UNIVERSITY OF IDAHO
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and Plant Pathology

Idaho Recommendation Chart
for
Plant Disease and Insect Control

By
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and
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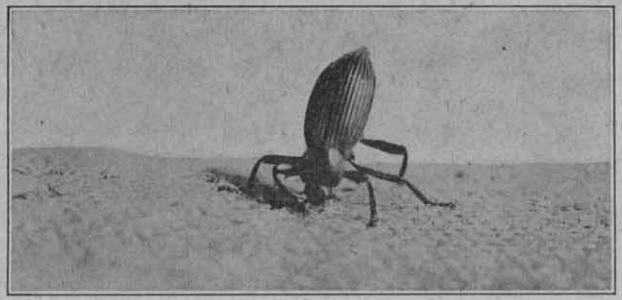
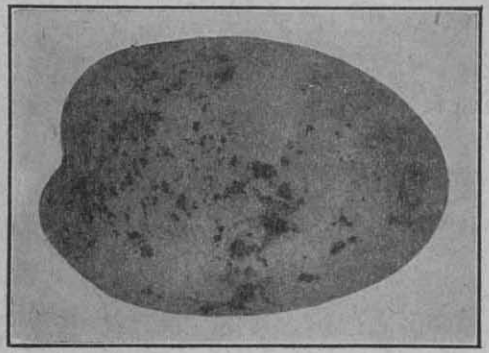
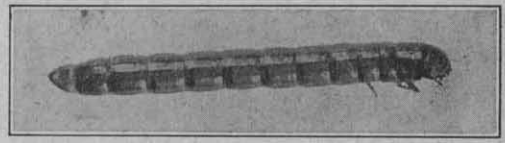


Adult of False Wireworm



Rhizoctonia on Potatoes

Dusting for Control of Snowy Tree Cricket



Dry Farm False Wireworm

Idaho Recommendation Chart

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This recommendation chart for methods of control of insect pests and plant diseases deals only with those of economic importance in Idaho. A discussion of the preparation and use of the fungicides and insecticides mentioned in these recommendations, in cases where additional explanation is necessary, will be found on pages 51 to 55.

ALFALFA

Disease or Insect	Recommendations	Time of Control
ALFALFA LOOPER—Green or yellowish worms up to 1 inch long. Move in looping fashion. Rarely injurious on first crop.	Cut crop and cure hay as soon as possible.	When infestation is severe on first crop.
ALFALFA WEEVIL—Small green worms with black head and light stripe on back. Destroy tips of plants of first crop and retard growth of second crop. Idaho Exp. Sta. Cir. 34. Idaho Extension Cir. 25.	Spray with calcium arsenate in water at rate of 2 pounds per acre.	When injury to first crop begins to be severe and tips of plants have ragged, eaten appearance over field generally.
	If infestation is light, clip first crop and remove from field as soon as possible.	
BACTERIAL WILT—Recently found in Idaho. Causes death of plants and loss of stand in old fields. Affected plants are dwarfed and spindling, and have many small stems giving the plant a "witches broom" appearance. Plants often wilt in hot weather. (bacterial)	Badly affected old stands should be plowed up and other crops grown for two or three years.	
CROWN WART—Warty outgrowths at the crown of the plant. Plants dwarfed. (fungus)	Plow under badly diseased areas and do not plant to alfalfa for several years.	
DOWNY MILDEW—Produces a gray mildewed growth on the leaves. May weaken the plants and cause dropping of the leaves. More severe in wet weather. (fungus)	No satisfactory control known. Excessive irrigation should be avoided.	

ALFALFA—(Continued)

Disease or Insect	Recommendations	Time of Control
GRASSHOPPERS—Eat foliage, destroy blossoms and seed pods. Eggs laid in ground in field or along ditches, roads, etc.	Cultivating destroys eggs.	Spring tooth soil in late fall so egg masses are broken up and exposed to winter conditions.
	Scatter poisoned bran mash broadcast at rate of 12 pounds per acre. See instructions for mixing poisoned bran page 51.	When young grasshoppers begin to attack crop or just following removal of first crop when they are migrating into a field. Middle of forenoon best time.
	For repellants spray forming seed pods with lime sulphur 1 part and water 50 parts; Bordeaux mixture 4-4-50; or with lead arsenate 4 pounds to 100 gallons water. See under "Bordeaux Mixture" Page 53.	In late season, grasshoppers center their attack on blossoms, seed pods or the stems of seed pods. Spraying done to prevent late season attack.
Idaho Extension Bul. 61		
LEAF BLOTCH—Yellow blotches covered with tiny dark spots appear on the leaves. Entire leaf often affected. (fungus)	In severe cases, hay should be cut and cured as soon as possible in order to save the leaves.	
LEAF SPOT—Dark brown circular spots on the leaves. Causes dropping of the leaves in severe cases. (fungus)	Same as for leaf blotch.	

ALFALFA—(Continued)

Disease or Insect	Recommendations	Time of Control
PEA APHID—Green plant lice usually numerous on first crop. On rare occasions cause severe injury in early spring.	Pasture late in fall to destroy overwintering adults and protective foliage.	Graze third crop or graze after third crop is cut.
	Granular calcium cyanide, 25 pounds per acre, sown on top of ground in grain drill gives control in spring.	Use cyanide when attack becomes severe in spring and while plants are small. Cyanide impracticable except in extreme cases.
STEM BLIGHT—A disease attacking the stems of the alfalfa plant causing a spotting and in severe cases a rotting of the stems. (bacterial)	No satisfactory control known.	

