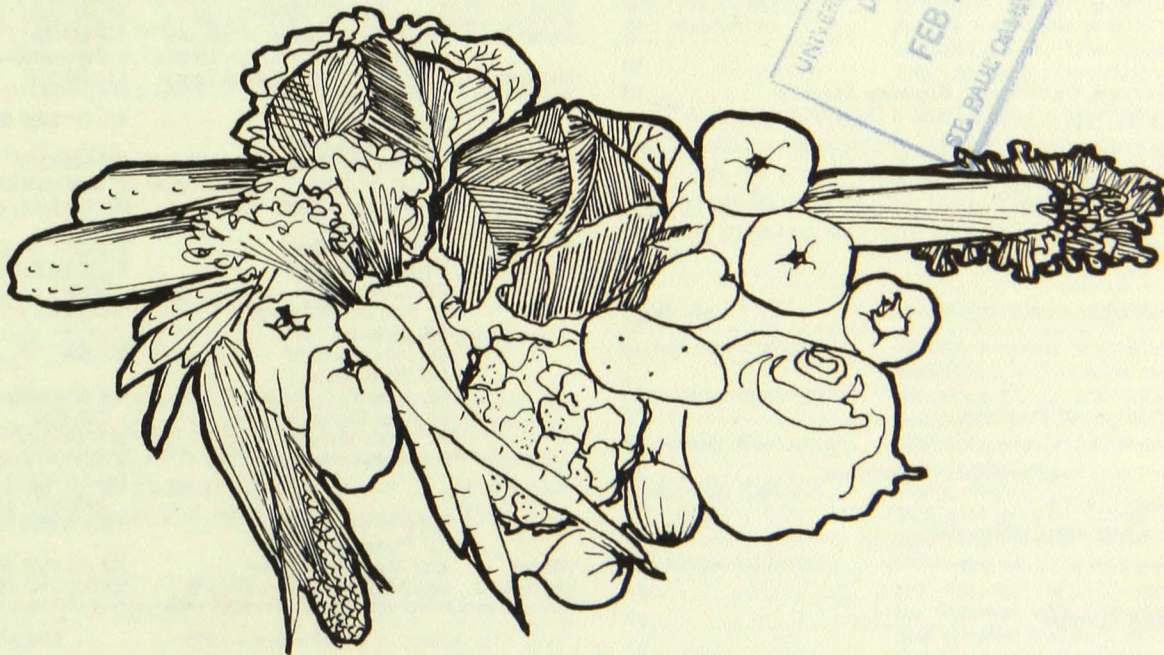


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1980
WEED, INSECT, AND DISEASE CONTROL
GUIDE FOR COMMERCIAL VEGETABLE GROWERS



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Contents

Minnesota Poison Information Centers	2
Rates of Application for Insecticides and Fungicides	4
Precautions	4
Chemical Residues	4
Farm Sprayer Calibration and Adjustment	4
Calibration of a Granular Applicator	5
Weights and Measures	5
Calibration of Aircraft Spray Equipment	6
Seedbed Fumigation for Plant Disease and Weed Control	6
Formaldehyde Seedbed Treatment	6
Seed Treatment	6
Postharvest Dip or Spray	6
Herbicide Mixtures	6
Characteristics of Nematicides	6
1980 Herbicide, Insecticide, and Fungicide Recommendations for Vegetable Crops	
Asparagus	7
Beans	8
Beets	10
Cabbage, Broccoli, Cauliflower, Brussels Sprouts	10
Carrots	12
Corn, Sweet	13
Cucumbers, Melons, Pumpkins, Squash	15
Eggplant	17
Lettuce	18
Onions	18
Parsnips	19
Peas	20
Peppers	21
Potatoes	22
Sprout Inhibition of Potatoes	22
Potato Vine Killers	22
Sprays for Color Improvement of Potatoes	22
Potato Insect Control	22
Nematodes and Verticillium Wilt	23
Radishes	26
Rhubarb	27
Rutabagas and Turnips	27
Spinach	27
Tomatoes	28

Minnesota Poison Information Centers

These centers have been established by the Minnesota Department of Health to provide physicians with information about pesticides and common household poisons, their antidotes, and treatments. Most of these centers operate on a 24-hour basis.

City	Poison Information Centers	Telephone
Bemidji	Bemidji Hospital	218-751-5430 (Ext. 32)
Brainerd	St. Joseph's Hospital	218-829-2861 (Ext. 100)
Crookston	Riverview Hospital	218-281-4682 (Ext. 450, 451, 452)
Duluth	St. Luke's Hospital 915 East 1st St.	218-727-6636 (Ext. 616, 617)
	St. Mary's Hospital 407 E. 3rd Street	218-727-4551 (Ext. 359) Night Ext. 291
Fergus Falls	Lake Region Hospital	218-736-5475 (Ext. 360, 3 p.m.-7 a.m. and week-ends; Ext. 361 7 a.m.-3 p.m.)
Mankato	Immanuel—St. Joseph's Hospital	507-625-4031
Marshall	Lewis Weiner Memorial Hospital	507-532-9661 Station 125
Minneapolis	Hennepin County Medical Center 619 South 5th Street	612-347-3141
Fridley	Unity Hospital 550 Osborne Road	612-786-2200 (Ext. 6890)
Morris	Stevens County Memorial Hospital	612-589-1313 Station 1
Rochester	Southeastern Minn. Poison Control Center	507-285-5123
St. Cloud	St. Cloud Hospital	612-251-2700 (Ext. 221)
St. Paul	Bethesda Hospital 559 Capitol Blvd.	612-221-2301, 2302, 2303
	St. Paul Ramsey Hospital 640 Jackson	612-221-2113
	St. John's Hospital 403 Maria Avenue	612-228-3132
	St. Joseph's Hospital 69 West Exchange	612-291-3348 or 291-3139
	St. Luke's Hospital 300 Pleasant Avenue	612-298-8201 after 11 p.m. 612-298-8541 before 11 p.m.
	Children's Hospital 311 Pleasant Avenue	612-298-8666 (Ext. 8402)
Willmar	Rice Memorial Hospital	612-235-4543 (Ext. 291)
Worthington	Worthington Regional Hospital	507-372-2941 (Ext. 156)

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WEED, INSECT, AND DISEASE CONTROL GUIDE FOR COMMERCIAL VEGETABLE GROWERS

Suggestions in this guide are based on current state and federal registrations and tolerances set by the Environmental Protection Agency (EPA). Directions given in this guide and on current container labels should be read, understood, and followed carefully in order to control pests and diseases effectively without causing excessive residues to remain on the crops. The following information is up to date at the time of this printing. Information regarding any changes during the 1980 season will be made available to all commercial growers.

This publication is for your information. The University of Minnesota and its officers or employees make no claims or representations that the chemicals discussed will or will not result in residues on agricultural commodities and assume no responsibility for results of their use.

State and Federal laws require that only certified applicators may use or supervise the application of certain pesticides with restricted uses. Information about certification is available from your county extension director.

At the present time the following compounds have some restricted uses:

- | | |
|----------------------------|----------------------|
| aldicarb (Temik) | methyl bromide |
| azinphos-methyl (Guthion) | methyl parathion |
| demeton (Systox) | mevinphos (Phosdrin) |
| endrin | paraquat |
| ethyl parathion | picloran (Tordan) |
| methomyl (Lannate, Nudrin) | TEPP |

In addition, Lindane is a restricted use pesticide in Minnesota.

The following pesticides have been **proposed** for restricted use classification by EPA. After a period of time for receiving comments, EPA will issue a final order regarding the classification of these pesticides. Some of these products could have restricted use labeling during 1980.

Pesticide	Restricted uses or formulations
aldicarb (Temik)	Agricultural uses of granules 10% and greater (other uses previously restricted).
carbofuran (Furadan)	Granules 2% and greater (except on pine and cottonwood plantation and nursery plantings).
carbon disulfide	Grain fumigation; burrow treatments for woodchuck, ground squirrel, prairie dog, and rats.
chloropicrin	Formulations greater than 2%; all formulations for rodent control
cyclohexamide (Actidione)	Formulations greater than 4%
disulfoton (Disyston)	Granules 10% and greater; granules 2% and greater <i>except</i> seed beds and transplant beds; granules 5% and greater in combination with ethoprop 10% and greater
dicrotophos (Bidrin)	Liquid formulations 8% and greater
ethoprop (Mocap)	Granules and fertilizer formulations 3% and greater

EPN	Formulations greater than 4%; granules 2% and greater
fenamiphos (Nemacur)	Granules 10% and greater
fensulfothion (Dasanit)	Granules and fertilizer combinations 2% and greater
fenthion (Baytex)	All formulations for aquatic, ornamentals, and bird control uses; all liquids 70% and greater
fonofos (Dyfonate)	Granules 5% and greater
methamidophos (Monitor)	Liquids 40% and greater; dusts 2.5% and greater
methidathion (Supracide)	All formulations except on nursery stocks, safflower, and sunflower
nicotine alkaloid	Formulations 14% and greater in greenhouses; all formulations on cranberries
oxamyl (Vydate)	Liquids 24% and greater
phorate (Thimet)	Granules 5% and greater
temephos (Abate)	Aquatic uses; liquid formulations in orchards
terbufos (Counter)	Granules 15% and greater
zinc phosphide	All dry formulations 60% and greater; all baits; all dry formulations 10% and greater for domestic uses

EPA has announced a **final order** classifying the following pesticides for restricted use. Restricted use labeling **may** show up on some of these products from now on, but registrants have a waiting period for getting restricted use labeling in place, so many may not be labeled until spring, 1980.

Pesticide	Restricted uses and formulations
carbofuran (Furadan)	All concentrates, suspensions, and wettable powders 40% and greater
chlorfenvinphos (4072)	All concentrates, solutions, or emulsions 21% and greater
clonitralid (Bayluscide)	Wettable powders 70% and greater; all molluscicide uses
dioxathion (Delnav)	Concentrates, solutions, or emulsions 30% and greater; domestic uses of solutions 3% and greater
disulfoton (DiSyston)	Concentrates 65% and greater; emulsion concentrates 21% and greater in combination with fensulfothion 43% and greater; e.c. 32% and greater in combination with 32% fensulfothion and greater; solutions 95% and greater for seed treatment; granules 10% and greater indoors (greenhouse)
ethoprop (Mocap)	Emulsion concentrates 40% and greater
fenamiphos (Nemacur)	Emulsion concentrates 35% and greater
fensulfothion (Dasanit)	Emulsion concentrates and solutions 63% and greater; e.c. 43% and greater in combination with disulfoton 21% and greater; e.c. 32% and greater in combination with disulfoton 32% or greater
fonofos (Dyfonate)	E.C. 44% and greater
monocrotophos (Azodrin)	Liquids 19% and greater
phorate (Thimet)	Liquids 65% and greater; granules on rice
phosacetin (Gophacide)	0.1% bait and greater
phosphamidon (Dimecron)	Liquids 75% and greater; dusts 1.5% and greater

Rates of Application for Insecticides and Fungicides

Sometimes small amounts of insecticides or fungicides are listed in terms of tablespoons and teaspoons. These always mean level measures—not rounded or heaping.

Recommendations may be given in terms of pounds or gallons of commercial preparation or as pounds of active ingredient per acre. "Pounds active ingredient" means the equivalent of 100-percent chemical. For example: 2 pounds of 50-percent methoxychlor wettable powder contains 1 pound of actual methoxychlor; 4 pounds of a 25-percent wettable powder contains 1 pound of active ingredient, and 20 pounds of a 5-percent dust contains 1 pound of active ingredient.

If you are preparing sprays that contain emulsifiable concentrates, read the label to determine how many pounds of active ingredient are in each gallon of concentrate. For example, 25-percent methoxychlor emulsifiable concentrate contains 2 pounds of active ingredient per gallon. If you wish to apply 1 pound of actual methoxychlor per acre, decide on the amount of liquid you want to apply per acre and add ½ gallon of 25-percent methoxychlor concentrate to the amount of water needed for 1 acre.

Most insecticides and fungicides can be mixed. Read the label instructions for specific combinations.

Precautions

All chemicals are potentially hazardous and should be used carefully. Follow exactly the directions, precautions, and limitations given on the labels of chemical containers and in this publication. Store all chemicals in a safe place where children, pets, and livestock cannot reach them. Do not reuse empty pesticide containers. Avoid inhaling fumes and dust from pesticides or spilling them. If chemicals are accidentally spilled, remove contaminated clothing and thoroughly wash the skin with soap and water immediately. Always wash thoroughly and change clothing after completing a spraying or dusting job.

Some of the pesticides, such as aldicarb, carbofuran, demeton (Systox), disulfoton (Di-Syston), parathion, mevinphos (Phosdrin), phosphamidon, and phorate (Thimet) are highly toxic and must be handled with special care. Observe the following rules:

1. Avoid drift from the application to adjacent areas occupied by humans or livestock or to bodies of water.
2. Wear goggles, an approved respirator, and neoprene gloves when loading or mixing pesticides. Aerial operators should have a ground crew to do loading.
3. Pour chemicals at a level well below the face in order to avoid splashing or spilling onto the face or into the eyes.
4. Have plenty of soap and water on hand to wash contaminated skin in the event of spilling.
5. Change clothing and bathe after the job is completed.
6. Know the insecticide, the symptoms of overexposure to it, and a physician who can be called quickly. In

case symptoms appear (contracted pupils, blurred vision, nausea, severe headache, dizziness), stop operations at once and contact a physician.

7. Aerial applicators and handlers should know the dangers of handling and applying parathion and other phosphates and carbamates, especially the danger of skin and respiratory absorption.

