days a week watching them grow in modules or plugs.

8. Recommended Plant Species Information

Most Robust



Delosperma Cooperi



Allium schoenoprasum



Talinum calycinum



Sedum kam. Var. ellecombianum

Moderately robust



Sedum spurium fuldaglut



Sedum kamtschaticum



Sedum rupestre Angelina



Sedum middendorffianum



Sedum album France



Sedum flor. Weihenstephaner Gold



Sedum spurium Roseum



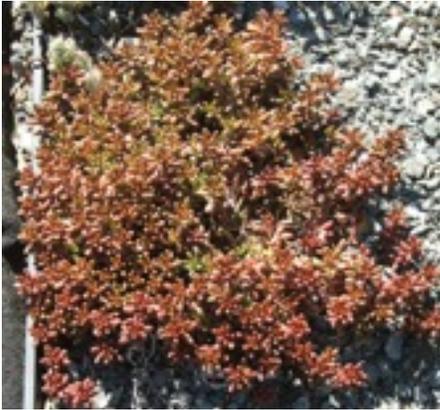
Sedum reflexum Blue Spruce



Sedum sexangular



Delosperma nubigenum



Sedum album Murale



Sedum spurium John Creech

9- About Carolina Stonecrops, Inc.

- Carolina Stonecrops has been a greenroof plant grower since 2005.
- We are located in Western North Carolina between Marion and Morganton
- We grow in zone 7 but supply species that go from zone 4-9.
- Sedums, ice plants, *Allium schoenoprasum* and *Talinum calycinum*
- Products:



- **Standard rooted plugs-** 1.5" diameter x 3" deep
- 72 per tray
- Species listed on www.greenroofplants4u.com
- Available as single species per tray or "Universal 12" dozen sedums in random mix
- Most available from inventory but custom growing is option



Prevegetated module

- **Prevegetated Modules-** 2 foot x 2 foot x 4' deep
- We utilize Green Roof Outfitters module
- Other modules can be grown in if supplied by customer

- 500 modules are normally in inventory containing Universal 12 mix.
- More or special mixes available custom grown (3 month minimum required.)

Sorry we don't have production capability for cuttings or mats.