APPLE

Disease or Insect	Recommendations	Time of Control
ANTS—Attracted by aphid honey dew. Become quite troublesome to thinners and pickers. (See under apple aphid)	Spray to kill aphids. Kill ants in nests by placing 1 ounce calcium cyanide 6 inches deep in hill and covering being careful to avoid the roots. Scatter cyanide in tree rows, also.	Cyanide in nests most effective in evening when ants are not abroad.
APPLE APHID—(Green apple aphis) Green plant louse that feeds on water sprouts and tender terminal leaves. Curls young leaves badly.	Spray with nicotine sulfate and oil at rate of ¾ pint nicotine and 5 pints commercial oil emulsion to 100 gallons water. Or, add ¾ pint nicotine sulfate to each 100 gallons delayed dormant oil or lime-sulfur spray.	When green tips of buds are appearing.
(See combination sprays for apple). Idaho Exp. Sta. Cir. 23.	Use above combination but nicotine may be decreased to ¼ pt. when temperature is from 80° to 90°, approximately.	In May, June, or July when infestation is severe. May be added to one of the codling moth sprays.
BLUE MOLD ROT—Widely distributed and is one of the most common storage rots. Rot starts at bruises or skin punctures. Blue fungus growth soon appears on the surface of rotted areas. (fungus)	Handle apples carefully, cool rapidly and keep in cool storage.	
BROWN MITE—(Clover mite)—Small, brown, 8-legged creature that injures leaf tissue, causing low vitality of tree. Eggs deposited on bark in fall. Does not spin web. Idaho Exp. Sta. Cir. 25. Technical Bul. 25; U. S. D. A.	Dormant applications of oil as for scale usually hold mites in check.	While trees are dormant or preferably in the delayed dormant.
	If summer spray is needed, use lime-sulfur 1 part to 40 parts water or use oil emulsion at ½% oil strength. Spray under sides of leaves carefully and thoroly.	Before injury becomes severe, first or second week of June.

Disease or Insect	Recommendations	Time of Control
CHLOROSIS—Chlorosis is induced by an excess of lime in the soil which makes unavailable the iron or magnesium necessary for the formation of green color in the leaves. The leaves turn yellow on a portion or all of the tree. In severe cases death of branches of the tree may result. This disease is in many ways similar to rosette and the two troubles may be found on the same tree. This disease may affect various fruit and shade trees as well as many herbaceous plants. (non-parasitic)	Copperas (iron sulfate) applied around the roots of the trees at the rate of 2 to 5 pounds per tree, depending upon the size of the tree, has given good results. The same chemical sprayed on the tree in a one percent solution also gives temporary correction. The addition of humus to the soil is also recommended .	

APPLE—(Continued)

Disease or Insect	Recommendations	Time of Control
CODLING MOTH—(Apple worm)—Larvae winter under bark or in soil or trash. From one to three broods annually in Idaho. Control varies according to locality.	Spray with lead arsenate 2 pounds to 100 gallons water.	
	Calyx spray.	When petals are from 75% to 95% fallen.
	First cover spray. (For first brood worms)	Should be completed 16 days after emergence of first spring-brood moths. Determine date by use of moth emergence cages.*
Instructions for making moth emergence cages and determining spray dates furnished upon application to Idaho Agricultural Experiment Station.	Second cover spray. (For first brood worms)	Should be completed 10 days after first cover spray, when four cover sprays are applied, or 15 days after, when three cover sprays are applied.
*Or, have first cover spray completed within 10 days after thermometer registers 60°F. or higher for two or more nights at 8 p.m. after the calyx spray.	Third cover spray. (For first brood worms)	Should be completed 14 days after second cover spray when four cover sprays are applied, or omitted when but three cover sprays are applied.
	Fourth cover spray. (For second brood) (This is the third cover spray when third spray above is omitted.)	Should be completed in from 8 to 10 days after emergence of first moth from first brood larvae. Determine date by use of moth emergence cages.
COMMON RED SPIDER—Minute creature, light or translucent green. Winters in soil as adult and migrates to foliage in spring. Spins dense web on under side of leaves. Eggs and mites protected by web. Technical Bul. 25; U. S. D. A. Idaho Exp. Sta. Cir. 25.	Dormant spray not effective. Apply foliage spray of oil emulsion at ½% oil strength or lime-sulfur 1 part to 40 parts water. Lime-sulfur does not kill eggs but oil kills both eggs and mites.	First or second week in June. Spray under side of leaves carefully and thoroly and use force to get liquid thru the web.

Disease or Insect	Recommendations	Time of Control
CROWN GALL—This disease attacks many different plants causing galls at or just below the surface of the ground. These galls are irregular, warty and of various sizes, often being larger than the diameter of the trunk. May also cause "hairy root." Diseased trees may become stunted after planting in the orchard. (bacterial)	All nursery stock should be carefully examined and only plants free from this disease should be used. Diseased trees in the orchard should be removed and destroyed. All dirt and small roots should be removed from the hole before another tree is planted.	
EUROPEAN FRUIT MITE—Small red colored, eight-legged creature that destroys leaf tissue causing low vitality of tree. Eggs deposited in fall on bark and in summer on under side of leaves. Does not spin web. Technical Bul. 25; U. S. D. A. Idaho Exp. Sta. Cir. 25.	Dormant applications of oil usually hold insect in check.	Before buds burst in spring.
	If summer spray is needed, use lime-sulfur 1 part to 40 parts water or oil emulsion at ½% oil strength. Oil gives better control. Spray under side of leaves carefully.	First or second week of June.

Disease or Insect	Recommendations	Time of Control
FIRE BLIGHT—This is a very serious disease of apples, pears and quinces. Kills the blossoms, twigs, branches and some times the whole tree. The disease is known as blossom blight, fruit blight, twig blight, body blight, collar blight or root blight depending upon the part of the tree attacked. Bacterial germs of the disease overwinter in cankers on larger limbs and are carried by insects to blossoms and smaller twigs. Cankers usually occur at bases of twigs, are diamond shaped and delimited by a crack in the bark. (bacterial)	All hold-over cankers should be removed. In pruning cut back at least six inches beyond any discoloration of the bark. Susceptible varieties should be avoided if possible. Trees should not be forced too rapidly as succulent growth is more readily attacked by disease germs.	
FRUIT TREE LEAF ROLLER—Green worms with brown heads. Larvae hang from trees by thread; roll and destroy leaves and eat holes in fruit. Flat egg masses laid on bark in July do not hatch until following spring. Idaho Exp. Station Bul. 137.	Spray with oil emulsion. In moderate or light infestation 4% oil gives good control. For severe outbreaks use 7% oil. Cover thoroly all branches and tips of twigs.	In late winter or early spring, dormant or delayed dormant period, when temperature during spraying and immediately following is not lower than about 25° above zero.
JONATHAN SPOT—Superficial spotting of fruit of Jonathan and a few other varieties of apples. Usually develops in storage. (non-parasitic)	Low temperatures and good ventilation in storage.	

