



VEGETABLE SEED TREATMENT

Treatment of vegetable seeds to kill disease-causing organisms (pathogens) carried within or on the seed has repeatedly been shown to prevent plant disease epidemics (epiphytotics). Chemical seed treatments also protect the seed or seedling from the common soil-inhabiting fungi that cause seed rots and damping-off diseases. When seed is planted in cold wet soil or is slow to germinate, it may be necessary to treat seed in order to obtain satisfactory plant stands. Seed treatment can be useful in reducing the amount of pesticide required to manage a disease, because an effective seed treatment can eliminate the need to make foliar applications of fungicides or bactericides later in the season. This reduction in pesticide use is both economically and environmentally beneficial. Treatments may disinfect (kill pathogens borne within the seed), disinfest (kill externally born pathogens), or protect the seed.

SEED DISINFECTION

The purpose of seed disinfection is to eradicate seed-infecting pathogens from the seed coat, the embryo, or both. If properly used, hot-water soaks will kill most seedborne fungi and bacteria without killing the seed. Seed lots of poor quality or lots more than one year old may not germinate well after hot-water treatment. Therefore, a small sample of each seed lot should be treated and tested for germination before the entire lot is treated. The water temperature must be carefully controlled, since a slight reduction in temperature may result in a failure to kill the fungi or bacteria, and a slight increase may result in severe seed injury. It is generally best to purchase seed that has been hot water treated by a commercial seed company. However, the following procedures should be strictly followed when commercially treated seed is not available or desirable.

1. Prewarm seed in a loosely woven cotton bag for 10 minutes in water at 100°F. Fill the treatment bag no more than half full and gently squeeze it during this soak to eliminate all air pockets and to make sure all seeds are wetted.
2. Place prewarmed seed in a water bath (5 to 10 times the volume of seed to be treated) that will hold the water at the recommended temperatures (Table 2). **The time and temperature of treatment must be exact.**
3. Immediately after the required treatment time has elapsed, place the sacks in cold water for a few minutes.
4. Spread the seeds out to dry. Old screens make excellent drying racks.
5. Apply a protective seed treatment.

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Crop	Water temperature (°F)	Time (minutes)
Broccoli	122	20-25
Brussels Sprout	122	25
Cabbage	122	25
Carrot	122	15-20
Cauliflower	122	20
Celery	122	25
Chinese Cabbage	122	20
Collard	122	20
Coriander	127	30
Cress	122	15
Cucumber	122	20
Eggplant	122	25
Garlic	120	20
Kale, Kohlrabi	122	20
Lettuce	118	30
Mint	112	10
Mustard	122	15
New Zealand Spinach	120	60-120
Onion (sets)	115	60
Pepper	125	30
Rape, Rutabaga	122	20
Shallot	115	60
Spinach	122	25
Sweetpotato (roots)	115	65
(cuttings, sprouts)	120	10
Tomato	122	25
Turnip	122	20
Yam (tubers)	112	30

Note: Other kinds of seed may be injured by hot water treatment or may not benefit from it.

SEED DISINFESTATION

The purpose of seed disinfestation is to kill pathogens living on the surface of the seed. Fungicides and bactericides, such as streptomycin, can be used. Some bacterial pathogens that are carried on the seed surface, such as those causing bacterial spot on pepper and tomato and bacterial canker on tomato, can be eliminated by dipping the seed in a solution of 1.0 quart household bleach (5.25 to 5.45 percent sodium hypochlorite) and 3 quarts of water for 1 to 2 minutes. Use 1 gallon of solution per pound of seed.

Bleach soaks are also used to free asparagus seed from the Fusarium wilt and root rot fungus. Seed in a cheesecloth bag should be continuously agitated for 40 minutes to a solution containing 1.0 pint of liquid household bleach (5.25 to 5.45 percent sodium hypochlorite) and 8.0 pints of water. Use 1 gallon of solution per pound of seed.

Transmission of tobacco mosaic virus on pepper and tomato seed can be eliminated or reduced by soaking seeds in a solution of a trisodium phosphate. Use 1 pound of trisodium phosphate per gallon of water; soak seed for 30 minutes, rinse, and dry before treating with household bleach.

