The single term used to describe underground, soil line, or crown rots of seedlings due to unknown causes is damping-off . The term actually covers several soil borne diseases of plants and seed borne fungi.

Rhizoctonia root rot (Rhizoctonia solani) is a fungal disease which causes damping-off of seedlings and foot rot of cuttings. Infection occurs in warm to hot temperatures and moderate moisture levels. The fungi is found in all natural soils and can survive indefinitely. Infected plants often have slightly sunken lesions on the stem at or below the soil line. Transfer of the fungi to the germination room or greenhouse is easily accomplished by using outdoor gardening tools inside or vice versa. The germination room should not be used for mixing potting soils or transplanting seedlings as a general rule.

Pythium Root Rot (Pythium spp.) is similar to Rhizoctonia in that it causes damping-off of seedlings and foot rot of cuttings. However, infection occurs in cool, wet, poorly-drained soils, and by overwatering. Infection results in wet odorless rots. When severe, the lower portion of the stem can become slimy and black. Usually, the soft to slimy rotted outer portion of the root can be easily separated from the inner core. Species of Pythium can survive for several years in soil and plant refuse.

Phytophthora root rot (Phytophthora spp.) are usually associated with root rots of established plants but are also involved in damping-off. These species enter the root tips and cause a water-soaked brown to black rot similar to Pythium. These fungi survive indefinitely in soil and plant debris.

Black root rot (Thielaviopsis basicola) is a problem of established plants. It does not occur in strongly acid soils with a pH of 4.5 to 5.5. It usually infects the lateral roots where they just emerge

from the taproot. The diseased area turns dark brown, and is quite dry. The fungi survive for 10 years or more in soil.

Miscellaneous fungi causing similar symptoms include Sclerotinia (white mold), Sclerotium rolfsii, Macrophomina phaseoli, some species of Botrytis (gray mold), Aphonomyces, Fusarium, Cylindrocladium, and others. Hence the need for the collective term known as damping-off.

Symptoms of Damping-off:
Seeds may be infected as soon as moisture penetrates the seed coat or a bit later as the radicle begins to extend, all of which rot immediately under the soil surface (pre-emergence damping-off). This condition results in a poor, uneven stand of seedlings, often confused with low seed viability. Cotyledons may break the soil surface only to whither and die or healthy looking seedlings may suddenly fall over (post-emergence damping-off). Infection results in lesions at or below the soil line. The seedling will discolor or wilt suddenly, or simply collapse and die. Weak seedlings are especially susceptible to attack by one or more fungi when growing conditions are only slightly unfavorable. Damping-off is easily confused with plant injury caused by insect feeding, excessive fertilization, high levels of soluble salts, excessive heat or cold, excessive or insufficient soil moisture, or chemical toxicity in air or soil.

Above ground symptoms of root rot include stunting, low vigor, or wilting on a warm day. Foliage of such plants may yellow and fall prematurely starting with the oldest leaves. The roots of a diseased plant will have some shade of brown or black and evidence of water-soaking. Healthy roots are fibrous appearing and are usually white or tan in color. These symptoms are easily confused with severe mite, aphid, scale infestations, or root-feeding by nematodes or insect larvae. Environmental factors such as

accumulated salts in the soil, insufficient light or nitrogen, potbound roots, cold drafts, etc. can be eliminated only by examination of the roots.

Damping-off diseases can be prevented:
Purchase disease free plants and seeds. Know your supplier. Do not be afraid of fungicidal coatings on seeds which will be direct sown out doors in cold soils, such as corn and peas. Seed borne disease can also be avoided by soaking the seeds for 15 minutes in a bleach soak (one teaspoon per quart of water) prior to sowing.
Use sterile well drained soil mediums. See article on soil mixes.
Try to maintain a soil mix pH at the low end of the average scale, i.e. 6.4 pH is less susceptible to root rot than a pH of 7.5. Commercially prepared germination mixes usually have a pH around 5.5. As you water the seed pots and your seedlings with tap water (which in many municipalities is quite alkaline), the pH in your pots gradually increases as does the susceptibility to damping-off diseases. Know the pH of your tap water, and condition it if necessary to maintain a lower pH while the plants are still in the germination room. I prefer the use of vinegar at the rate of one tablespoon per gallon of water.
Plants must not have their crowns below the soil line. Seeds must not be covered more than 4 times the thickness of the seed.
Use plant containers with drainage holes, water from the bottom only, and avoid excess watering. Do not allow pots to stand in water as excess water cannot drain and the roots will be starved for oxygen bringing all growth to a halt.
Avoid overcrowding and overfeeding of plants. It is important to maintain constant levels of growth through proper lighting and complete control of the growing environment.
Avoid working with plants (taking cuttings or transplanting) when the soil is wet. Do not use water from ditches or drainage ponds or rain barrels in the germination room.
Avoid spreading soil from infested areas or tools which have been