Disease or Insect	Recommendations	Time of Control
LEAFHOPPER—Tiny greenish-yellow or pale yellow sucking insects that feed on lower leaf surfaces causing flecking and mottling. When numerous they stain the fruit with brown spots of excrement making it unsightly and lowering market value.	Spray with nicotine sulfate ½ pint and commercial oil emulsion 5 pints to 100 gallons water. Direct spray stream upward and thoroly cover the under sides of the leaves.	Before nymphs become winged in early June or when the second brood nymphs appear in late July or early August. Control not effective after insects obtain wings.
POWDERY MILDEW—Mildew growth comes on tips of branches and the leaves are curled and dwarfed. Death of tips of twigs often results. (fungus)	Prune infected shoots. Spray with lime-sulfur summer strength same as for apple scab.	
OYSTERSHELL SCALE—Small insects that become fixed on bark or fruit and that cover themselves with a secretion resembling in shape an oyster shell.	Spray with lime-sulfur 1 part to 9 parts water.	Delayed dormant period.
	Under average conditions oil emulsion at 4% oil strength gives good commercial control.	Dormant or delayed dormant period.
	For extremely heavy infestations use oil emulsion at 7% oil strength.	Dormant period when temperature while spraying and immediately following is higher than 25° above zero.
PEAR LEAF BLISTER MITE—Minute mite that winters beneath budscales and burrows beneath leaf surfaces in summer causing "rusty" spots.	Spray with lime-sulfur 1 part to 9 parts water.	Dormant period before buds begin to crack.
	Good commercial control often obtained by using oil emulsion at 4% to 7% oil strength but lime-sulfur is more dependable.	Oil sprays are most effective if applied just as buds are cracking and before green leaf tips appear.

APPLE—(Continued)

Disease or Insect	Recommendations	Time of Control
ROSETTE—All or portions only of a tree may be affected. Leaves are narrow and often very small, forming in a cluster at the tips of the branches giving the disease the name rosette. Caused by a lack of available plant food in the soil. (non-parasitic)	Alfalfa grown around the trees for a number of years usually overcomes this trouble. Addition of humus-forming substances such as manure and straw also helps.	
ROSY APPLE APHID—Pink, green, or purplish plant lice that roll leaves severely and cause dwarfed, misshapen fruit. Attack not restricted to tender leaves and new growth. Eggs hatch just before buds burst. Idaho Exp. Station Cir. 23.	Spray with nicotine sulfate ¾ pint and commercial oil emulsion 5 pints per 100 gallons water.	Just as cluster buds are separating. Control is very difficult after leaves become rolled.
	Nicotine may be combined with dormant lime-sulfur or oil spray for San Jose scale.	Delay application until cluster buds are separating.
SAN JOSE SCALE—Tiny yellow insects that fix themselves on bark or fruit and suck sap. Body of insect is covered with ash-colored secretion or scale.	Oil emulsion sprays of 3% oil strength give complete control in Idaho with possible exception of Lewiston district where 4% oil strength is recommended.	Dormant or delayed dormant period.
Idaho Exp. Station Bul. 137.	Lime-sulfur, 4° strength, gives satisfactory control under ordinary conditions. In extremely severe cases 5° strength is recommended.	Dormant or delayed dormant period.

APPLE—(Continued)

Disease or Insect	Recommendations	Time of Control
SCAB—This disease is common only in the northern part of Idaho. Causes scabby spotting of fruit and olive colored spots on the leaves. Fruit is often misshapen. The organism causing the disease overwinters on old leaves under the tree. (fungus)	Destruction of old leaves in the fall or early spring is advisable. Spray with lime-sulfur summer strength (1) when blossoms show pink, (2) when 80 per cent of the petals have fallen and again (3) three weeks later. The last two sprays may be combined with codling moth sprays.	
SCALD—Browning of the green or unblushed side of the apple fruit. General during the latter half of the storage season. (non-parasitic)	Pack box apples in oil wraps and barrel apples in shredded oiled papers. Cool as rapidly as possible.	
WOOLY APPLE APHID—Purplish plant louse clustered in crevices or wounds in the bark or on the roots and covered with "wooly" secretion.	Spray with nicotine sulfate, ¼ pint and commercial oil emulsion, 5 pints to 100 gallons water. Use coarse, drenching spray with high pressure to penetrate thru the wool.	When infestation becomes severe. Usually advisable to wait until early June when weather is warm and migration to limbs and trunk has taken place.

APPLE—COMBINATION SPRAYS

Disease or Insect	Recommendations	Time of Control
SAN JOSE SCALE and green aphid or rosy aphid. Idaho Exp. Sta. Cir. 23.	Add nicotine sulfate, ¾ pint to 100 gallons dormant lime-sulfur or oil spray.	Delay application until tips of buds are beginning to show green.
SAN JOSE SCALE and fruit tree leaf roller.	Use oil emulsion spray as recommended for leaf roller.	Before buds burst.

APPLE—COMBINATION SPRAYS—(Continued)

Disease or Insect	Recommendations	Time of Control
SAN JOSE SCALE and pear leaf blister mite.	Use lime-sulfur spray as recommended for San Jose scale.	Application must be completed before buds burst.
	Oil spray is effective against scale and usually gives high degree of control of mite.	Apply just as the buds are bursting.
	3% oil plus lime-sulfur at 2½% strength gives complete control of both scale and blister mite.	Application must be completed before buds burst.
FRUIT TREE LEAF ROLLER and pear leaf blister mite. Also San Jose scale when that is present.	Use oil emulsion at oil strength recommended for leaf roller. Results not always satisfactory for blister mite but good commercial control usually obtained.	Delay application until buds are bursting.
	Add oil emulsion to lime-sulfur solution to make 4% oil strength. Use lime-sulfur 1 part to 6 parts water.	In the dormant period.
CODLING MOTH and **APPLE APHIDS.**	Add commercial oil emulsion, 5 pints, and nicotine sulfate, ⅜ pint to each 100 gallons lead arsenate spray. Make exceptionally thoro application.	First or second cover spray for codling moth. When weather is warm.
CODLING MOTH and **SPIDER MITES.**	Add 5 pints commercial oil emulsion to each 100 gallons lead arsenate spray. Make thoro application directing spray stream with force against undersides of leaves.	Second cover spray.