After the seed is treated using bleach or trisodium phosphate, it should be air-dried and treated with a protectant fungicide such as captan.

SEED PROTECTION

The purpose of seed protection is to prevent seed rots and damping-off caused by soil-inhabiting fungi. Fungicides such as thiram, captan, etridiazole, metalaxyl, chloroneb, maneb, mancozeb, and PCNB are commonly used as seed protectants. Specific recommendations are given in Table 2.

Pretreated seed is available from most vegetable seed supply houses. Be certain to read the label carefully to determine what, if any, treatment has been used. Many growers combine both a fungicide and an insecticide in a seed treatment. Current insecticide recommendations, label precautions, and a compatibility chart should be consulted before combining a fungicide and an insecticide.

TREATMENT METHODS

Seed treatment chemicals, used in seed disinfestation or protection, may be applied by either the dust method or the slurry method.

Dust Method

Place the seed and fungicide in a closed container (Mason jar or drum) and agitate vigorously for several minutes until the seed is uniformly coated with dust. Best results are obtained when the container is twice the volume of the seed to be treated.

Slurry Method

Add enough water to a wettable powdery formulation of the selected fungicide to make a sloppy paste. Place the seed in the slurry and stir or swirl until the seeds are thoroughly coated. Dry the seed before planting. Precaution: Remember that 1 to 3 ounces of seed protectant are sufficient to treat an entire bushel of seed. Do not overdose.

All seed-treatment chemicals are poisonous to man and animals when taken internally, and some may cause mild to severe skin irritation if allowed to accumulate. Avoid inhaling the dusts or fumes. Treat seed outdoors or in a well-ventilated room. Wear protective clothing, eye wear, rubber gloves, and a respirator to reduce the risk of exposure. After treatment or at frequent intervals, wash exposed skin with soap and water.

Carefully mark treated seed and **do not use** it for feed, food, or oil purposes. Keep seed-treatment chemicals in a locked cabinet in their original containers. Make sure that containers used for treated seed are thoroughly cleaned before they are reused as seed bags—never use such bags for feed or food. Follow the manufacturer’s directions given on the container regarding concentration, dosage, mixing, and other handling precautions.

Please note: label registrations can change at any time. Thus, information provided in this publication may become invalid. The user is encouraged to read carefully the entire, most recent label and follow all directions and restrictions.

Table 2. Seed Treatment, Materials, and Disease Control for Vegetable Crops

Crop	Chemical & method ^a	Disease controlled, remarks
Asparagus Seed	bleach soak	Bleach soak controls Fusarium wilt
Crowns	captan D mancozeb D	Mancozeb controls crown rots
Bean ^b	captan D, S, PB chloroneb S,PB etridiazole and PCNB D,S,PB ^c metalaxyl S PCNB D,S streptomycin S thiram D,S	Seed rot, damping-off, Pythium and Rhizoctonia root rot. Streptomycin is partially effective in eliminating surface contamination by the halo blight organism. PCNB can be used for better protection against <i>Rhizoctonia</i> . Metalaxyl will provide optimal control of <i>Pythium</i> .
Beet	captan D,S thiram D,S	Seed rot, damping-off, black rot (seedling stage). Application of Solubor may reduce damping-off if boron is deficient.
Carrot	hot water soak, followed by thiram D,S	Hot water soak controls seedborne bacterial blight. Thiram controls seed rot and damping-off.
Corn (Pop and sweet)	captan D,S metalaxyl S thiram D,S, ^a carboxin S,PB	Most of these products control seed rot and damping-off. Metalaxyl controls only <i>Pythium</i> .

Table 2. Seed Treatment, Materials, and Disease Control for Vegetable Crops (Cont)

Crop	Chemical & method ^a	Disease controlled, remarks
Crucifers ^b (cabbage, broccoli, brussels sprouts, caulif- flower, collards, kale, kohlrabi, mustard, radish, turnip)	hot water soak, followed by captan D,S thiram D,S	Hot water soak controls seedborne black rot, blackleg, downy mildew, anthracnose, and Alternaria leaf spot and blight. Fungicides control seed rot and damping-off.
Eggplant	hot water soak, followed by captan, D,S thiram D,S	Hot water soak controls seedborne Phomopsis blight and Collectotrichum fruit rot. Thiram controls seed rot and damping-off.
Endive	thiram D,S	Seed rot, damping-off
Garlic (cloves)	PCNB D,S	White rot
Okra	metalaxyl S thiram D,S	Seed rot, damping-off
Onion	thiram D,S, pelleted with methocel sticker	Seed rot, damping-off, smut.
Pea	captan D,S,PB etrizazole and PCNB M,PB metalaxyl S PCNB M,D,S thiram D,S	Seed rot, damping-off. Give partial control of Ascochyta and Mycosphaerella blights.
Pepper ^b	hot water soak or bleach soak, followed by captan D,S thiram D,S	Soaks control seedborne anthracnose and bacterial spot. Fungicides control seed rot and damping-off.

Table 2. Seed Treatment, Materials, and Disease Control for Vegetable Crops (Cont)

Crop	Chemical & method ^a	Disease controlled, remarks
Potato ^b	captan D maneb D mancozeb D, dip thiophanate methyl and fir bark, D Streptomycin, D	Fusarium or seed piece rots or decays Blackleg (bacterial)
Spinach	hot water soak, followed by captan D,S thiram D,S	Soak controls seedborne downy mildew and anthracnose. Fungicides control seed rot and damping-off.
Sweet potato	Botran dip Thiabendazole dip	Black rot, stem rot, scurf
Swiss chard ^b	captan D,S thiram D,S	Seed rot, damping-off, leaf spot.
Tomato	hot water soak, followed by captan S, thiram D,S, or mancozeb S trisodium phosphate soak, followed by captan S, thiram D,S, or mancozeb S trisodium phosphate and bleach soak, followed by captan S, thiram D,S, or mancozeb S	Soak controls seedborne bacterial spot, anthracnose, and Phoma rot. Fungicides control seed rots and damping-off. Soak controls seedborne tobacco mosaic virus. Fungicides control seed rots and damping-off. Soaks control seedborne tobacco mosaic virus, anthracnose, and bacterial spot. Fungicides control seed rots and damping-off.
Vine crops (cantaloupe, cucumber, pumpkin, squash, watermelon)	captan D,S,PB thiram D,S	Seed rot, damping-off, seedborne <i>Fusarium</i> , foot rot of squash, black rot.

Table 2. Seed Treatment, Materials, and Disease Control for Vegetable Crops (Cont)

Crop	Chemical & method ^a	Disease controlled, remarks
(Other melons)	Seed rot, damping-off.	captan D,S

^aD = Dust; S = Slurry; PB = Planter Box; M = Machine.

^bObtain certified disease-free seed or seed grown in the semi-arid areas of the western United States.

^cField, kidney, snap, and lima beans.

^dSweet corn only

Captan is sold as Gustafson Captan 30DD, 300, 400, 400-D, and Captan 75 Seed Protectant.

Carboxin is sold as Vitavax and Vitavax 34 and in combination with PCNB as Vitavax-PCNB.

Chloroneb is sold as Chloroneb 65W.

Etridiazol is sold as Terrazole 35%. It is sold in combination with PCNB as Gustafson Terracoat L-205N, Terraclor Super-X 20-5 Dust, and Terracoat 5D 205 Seed Dust Fungicide.

Maneb is sold as Maneb 80.

Metalaxyl is sold as Apron Dry, Apron FL, and Apron 25W. It is also sold in combination with PCNB as Apron-terrachlore.

Thiabendazole is sold as Mertect 340F.

Mancozeb is sold as Manzate 200, Dithane M-45, and Penncozeb.

PCNB is sold as Terraclor 10G and 75% WP Dust.

Streptomycin is sold as Agri-strep, Agrimycin 17, and Streptomycin 17.

Thiram is sold as Chipco Thiram 75, Gustafson Thiram-30 Fungicide, 50WP, and 42-S.

Thiophanate methyl plus fir bark is sold as TOPS 2.5D.