Some pesticides, such as carbaryl (Sevin), parathion, methyl parathion, and ULV malathion are highly toxic to bees. They should not be applied to crops in bloom nor on or near bee yard locations. The dust formulations should not be applied to sweet corn which is pollinating. Spray pollinating corn in late evening when bees are not in the field. Advise beekeepers in your area about your spray schedule. Do not use carbaryl or PennCap M on sweet corn if bees are gathering pollen from the field.

Chemical Residues

Safe levels, or tolerances, for residues of chemicals in or on agricultural commodities have been set by the Environmental Protection Agency. Crops containing residues in excess of the tolerance are subject to seizure.

Recommendations and label directions usually specify rates, methods, and times of application that will cause no residues or residues within the established tolerances. Therefore, the limitations such as rates of applications, number of applications, and minimum time intervals between treatment and harvest must be followed very closely. Do not use a higher rate or dosage than that given in the recommendations or on the labels, do not apply a chemical closer to harvest than the recommended time intervals, and do not use a chemical on a crop not listed on the label or included in this publication.

Keep a record of all chemical applications.

Recommendations for use of chemicals given herein are for field use only, except where otherwise specified.

Farm Sprayer Calibration and Adjustment

Uniform application of spray chemicals is essential for effective control. A small variation in the rate of application may result in poor kill of the weeds or injury to the crop, thereby causing a loss of time, effort, and money.

Rates in this bulletin are in terms of active ingredient or acid equivalent per acre treated. Rate per acre in the treated area should be the same for broadcast as for band applications. But proportionately less material is used per crop acre with band than broadcast applications. For example, a 3 pound per acre rate requires 3 pounds of material per crop acre with broadcasting, but only half as much per crop acre (1½ pounds) if a 15-inch band is treated on rows spaced 30 inches apart.

To determine how much liquid a sprayer applies per acre:

1. Check the output of all nozzles for a set time to make sure that all nozzles discharge at the same rate.

2. Start with a full tank of clean water and have the pressure adjusted as you will use it in the field (usually 20 to 40 pounds).
3. Drive exactly $\frac{1}{8}$ mile (40 rods) (660 feet) in a field at the speed you will use when spraying—usually 4 to 5 miles per hour. Mark the throttle setting or speed indicator reading and maintain the same speed when spraying.
4. Refill the tank, carefully measuring the amount of liquid required. (If water spillage from a full tank is a problem, you can use a calibrated stick to measure amount of liquid used.)

To calculate broadcast application rate:

$$\frac{\text{Number of gallons used} \times 66}{\text{Boom width in feet}} = \text{gallons per acre.}$$

Example: If $2\frac{1}{2}$ gallons were used in $\frac{1}{8}$ mile and the width covered by the boom is 24 feet, multiply $2\frac{1}{2}$ by 66 and divide by 24. The result is 6.9 gallons per acre.

Calculate the band application rate (volume per acre applied to the area within the band that is sprayed) as follows.

$$\frac{\text{Number of gallons used} \times 66}{\text{Boom width in feet} \times \text{Number of bands}} = \text{gallons per acre}$$

Example: If $1\frac{1}{2}$ gallons were used in $\frac{1}{8}$ mile and the sprayer applied four bands 15 inches ($\frac{1}{4}$ feet) in width, multiply $1\frac{1}{2}$ by 66 and divide by $\frac{1}{4}$ by 4. The result is 19.8 gallons per acre. This is the volume per acre applied to the area within the band that is sprayed.

To determine the amount of formulation to use per acre sprayed:

1. Determine the number of pounds of acid equivalent or active ingredient suggested per acre for your situation. Use acid equivalent if it appears on the label. Otherwise, use active ingredient.
2. For dry materials, divide the number of pounds of active ingredient or acid equivalent desired by the percent of active ingredient or acid equivalent in the commercial product to determine the number of pounds of material to apply per acre.

Example: If 3 pounds of active ingredient are required and the commercial product is an 80-percent active ingredient powder, divide 3 by .8 (3.75 pounds of commercial powder per acre).

For liquids, determine the volume of commercial product to apply per acre to get the proper amount of acid equivalent or active ingredient per acre.

Example: If $\frac{1}{2}$ pound of acid equivalent is required per acre, and the commercial product contains 4 pounds acid equivalent per gallon, then 1 quart contains 1 pound acid equivalent; 1 pint contains $\frac{1}{2}$ pound acid equivalent.

To determine the amount of pesticide to put in the tank:

1. Divide the number of gallons the tank will hold by the number of gallons your sprayer applies per acre. This will give you the number of acres one filling will spray.

2. Multiply the number of acres the tank will spray by the amount of formulation to be used per acre. This will give the amount of formulation to be used per tank.

Calibration of a Granular Applicator

1. Determine the number of pounds of active ingredient or acid equivalent suggested per acre for your situation.
2. Divide the number of pounds of active ingredient or acid equivalent desired by the percentage of active ingredient or acid equivalent in the commercial material to determine the number of pounds of the material to apply per acre. Some labels show rate in terms of amount of product per 1,000 feet of row or other unit area.
3. Consult the manufacturer's recommendation for an approximate setting. Adjust the setting on each hopper.
4. Select an area for a test run, preferably in the field to be treated, so that speed and traction conditions are constant. Measure off a distance of 660 feet (40 rods).
5. Fill hoppers and attach a suitable container (sack, pail, etc.) to each hopper spout to catch granules from each hopper.
6. Put machine in gear and drive the measured distance at the same speed that will be used when applying the chemical.
7. Weigh the material collected from each hopper. Multiply this weight in pounds by 66 and divide by the band width (in feet). This will give the pounds of granular material applied per acre on the area treated. In equation form:

$$\frac{\text{Weight of granules in pounds} \times 66}{\text{Band width in feet}} = \text{Pounds of granules applied per acre}$$

8. Readjust machine, output and repeat the calibration process until the desired amount is obtained from each hopper.

WEIGHTS AND MEASURES

- 1 pound**=16 ounces; 454 grams.
- 1 gallon**=4 quarts; 8 pints; 128 fluid ounces; 256 level tablespoonsful; 3,785 cubic centimeters (milliliters).
- 1 tablespoon**=3 teaspoonsful; one-half fluid ounce; 14.8 milliliters.
- 1 acre**=43,560 square feet; 160 square rods; an area 208.7 feet square; an area $16\frac{1}{2}$ feet wide and one-half mile long; 0.4 hectare.
- 1 mile**=5,280 feet; 1,760 yards; 320 rods; 1.61 kilometers.
- 1 rod**= $5\frac{1}{2}$ yards; $16\frac{1}{2}$ feet.
- 1 hectare**=2.47 acre.

Calibration of Aircraft Spray Equipment

$$\text{Acres covered} = \frac{\text{Length of swath in miles} \times \text{width in feet}}{8.25}$$

$$\text{Acres per minute} = \frac{2 \times \text{swath width} \times \text{mph}}{1,000}$$

$$\text{Gallons per minute} = \frac{2 \times \text{swath width} \times \text{mph} \times \text{gallons per acre}}{1,000}$$

Delivery rating of the nozzle system should be checked in the manufacturer's spray nozzle manual. Keep in mind orifice and core size, pressure, and spraying speed.

Seedbed Fumigation for Plant Disease and Weed Control

Annual weed seeds and plant disease organisms have been successfully controlled prior to seeding by steam sterilization or fumigation with methyl bromide, SMDC (Vapam), DMTT (mylone), or chloropicrin. The period after treatment before crops can be safely planted will vary depending on moisture and temperature conditions. Fall treatment is often preferable, especially for early spring seeding.

Manufacturer's directions must be followed closely for safety and satisfactory results when using these fumigants. Soil must be worked up before treating. Crop residues must be well-rotted or removed. Soils must be moist and in a good state of tilth at time of treating for best results. Do not disturb the soil below the depth of treatment after treating or the beneficial results likely will be lost.

See table 1 for specific chemicals and approved uses for soil fumigation.

FORMALDEHYDE SEEDBED TREATMENT

Formaldehyde is a good general purpose soil fumigant. A tight cover of some kind is necessary to confine the gas for 3 or 4 days following treatment. Crop residue must be removed and the soil loosened to plow depth. Mix 1 gallon of 37-percent commercial formalin (formaldehyde) with 50 gallons of water. Apply to soil at a rate of 1 gallon of the mixture per square foot of area. Apply slowly and evenly to the area.

At least 2 weeks of drying weather are required following treatment before plants can be safely planted. Aeration

of the soil by tillage may be necessary to clear the chemical from the soil. Early fall treatment is preferable in most cases and is necessary for early planting in the spring. Therefore, it is necessary to plan ahead to have the area open by late summer for the treatment.

During the growing season, green plants exposed to these fumes may be subject to injury.

SEED TREATMENT

A seed-soak treatment with Thiram is suggested for vegetable and flower seeds where the standard seed treatments have not proven effective. It is especially effective for tomatoes and most of the vine crops. Soak the seed in a .2 percent solution of Thiram (4 ounces of Thiram 75% in 10 gallons of water) for 24 hours at 86° F. Drain and air dry the seed at 77° F.

Postharvest Dip or Spray

A postharvest dip or spray may be used on green or bulb onions, muskmelons, cucumbers, and potatoes being prepared for market. The maximum permissible dosage is a dip in a 0.12-percent suspension of captan fungicide for onions and potatoes and a 0.25-percent suspension for cucumbers and muskmelon. This dosage figures out to 2 pounds and 4 pounds, respectively, of Captan 50-percent wettable powder per 100 gallons of water. Special formulations of captan are also available for this purpose. This treatment has been found to reduce certain types of rotting.

Herbicide Mixtures

Some herbicide mixtures are in use and several new herbicide mixtures show promise for overcoming limitations of single chemicals. Certain mixtures may (1) control more kinds of weeds, (2) give more consistent performance with different soils and weather conditions, (3) lessen soil residue problems, (4) increase persistence enough to give full-season weed control, or (5) reduce crop injury.

Only those mixtures that have been field tested under local conditions and registered for use by the U.S. Environmental Protection Agency should be used. Use of unregistered mixtures may result in poor weed control, crop injury, or accumulation of illegal chemical residues in the crop. Growers are responsible for residues resulting from use of unregistered mixtures.

Table 1. Characteristics of nematocides

Trade name	Active ingredients	Hazards to mammals†		Effective against		
		Oral	Dermal	Nematodes	Soil fungi	Weed seeds
Brozone Brom-O-Sol	methyl bromide (68.6%) chloropicrin (1.4%)	serious inhalation hazard		*	*	*
Chloropicrin Picfume Larvicide Chlor-O-Pic	trichloronitromethane (99%)	serious inhalation hazard		*	*	*

†Most fumigants are vesicants which cause severe burns when in contact with skin or mucous membranes. Avoid direct contact and INHALATION of these materials.

Table 1. Characteristics of nematicides (continued)

Trade name	Active ingredients	Hazards to mammals†		Effective against		
		Oral	Dermal	Nematodes	Soil fungi	Weed seeds
D-D Mixtures D-D Vidden D	1,3-dichloropropene-1,2-dichloropropane and related chlorinated hydrocarbons	moderate	low	★		
Dorlone	ethylene dibromide (18.9%) 1,3-dichloropropenes and related C ₃ hydrocarbons (79.9%)	moderate	moderate	★		
DowFume MC-2 Brom-O-Gas	methyl bromide (98%) and chloropicrin (2%)	serious inhalation hazard		★	★	★
DowFume MC-33 Terr-O-Gas	methyl bromide (67%) and chloropicrin (33%)	serious inhalation hazard		★	★	★
Ethylene Dibromide DowFume W-85 Soilbrom-85	1,2-dibromoethane	moderate	moderate	★		
Ethoprop (Mocap)	O-ethyl, S,S-dipropyl phosphorodithioate	high	high	★		
Telone	1,3-dichloropropene and related chlorinated hydrocarbons (100%)	moderate	moderate	★		
Vapam VPM	sodium methyl dithiocarbamate (32.7%)	low	moderate	★	★	★
Terr-O-Cide 15	1,2-dibromoethane (40%) and chloropicrin (15%) —or—	moderate	moderate	★	★	
Terr-O-Cide 30	1,2-dibromoethane (36%) and chloropicrin (30%)					
Terr-O-Cide 15-D	1,3-dichloropropene-1,2 dichloropropane and other halogenated C ₃ compounds (85%) and chloropicrin (15%) —or—	moderate	low	★		
Terr-O-Cide 30-D	1,3-dichloropropene-1,2 dichloropropane and other halogenated C ₃ compounds (70%) and chloropicrin (30%)					

†Most fumigants are vesicants which cause severe burns when in contact with skin or mucous membranes. Avoid direct contact and INHALATION of these materials.

Table 2. 1980 herbicide, insecticide, and fungicide suggestions for vegetable crops

ASPARAGUS

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
SEEDBEDS			
Annual weeds	chloramben (Amiben)	3	Apply immediately after seeding. Needs good soil moisture for activity.
	stoddard solvent (Several trade names)	40 gal/A	Apply before asparagus emerges and after weeds emerge.
	paraquat (Paraquat CL)	1	Apply before asparagus emerges and after weeds emerge.
ESTABLISHED BEDS			
Annual weeds	diuron (Karmex)	2 to 3	Apply after discing or chopping fern in the spring before weeds emerge. May be reapplied after harvest season if needed. Do not exceed a total of 4.8/lbs/acre/year.
	simazine (Princep)	2 to 4	Same as above except do not exceed 4 lb./acre/year.
	metribuzin (Sencor, Lexone)	1 to 2	Apply in the spring before asparagus emerges, no later than 14 days prior to harvest.
	2,4-D alkanolamine Salts (Formula 40)	1½ to 2	Apply before, during, or after harvest to actively growing weeds. Postharvest sprays should be made using drop nozzles to avoid contact with the fern.