APPLE—COMBINATION SPRAYS—(Continued)

Disease or Insect	Recommendations	Time of Control
Codling moth and leaf hoppers. Effective also against aphids and spider mites.	Add commercial oil emulsion 5 pints and nicotine sulfate ½ pint to each 100 gallons lead arsenate spray. Make very thoro application directing spray stream at underside of leaves.	Second cover spray.

APRICOTS

Disease or Insect	Recommendations	Time of Control
PEACH BLIGHT—Apricots are often attacked by this fungus disease. Buds are killed back in the spring, and small cankers formed on the twigs. Shot holes are formed in the leaves and the fruit is often spotted. (fungus)	Dormant lime-sulfur or Bordeaux mixture 6-6-50.	Apply late in fall or early in spring, before buds begin to swell.
PEACH TWIG BORER.	See under "Peach".	
SAN JOSE SCALE.	See under "Apple".	

BARLEY

Disease or Insect	Recommendations	Time of Control
ERGOT—Causes black or brown bodies to form in place of kernels of grain. These ergot bodies are poisonous to animals when fed with the grain. fungus).	Secure clean seed if possible. If necessary to plant grain containing ergot, pour the grain into a salt solution (20% to 30%) and skim off the ergot.	
SMUT (Covered)—A fungus disease, the brown spore masses of which take the place of the kernel. This fungus mass retains somewhat the shape of the kernel and is to be found in the threshed grain. Spores become lodged on healthy kernels and infect the barley plant in seedling stage. (fungus)	Treat seed with a solution of 1 pint formalin to 40 gallons of water dipping it for 5 minutes or sprinkling it until every kernel is wet. Dry and sow at once.	
SMUT (Loose)—This disease differs from covered smut in that the spore masses break away from the head leaving the bare stalk. Spores are blown by the wind from diseased to healthy heads soon after plants head out and the fungus enters and remains on the inside of kernel. These kernels produce smutted plants. (fungus)	Secure seed free from the disease if possible. Hot water treatment only known method of control. This treatment not recommended except for small amount of seed for seed plot.	
STRIPE DISEASE—Caused by a fungus which overwinters in the seed. Plants dwarfed, leaves striped and heads often destroyed. Whole plant attacked and usually killed. (fungus)	Use disease free seed.	

BEANS

Disease or Insect	Recommendations	Time of Control
COMMON RED SPIDER—Sometimes injures beans near weeds, fence rows, ditches, etc., causing leaves to turn brown and to become dry.	Spiders can be held in check by dusting affected plants with dusting sulfur.	When infestation is discovered or injury becomes apparent.
MOSAIC—This disease is carried by infected seed and spread in field by aphids and perhaps other insects. Leaves mottled and curled. Plants dwarfed and produce few small pods. (virus)	Secure certified or other disease free seed and keep seed stock disease free by means of carefully rogued seed plot.	
SEED CORN MAGGOT—Small fly lays eggs near bean plants. Maggots emerging make their way to germinating beans or young plants, killing them or causing light stand and "baldhead."	No direct control method known. Satisfactory stands and yields are obtained by replanting fields.	Replant fields as soon as it is determined they are severely injured.

CABBAGE AND CAULIFLOWER

Disease or Insect	Recommendations	Time of Control
CABBAGE APHID—Dark green or bluish plant lice that are covered with white, powdery secretion. Become exceedingly abundant on the under sides of leaves of individual plants.	Dusting plants heavily with nicotine sulfate dust of 2% nicotine content is most effective method of control. Spray with nicotine sulfate, ¼ pint, and water, 25 gallons in which is first dissolved 1 pound laundry soap. Cover plants thoroly and keep them free from aphids until after heads have begun to form well.	Begin spraying as soon as first aphids are noticed. Late season spraying is not very satisfactory and is unnecessary if early control is maintained.
CABBAGE MAGGOT—Small, cream-colored maggots that eat into roots causing plants to wilt and die. Idaho Exp. Sta. Cir. 24.	Pour a solution of corrosive sublimate, 1 ounce in 10 gallons water around stems of plants and on ground immediately around plants. Dissolve the corrosive sublimate in hot water.	Four or five days after setting plants and repeate two or three times at 10 day intervals.
CABBAGE WORM—Green, velvety appearing worm an inch long or less, that eats large holes in the leaves and the forming head.	Dust thoroly with Paris green 1 part, mixed with 25 parts flour for most satisfactory control. Spray with lead arsenate, 1 pound to 25 gallons water in which is first dissolved 1 pound laundry soap.	Begin when larvae are first noticed and keep plants heavily covered until after heads have begun to form well. Heavy dusting before head forms prevents necessity of later control when there is danger from applying poisons.
DIAMOND-BACK MOTH—Tiny, green, tapering worms that riddle leaves and head and spin light webs about themselves on upper surfaces of leaves.	Dust thoroly with a mixture of 25 pounds flour and 1 pound Paris green or with pure calcium arsenate.	See under "Cabbage worm" above.

Disease or Insect	Recommendations	Time of Control
WESTERN CABBAGE FLEA BEETLE—Tiny, shiny, black beetle that hops. Eats holes in leaf surface and kills or injures plants in hot beds or shortly after planting.	Dust with a mixture of: Lead arsenate .....1 part Fine sulfur .....1 " Tobacco dust .....4 " Hydrated lime .....4 " Shake dust so it will cover the ground immediately around the plant, also. Or spray with Bordeaux mixture 4-4-50. See Bordeaux mixture, page 53.	While in hot beds and immediately after setting out.