used out of doors. Disinfect tools and containers with one part bleach in four parts water or with 70 percent rubbing alcohol (isopropyl).
In the germination room, sow all your seeds on the surface of the media, then cover the seeds to necessary depth with a material which is less likely to harbor fungi than the media itself. Use one or more of the following seed toppings instead of soil mix:
milled sphagnum moss
chick grit
course sand or fine aquarium gravel
composted hardwood bark (steamed)
In the germination room, mist seedlings in communal pots or flats once or twice per day with water containing a known anti-fungal agent such as:
Captan (or other approved fungicide) especially if walls or floors are damp, or
Cheshunt compound, a copper/aluminum formulation, or
chamomile tea, or
clove tea, or
a one-time light dusting of powdered cinnamon on the soil surface, or
a one-time light dusting of powdered charcoal on the soil surface, or
if stinging nettle is endemic in your area, make a fermented infusion to use like clove tea. These last five actions are suggested by sufficient anecdotal evidence to prove the existence of a low level of fungicidal activity. I would not hesitate to use them in germination environments which have no history of damping-off diseases.
Rotate plantings on a 2 to 3 year schedule using plants from different families in order to starve out existing pathogens.
Provide constant air movement not tied in with the light timer. Air should move freely 24 hours per day, but not directly aimed at the plants. This helps the seedlings to aspirate, and excess soil

moisture to wick. If you do everything else right but do not provide plenty of air movement, you will still get damping-off.
So, what do I do? Answer: all of the above, all of the time.
Damping-off diseases can be controlled:
Fungicides may be applied as a soil drench after planting. They may be incorporated into the soil before planting as a dust. They can be sprayed in mist form on all seedlings as a precaution until they have been transplanted into individual pots. Once transplanted, only those seedlings known to be especially sensitive to damping-off need be misted with fungicide daily until the first or second seed leaves have emerged. The following chemicals are not recommended for use by the average recreational gardener, but may still be available for use (if not yet banned), providing the manufacturer's instructions are followed to the letter.

Captan (sold as Captan) controls most pathogens, but not Rhizoctonia.

Metalaxyl (sold as Subdue or Apron) controls Pythium, Phytophthora, and Aphanomyces.

Iprodione (sold as Chipco) controls most pathogens, but not Pythium, Phytophthora, or Aphanomyces.

Etridiazole and Thiophanate-methyl (sold as Banrot) controls most all pathogens.

PCNB-etridiazole (sold as SA-Terraclor or Super-X) good general purpose fungicide.

PCNB-quintozene (sold as Terraclor, Fungi-clor, or PCNB) controls Rhizoctonia and Sclerotinia species.

Fosetyl-A1 (sold as Aliette) controls Pythium, Phytophthora, &

Aphanomyces.

Well, you get the idea. There are too many to list, and they go on and off the market very quickly (mostly because they are very dangerous when used improperly, and some are too dangerous to have been put on the market at all.)

So, what do I use? Answer: Just enough Captan as needed.
The Future of Damping Off Control:
Biocontrol with microbial fungicides is being investigated in several academic labs. Typical targets are those plants being mass-produced in nearby commercial greenhouses. Early results indicate damping-off prevention comparable to that achieved with the use of standard fungicidal drenches like those mentioned above. However, there remain some notable drawbacks in biocontrol of damping-off.

First, microbial fungicides act against only one species of root or stem rot, and must be applied in advance. So, in order to prevent damping-off, you must know in advance which species of Pythium or Rhizoctonia or other fungi is likely to attack your crop. That limits their use to large production facilities.

Second, some formulations of microbial fungicides have been shown to produce substances that are phytotoxic to certain crops.

Finally, small changes in environmental conditions during test periods seem to cause significant differences in test results