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetttable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

ASPARAGUS (continued)

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
Quackgrass	dalapon (Dowpon, Basfapon)	7½	Apply before harvest and again 3 to 4 weeks if needed. Treat when quackgrass is 4 to 6 inches high. Do not spray the fern. Apply up to 1 week prior to spear emergence or after last harvest. Do not contact fern growth. Quackgrass should be at least 8-inches tall when treated
	glyphosate (Roundup)	1½	
Canada thistle, field bindweed, hemp dogbane, milkweed, swamp smartweed	glyphosate	1½ to 3¾	Apply up to 1 week prior to spear emergence or after last harvest. Do not contact fern growth.
Insects	Chemical†		Remarks and limitations
Asparagus beetles	carbaryl (Sevin) 1 lb. (1¼ lb. 80% WP) malathion 1¼ lb. (2 pt. 5 lb. EC) methoxychlor 1 lb. (2 lb. 50% WP)		1 day. Do not repeat within 3 days. 1 day. 3 days (unless washed and/or blanched).
Cutworms	carbaryl (Sevin) 2 lb. as bait		1 day. Do not repeat within 3 days.
Diseases	Chemical†		Remarks and limitations
Rust	Resistant varieties		Grow resistant varieties such as Mary and Martha Washington, Faribo Hybrid, and Waltham Washington. Destroy volunteer asparagus plants in vicinity. Do not allow fern growth in field until after harvest.
	Spray in field, use label directions: maneb zinc ion plus maneb 1 to 1½ lb. WP zineb 1 to 1½ lb. WP Polyram 1 to 1½ lb. WP		Only on fern growth after spears are harvested. Apply every 7 to 10 days to fern growth only.

BEANS

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
SNAPBEANS			
Annual grasses	EPTC (Eptam)	3	Apply before planting and immediately incorporate. Also may be applied via center pivot irrigation in ½ to ¾ inches of water. Apply before planting and incorporate. Use lower rate on sandy soils.
	trifluralin (Treflan)	½ to ¾	
	profluralin (Tolban)	½ to 1	
Annual broadleaves	dinoseb amine (Premerge, Sinox PE)	3 to 6	Apply before crop emergence or at the crook stage. Use lower rate at crook stage.
	bentazon (Basagran)	¾ to 1	
Quackgrass	glyphosate (Roundup)	1½	Apply to 8-inch tall quackgrass in the fall or spring prior to planting. Allow 3 days after treatment before tillage.
Canada thistle, field bindweed	glyphosate	1½ to 3¾	Apply before planting when Canada thistle is at or beyond bud stage and field bindweed is at or beyond full bloom. Allow 7 days after treatment before tillage.
LIMA BEANS			
Annual grasses	trifluralin	½ to ¾	See snapbeans. See snapbeans. Apply before planting and incorporate. Use higher rate for nightshade control.
	profluralin	½ to 1	
	alachlor (Lasso)	2½ to 3	
Annual broadleaves	chloramben (Amiben)	2 to 4	Apply immediately after seeding.
	bentazon	¾ to 1	Apply early postemergence when the beans have one fully expanded trifoliate leaf and the weeds are small, actively growing.

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

BEANS (continued)

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
Annual weeds	alachlor+ trifluralin chloramben+ trifluralin	2½ to 3+ ½ 2 to 4+ ½	Apply before planting and incorporate. Use higher rate of alachlor for nightshade control. Apply trifluralin before planting and incorporate. Apply chloramben immediately after planting.
Quackgrass	glyphosate	1½	See snapbeans.
Canada thistle, field bindweed	glyphosate	1½ to 3¾	See snapbeans.
Yellow nutsedge, Canada thistle	bentazon	¾ + ¾	Use split application. Apply when the beans have one fully expanded trifoliate leaf. The weeds should be 6 to 8 inches tall. Make second application 10 days later.
Insects	Chemical†		Remarks and limitations
Aphids	diazinon ½ lb. (1 lb. 50% WP) dimethoate (Cygon, De-Fend, Dimex, Rebelate) ½ lb. (1½ pt. 2.67 lb. EC; ½ to 1 pt. 4 lb. EC) endosulfan (Thiodan) ¾ lb. (1½ qt. 2 lb. EC) malathion 1 lb. (1½ pt. 5 lb. EC)		7 days for beans; 4 days for hay; 1 day for forage. NTL. Do not feed treated forage to livestock. Do not exceed three applications. Do not treat lima beans. Do not feed forage. May be combined with pyrethrin 3 days. 1 day.
Bean leaf beetle	carbaryl (Sevin) 1 lb. (1¼ lb. 80% WP) ethion ¼-½ lb. (1-2 lbs. 25% WP or ½ to 1 pt. 4 lb EC) methoxychlor 1 lb. (2 lb. 50% WP, 2 qt. 2 lb. EC)		NTL. 2 days. Do not feed treated vines to livestock. 3 days.
Green cloverworm	carbaryl (Sevin) 1 lb. (1¼ lb. 80% WP) dimethoate (Cygon, De-Fend, Dimex, Rebelate) ½ lb. (1½ pt. 2.67 lb. EC; ½ to 1 pt. 4 lb. EC) malathion 1 lb. (1½ pt. 5 lb. EC) acephate (Orthene) ½ lb. (¾ to 1¼ lb. 75 S)		NTL. NTL. Do not feed treated forage to livestock. 1 day. 14 days dry, snap: NTL Limas.
Leafhoppers	carbaryl (Sevin) 1 lb. (1¼ lb. 80% WP) diazinon ½ lb. (1 lb. 50% WP) dimethoate (Cygon, DeFend, Dimex, Rebelate) ¼ lb. (¾ pt. 2.67 lb. EC, ½ to 1 pt. 4 lb. EC) endosulfan (Thiodan) ¾ lb. (1½ qt. 2 lb. EC) ethion ½ lb. (2 lbs. 25% WP or 1 pt. 4 lb. EC) malathion 1 lb. (1½ pt. 5 lb. EC) methomyl (Lannate) ¼ to 1 lb./A (¼-½ soluble powder, ½ pt. "L") methoxychlor 1 lb. (2 lb. 50% WP) oxydemeton methyl ½ lb. (Meta-Systox-R) (2 pts.)		NTL. 7 days. Do not feed treated vines. See remarks and limitations under aphids. 2 days. Do not feed forage. 1 day. 1 day (succulent beans only). 3 days. 21 days.
Spider mites	dicofol (Kelthane) ½ lb. (1½ lb. 35% WP) ethion ¾ lb. (20 lb. 4% D) oxydemeton methyl ½ lb. (Meta-Systox-R) (2 pts.)		7 days. Do not feed treated vines. 2 days. Do not feed treated foliage to livestock. 21 days.
Seed corn maggot	diazinon, heptachlor, or lindane, 1 oz. per bu. chlorpyrifos (Lorsban 25 SL, 4 oz. per 100 lb. seed)		Seed treatment only. Lorsban for Limas and snapbeans only.
Wireworms, white grubs	diazinon 3½ lb. (25 lb. 14% G)		Broadcast soil treatment before planting. Disc in thoroughly.

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

BEANS (continued)

Diseases	Chemical†	Remarks and limitations
Seed rot, damping off	Captan 2.5 oz. 75 WP/100 lb. seed Chloranil 4 oz./100 lb. seed Dexon 0.7 oz./100 lb. seed Thiram 1.5 oz. 75 WP/100 lb. seed	Do not use treated seed for food or feed. Dexon or captan overdose may cause injury to seedlings.
Common and Halo blight	Kocide 2 lb. Sprays for bacterial blight control Streptomycin formulations	Use western grown seed, practice a 3- to 5-year crop rotation, plow down crop refuse in the fall. If symptoms appear, begin a spray program early. Applications should be made at 7- to 10-day intervals. Not over 400 ppm concentration. Apply only on seed crop or before pods appear on table beans. Do not feed treated vines to livestock.
White mold	Benomyl 1 lb. 50 WP Botran 3 lb. 75 WP	Do not plant on bean, potato, tomato, lettuce, sunflower, or crucifer ground. Where you have had the problem before, spray with Benomyl at green bud stage and again in 5 to 7 days. Harvest limitations: Benomyl, 14 days for snap and dry beans; 28 days for Lima. Botran, 2 days for snap.
Anthracnose	Zineb Ziram 2 lb./100 gal. water and spread sticker Ferbam 3 lb./100 gal. water Tri Basic Copper Sulfate 1½ to 2 lb. WP Kocide-101 ¾ to 1 lb. WP	Protective sprays should be started early before symptoms appear and applied at 10-day intervals. Do not apply Ferbam within 4 days of harvest. Not over 4 lb. metallic copper equivalent per acre per application. NTL.
Rust	Maneb (1½ to 2 lb.) Zineb (1½ to 2 lb.)	Use a crop rotation system so that beans do not occur more than once every 3 years. Bury all bean crop debris before planting new crop. NTL on maneb usage when sprayed on dry beans. 4 days on snap beans.
Rust (snap beans)	Bravo 500 4½ pts.	Begin applications during early bloom stage or when disease first threatens and repeat at weekly intervals or as necessary to maintain control. Do not apply within 7 days of harvest.
Mosaics	See aphid control	Use certified or disease free seed.

BEETS

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
Annual weeds	pyrazon (Pyramin)	4	Apply after seeding before weeds have two leaves.
	cycloate (Ro-neet)	3 to 4	Apply before planting and incorporate immediately. Do not use muck or peat soils.
Insects	Chemical†		Remarks and limitations
Leaf miner	malathion 20 oz. (2 pt. 5 lb. EC)		7 days.
Cutworms	carbaryl (Sevin) 1 to 2 lb. (20 to 40 lb. 5% bait)		3 days (14 days for tops).
Diseases	Chemical†		Remarks and limitations
Seed rot, damping off	Captan 9 oz. 75 WP/100 lb. seed Dexon 4 oz. 75% WP/100 lb. (dust) seed Thiram 96 gm./10 gal. water		Do not use treated seed for food or feed.
Cercospora leaf spot	See section on carrots.		NTL unless tops are to be eaten; then stop spray 7 days before harvest.

CABBAGE, BROCCOLI, CAULIFLOWER, BRUSSELS SPROUTS

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
DIRECT SEEDED			
Annual grasses	trifluralin (Treflan)	½ to ¾	Apply before seeding and incorporate. Use lower rate on sandy soils. Not effective on ragweed and mustards.

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

CABBAGE, BROCCOLI, CAULIFLOWER, BRUSSELS SPROUTS (continued)

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
Annual broadleaves	nitrofen (TOK)	4 to 6 2 to 3	Apply immediately after seeding. Apply after crop has at least 3 true leaves, weeds are up to 1-inch tall. Use only the wettable powder formulation. Not effective on ragweed and mustards.
TRANSPLANTS			
Annual grasses	trifluralin	½ to ¾	Apply before transplanting and incorporate. Use lower rate on sandy soils.
	DCPA (Dacthal)	8	Apply after transplanting, before weeds emerge.
Annual broadleaves	nitrofen	2 to 3	Apply 1 to 2 weeks after transplanting to weeds up to 1-inch tall. Use only wettable powder formulation.
Insects	Chemical†		Remarks and limitations
Aphids	demeton (Systox) ½ lb. (2 pt. 2 lb. EC)		21 days.
	diazinon ½ lb. (1 lb. 50% WP)		7 days for cabbage and Brussels sprouts; 5 days for broccoli and cauliflower.
	dimethoate (Cygon, DeFend, Dimex, Rebelate) ¼ to ½ lb. (½ to 1 pt. 4 lb. EC)		3 days for cabbage, 7 days for broccoli and cauliflower.
	disulfoton (Di-Syston) 1 lb. (6.7 lb. 15 G)		One application per season as furrow treatment or side dressing. 42 days cabbage; 40 days cauliflower; 14 days broccoli; 30 days Brussels sprouts.
	endosulfan (Thiodan) ¾ lb. (1½ qt. 2 lb. EC)		7 days cabbage, 4 days broccoli; 14 days cauliflower and Brussels sprouts. May be combined with pyrethrin.
	malathion ½ to ¾ lb. (¾ to 1 pt. 5 lb. EC)		7 days.
	oxydemetonmethyl (Meta Systox-R) ½ lb. (2 pt. 2 lb. EC)		3 days Brussels sprouts; 7 days broccoli, cabbage, and cauliflower. Not more than 3 times per season.
	mevinphos (Phosdrin) ¼ lb. (1 pt. 2 lb. EC)		1 day broccoli, cabbage; 3 days cauliflower, Brussels sprouts.
	methamidophos (Monitor) ½ to 1 lb. (1 to 2 pt. 4 lb. EC)		28 days for cauliflower, 21 days for broccoli, 14 days for Brussels sprouts, and 35 days for cabbage.
	naled (Dibrom) 1 lb. (1 pt. 8 lb. EC)		As labelled.
pyrethrins + piperonyl butoxide (Pyrocide)		1 day.	
Flea beetles	carbaryl (Sevin) 1½ lb.		3 days.
	diazinon ½ lb. (1 lb. 50% WP)		7 days cabbage and Brussels sprouts; 5 days broccoli, cauliflower.
	disulfoton (Di-Syston) 1 lb. (6.7 lb. 15 G)		One application per season as furrow treatment or side dressing. 42 days cabbage; 40 days cauliflower; 14 days broccoli; 30 days Brussels sprouts.
	endosulfan (Thiodan) ¾ lb. (1½ qt. 2 lb. EC)		7 days cabbage, broccoli; 14 days cauliflower and Brussels sprouts.
	methoxychlor 1½ lb. (3 lb. 50% WP)		3 days for cabbage; 7 days for cauliflower; 14 days for broccoli, Brussels sprouts.
	toxaphene 1 lb. (1¼ pt. 6 lb. EC)		Before heading only.
Cabbageworm, loopers NOTE: Loopers should be controlled when they are small. Fully-grown loopers are very difficult to control.	<i>Bacillus thuringiensis</i> (Biotrol, Dipel, Thuricide) as labeled		NTL.
	azinphosmethyl (Guthion) ½ to ¾ lb. (1 to 1½ lb. 50% WP), (2 to 3 pt. 2 lb. EC)		15 days broccoli and cauliflower; 7 days Brussels sprouts; 21 days cabbage.
	carbaryl (Sevin, Sevimol) 1½ to 2 lb. (2 to 2½ lb. 80% WP)		3 days.
	endosulfan (Thiodan) ¾ lb. (1½ qt. 2 lb. EC)		See remarks and limitations under aphids. May be combined with parathion.
	methomyl (Lannate, Nudrin) ½ to 0.9 lb. (½ to 1 lb. soluble powder)		1 day for cabbage; 14 days for broccoli, cauliflower, and Brussels sprouts.
	methyl parathion or parathion ¼ lb. (1 lb. 25% WP)		7 days for Brussels sprouts, broccoli, cauliflower; 10 days for cabbage. May be combined with endosulfan or toxaphene.
	mevinphos (Phosdrin) ½ lb. (1 qt. 2 lb. EC)		1 day for broccoli, cabbage; 3 days for cauliflower and Brussels sprouts.
	methamidophos (Monitor) ½ to 1 lb. (1 to 2 pt. 4 lb. EC)		28 days cauliflower, 21 days broccoli, 14 days Brussels sprouts, and 35 days cabbage.
naled (Dibrom) 1 lb. (1 pt. 8 lb. EC)		1 day.	
pyrethrins + piperonyl butoxide (Pyrocide)		As labelled.	
toxaphene 3 lb. (½ gal. 6 lb. EC)		Before heading only. May be combined with parathion.	

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

CABBAGE, BROCCOLI, CAULIFLOWER, BRUSSELS SPROUTS (continued)

Insects	Chemical†	Remarks and limitations
	trichlorfon (Dylox) 1 lb. (20 oz. 80% soluble powder, 20 lb. 5% bait)	21 days.
Cabbage maggot	diazinon 2 to 3 lb. (4 to 6 lb. 50% WP) diazinon 4 lb. (8 lb. 50% WP or 28 lb. 14% G)	As furrow drench or in transplant water. Broadcast soil treatment before planting.
Cutworms	carbaryl (Sevin, Sevimol) 2 lb. (2½ lb. 80% WP, 40 lb. 5% bait) diazinon 4 lb. (8 lb. 50% WP) trichlorfon (Dylox) 1 lb. (20 oz. 80% soluble powder, 20 lb. 5% bait)	3 days. Broadcast soil treatment before planting. 21 days.
Diseases	Chemical†	Remarks and limitations
Black rot, blackleg	Hot-water seed treatment 122° F. Cabbage: 25 minutes; broccoli and cauliflower: 20 minutes	Dry seed thoroughly. Crop rotation and sanitation are also necessary.
Seedbed diseases	See table of contents for section on seedbed fumigation.	
Seed rot, damping off	Seed treatment; captan, thiram, or chloranil ½ tsp. 75% WP per lb. of seed. 4 to 8 oz. per 100 lb. seed	Follow hot-water treatment after seed is dry. Do not use treated seed for food or feed.
Club root	PCNB 75% WP 2 to 6 lb. per 100 gal. transplant water—½ to ¾ pt. per plant PCNB dust 60 lb. actual per acre broadcast or 40 lb. actual per acre band or row application Lime	Plant in noninfested soil if possible. High rate for heavy infestations and muck soils. May be mixed with insecticides in transplant water. Broadcast dust and mix thoroughly in soil before planting. Use hydrated lime to reach pH 7 or above. Use a long crop rotation.
Downy mildew	Bravo 500 2¼ pts.	
Alternaria leaf spot	Bravo W75 1½ lb. Maneb 2 lb. Fixed coppers 2 lb.	Begin applications after transplants are set in field, or shortly after emergency of field seeded crop, or when conditions favor disease development. Repeat at 7- to 10-day intervals or as necessary to maintain control.
Mosaic (internal spotting of cabbage head)		Control aphids that spread the virus.

CARROTS

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
Annual weeds	stoddard solvent (Several trade names)	20 to 100 gal/A	Apply postemergence to weeds not larger than 1 inch. Carrot roots should not be larger than ¼ inch in diameter. Crop injury may occur when temperature exceeds 75° F.
	linuron (Lorox)	¾ to 1½	Apply before crop emergence or after the crop is at least 3-inches tall. Use higher rate preemergence or when the weeds are over 2-inches tall. Do not exceed 40 PSI, mix with other pesticides or apply when when temperatures exceed 85° F. Multiple applications may be made but do not exceed 4 lb./acre/year.
Annual broadleaves	nitrofen (TOK)	2 to 4	Apply after crop is at least 1-inch tall and weeds are less than 2-inches tall.
Annual grasses	trifluralin (treflan)	½ to ¾	Apply before planting and incorporate into soil 2 to 3 inches. Do not use on muck or peat soils.
Insects	Chemical†	Remarks and limitations	
Aster leafhoppers NOTE: Insecticide reduces aster yellow transmission through	carbaryl (Sevin) 1 lb. (1¼ lb. 80% WP) methoxychlor 2 lb. (1 gal. 2 lb. EC) malathion 1 lb. (1½ pt. 5 lb. EC)	NTL. 14 days if tops are used; 7 days roots. 7 days.	

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetttable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

CARROTS (continued)

Insects	Chemical†	Remarks and limitations
reduction of leaf-hopper numbers.		
Diseases	Chemical†	Remarks and limitations
Seed rot, damping off	Seed treatment, captan or thiram 50% WP, 2 tsp. per lb. seed. 8 oz. per 100 lb. seed	Follow hot-water treatment for bacterial blight after seed is dry.
Bacterial blight and Cercospora leaf spot and Alternaria leaf spot	Spray infield: fixed copper—use label directions Tri Basic Copper Kocide 101 Bravo 500 2¼ to 2¾ pts. maneb—use label directions zinc ion plus maneb—use label directions zineb—use label directions	7- to 10-day intervals. Start applications when disease threatens and repeat at 7- to 10-day intervals or as necessary to maintain control. NTL. Not later than 7 days before harvest. Do not use tops for food or feed. Not later than 7 days before harvest if tops are to be used for food or feed.
Aster yellows	control leafhoppers that spread the disease (see above)	
Root knot nematode	DD, Vidden-D, Telone, Vortex, or EDB	See table 1 for trade names. Use at rates suggested on label. Treatment must be made at least 14 to 21 days before planting, preferably during the fall previous to planting. A 2- to 3-year rotation with grass sod will eliminate the nematode.
Storage	0.05-0.1% Dowcide A Botran 1 lb. 75 WP/100 gal.	Carrots may be dipped or sprayed. Postharvest use only.

CORN, SWEET

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations	
Annual grasses	alachlor (Lasso)	2 to 4	Apply before planting and incorporate; or apply after planting but before the crop or weeds emerge. Also may be applied via center pivot irrigation in ⅓ to ¾ inches of water.	
	butylate (Sutan+)	4	Apply before planting and incorporate. Do not use on muck or peat.	
	EPTC with protectant (Eradicane)	3 to 4	Apply before planting and incorporate. Also may be applied via center pivot irrigation in ½ to ¾ inches of water.	
	propachlor (Ramrod, Bexton)	4 to 6	Apply after planting, before crop and weeds emerge.	
Annual broadleaves	atrazine (Several trade names)	1 to 3	Apply before planting and incorporate after planting but before weeds are 1-inch tall. Do not plant sugar beets, vegetables, spring-seeded small grains, or small-seeded legumes the year following atrazine application or injury may occur. Do not graze or feed forage for 21 days after treatment.	
	cyanazine (Bladex)	1½ to 3	Apply after planting before crop or weeds emerge. Do not use on sandy soils, peat, or muck.	
	2,4-D amine or 2,4-D ester	½ or ¼	Apply after corn emergence up to 18-inches tall. After corn reaches 8 inches, use drop nozzles.	
	atrazine+ oil concentrate or emulsifiable oil	1+ or 1 gal/A	Apply after corn and weeds emerge. Most effective on weeds less than 1-inch tall.	
	Annual weeds	alachlor+ atrazine	1½ to 2½+ or 1 to 1½	Apply before planting and incorporate or after planting before crop and weeds emerge. Also may be applied via center pivot irrigation in ⅓ to ¾ inches of water.
		alachlor+ cyanazine	2 to 2½+ or 1 to 2	Apply after planting before crop or weeds emerge. Do not use on sandy soils.
butylate+		3 to 4+	Apply before planting and incorporate.	

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CORN, SWEET (continued)

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
	atrazine	1 to 1½	
	butylate+	3 to 4+	Apply before planting and incorporate. Do not use on sandy soils.
	cyanazine	1 to 2	
	EPTC and protectant+	3 to 4+	Apply before planting and incorporate.
	atrazine	1 to 1½	
	EPTC and protectant+	3 to 4+	Apply before planting and incorporate. Do not use on sandy soils.
	cyanazine	1 to 2	
Quackgrass	glyphosate (Roundup)	1½	Apply in the fall or spring before planting. Quackgrass should be at least 8-inches tall, actively growing. Allow 3 days after treatment before plowing. Also may use as a spot treatment in the crop.
	atrazine	2+2	Use split application in fall and spring. Only corn can be grown in the year following treatment.
Yellow nutsedge	bentazon (Basagran)	¾+¾	Treat when nutsedge is 3- to 6-inches tall and repeat 10 days later.
	butylate	4	See annual grasses above.
	EPTC and protectant	4	See annual grasses above.
	alachlor	4	See annual grasses above.
Canada thistle	bentazon	¾+¾	Treat when thistle is 3- to 6-inches tall and repeat 10 days later.
	glyphosate	1½	Apply before planting or as a spot treatment when thistle is in the bud stage.

Insects	Chemical†	Remarks and limitations
Aphids	diazinon ½ lb. (1 lb. 50% WP) malathion 1 lb. (1½ pt. 5 lb. EC) parathion ½ lb. (2 lb. MP)	NTL. 5 days. 12 days.
Cutworms NOTE: Worms more than half grown are difficult to control	carbaryl (Sevin) 2 lb. (2½ lb. 80% WP, 40 lb. 5% bait) diazinon 4 lb. (8 lb. 50% WP, 4 qt. AG 500 or 28 lb. 14G) trichlorfon (Dylox) 1 lb. (20 oz. 80% soluble powder) toxaphene 2 lb. (⅓ gal. 6 lb. EC)	NTL. For cutworms only. Broadcast incorporated soil treatment before planting. NTL. Do not feed forage.
Corn earworm	carbaryl (Sevin) 1½ to 2 lb. (2 to 2½ lb. 80% WP) diazinon 1½ lb. (1½ qt. AG500 or 3 lbs. 50% WP) endosulfan (Thiodan) 1½ lb. (3 qts. 2 lb. EC) methomyl (Lannate, Nudrin) ¼ to ½ lb. (¼ to ½ lb. soluble powder) Methyl parathion (PennCap M) ½ lb., 4 pts.	NTL. Carbaryl is extremely toxic to bees. Avoid drift into bee yards; do not use dusts on corn; avoid treatment while bees are in field. NTL. <i>Do not use on corn for processing.</i> Do not feed forage. Not more than 5 applications. NTL 3 days for forage. May injure some varieties. 3 days (12 for forage).
Corn rootworm	fensulfthion (Dasanit) 1 lb. (7 lb. 15% G) fonofos (Dyfonate) 1 lb. (10 lb. 10% G) ethoprop (Mocap) 1 lb. (10 lb. 10% G) phorate (Thimet) 1 lb. (7 lb. 15% G) terbufos (Counter) 1 lb. (7 lb. 15% G)	Apply one of these insecticides in 7-inch band just ahead of press wheels at planting time. Rates are for 40-inch rows.
Corn rootworm adults ("Silk beetles")	carbaryl (Sevin) 1 lb. (1½ lb. 80% WP) malathion 1 lb. (3 pt. 5 lb. EC) or 4 oz. ULV by air diazinon ½ to 1 lb. (1 to 2 pt. AG 500, 1 to 2 lb. 50% WP)	NTL. 5 days. NTL.

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wettable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

CORN, SWEET (continued)

Insects	Chemical†	Remarks and limitations
European corn borer NOTE: For second brood treat at the time of egg hatch or 7 to 10 days after moths are detected in traps (mid to late August). Direct spray at ear zone. Additional treatments should be made at 3- to 7-day intervals as determined by egg counts or moth flights. Treatment for first brood usually not warranted in Minnesota unless infestation is extremely heavy in late June and early July.	<i>Bacillus thuringiensis</i> (Biotrol, Dipel, Thuricide) as labeled carbaryl (Sevin) 1 to 2 lb. (1¼ to 2½ lb. 80% WP, or 5 to 10 lb. 20% G) diazinon 1 to 2 lb. (7 to 14 lb. 14% G) methomyl (Lannate, Nudrin) ½ lb. (½ lb. 90% soluble powder) methyl parathion (PennCap M) ½ lb.	NTL. Highly toxic to bees (see corn earworm). NTL. NTL for grain; 3 days for forage. 3 days (12 for forage).
Sap beetles		Follow thorough corn earworm and second brood corn borer control to help control beetles directly and to help prevent their entrance into ear tips by controlling worm damage.
Seed corn maggot, corn seed beetle, wireworms	heptachlor, lindane diazinon 4 lb. (8 lb. 50% WP or 28 lb. 14G)	1 oz. per bushel as seed treatment only. For wireworms. Broadcast soil treatment at planting.
Seed corn beetles, maggots	fensulfothion (Dasanit) 1 lb. (6.7 lb. 15G) fonophos (Dyfonate) 1 lb. (10 lb. 10G) diazinon seed treatment	Apply in 7-inch band just ahead of press wheels at planting time. Rates are for 40-inch rows.
Seed corn maggot	chlorpyrifos (Lorsban SL) seed treatment	

Diseases	Chemical†	Remarks and limitations
Seed rot, damping off	Seed treatment: captan, chloranil, dichlone, or thiram 2 to 4 oz. 75% WP Bravo W-75 1½ to 2 lb.	Do not use treated seed for food or feed. Follow label directions. Do not apply within 14 days of harvest. For fresh market only.
Southern leaf blight	zinc ion maneb 1.2 lb./acre with sufficient water Maneb 1.2 lb./100 gal. water Zineb	7 days. Start early in season. Follow through with application in 7- to 10-day interval. See label directions.
Helminthosporium leaf blight	Bravo 500 2¼ to 2¾ pts.	Begin application when conditions favor disease blight development and repeat at 4- to 7-day intervals or as required to maintain control. Do not apply within 14 days of harvest. For use on fresh market crop only. Do not apply to sweet corn to be processed.

CUCUMBERS, MELONS, PUMPKINS, SQUASH

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
ALL CUCURBITS Annual grasses	bensulide (Prefar)	5 to 6	Apply before planting and incorporate or after planting and immediately irrigate.
Annual broadleaves	dinoseb amine (Premerge, Sinox PE)	1½ to 3	Apply after seeding before crop emergence. Use lower rate when crop is close to emergence. Do not use on light sandy soils.
CUCUMBERS & MELONS Annual broadleaves	naptalam (Alanap)	4	Apply after seeding before weeds emerge. Irrigation after application will improve results. Varieties of pumpkins and squash

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wettable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

CUCUMBERS, MELONS, PUMPKINS, SQUASH (continued)

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
			differ in their tolerance.
	chloramben-methyl ester (Vegiben 2E)	1½ to 3	Apply after planting before the crop and weeds emerge. Use lower rate on sandy soils. Do not use on watermelon.
Annual weeds	bensulide+naptalam	4 to 6+ 3 to 4	Apply as a tank mix after planting and irrigate immediately or apply bensulide prior to planting, incorporate, plant, and then apply naptalam. Use lower rates on light, sandy soils.
PUMPKINS & SQUASH Annual broadleaves	chloramben (Amiben)	3 to 4	Apply after planting before the crop and weeds emerge.
Insects	Chemical†		Remarks and limitations
NOTE: Make light applications using dusts or wettable powders on cucurbits. These plants are injured by heavy treatments and by certain formulations.			
Aphids	diazinon ½ lb. (1 lb. 50% WP, 1-1½ pt. AG 500)		7 days.
	dimethoate (Cygon, Defend, Dimex, Rebelate) ¼ to ½ lb. (1 pt. 4 lb. EC)		Melons only. 3 days.
	endosulfan (Thiodan) ½ lb. (1 qt. 2 lb. EC)		NTL.
	malathion ½ lb. (12 lb. 4% D)		1 day.
	oxydemetonmethyl ½ lb. (Metasystox R) 1½ to 2 pts.		14 days, winter squash, cucumbers, pumpkins. 1 day, summer squash
	parathion ¼ lb. (1 pt. 2 lb. EC)		15 days.
Cucumber beetles (striped and spotted)	aziphosmethyl (Guthion) ½ lb. (2 pts. 2 lb. EC)		1 day.
	carbaryl (Sevin) 1 lb. (1¼ lb. 80% WP)		NTL. Carbaryl is very toxic to honey bees. Avoid treating when bees are in field.
	endosulfan (Thiodan) ½ to 1 lb. (¾ lb.-1½ lb. 80% WP)		NTL.
	malathion 1¼ lb. (1 qt. 5 lb. EC)		1 day.
	methoxychlor 1 lb. (10 lb. 10% D or 2 lb. 50% WP)		1 day.
Cutworms	carbaryl (Sevin) 1 to 2 lb. (20 to 40 lb. 5% bait)		NTL.
	diazinon 4 lb. (8 lb. 50% WP, 4 qt. AG 500)		Broadcast soil treatment at planting.
Squash bugs	endosulfan (Thiodan) ½-1 lb. (1-2 qt. 2E)		NTL. Lower dosage for nymphs.
	carbaryl (Sevin) 1 lb. (1¼ lb. 80% WP)		NTL.
	parathion ¼ lb. (1 pt. 2 lb. EC)		15 days.
White grubs, wireworms	diazinon 4 lb. (8 lb. 50% WP)		Broadcast soil treatment at planting.
Diseases	Chemical†		Remarks and limitations
Seed rot, damping off	Captan 3 oz./100 lb. Chloranil 3.8 oz./100 lb. Thiram 3 oz. 75 WP/100 lb.		Do not use treated seed for food or feed.
			Crop rotation: At least 2 intervening years of other unrelated crops. Copper is needed to control bacterial diseases.
Angular leaf spot on cucumbers.	Spray or dust in field		Apply at weekly intervals during humid weather.
Anthraxnose on cucumbers and Black rot on pumpkins and squash.	zinc ion maneb, maneb, or polyram 1¼ to 2½ lb. WP Plus Tri basic Copper Sulfate		Do not use maneb, zineb, or fixed copper on young plants before runners form. Maneb and zineb are good general fungicides for most diseases of these crops.
Scab on cucumbers and melons. NOTE: Plant resistant varieties. Control cucumber beetles.	1½ to 2½ lb. WP Kocide 101 1 to 2 lb. WP Difolatan 2½ to 5 pt.		Fixed copper and Kocide 101 are good for angular leaf spot (a bacterial disease). Bravo, captan, and folpet are good fungicides for scab control above 50°F. The above fungicides may be used in various combinations, depending upon the diseases present, or they may be alternated.

†Abbreviations used in tables NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetable powder. Dosages of insecticides are actual chemical per acre, with some exceptions

CUCUMBERS, MELONS, PUMPKINS, SQUASH (continued)

Diseases	Chemical†	Remarks and limitations
	Bravo W-75—use label directions Bravo 500 2¾ to 4¼ pts.—use label directions captan 50% WP—use label directions Fixed copper—use label directions folpet—use label directions maneb—use label directions zineb—use label directions zinc ion maneb—use label directions	NTL. NTL. NTL. NTL. NTL. NTL. NTL. NTL on cucumbers and melons. Do not use on other vine crops.
Cucumber mosaic virus (CMV)	See weed, aphid, and cucumber beetle control.	Plant resistant varieties.
Powdery mildew	Karathane ½ lb. WP Benomyl ¼ lb. WP Bravo 500 2¾ to 4¼ pts.—use label directions	At first sign of mildew, apply Karathane and again in 7 days. Apply Benomyl at first signs of mildew and again in 10 days. Days to harvest: Karathane, 7 days; Benomyl, NTL. Use disease resistant varieties. NTL.
Alternaria leaf spot on cucumbers and melons	Bravo 500 2¾ to 4¼ pts.—use label directions Dithane M-45 216 WP Difolatan 2½ to 5 pt. maneb 2 lb. WP	Days to harvest: Dithane M-45, 5 days, maneb, 5 days; Bravo and Difolatan, NTL.
Bacterial wilt, black rot, storage rot of pumpkins and squash, leaf blight, scab, anthracnose	Spray in field as for anthracnose control or use Benomyl at 7- to 14-day intervals (see label directions). See cucumber beetle control. Bravo 500 2¾ to 4¼ pts.—use label directions	Long rotations of unrelated crops are important. Handle carefully during harvesting and storing. Prevent damage to rind. Cure the rind at 75 to 85° F. for 2 weeks and store at 45 to 50° F. Spray 3 to 4 times.
Cucumber fruit rot (Rhizoctonia), fruit rot, muskmelon and cucumber	Bravo 500 4½ pts.—use label directions Captan 1.2 lb./100 gal. Folpet 1.2 lb./100 gal. Maneb 1.2-1.6 lb./100 gal.	See table of contents for section on postharvest dip or spray.

EGGPLANT

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
Annual weeds	DCPA (Dacthal)	8	Apply 4 to 6 weeks after transplanting. Not effective on emerged weeds.

Insects	Chemical†	Remarks and limitations
Aphids	malathion 1 lb. (1½ pt., 5 lb. EC) oxydemetonmethyl ½ lb. (MetaSystox-R) (2 pt., 2 lb. EC)	3 days. 7 days.
Flea beetles	carbaryl 1 lb. (1¼ lb. 80 WP)	NTL.
Cutworms	carbaryl 2 lb. spray or bait (2½ lb. 80 WP), (40 lb. 5% bait)	NTL.

Diseases	Chemical†	Remarks and limitations
Damping off:	Captan 2 lb. 50 WP Weekly spray 2 lb. WP/100 gal.	Hot water soak 122° F. for 25 minutes. Dry, then dust seed with thiram (4 oz. 75 WP/100 lb.).
Verticillium wilt	Fumigate with Vorlex or Vapam. Soil must be free of clods and old plant debris.	See fumigation chart, table 1.

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

LETTUCE

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
Annual grasses	benefin (Balan)	1 to 1½	Apply before planting and incorporate. Do not use on muck or peat soils.
Annual weeds	CDEC (Vegadex)	4	Apply after seeding before crop and weeds emerge.
Insects	Chemical†		Remarks and limitations
Leafhoppers	carbaryl (Sevin) 1 to 1½ lb. (¼ to 2 lb. 80% WP)		3 days for head lettuce; 14 days for leaf lettuce.
	dimethoate (Cygon, DeFend, Dimex, Rebelate) ¼ lb. (½ pt. 4 lb. EC)		7 days for head lettuce; 14 days for leaf lettuce.
	disulfoton (Di-Syston) 2 lb. (4 to 8 oz. 15% G per 1000 ft. of row)		60 days. Do not use on transplanted lettuce.
	malathion 1¼ lb. (1 qt. 5 lb. EC)		7 days for head lettuce; 14 days for leaf lettuce.
	methoxychlor 1½ to 2 lb. (3 to 4 lb. 50% WP)		14 days.
	mevinphos (Phosdrin) ¼ lb. (1 pt. 2 lb. EC)		2 days.
Greenhouse pests: Aphids Fungus Gnats White Flies Mealy Bugs	malathion 15% aerosol 1 lb. per 50,000 cu. ft.		10 days.
	parathion 10% aerosol 1 lb. per 50,000 cu. ft.		21 days.
Diseases	Chemical†		Remarks and limitations
Seed rot, damping off	Seed treatment; captan or chloranil		Use label for directions. Do not use treated seed for food or feed.
Aster yellows	Control aster leafhoppers (see above).		
Botrytis gray mold	Botran 2.7 lb. 75% WP per acre		Several days after thinning and again in 7 and 14 days or work Botran 4% dust into top 3 inches of soil 2 to 3 days before planting. Use 1 oz./sq. yd. Do not spray later than 14 days before harvest.

ONIONS

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
SEEDED			
Annual grasses	CDAA (Randox)	4 to 6	Apply after planting to onions up to the loop stage and weeds which have not emerged or are just emerging. Repeat applications may be made when onions are larger than the two true leaf stage. Do not use more than 4 lb./acre on mineral soils. Do not apply closer than 45 days before harvest.
	DCPA (Dacthal)	8	Apply after planting before the crop and weeds emerge. For use on mineral soils only.
Annual broadleaves	chlorpropham (Furloe Chloro IPC)	4 to 6	Same as CDAA above.
	nitrofen (TOK)	1 to 2	Apply after the crop and weeds have emerged. The onions should have more than two true leaves and the weeds should be shorter than 1 inch. Repeat applications may be made but only a total of 6 lb./acre/year applied. The wettable powder formulation is preferred. Do not apply at greater than 40 PSI, with wetting agents or other liquid pesticides.
Annual weeds	CDAA+ chlorpropham	4 to 6+ 4 to 6	Applied same as for CDAA alone. Frequently lower rates can be used than either chemical alone with better weed control than either alone.
Prevention of sprouting in storage	Chemical†		Remarks and limitations
	3 lb. maleic hydrazide (1 gal. MN 30)		Apply 2 weeks before harvest but when bulbs are mature and tops still show green. Use in 100 to 140 gallons water. Do not add wetting agent. If applied too early, may cause some breakdown in storage.

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wettable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

ONIONS (continued)

Insects	Chemical†	Remarks and limitations
Onion maggot	carbophenothion (Trithion) 2 lb. (8 lb. 25% WP) fensulfothion (Dasanit) 1 lb. for 18-inch row spacing. (6½ lb. 15% G) diazinon 1 lb. (2 lb. 50% WP) diazinon 2 to 4 lb. (4 to 8 lb. 50% WP or 14 to 28 lb. 14% G) fonofos (Dyfonate) 1 lb. (10 lb. 10% G) ethion 1 lb. (12½ lb. 8% G, 20 lb. 5% G)	Furrow treatment. Not for green onions. Furrow treatment. As furrow drench. Broadcast and incorporate into soil before planting. Furrow treatment for dry bulb onions only. Furrow treatment at planting time.
Onion thrips, aster leafhopper	diazinon 1 lb. (2 lb. 50% WP) malathion 1 lb. (4 lb. 25% WP, 2 pt. 5 lb. EC) azinphosmethyl (Guthion) (1 lb. 50% WP)	10 days. 3 days. 28 days. Not more than 3 times per season.
Diseases	Chemical†	Remarks and limitations
Seed rot, damping off	Seed treatment: captan, chloranil, or thiram	Use label directions. Do not use treated seed for food or feed.
Onion smut	formaldehyde 37% liquid 1.4 gal. per acre nabam, 1 gal. (2 EC) per acre OR maneb (Manzate 200, Dithane M-45 3 lbs. 80% WP)	The most complete control of onion smut can be ex- pected with this method. Apply in 75 to 125 gallons of water per acre in the seed furrow at planting time. (Low rate for moist soil; high rate for dry soil.) Use appli- cator on planter with a stream of solution running into each seed furrow in contact with seed. Calibrate carefully. An emulsifiable insecticide can be added to the dilute formaldehyde solution for maggot control. Apply in 50 to 100 gallons of water per acre.
Onion smut seedbox treatment method	thiram 75% ½ lb. per lb. of seed in planter box as a seed treatment or as granulated material mixed with insecticide	Do not use formulations containing oil. They have been found to interfere with germination when used at heavy rates.
Blast, downy mildew, purple blotch	Spray infield with Maneb 3 lb./acre zinc ion maneb 3 lb./acre	Spray weekly starting June 1. Use a spreader-sticker. Not later than 7 days before harvest on green onions. 7 days. Do not apply to exposed bulbs.
Botrytis blast	Bravo 500 2¼ to 4¼ pts.	Apply before disease appears and repeat at 7- to 10-day intervals. Under severe disease conditions, use the higher application rate and shorten the intervals be- tween applications. Do not apply on dry bulb onions within 7 days of harvest or on green onions within 14 days of harvest. Do not apply more than three times per season on green onions. Do not apply to sweet Spanish onions.
Aster yellows viros		Control six-spotted leafhoppers.
Bulb rot	Captan 1.25 lb./100 gal.	See table of contents for section on postharvest dip or spray.

PARSNIPS

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
Annual weeds	stoddard solvent (Several trade names)	20 to 100 gal/A	Apply before or after crop emergence. Weeds should be less than 1-inch tall and the parsnips less than five true leaves.
	linuron (Lorox)	1½	Apply after seeding before crop emergence. Crop should be planted a minimum of ½-inch deep.
Insects	Chemical†	Remarks and limitations	
Aster leafhopper	Carbaryl 1 lb. (1¼ 80 W) Malathion 1 lb. (1½ pt. 5 lb. EC)	NTL. 7 days.	

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetttable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

PARSNIPS (continued)

Diseases	Chemical†	Remarks and limitations
Leaf spot and canker	Kocide 101 (3.4 lbs.) Fixed copper (2 lbs. metallic)	Apply every 10 days beginning August 1 until tops die. Especially needed during wet weather.
Root knot nematode	DD, Vidden-D, Telone, Vorlex, or EDB	See table 1 for trade names. Use at rates suggested on label. Treatment must be made at least 14 to 21 days before planting, preferably during the fall previous to planting. A 2- to 3-year rotation with grass sod will eliminate the nematode.

PEAS

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
Annual grasses	alachor (Lasso)	2 to 2½	Apply after planting before crop and weeds emerge. Cold, wet soils after treatment may delay maturity and reduce yield.
	propachlor (Ramrod, Bexton)	4	Apply after planting before crop and weeds emerge.
	CDAA (Randox)	4	Same as propachlor.
	trifluralin (Treflan)	½ to ¾	Apply before planting and incorporate. Use lower rate on lighter soils.
	profluralin (Tolban)	½ to 1	Same as trifluralin.
	dinitramine (Cobex)	¼ to ½	Same as trifluralin.
Annual broadleaves	dalapon (Dowpon, Basfapon)	¾	Apply after peas are 2- to 6-inches tall and have four to six nodes. Do not apply within 25 days of harvest or feed treated pea vine to livestock.
	dinoseb amine (Premerge, Sinox PE)	1 to 2	Apply after peas are 2- to 8-inches tall and weeds are less than 1-inch tall. Do not apply when flower buds are visible. Use 1 lb./acre at 80° F, 1½ lb./acre at 70° F-80° F, and 2 lb./acre below 70° F.
Annual broadleaves, Canada thistle	bentazon (Basagran)	¾ to 1	Apply after the peas have three pairs of leaves or four nodes and the weeds are less than 2-inches tall. Do not apply more than 1 lb./acre/year.
	MCPB sodium salt (Can-trol, Thistrol)	¾ to 1	Apply before flowering stage when crop has 6 to 12 nodes and before thistles are 9-inches tall. Apply in at least 15 gallons of water. Do not feed treated vines to livestock.
Quackgrass	MCPA amine (MCPA Amine)	2 to 2.6 oz./A	Apply in at least 15 gallons water per acre when peas are 3- to 7-inches tall, before first flowering and weeds are small. Higher rates of 4 to 6 oz. (½ to ¾ pt.) may improve control of difficult weeds but crop injury may occur. Do not apply if peas are taller than 7 inches or when stressed for lack of soil moisture. Do not apply when temperatures are over 90° F. Do not feed treated vines to livestock. <i>MCPA can cause injury and delayed maturity to peas.</i> Can be applied by air.
	glyphosate (Roundup)	1½	Apply in fall or spring before planting. Quackgrass should be at least 8-inches tall and actively growing. Allow 3 days after treatment before tillage.

Insects	Chemical†	Remarks and limitations
Pea aphid	demeton (Systox) ¼ lb. (1 pt. 2 lb. EC)	21 days.
	diazinon ½ lb. (1 lb. 50% WP, 1 pt. AG 500)	Do not feed as hay for 4 days after treatment. No waiting period for harvesting peas.
	dimethoate (Cygon, De-Fend, Dimex, Rebelate) ⅙ lb. (¼ to ½ pt. 4 lb. EC)	NTL. Do not feed or graze vines if mobile viner is used. Do not feed or graze within 21 days after treatment if stationary viner is used.
	disulfoton (DiSyston) 1 lb. (10 lbs. 10% G)	In furrow at planting or side dress—50 days.
	malathion 1 lb. (1½ pt. 5 lb. EC, 4 lb. 25% WP)	3 days, 7 days for forage.
	mevinphos (Phosdrin) 0.2 lb. (1 pt. 2 lb. EC) naled (Dibrom) 1 to 2 lb. (1 to 2 pt. 8 lb. EC)	1 day. 4 days.

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetttable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

PEAS (continued)

Insects	Chemical†	Remarks and limitations
	oxydemeton methyl $\frac{3}{8}$ lb. (Meta-Systox-R) (1½ pt.)	21 days.
	parathion $\frac{1}{4}$ to $\frac{1}{2}$ lb. (1 to 2 pt. 2 lb. EC)	10 days.
Loopers	carbaryl (Sevin, Sevimol) 1½ lb. (2 lb. 80% WP) parathion $\frac{1}{2}$ lb. (2 pt. 2 lb. EC) methomyl (Lannate, Nudrin) $\frac{1}{2}$ to 1 lb. ($\frac{1}{2}$ to 1 lb. 90% SP) mevinphos (Phosdirn) 4 oz. (1 pt. 2 lb. EC)	NTL. 15 days for forage, 10 days for peas. 1 day. Do not feed or graze within 5 days. Do not feed pea vine hay within 14 days. 1 day.
Seed corn maggot	diazinon 1 oz. per bu.	Seed treatment.
Diseases	Chemical†	Remarks and limitations
Seed rot	Seed treatments: Captan (follow label directions) Chloranil 3 oz. actual/100 lb. (dry) Dexon 0.75 oz. 70 WP/100 lb. Dichlone 1 oz./100 lb. Thiram 2 oz. 75 WP/700 lb.	Do not use treated seed for food or feed.
Root rot		Grow on clean land and use 5-year interval between crops of peas. A soil test for determination of degree of infestation by root-rot-causing fungi is useful for land selection.

PEPPERS

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
Annual weeds	trifluralin (Treflan) diphenamid (Enide)	$\frac{1}{2}$ to 1 5	Apply before transplanting and incorporate. Use lower rate on sandy soils. Apply after transplanting and before weeds emerge.
Insects	Chemical†	Remarks and limitations	
European corn borer	acephate (Orthene) $\frac{1}{2}$ lb. ($\frac{3}{8}$ lb. 75S) carbaryl (Sevin) 1½ lb. (2 lb. 80% WP) carbofuran 2 lb. (Furadan) 29 lb. 10G	7 days. NTL. 21 days. Sidedress 2 to 4 weeks after planting. Another treatment of 30 lb. 10G, 4 to 6 weeks later if second brood develops.	
Aphids	acephate (Orthene) $\frac{3}{4}$ to 1 lb. (1-1½ lb. 75S) malathion 1 lb. methomyl 0.45 lb. (Lannate, Nudrin) dimethoate (Cygon, DeFend, Dimex, Rebelate) $\frac{1}{2}$ lb. oxydemeton methyl (Metasystox R) $\frac{1}{2}$ lb. 2 pts.	7 days. 3 days. 6 days. NTL. NTL.	
Diseases	Chemical†	Remarks and limitations	
Seedbed or flat treatment for damping off	Captan—2 lb./100 gal.	Apply 1 gallon over each 100 square feet of surface. Do not use if house temperatures go above 90° F.	
Leaf and fruit spots	Bacterial Zineb (use label directions) Fixed copper 1.5 lb./100 gal. Fungal Captan 1.5 lb./100 gal. Maneb 1.2-1.6 lb./100 gal. Zineb (use label directions)	NTL. NTL. NTL.	
Mosaic		See aphid and weed control.	
Root rot	Zineb 1½ lb. WP/100 gal. Copper oxychloride 2 lb. dust or 1¼-2 lb. WP/25 to 100 gal.	NTL.	

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wettable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

SPROUT INHIBITION OF POTATOES

Maleic hydrazide is effective as a potato sprout inhibitor when applied at 2 to 3 pounds per acre ($\frac{2}{3}$ to 1 gallon MH 30) as an overall spray to the plants at the late full-bloom to postbloom stage (tubers under the vine should be 1 to 2 inches in diameter). Apply 4 to 6 weeks before harvest. Potatoes from plants sprayed in this way can be stored at temperatures of 50°-55° F. for as long as 8 months with little or no sprouting. Do not use on seed potatoes.

CIPC (Chloro-IPC) can be used to inhibit sprouting of potatoes already in storage. This chemical is distributed as a fine mist suspended in the airstream circulating around the potatoes. It is used at the rate of 1 pound CIPC (1 quart Chloro-PIC) per 1,000 bushels of potatoes. CIPC may be applied any time after the harvest wounds have healed (at least 2 weeks after harvest), and before sprouting has occurred. This treatment can be used on potatoes stored in bulk but not in burlap bags. Use custom application. Do not use herbicide type CIPC for this purpose.

TCNB (Fusarex) is not approved as a postharvest application to inhibit sprouting of potatoes in storage. Apply as a dust at the rate of 0.01 pound actual TCNB per 100 pounds (1 pound Fusarex per 600 pounds) of potatoes as they are placed in storage. Application can be made any time before sprouting begins. Do not feed treated potatoes to livestock.

Chemical sprouting inhibitors should not be applied to seed potatoes.

POTATO VINE KILLERS

The most generally used chemical for killing potato vines is dinoseb which is sold as Dow General or Sinox General.

For ground application apply dinoseb at $1\frac{1}{4}$ to $2\frac{1}{2}$ pounds (1 to 2 quarts Dow General or Sinox General) with either:

5 gallons of diesel fuel plus water
or

1 quart of any EPA registered surfactant plus water
or

1 to 2 gallons of emulsifiable crop oil plus water to make up 25 to 40 gallons of mixed spray per acre.

For aerial application apply dinoseb at $1\frac{1}{4}$ to $1\frac{3}{4}$ pounds (1 to $1\frac{1}{2}$ quarts Dow General or Sinox General) with either:

3 to 5 gallons of diesel fuel oil
or

1 quart of any EPA registered surfactant plus water
or

1 to 2 gallons of emulsifiable crop oil plus water to make up 3 to 5 gallons of mixed spray per acre.

Use the higher rates during cool, cloudy weather or where foliage growth is especially heavy. Application should be made 10 to 20 days before harvest. Complete coverage of vines is essential. Do not spray exposed tubers or graze livestock on treated areas.

A split application of dinoseb at $1\frac{1}{4}$ pounds (1 quart Dow General or Sinox General) may be made 7 to 10 days apart.

Dinoseb amine at $2\frac{1}{4}$ pounds (3 quarts Premerge or Sinox PE) also can be used 10 to 20 days before harvest. Do not spray exposed tubers or graze livestock on treated areas.

Endothall, which is sold under the trade name Des-i-cate, is another newly registered potato vine killer. Apply to potato vines 10 to 14 days prior to harvest using $1\frac{1}{2}$ to 2 gallons per acre in 20 to 100 gallons of total spray where vines are light to medium and 2 gallons per acre in 20 to 100 gallons of total spray where vines are heavy. Fill tank first with water and then add Des-i-cate. Additives are necessary only when a quick kill is required. The addition of 3 to 5 gallons per acre of diesel fuel or 1 pint of paraffin base herbicidal oil for each 20 gallons of total spray will speed up the kill. Do not use high rate, diesel fuel, or other oils when conditions are favorable for rapid vine kill (low soil moisture or high temperatures), since stem end discoloration may occur. Use a cone nozzle (hollow or solid) for best coverage.

Ametryne, which is sold under the name Evik 80W, is a new desiccant recently approved for potato vine killing. Apply ametryne 2 to $2\frac{1}{4}$ pounds ($2\frac{1}{2}$ to 3 pounds of Evik 80W) in 100 gallons of water per acre to mature green potato vines. With heavy vine growth, it may be desirable to use an E.P.A. registered surfactant. In limited trials, Evik has given a slower kill with vines turning brown in 7 to 10 days. Skin set and quality appear to be improved with the slower kill. Vine killing is slower, however, when temperatures are cooler. Higher rates may damage rye cover crop planted after harvest. Do not graze livestock on treated areas.

Paraquat also may be used as a preharvest vine killer for potatoes not intended to be used for seed or storage. Apply paraquat at $\frac{1}{2}$ pound (1 quart Paraquat) per acre. Do not apply within 3 days before harvest. Paraquat also may be applied as a split application at intervals of 5 or more days. It should not be used on peat or muck. Do not allow livestock to graze on treated fields.

Vine killers may often cause browning of the stem and/or vascular ring of tubers, especially with too fast a kill and where soil moisture is low at the time of vine killing. This discoloration often disappears during the storage period.

SPRAYS FOR COLOR IMPROVEMENT OF POTATOES

2,4-D can be applied to potato vines to intensify red color and improve skin appearance. Application should be made in the prebud stage when plants are 7 to 10 inches high. A second application can be made 10 to 14 days later. Do not apply more than a total of 1.12 ounces per acre.

POTATO INSECT CONTROL

A large number of insecticides are registered for the control of the several insect pests attacking potatoes. The

selection of insecticides will depend on the pests involved and whether or not the crop is for seed or table stock. Research in Minnesota has shown that the use of most insecticides on a regular calendar schedule leads to a resurgence in aphid populations. This is a result of the rapid development of resistance by the aphids to the insecticides and the drastic reduction of parasites and predators by the insecticides. Virus carrying aphids also increase in numbers with related increases in virus transmission. Therefore, it is suggested that fields be monitored and treated with foliar insecticides only when absolutely necessary.

Action Thresholds for Insecticide Use. Aphids—Examine 100 leaves on the lower third of the plants in several locations in the field. For table stock or processing, 30 aphids per 100 leaves is the action threshold; for seed stock, 10 aphids per 100 leaves. Potato leafhoppers—Examine 100 leaves and treat when number of leafhopper nymphs reaches 10 per leaf. Defoliators—(Colorado potato beetle, flea beetle, grasshoppers, loopers, etc.)—At times of the season other than during bloom, 10 percent defoliation is the action level. Defoliation is most critical during the blooming period.

Soil Applied Systemic Insecticides. One widely adopted practice is the planting time application of aldicarb (Temik), carbofuran (Furadan), disulfoton (DiSyston), or phorate (Thimet) in the seed furrow or in the fertilizer bands. The systemic action against aphids, flea beetles, and leafhoppers will usually last into July. Some control of Colorado potato beetles may be obtained in most cases.

Frequently, this may be the only insecticide application needed. In some years, late season infestations of leafhoppers or aphids may require foliar applications. Foliar applications now recommended for aphid control are those which do not cause population resurgence.

Soil Insects (wireworms, white grubs, cutworms). A preventive soil treatment at planting time is the only way to prevent damage from wireworms and white grubs. Some of the soil applied systemics may aid in reducing some soil insect damage.

In the past chlordane has been a widely used soil insecticide but the EPA has cancelled label registrations.

If wireworms are expected to be a problem, use 4 lb. of actual fonofos (Dyfonate) or diazinon per acre broadcast and incorporate just prior to planting. Phorate applied as a soil systemic at 3 lb. AI/acre may give adequate wireworm control. Diazinon may give some cutworm control, but fields should be monitored to detect early cutworm injury.

NEMATODES AND VERTICILLIUM WILT

Systemic Insecticides. The application of the systemic insecticide †aldicarb (Temik) in the seed furrow at planting time for insect control has been shown to suppress populations of certain nematodes. Where nematode populations have been found to be high, such as in sandy soils, †aldicarb (Temik) is recommended for nematode control. It is advisable to attach a row bander to the end of the granular applicator discharge tube so as to spread the granules in a band approximately 4 inches wide in the seed furrow.

Fumigation. Broadcast soil fumigation in the fall (or summer if land is fallowed) may be economically feasible for the control of Verticillium wilt and nematodes where these cause consistently serious yield losses. Chemicals that have produced significant yield responses are Vapam, Vorlex, Telone, and Telone C.

Soil fumigant	Rate/acre	Limitations
Vapam	30-50 gal.	The lighter of these dosages is suggested for lighter soils.
Vorlex	20-30 gal.	The lighter of these dosages is suggested for lighter soils.
DD or Vidden-D	20 gal.	Does not control Verticillium wilt.
Telone	16 gal.	Does not control Verticillium wilt.
Telone C	20-30 gal.	

A number of factors have a pronounced effect on the success or failure of soil fumigation. These are:

Soil preparation prior to fumigation. Soil should be plowed deep (10 inches or more) in order to incorporate previous crop debris as thoroughly as possible and to prevent the “turning up” of nonfumigated soil during fitting in the spring. This should be followed by disking or any other means of fitting that will leave the soil in seedbed condition. Clods and poorly incorporated debris will provide “chimneys” through which fumigant can escape prematurely from the soil.

Soil moisture. The soil should be neither too wet nor too dry. A good rule of thumb is that moisture content is most favorable when soil will just “ball” in one’s hand when pressure is applied. If soil is excessively dry and irrigation is available, moisture supplementation before fumigation is recommended.

Soil temperature. 50°-75° F. is optimal for most fumigants. At warmer temperatures, thorough and rapid dissipation of fumigant is favored, the soil is usually not excessively wet, nematode larvae (which are easier to kill than eggs) have emerged, and a more effective kill of all nematode stages can be expected.

Crop debris. Undecomposed residues from previous crops prevent even distribution of fumigant through the soils, irreversibly absorb fumigant, interfere with application equipment, prevent proper sealing of the soil surface, and protect nematodes and nematode eggs from fumigant action. Raking, burning, or deep incorporation of such debris should precede fumigation.

Sealing of soil surface. It is essential that fumigated soil be thoroughly sealed as soon after application as possible. This can be achieved by means of equipment such as a cultipacker, chain harrow, or float, or by means of spray irrigation.

Interval between fumigation and planting. Under “average” conditions, with a soil temperature of ±50° F., a minimum of 3 weeks is regarded as necessary between fumigation and planting to prevent phytotoxicity to potatoes. Fall fumigation allows a more than adequate interval between application and planting.

POTATOES (continued)

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
Annual grasses	alachlor (Lasso)	2½ to 3	Apply after final drag-off before crop and weeds emerge. Do not use in Red River Valley. Cold, wet soil conditions after treatment may delay maturity and/or reduce yields of Superior and other varieties.
	EPTC (Eptam)	4½ to 6	Apply and incorporate in late fall prior to ground freeze.
		3 to 6	Apply and incorporate immediately before planting, or apply after planting and incorporate at drag-off before the crop and weeds emerge.
		3 to 4	Apply at layby as a directed spray or up to 3 lb./acre can be applied via irrigation water to clean cultivated soil. Do not apply within 45 days of harvest. For all EPTC applications: Do not apply more than 6 lb./acre/season. Do not use on muck or peat. Use lower rates on coarse-textured soils. Under stress conditions, early season stunting of Superior may occur.
	trifluralin (Treflan)	¾ to 1	Apply and incorporate after planting, up to or immediately following drag-off before weeds emerge. Use lower rate on sandy soils. Do not use on muck or peat.
Annual broadleaves	dinoseb (Premerge, Sinox PE)	3 to 6	Apply before crop emerges and before or after weeds emerge. Most effective on emerged weeds.
	linuron (Lorox)	¾ to 2	Apply before crop emerges after drag-off or hilling, and before or after weeds emerge. Weeds should be less than 2-inches tall. Use lower rates on coarse textured soils.
	metribuzin	½ to 1	Apply just as potatoes emerge, before or after the weeds emerge. Use lower rate on coarse-textured soils. Do not apply to red skinned or White Rose varieties.
		¼ to ½	Apply after crop and weeds emerge. Do not apply: to red skinned; early maturing white skinned varieties; within 3 days after periods of cool, wet, or cloudy weather; within 60 days of harvest; or within 24 hours preceding or following other pesticide applications.
Annual weeds	paraquat (Paraquat CL)	½	Apply before crop emerges, after weeds emerge. Do not apply on peat or muck soils.
Wild oats	diallate (Avadex)	2	Apply before planting and incorporate.
Quackgrass	EPTC	6	Apply before planting and incorporate. See remarks under annual grasses—EPTC.
	dalapon (Dowpon, Basfapon)	11	Apply in the fall to actively growing quackgrass. Plow 1 to 2 weeks after application.
		6	Apply prior to planting in the spring to actively growing quackgrass, 4- to 6-inches tall. Wait 4 days after treatment before plowing.

Insects	Chemical†	Remarks and limitations
NOTE: See "POTATO INSECT CONTROL" section for information on action thresholds for insecticide use.		
Aphids	aldicarb (Temik) 2 to 3 lb. (13 to 20 lb. 15G)	Row treatment at planting, 90 days.
	disulfoton (DiSyston) 2 to 3 lb. (20 to 30 lb. 10G)	Row treatment at planting. May also be side-dressed postemergence. 75 days.
	phorate (Thimet) 2 to 3 lb. (13 to 20 lb. 15G)	Row treatment at planting, 90 days.

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetttable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

POTATOES (continued)

Insects	Chemical†	Remarks and limitations
	endosulfan (Thiodan) (1 lb. to 2 lbs. 50% WP) methomyl (Lannate, Nudrin) ½ to 1 lb. methamidophos (Monitor) ¾ to 1 lb. pirimicarb (Pirimor) ⅛-¼ lb. AI	6 days. 14 days. NTL.
Colorado potato beetle	azinphosmethyl (Guthion) ½ lb. monocrotophos (Azodrin) ¼ to ½ lb. carbaryl 1½ lb. carbofuran (Furadan) ½ to 1 lb. (1 to 2 pts. 4F)	7 days. 7 days. NTL. 14 days. Check label for limitations on crops which may follow in the rotation.
	diazinon ½ lb. endosulfan 1 lb. methamidophos (Monitor) ¾ lb.	35 days. NTL. 14 days.
Cutworms	carbaryl 2 lb.	NTL.
Flea beetle (Also see "Soil Applied Systemic Insecticides" under "POTATO INSECT CONTROL," and "Aphids" on page 24)	azinphosmethyl ½ lb. monocrotophos (Azodrin) ¼ to ½ lb. carbaryl 1 to 1½ lb. carbofuran (Furadan) ½ to 1 lb. (1 to 2 pts. 4F)	7 days. 7 days. NTL. 14 days. Check label for limitations on crops which may follow in the rotation.
	diazinon ¼ to ½ lb. endosulfan ½ to 1 lb. methamidophos (Monitor) ¾ to 1 lb.	35 days. NTL. 14 days.
Grasshoppers	carbaryl 1 lb.	NTL.
Leafhoppers (Also see "Soil Applied Systemic Insecticides" under "POTATO INSECT CONTROL," and "Aphids" on page 24)	monocrotophos (Azodrin) ¼ to ½ lb. carbaryl 1 to 1½ lbs. carbofuran (Furadan) ½ to 1 lb. (1 to 2 pts. 4F)	7 days. NTL. 14 days. Check label for limitations on crops which may follow in the rotation.
	diazinon ½ lb. dimethoate ½ lb. endosulfan ½ to 1 lb. malathion ¾ lb. (1 pt. 5 lb. EC) methomyl ½ to 1 lb. methamidophos (Monitor) ¾ to 1 lb. oxydemeton methyl ½ lb. (Meta-Systox-R)	35 days. NTL. NTL. NTL. 6 days. 14 days. 7 days.
Loopers	methomyl (Lannate, Nudrin) 1 lb. methamidophos (Monitor) 1 lb.	6 days. 14 days.

Diseases	Chemical†	Remarks and limitations
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Seed-piece decay

NOTE: Keep seed storage temperatures at 40° F. during winter. In spring, warm seed to 60 to 70° F. for 1½ to 2 weeks before planting. Cut seed may be treated with an organic fungicide (captan, maneb, Polyram, or zineb or a combination of these materials plus an antibiotic.) Plant immediately in moist, warm soil, above 50° F.

Seed-piece treatment:	Dip or dust cut potatoes, 0.5 lb. actual per bushel.
captan 8%	
captan 8% plus streptomycin 100 ppm	
Dithane M45 or Manzate 200 8% dust	
maneb 8%	Dip seed pieces or whole tubers. 1 lb. per 10 gallons water.
maneb 8% plus streptomycin 1ppm	These dusts should be applied with a drum-type dust treater. Application using other devices may give poor coverage and increase the chance of personal contamination with the fungicide.
Polyram—0.11 lb. actual as dust per 100 lb. seed	Not over 0.15 lb. actual as a dust per 100 cut or whole seed pieces or 1 lb. actual per 50 gallons water. Seed piece dip.
zineb 8%	
zineb 8% plus streptomycin 1 ppm	

Blackleg Seed-piece treatment Avoid infected seed potatoes. Warm seed before planting and plant in warm soil.

Scab Resistant varieties If possible, grow resistant varieties such as Cherokee, Tawa, Plymouth, Antigo, Norland, LaRouge, Norgold, and Superior. Do not apply manure or other forms of

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetttable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

POTATOES (continued)

Diseases	Chemical†	Remarks and limitations
		organic matter immediately before the potato crop. Apply organic matter at other times in the crop rotation. Do not apply lime to potato soils. Keep soil in acid condition if possible.
Purple top wilt	Spray for leafhoppers	This is the aster yellows disease of potatoes. Control the aster leafhopper. Leafhopper control during the first half of the growing season is most important.
Late blight	Spray or dust in field	Available recommended fungicides are protectants. They must be on the plant to prevent infection. They will not control the disease after infection has occurred. Plan on a 7- to 10-day interval of application and vary the application depending on weather conditions and presence of disease. During cool, moist periods the interval may be 4 to 5 days while during dry, hot weather the interval may be about 15 days.
Late blight and early blight	Sprays—see label for rates Bravo 75 WP Bravo 500 1½ to 2¼ pts. Difolatan 4 Flowable Duter Fixed Coppers Kocide 101 Oxy Cop 8L Tri-Basic-Copper Sulfate maneb 80% WP 1½ to 2 lb. per acre maneb zinc ion complex (Dithane M45 or Manzate 200) Polyram Dust formulations of some of the above materials are also available. These are usually 6% to 8% and applied at rates between 20 and 40 lb. per acre.	Begin applications when plants are 6-inches high or when disease threatens and continues at 7- to 10-day intervals or as needed to maintain disease control. Under severe disease conditions use the 2¼ pts. per acre and shorten spray intervals. Do not apply more than label recommendation or plant injury may occur. Do not cut the recommended amount of water for your sprayer. Weed sprayers are not designed for this work.
Tuber rot postharvest	captan mertect 340F 42 fl. oz. per 100 gal. water. Use 1 gal. of solution per 2,000 lb. of potatoes.	See table of contents for section on postharvest dip or spray. Postharvest spray for control of storage rot, especially Fusarium and seed piece decay. Apply as a mist to unwashed tubers on a conveyor line into storage or to seed potatoes at time of grading for shipment or field use.
Fusarium and verticillium wilt		Wilt disease is carried in tubers and in the soil. Crop rotation and certified seed use will help reduce losses. Do not spread cull potatoes on fields to be planted to potatoes in future years. Warm seed before planting and plant in warm soil.
Rhizoctonia	Terrachlor EC (see label)	Used as soil treatment.
Nematodes	See table 1.	Soil fumigation for nematode and wilt control.

RADISHES

Insects	Chemical†	Remarks and limitations
Cabbage maggot	diazinon 1 to 4 lb. (2 to 8 lb. 50% WP; 7½ to 28 lb. 14% G) fonofos (Dyfonate) 2 lb. (20 lb. 10% G)	Row or broadcast treatment before or at planting time. 1 lb. row; 4 lb. broadcast. Broadcast, disk in before planting.
Flea beetles	carbaryl (Sevin) 1 lb. (1¼ lb. 80% WP) diazinon ½ lb. (1 lb. 50% WP, ½ to 1 pt. AG 500)	3 days. 10 days.

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RADISHES (continued)

Insects	Chemical†	Remarks and limitations
	malathion 1 lb. (1½ pt. 5 lb. EC) methoxychlor 1 lb. (2 lb. 50% WP)	7 days. 7 days.
Diseases	Chemical†	Remarks and limitations
Seed rot and damping off	Seed treatment: chloranil	Use label directions. Do not use treated seed for food or feed.
Root rot	soil fumigation: Vapam, Vorlex, Terr-O-Cide-15	Cultivate prior to planting. Do not plant within 7 days of treatment on light soils or 14 days on heavy soils. Minimum rate 20 gallons per acre.

RHUBARB

Insects	Chemical†	Remarks and limitations
Rhubarb curculio	Handpick from plant. Control weeds, especially dock in which insects breed.	Effective insecticides have not been registered for use on rhubarb.
Stalk borer	Control grassy and large-stemmed weeds.	
Diseases	Chemical†	Remarks and limitations
Leaf spot	Spray with captan (forcing under glass) Captan—1 lb./100 gal.	N.T.L. Harvest stems having leaves with spots first. After frost in fall, remove all top growth and destroy. Badly wilted plants should be removed. Make new planting on ground away from old planting. Apply following budding and weekly until harvest.

RUTABAGAS AND TURNIPS

Insects	Chemical†	Remarks and limitations
Cabbage maggot	fensulfothion (Dasanit) 1 to 2½ lb. (7 to 16 oz. 15G per 1,000 ft. of row) or 2 fl. oz. spray concentrate diazinon 1 to 4 lb. (2 to 8 lb. 50% WP; 7½ to 28 lb. 14% G)	Apply in 4 to 6 inch band prior to seeding. Incorporate granules into upper inch and plant in treated bands. Liquid formulation may be applied as a drench over the row about 4 weeks after planting or when flies appear. No more than 4 applications per season. 40 days. Row or broadcast treatment before or at planting time. 1 lb. row; 4 lb. broadcast, plus a drench treatment over the row when flies appear for second generation. Turnips only.
Flea beetles	carbaryl (Sevin) 1 lb. (1¼ lb. 80% WP) diazinon ½ lb. (1 lb. 50% WP, ½ to 1 pt. AG 500) malathion 1 lb. (1½ pt. 5 lb. EC) methoxychlor 1 lb. (2 lb. 50% WP)	3 days. 10 days, turnips only. 3 days. 7 days.
Diseases	Chemical†	Remarks and limitations
Black rot and blackleg	Hot-water seed treatment 122° F. for 20 min.	Dry seed thoroughly. Crop rotation and sanitation are necessary also. Seedbed area should be changed or soil fumigated.
Seed rot, damping off of turnips	Seed treatment: chloranil	Use label directions. Do not use treated seed for food or feed.

SPINACH

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
Annual weeds	cycloate (Ro-neet)	3 to 4	Apply before planting and incorporate. Do not use on muck or peat soils.
	CIPC (Furloe Chloro CIPC)	2	Apply after seeding before crop and weeds emerge.
	CDEC (Vegadex)	4	Apply after seeding before crop and weeds emerge. Do not use on peat or muck soils.

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetttable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

SPINACH (continued)

Insects	Chemical†	Remarks and limitations
Leaf miner	azinphosmethyl (Guthion) ½ lb. (2 pt. 2 lb. EC) diazinon ½ lb. (1 lb. 50% WP, 1 pt. AG 500) dimethoate (Cygon, De-Fend, Rebelate) ¼ lb. (½ pt. 4 lb. EC) malathion 20 oz. (2 pt. 5 lb. EC) or 2 lb. 25% WP per 100 gal. water	14 days. 10 days. 14 days. 7 days.
Diseases	Chemical†	Remarks and limitations
Damping off	Seed treatment Thiram 6 oz. 75 WP/100 lb. Captan 6 oz. 75 WP/100 lb.	Spray 5 to 7 lb. in 25 to 30 gal. of water into the furrow at planting time. Apply 25 to 30 lb. into furrow at planting time.
Root rot	Captan 50 WP Captan 10% dust	2-6 lb./acre in furrow at planting time.

TOMATOES

Weeds	Chemical†	Pounds/acre active ingredient	Remarks and limitations
SEEDED			
Annual grasses	diphenamid (Enide)	6	Apply before seeding and incorporate or after seeding before crop and weeds emerge.
Annual broadleaves	metribuzin (Sencor, Lexone)	¼ to ½	Apply when tomatoes have five to six leaves and the weeds are less than 1-inch tall. May be reapplied at no less than 17-day intervals. Do not apply more than 1 lb/acre/year; within 24 hours of other pesticide applications; or within 3 days after periods of cool, wet, and cloudy weather.
TRANSPLANTS			
Annual grasses	diphenamid trifluralin (Treflan)	6 ½ to 1	Apply after transplanting, before weeds emerge. Apply before transplanting and incorporate. Use lower rates on sandy soils.
Annual broadleaves	chloramben (Amiben Granular)	3 to 4	Apply after transplanting before weeds emerge. Do not use on sandy soils. Use granular formulation only.
	metribuzin	¼ to ½	Apply after transplanting when transplants recover from transplant shock and show new growth. Weeds should be emerged but less than 1-inch tall. For other restrictions, see SEEDED—metribuzin.
Annual weeds	metribuzin + trifluralin	¼ to ½ + ½ to 1	Apply before transplanting and incorporate. Use lower rates on sandy soils.

Insects	Chemical†	Remarks and limitations
Aphids	diazinon ¼ lb. (½ lb. 50% WP, ½ pt. AG 500) demeton (Systox) ¼ lb. (1 pt. 2 lb. EC) dimethoate (Cygon, De-Fend, Rebelate) ¼ to ½ lb. (½ to 1 pt. 4 lb. EC) disulfoton (Di-Syston) 1 lb. (6.7 lb. 15% G)	1 day. 3 days. 7 days.
	endosulfan (Thiodan) ½ lb. (1 qt. 2 lb. EC) malathion ½ lb. (2 lb. 25% WP, ½ pt. 5 lb. EC) malathion 0.15 lb. actual per 50,000 cu. ft. as aerosol parathion ¼ lb. (1 pt. 2 lb. EC) parathion 0.1 lb. actual per 50,000 cu. ft. as aerosol	Apply as side-dress at planting. Do not place in contact with seed or use as a soil treatment before transplanting. 30 days. 1 day. 1 day. For greenhouse tomatoes. 15 hours. 10 days. For greenhouse tomatoes. 10 days.
Cutworms	carbaryl (Sevin) 2 lb. (2½ lb. 80% WP) spray or bait diazinon 4 lb. (8 lb. 50% WP or 4 qt. AG 500) trichlorofon (Dylox) 1 lb. (20 lb. 5% bait)	NTL. Broadcast soil treatment at planting. 28 days for bait, 21 days for spray.

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetttable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

TOMATOES (continued)

Insects	Chemical†	Remarks and limitations
Flea beetles	carbaryl (Sevin) 1 lb. (1¼ lb. 80% WP) endosulfan (Thiodan) ½ lb. (1 qt. 2 lb. EC) methoxychlor 1 lb. (2 lb. 50% WP) toxaphene 2 lb. (½ gal. 6 lb. EC)	NTL. 1 day. 1 day. 1 day.
Leafhoppers	carbaryl (Sevin) 1-1½ lb. (1¼-1½ lb. 80% WP) dimethoate (Cygon, De-Fend, Dimex, Rebelate) ¼ to ½ lb. (½ to 1 pt. 4 lb. EC) disulfoton (Di-Syston) 1 lb. (6.7 lb. 15% G) malathion 1¼ lb. (5 lb. 25% WP) methoxychlor 1½-2 lb. (3 to 4 lb. 50% WP)	NTL. 7 days. Apply as side-dress at planting. Do not place in contact with seed or use as a soil treatment before planting. 1 day. 1 day.
Fruit flies (for processing)	Dust or spray fruit and hampers with synergized pyrethrins (Pyrenone, Pyrocide) to cover fruit lightly but thoroughly. Avoid crushing or cracking fruit. Apply 1½ lb. trichlorfon (Dylox) per A immediately before harvest.	Do not use on fresh market tomatoes.
Diseases	Chemical†	Remarks and limitations
Bacterial spot, bacterial speck, bacterial canker	Hot-water seed treatment 122° F. for 25 min. Then treat with Thiram 75 (5.5 oz./100 lb. or 1 tsp./lb.) Fumigation of seedbed soil Fumigation of all wood and other equipment: formaldehyde 37%, 1 part ot 20 parts water. Spray or dust in field Fixed copper—use label directions	Cool and dry seed thoroughly. Crop rotation and sanitation are necessary also. See section on seedbed fumigation, page 5. Dip or spray all equipment used the previous season. 7- to 10-day intervals. No time limitations. Early season applications are most important. Burning may result from spraying very young and tender plants.
Rhizoctonia	PCNB—not over 0.5 pt. of 0.2% solution per plant (about 2 lb. 75% WP per 100 gal.)	Transplant water. For both field and greenhouse.
Seed rot, damping off	Seed treatment: captan, chloranil, dichlone, or thiram Soil drench—captan 50% WP 1 to 2 lb. per 100 gal. water	Follow hot-water treatment after seed is dry. Use label directions. Do not use treated seed for food or feed. Immediately after planting. For both field and greenhouse. Apply 5 gallons per 100 square feet.
Late blight, early blight, gray septoria leaf spot and mold	Spray or dust in field with any of the following: Bravo 500 ¼ to 2¾ pts. Bravo W-75 Difolatan Kocide 101 maneb Polyram zinc ion plus maneb	Begin application when disease threatens and repeat at 7- to 10-day intervals. Under severe disease conditions shorten spray intervals. Use label directions for all fungicides. Burning may result from spraying very young and tender plants. Use locally grown plants. Begin spray when first fruit clusters becomes visible. Repeat every 10 to 12 days. NTL. NTL. 5 days before harvest. NTL. 5 days before harvest.
Anthracos	Bravo 500 2¾ to 4¼ pts.	Begin application when disease threatens and repeat at 7- to 10-day intervals. Under severe disease conditions shorten spray intervals.
Aster yellows	Control Aster (six-spotted) leafhoppers. Early season control is most important (see above).	
Fusarium and verticillium wilt greenhouse tomatoes		Plant Fusarium and Verticillium wilt resistant varieties.

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wetable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.

TOMATOES (continued)

Diseases	Chemical†	Remarks and limitations
Botrytis mold	Bravo Chlorothionil Dithane M-45 Manzate 200	Control humidity by heating and venting, especially at night. Spray following label directions or use exotherm.
Botrytis gray mold, early blight, gray leaf spot and late blight	Exotherm Termil 100 gm. treats 1,000 sq. ft.	Do not apply when greenhouse temperature is above 75°F. Read table for additional information.
Botrytis mold, Cladosporium, Cercospora, Phoma, and Sclerotinia	Benlate ½ to 1 lb. per 100 gal. water.	Begin application when disease first appears. Spray at 7- to 10-day intervals.

†Abbreviations used in tables: NTL—no time limitations, EC—emulsifiable concentrate, D—dust, G—granules, S—solution, and WP—wettable powder. Dosages of insecticides are actual chemical per acre, with some exceptions.