CANTALOUP

Disease or Insect	Recommendations	Time of Control
CUTWORMS—See under Garden Insects.	Scatter poisoned bran mash close to hills. See page 51.	Just before plants are up and again three days later.
	When paper forcing cones are used place a spoonful of the mash beneath each cone.	At the time cones are placed over planted seeds.

CELERY

Disease or Insect	Recommendations	Time of Control
LATE BLIGHT—Leaves and stems covered with dark brown spots on which later appear the fruiting bodies of the fungus causing the disease. (fungus)	Spray with Bordeaux 5-5-50 or dust with copper lime 20-80 in seed bed when plants are one inch tall and again just before transplanting. Follow this by the same treatment in the field each week until ten days before harvest.	
ZEBRA CATERPILLAR—Black and yellow striped caterpillar that feeds in colonies on foliage. They are found first in clusters and defoliate single plants before spreading to others.	Destroy colonies on leaves by picking leaves and destroying or by spraying with lead arsenate, 4 pounds per 100 gallons water, when plants are small.	When larvae appear.

CHERRY

Disease or Insect	Recommendations	Time of Control
BLACK CHERRY APHID—Shiny, black plant louse that curls terminal foliage of sweet cherry and excretes sticky honey-dew on leaves and fruit. Idaho Exp. Sta. Cir. 26.	Spray with nicotine sulfate ¾ pint and 5 pints commercial oil emulsion to 100 gallons water or add nicotine sulfate to the oil or lime-sulfur spray used for San Jose scale.	Delay application until green tips begin to appear on blossom buds.
CHERRY MAGGOT OR CHERRY FRUIT FLY—Small white maggot inside of ripe or ripening fruit. Ore. Exp. Sta. Cir. 35.	Apply poison bait made of lead arsenate, ½ pound, syrup or molasses, 2 quarts, and water 8 gallons, in coarse drops to outer foliage where flies feed on it before depositing their eggs.	First spray applied when adults appear or about time Royal Anns show good color. Second spray about 10 days later and third spray a week or 10 days after second spray.
PEAR SLUG—Shiny, sticky, dark green larvae that move but little and destroy upper leaf surface causing leaves to turn brown and become crisp.	Spray with lead arsenate, 2 pounds to 100 gallons water, or dust with lead arsenate or air-slacked lime.	When injury becomes apparent in spring and again in fall, to prevent injury to next season's crop.
SAN JOSE SCALE—	See under "Apple".	

CHRYSANTHEMUM

Disease or Insect	Recommendations	Time of Control
GRASSHOPPERS—Cluster on buds late in fall and destroy buds and blossoms.	Spray buds with Bordeaux mixture 4-4-50 or with lime-sulfur 1 part to 40 parts water. These materials act as repellants.	Keep buds covered with spray until blossoms are out.

CLOVER

Disease or Insect	Recommendations	Time of Control
ALFALFA LOOPER—	See under "Alfalfa."	
CLOVER APHID—Small green or pink plant lice that become very abundant in blossoms and secrete a sticky honey-dew that lowers quality of seed. Idaho Exp. Sta. Research Bul. 3. Idaho Exp. Sta. Bul. 148.	Produce seed from second crop. Clip first crop when infestation is becoming heavy, remove hay as quickly as possible and allow field to remain without water until plants are dry (about ten days in good sandy loam soil). If sun is hot and ground dry, good control is produced on second crop.	At different elevations clipping date varies from first week of June to July 1. The aim should be to clip first crop as late as possible and still be assured of maturing seed on second crop.
CLOVER NEMATODE or eelworm—Tiny worms hardly visible to the naked eye attack the plant at the crown. Cause swelling of the stems at the bases of leaves. Much winter killing induced by eelworms. Idaho Exp. Sta. Bul. 130.	Infected fields should be plowed up not later than third fall after seeding.	
CLOVER ROOT BORER—Tiny brown beetles and cream colored grubs that bore into the roots forming tunnels, killing plants and allowing entrance of disease organisms. Idaho Exp. Sta. Bul. 148.	Of little importance where stands are maintained for only one seed crop year. Advisable to rotate land after one clover seed crop has been produced on it.	

CLOVER—(Continued)

Disease or Insect	Recommendations	Time of Control
CLOVER SEED CHALCID—Larvae of a tiny fly. Eat out interiors of forming seed. At harvest, infested seeds have small hole in them and are so light many of them blow out in chaff. Idaho Exp. Sta. Bul. 148.	Destroy volunteer alfalfa and clover plants near seed fields. Fall cultivation of clover fields kills many hibernating larvae. Practices outlined for clover aphid reduce chalcid injury but any method of control only partially effective.	Destroy late seeding plants in the fall and volunteer plants before they set seed in the spring. Springtooth fields in late fall where stands are being held over. Clip first crop in June as for clover aphid.
CLOVER SEED MIDGE—Pink colored worms found in the florets. They destroy florets before seed is formed. Idaho Exp. Sta. Bul. 148. Farmers' Bul. 942, U. S. D. A.	Pasture or clip the spring crop to prevent first brood larvae from becoming adults. Procedure outlined for clover aphid should be effective against midge.	See under "Clover aphid."
GRASSHOPPERS—	See under "Alfalfa."	
POWDERY MILDEW—This disease is rapidly becoming very serious in Idaho. Causes white mildewed appearance of leaves. Reduces vigor of plants and reduces set of seed. (fungus)	Dust with fine dusting sulfur, 10 to 15 pounds to the acre, when plants are 4 to 6 inches high. Make further applications as necessary. Or use lime-sulfur, 1½ gallons to 100 gallons of water, for each 1½ acres.	

CORN

Disease or Insect	Recommendations	Time of Control
COMMON SMUT—This disease produces black smut balls on various parts of the plant above ground. (fungus)	Remove and destroy diseased portions of the corn plant. The smut fungus overwinters in the soil and in manure. It is not carried by the seed corn.	
CORN EAR WORM—Worms that eat into the corn ears. When fully grown they are about 1½ inches long. Eggs deposited on silks.	Control diifficult and unsatisfactory. Keeping silks heavily dusted with pure calcium arsenate gives a measure of control but is not practical excepting in small gardens.	Apply dust as soon as silks appear and make frequent applications thereafter.
WIREWORMS—Shiny, yellow, hard worms that bore into planted kernels and young plants.	No practical control known. Avoid planting corn on known infested land. Land that has been in alfalfa for at least 5 years can usually be followed by corn or potatoes with safety for 1 or 2 years.	Plant corn as early as safe from frost.

CUCUMBER

Disease or Insect	Recommendations	Time of Control
CUTWORMS—	See under "Cantaloup".	

CURRANT

Disease or Insect	Recommendations	Time of Control
CURRANT APHID—Plant lice that cluster on tips and cause leaves to curl.	Spray with 1 teaspoonful nicotine sulfate in ¾ gallon water in which has been dissolved lump of laundry soap size of large walnut.	As soon as aphids are observed. Spraying after leaves have become curled not very effective.
GREEN CURRANT WORM—Uniformly pale green worm about ½ inch long that defoliates currant and gooseberry bushes.	Spray bushes thoroly with lead arsenate, 2 pounds per 100 gallons water.	First spray at time fruit is beginning to set to prevent injury from first brood larvae. Second spray after fruit is picked to prevent late defoliation and reduce infestation for next year.
IMPORTED CURRANT WORM—Green colored caterpillar with numerous black spots on the body. Defoliates currant and gooseberry bushes.	See under "Green currant worm" above.	

ELM

Disease or Insect	Recommendations	Time of Control
COTTONY MAPLE SCALE—	See under "Maple."	
ELM APHID—Bluish colored plant lice that cause severe curling of leaves in early spring and sticky honey-dew drips from trees in summer.	Where trees are large, control is rarely practicable. On young trees spray with nicotine sulfate ¾ pints and commercial oil emulsion 10 pints per 100 gallons water.	Spray in spring just as leaf buds are beginning to show green.
	Add ¾ pint nicotine sulfate to 100 gallons oil spray when spraying for elm scale.	When leaf buds begin to show green.
EUROPEAN ELM SCALE—Reddish-brown, plump bodied insects fringed with white and with a "mealy" covering. In crevices of bark and on undersides of limbs.	Very satisfactory control with oil emulsion spray at 7% oil strength.	Spray thoroly just before buds burst in the spring.
MOURNING CLOAK BUTTERFLY—Spiny, black caterpillars marked with white and red dots. Occur in groups and defoliate individual branches.	Clip and destroy affected branches or if infestation is severe spray with lead arsenate, 3 pounds in 100 gallons water.	When caterpillars make their appearance.

GARDEN INSECTS

See also under bean, cabbage, celery, cantaloup, cucumber, corn, onion, pea, potato, radish, strawberry, currant, tomato, turnip.

Disease or Insect	Recommendations	Time of Control
CUTWORMS—Smooth, shiny, gray to black worms that rest in curled position just below surface of ground. Feed mostly at night and cut plants off just at surface of ground.	Scatter poisoned bran mash around plants or scatter at planting time. See directions for poisoned bran mash, page 51.	Just before planting or setting plants to rid soil of cutworms before they can destroy new plants. Should be scattered just before evening.
GARDEN WEBWORM—Green larvae with small black dots. Worms spin webs which cover plants. Defoliate many plants and spread from weeds.	Destroy weeds in and near garden.	
	Spray with lead arsenate, 3 pounds, or Paris green, 2 pounds, to 100 gallons water.	When larvae are first noticed and before heavy webbing is formed.
GRASSHOPPERS—	See under "Alfalfa."	
WIREWORMS—See under "Corn."	Arrange a rotation, if possible so that garden can be planted on alfalfa land (see under "Alfalfa") or have garden patch that can be divided and half of it used as a chicken enclosure on alternate years. Irrigate and cultivate the chicken enclosure often so wireworms will stay close to surface and can be scratched out by fowls.	

GOOSEBERRY

Disease or Insect	Recommendations	Time of Control
	See under "Currant."	
MILDEW—Produces white cobwebby growth on leaves and fruit. (fungus)	Three or four applications of lime-sulfur, 1½ gallons to 50 gallons of water, beginning as soon as leaf buds open.	

GRAINS

Disease or Insect	Recommendations	Time of Control
ALFALFA LOOPER—	See under "Alfalfa."	
FALSE WIREWORMS—	See under "Wheat."	
GRASSHOPPERS—	See under "Alfalfa."	

HOLLYHOCK

Disease or Insect	Recommendations	Time of Control
APHIDS—Reddish plant lice that cluster on buds and leaves.	Spray with nicotine sulfate, 1 teaspoonful in ¾ gallon water, in which is first dissolved chunk of laundry soap the size of a large walnut.	When aphids are first observed and repeat if necessary.
RUST—Leaves covered with yellow to brown rust pustules. (fungus)	Remove and destroy affected leaves. Dust with sulfur in the spring.	

HOP

Disease or Insect	Recommendations	Time of Control
HOP SNOUT MOTH—Pale green larvae frequently attack ornamental hop vines causing leaves to have ragged, unsightly appearance.	Dust with pure calcium arsenate or lead arsenate or spray with lead arsenate, 3 pounds to 100 gallons water.	When first holes are noticed in leaves and repeat two or three weeks later if necessary.

HOUSEHOLD INSECTS

Disease or Insect	Recommendations	Time of Control
ANTS—Many species which get into cellars, bins, cupboards, etc.	Find nest if possible and kill ants by placing 1 ounce calcium cyanide or carbon disulphide 6 inches deep in nest and covering with soil.	In the evening and repeat if necessary for it is rarely possible to kill all the ants at one application.
	A safe and effective insecticide for ants on shelves, in cupboards, etc., is a mixture of Sodium fluoride .....75 parts Granulated sugar .....15 " Buhach (fresh) .....10 " Sprinkle freely in places frequented by ants. Can be kept on pantry shelves, behind bins, etc., and usually is quite effective.	
BEDBUGS—	Fumigation cheap and effective but dangerous. Write for special instructions.	
CLOTHES MOTHS—Cream colored larvae destroy woolen clothing, upholstered furniture, rugs, etc.	Fumigation usually effective but dangerous. Write for special instructions.	
COCKROACHES—	Sprinkle sodium fluoride powder or powdered boric acid freely in places frequented by roaches. Treat especially damp, dark places as under sinks, behind baseboards, etc.	Repeat applications frequently until premises are entirely rid of the pests.

Disease or Insect	Recommendations	Time of Control
HOUSEFLY—Breeds in all kinds of filth, garbage, human excrement, manure, etc. The housefly is a filth and disease carrier. Its presence is indicative of filth some place. "No filth, no flies."	Burn or bury garbage. Keep garbage cans covered. Protect foods by screening. Keep stables clean and haul manure away at least once a week and spread it where exposed to sunshine. Fly populations around barns, homes, stores, etc., can be greatly reduced by use of traps a number of which are on the market. Proprietary poisons and sticky fly papers are on the market that aid in greatly reducing numbers of flies. A good fly poison may be made at home by mixing together 1 tablespoonful of 40% formalin, ¼ pint sweet milk or buttermilk and ¼ pint water. Expose to flies in shallow dishes. Flies may be stupified by burning pyrethrum powder on hot stove lid when they may be swept up and burned. There are also a number of proprietary sprays on the market that serve the same purpose.	
INSECTS INFESTING FOODS—Several species of moth and beetles, larvae of which infest flour, cornmeal, breakfast foods, and other stored products.	Destroy infested foods and clean up containers. Often infestation is only on top or around outside of bags, etc., and with care contents in the interior may be saved. Exercise extreme care to clean out all cracks or accumulated food particles, to destroy eggs and small larvae. Spray cracks with gasoline or commercial insect sprays and fill them with paint. Fumigation not often practicable under household conditions but it may be necessary at times. Write for special information on fumigation. When infestation is first discovered, waste no time in destroying all forms of the insects before they increase and spread. The sacrifice of foodstuffs at once is often economy in the end.	

LETTUCE

Disease or Insect	Recommendations	Time of Control
CUTWORMS—	See under "Garden insects."	
GRASSHOPPERS—Often injure lettuce where planted near weeds or alfalfa fields. A few insects soon destroy stand completely.	Scatter poison bran mash freely around borders of lettuce fields. See also under "Alfalfa."	Apply a week before planting time and repeat applications at 3 day intervals until danger is past. Make applications about 9 o'clock a. m.
TIP BURN—Edges of leaves turn brown and die. Sometimes accompanied by decay. (non-parasitic)	No control known under field conditions. In green house avoid excess moisture and high temperature.	
ZEBRA CATERPILLAR—	See under "Celery."	

MAPLE

Disease or Insect	Recommendations	Time of Control
COTTONY MAPLE SCALE—Small sucking insects covered by conspicuous cottony secretion. Adhere thickly on branches.	Spray with oil emulsion at 7% oil strength.	Just before buds break in spring.

MELONS

Disease or Insect	Recommendations	Time of Control
	See under "Cantaloup."	

NASTURTIUM

Disease or Insect	Recommendations	Time of Control
CABBAGE WORM—	See under "Cabbage".	

OATS

Disease or Insect	Recommendations	Time of Control
BLAST—Parts or all of the kernels of the panicle fail to develop. (non-parasitic)	No control known.	
LOOSE AND COVERED SMUTS—Heads smutty. Floral parts destroyed and masses of black smut spores produced. (fungus)	Spray seed with formalin one part to 10 parts of water using a quart sprayer. Cover oats one hour after treating. See page 54.	

ONION

Disease or Insect	Recommendations	Time of Control
NECK ROT—Soft decay starts at neck and spreads rapidly downward. (fungus)	Cure crop as rapidly as possible. Avoid exposure to rain after harvest. Keep storage dry and cool.	
ONION THRIPS—Tiny, slender, yellow or brown insect that hides in "crotches" in daytime and feeds on leaves at night or in murky weather. Injured leaves assume silvery appearance and become crisp and dry.	Drench plants with nicotine sulfate, 1 pint to 100 gallons water, in which is first dissolved 4 pounds laundry soap. Use spray rod or spray gun and cover every plant until liquid runs into crotches. Control by any known method is but partially effective.	Begin spraying as soon as thrips are observed on plants (about June 1st) and repeat applications at 10-day intervals until tops have attained growth or injury is past.
SMUT—Swellings appear on leaves which later break open exposing the black smut spores. (fungus)	Use formalin drip method for control. See United States Department of Agriculture Bulletin No. 1060.	
WIREWORMS—	Do not plant onions on ground known to be infested.	If infested ground must be used plant early as possible.

PANSY

Disease or Insect	Recommendations	Time of Control
COMMON RED SPIDER—	See under "Raspberry."	

PEA

Disease or Insect	Recommendations	Time of Control
PEA WEEVIL—Small gray-brown beetle that lays eggs on pods. Larvae eat into seeds and when they emerge leave large holes.	If planting infested seed in territory where weevil does not already exist, fumigate it with carbon disulphide. See page 53.	Adults hibernate and fly to fields in spring. No method of control known where infestation is already established.
POWDERY MILDEW—Gray cobwebby growth on leaves, pods and stems. (fungus)	Early planting and proper drainage. Dust with sulfur.	
WIREWORMS—Brown or yellow, shiny, hard worms that destroy seed after planting. Adult is narrow, brown beetle 3/8 inches long called a click beetle.	Fall-plow land and plant peas in spring as early as possible before wireworms become active. A good stand can be secured in heavily infested land by early planting which is practicable, for peas grow well in cool weather and withstand quite severe frosts. After roots are well established and plants are up wireworms do little damage.	

PEACH

Disease or Insect	Recommendations	Time of Control
BLACK PEACH APHID—Black plant lice that attack new growth. Idaho Exp. Sta. Cir. 26.	Spray with nicotine sulfate. See under "Apple aphid."	When insect becomes numerous.
CROWN GALL—	Same as for "Apple."	
GREEN PEACH APHID—Green plant lice that injure new growth. Idaho Exp. Sta. Cir. 26.	Spray with nicotine sulfate or add nicotine sulfate to delayed dormant spray. See under "Apple Aphid".	Delayed dormant period.
PEACH BLIGHT—	Same as for "Apricot".	
PEACH BORER—Moth lays eggs on trunk near ground. Grubs make way into trunk just below soil surface and often kill trees.	Smooth ground around base of tree, lowering level as little as possible. Spread a narrow ring of para-dichloro-benzene (One-half ounce dose for young trees; three-fourths ounce to one ounce dose for trees five years or older) 2 inches from tree and all around trunk. Cover with 4 inches dirt and pat down.	Best results obtained by making application Sept. 15. If grubs are causing severe injury and it seems necessary not to wait until September, orchard may be protected by application as soon as it becomes warm in the spring.
PEACH LEAF CURL—Young leaves and shoots reddened, swollen and distorted. (fungus)	Spray with lime-sulfur winter strength or Bordeaux mixture 6-6-50 when trees are dormant; must be done before buds swell.	
PEACH LECANIUM—Brown, hemispherical scale adhering to smaller branches.	Spray with oil emulsion at 4% oil strength. See page 51 for oil emulsions.	Just before buds burst in the spring.

PEACH—(Continued)

Disease or Insect	Recommendations	Time of Control
PEACH TWIG BORER—Brown worm with light, transverse stripes. Hibernates in bark in crotches. Spring brood bores into tips of twigs and summer brood feeds in fruit.	Spray with lime-sulfur 1 part to 9 parts water. Oil not effective.	Dormant or delayed dormant period.
SAN JOSE SCALE—	See under "Apple."	

PEAR

Disease or Insect	Recommendations	Time of Control
CODLING MOTH—	Spray as for apple. First and second cover sprays usually sufficient.	
CROWN GALL—	Same as for "Apple."	
FIRE BLIGHT—	Same as for "Apple."	
PEAR LEAF BLISTER MITE—	See under "Apple."	
PEAR SLUG—	See under "Cherry."	
SAN JOSE SCALE—	See under "Apple."	

PLUM

Disease or Insect	Recommendations	Time of Control
	See under "Prune."	

POTATO

Disease or Insect	Recommendations	Time of Control
BLACKLEG—Causes the stems of the plant to turn black and the leaves to roll and become yellowed. Soft rot of stem and tubers develops later. (bacterial)	Use only seed from disease free fields if possible. Seed treatment will aid in control of this disease. See page 53.	
COLORADO POTATO BEETLE—Plump, yellow-and-black-lined beetle. Larva is brick red "hump-backed" grub. Beetles and grubs defoliate vines.	Spray with lead arsenate, 4 pounds to 100 gallons water. Use good pressure and cover vines thoroly. Or dust with pure calcium arsenate 10-15 pounds per acre.	Make application as soon as first beetles appear. Apply again when grubs appear and later if necessary. Early applications when vines are small most important.
COMMON SCAB—Scabby spots appear on the tubers. (bacterial)	Rotate crops and treat seed with hot formalin or corrosive sublimate.	
FALSE CHINCH BUG—Small brown to black, flat bodied bugs that suck sap from leaves and when numerous cause leaves to turn brown and become brittle.	Destroy weeds and plant potatoes away from waste or weedy ground.	Plow under weeds the fall before planting and destroy them in the early spring to prevent breeding of bugs which migrate to potatoes when weather becomes hot and weeds dry out.
FUSARIUM WILT—A disease causing rapid wilting of plants in dry, hot weather. Internal discoloration of stem often present. (fungus).	Rotate crops. In sections where severe, plant only whole potatoes.	
LEAF ROLL—Leaves rolled upward, papery, brittle and yellowish or reddish in color. (virus)	Same as for Mosaic.	

Disease or Insect	Recommendations	Time of Control
MOSAIC—There are several types of mosaic. They cause either mottling, crinkling, streaking of the leaves or dwarfing of the plants and are carried from year to year by tubers and transmitted in the field by aphids. (virus)	If possible use only high grade certified seed and keep it free from disease by means of well isolated and carefully rogued seed plot.	
RHIZOCTONIA—Black resting bodies of the fungus occur on the tubers. Disease causes cankers on the stems and aerial tubers on the plant. May reduce stand materially. (fungus)	Rotate crops and treat seed with hot formaline or corrosive sublimate. See page 53.	
SPINDLE TUBER—Plants spindling and upright in growth. Tubers long and spindle shaped. (virus)	Same as for mosaic.	
SPOTTED BLISTER BEETLE—Large gray beetles with black spots. Sometimes congregate on potato vines near borders of fields and defoliate plants.	Control not very often necessary. Spray vines heavily with lead arsenate 4 pounds per 100 gallons water or dust them with sodium fluocilicate.	When injury is noticed.
TARNISHING PLANT BUG—Flat bodied bugs, green to brown, with triangular mark on back. Injury similar to that of false chinch bug.	See "False chinch bug."	
WESTERN POTATO FLEA BEETLE—Small, shiny, black beetle that hops. Eats holes in young vines.	Rarely injurious, may be repelled by spraying with Bordeaux mixture 4-6-50.	Soon after plants appear above ground.
WIREWORMS—	See under "Corn."	

PRUNE

Disease or Insect	Recommendations	Time of Control
BUD MOTH—Chocolate-brown worm 1/3 inch long, webs leaves together at tips of branches and eats into buds in early spring.	Spray with lead arsenate, 3 pounds to 100 gallons water, paying special attention to tips of branches.	As leaf tips are showing green in the spring. In severe cases make a second application a week or ten days later.
COMMON RED SPIDER—	See under "Apple." Do not spray with oil after bloom starts to form, for oil then causes spotting of fruit.	
DESTRUCTIVE PRUNE WORM—(Mineola moth)—Chocolate-brown worm that destroys fruit buds in spring and eats into prunes in summer. Fully grown larvae measures more than ½ inch long.	Experiments being conducted but no control method yet known.	
EUROPEAN FRUIT MITE—	See under "Apple." Do not spray with oil after bloom starts to form for oil then causes spotting of fruit.	
MEALY PLUM APHID—Green plant louse covered with "mealy" secretion. