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Damping-Off

And Its Control

Should any of the fungicides recommended in this circular become unavailable, substitute fungicide recommendations will be available from the Extension Plant Pathologist at the Colorado State College or through your County Agricultural Extension Agent's office.

Damping-Off And Its Control

By W. J. HENDERSON, Extension Plant Pathologist

Truck gardeners and greenhouse men often obtain unsatisfactory stands of tomato, cabbage, cauliflower, onion, celery, and many other vegetable seedlings because of heavy losses due to damping-off disease. It is especially serious in hotbeds, greenhouse flats, and benches where soil moisture and air humidity are high.

The disease is caused by certain mold (fungus) organisms that live from year to year in the soil, or which may over-winter on the surfaces of seeds.

Damping-off is characterized by rotting of seeds in the soil, death of seedlings before they emerge from the soil, and by a water-soaked rotting of the stems near the ground line, which causes the seedlings to wilt, fall over, and die.

Control Methods

Since the molds which cause damping-off are seed-borne as well as soil-borne, and high soil and air-moisture conditions greatly favor their development, control of this disease involves seed treatment, soil disinfection, and certain cultural practices.

Seed Treatment.—The first step in controlling damping-off of seedlings is that of disinfecting the surface of the seeds with a standard seed-treating fungicide. The results from tests conducted in a number of the truck-crop districts in Colorado show definitely that it is a sound practice to treat all vegetable seed either with Semesan or Cuprocide. These dusts can be applied to the seeds either in a drum seed-treating device, or in a quart jar. In either case, the seeds should be well coated with dust. The vegetable-seed treatments recommended for Colorado truck gardeners and greenhouse men are shown on the next page.

Soil Disinfection by Steam.—The handiest method of introducing steam into the soil of hotbeds and greenhouse benches is through 3-inch drain tile laid in parallel rows (as for drainage), 12 inches apart, and deep enough to avoid cultivating tools. A shovelful of finely broken stones, placed about each joint helps the steam pene-

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Seed Treatments For Control of Damping-Off Disease of Vegetables

Crop	Materials	
	Semesan	Cuprocide
Beans	¼ oz. per bu. seed*	2½ oz. per bu. seed
Cantaloupes and Honeydews	¾ oz. per 15 lb. seed	1 oz. per 3 lb. seed
Carrots	½ Tsp. per lb. seed	½ oz. per 3 lb. seed
Cauliflower	½ Tsp. per lb. seed	
Cabbage	½ Tsp. per lb. seed	
Celery	¼ Tsp. per lb. seed	1½ Tsp. per lb. seed
Cucumbers	½ Tsp. per lb. seed	¼ Tsp. per lb. seed
Eggplants	½ Tsp. per lb. seed	1½ Tsp. per lb. seed
Kohlrabi	½ Tsp. per lb. seed	
Lettuce		1½ Tsp. per lb. seed
Onions	¼ Tsp. per lb. seed	
Peas	1 oz. New Improved Ceresan per 100 lb. seed	4 oz. per 100 lb. seed**
Peppers	½ Tsp. per lb. seed	1½ Tsp. per lb. seed
Spinach	½ Tsp. per lb. seed	1½ Tsp. per lb. seed
Squash	½ Tsp. per lb. seed	2 Tsp. per 10 lb. seed
Tomatoes	¼ Tsp. per lb. seed	1½ Tsp. per lb. seed
Watermelons	½ Tsp. per lb. seed	¼ Tsp. per lb. seed

*Do not use Semesan on Lima beans.

**If seed is to be planted in drill, add 1 oz. of powdered graphite for every 2 oz. of Cuprocide to prevent cracking of seed by drill and drill trouble. If planted by hand, graphite is not needed.

trate the soil more freely. A 50 h. p. boiler can easily steam 500 square feet at a time. In 4 to 8 hours the area should be disinfected to a depth of from 16 to 22 inches.

In a similar way, galvanized eaves-trough pipes or 2-inch iron pipes, with 2 rows of ⅛ to 3/16-inch holes, 12 inches apart may be used. The rows of holes should be on opposite sides of the pipes and arranged so that the holes of 1 row are about half way between those of the other row. Each pipe is connected with an iron head-pipe which receives the steam from the boiler. The soil should be steamed until it reaches a temperature of 165 degrees Fahrenheit, then it can be turned off. If soil has been covered with sacks or mats it will retain the heat longer.

Soil Disinfection by Formaldehyde.—This method is quite effective in hotbeds and greenhouse benches. The soil should be loose and fairly dry. Mix 1 gallon of formaldehyde with 25 gallons of water. Apply one-half gallon of the formaldehyde solution to each square foot of soil, with a sprinkling can. Cover the treated soil with old sacks, burlap, or canvas for 12 hours. It is not safe to plant seed in the treated soil for at least 10 days after the treatment.

Soil Disinfection with Chloropicrin (Tear Gas).—Chloropicrin (tear gas) has lately been successfully used as a soil disinfectant. It not only controls disease-producing molds (fungi) and bacteria, but is also effective in destroying nematodes and certain other insects as well as killing weed seeds.

When using chloropicrin for disinfecting soil, the best results will be obtained by following certain general rules. The soil should be loose, moist but not too wet, and at a temperature of 65 degrees Fahrenheit or above. The chloropicrin should be injected into holes that are 5 to 6 inches deep, in rows 12 inches apart, and spaced 12 inches apart in the rows so that the holes of each row will be staggered with those of adjacent rows. In raised benches or hotbeds, where the soil is less than 12 inches deep, the holes should be arranged in a similar manner and chloropicrin applied at a depth of two-thirds of the distance between the surface and bottom. Inject from 2½ to 3 cc. in each hole, which should be immediately plugged by kicking dirt into it.

As each area is finished, level the soil and create a water seal by sprinkling sufficiently to wet the soil to a depth of about 1 inch. Repeat the sprinkling as often as necessary to keep the top inch of soil moist for 3 days. Do not plant seed until after all traces of the gas have left the treated soil. This period varies according to the temperature and moisture of the soil, but usually it is from 10 to 12 days after the treatment is applied.

Chloropicrin (tear gas) should be handled with great caution, and applied with an applicator which automatically deposits the desired amount of chloropicrin at the bottom of each hole.

This method of disinfecting the soil is especially adaptable for greenhouses and hotbeds and may be practical for use in small fields. All plants should be removed from sections of greenhouses before using chloropicrin soil-treatment, and it is advisable to wear a gas mask while working with it inside.

Cultural Practices. — 1. Light is essential for best seedling growth. Damping-off occurs in dark, cloudy weather. Keep glass clean. Cover all possible surface, except glass, with either aluminum or white paint because of their high, reflecting power for light.

2. Watering and drainage are extremely important. Soil of hotbeds, greenhouse benches, and flats should be level. Apply the water with a fine-mist spray. Water in the morning and preferably only on bright days.

3. Ventilation or air drainage in greenhouses and hotbeds is of primary importance for control of diseases.

4. Spraying the surface of the soil with Yellow Cuprocide aids in preventing damping-off.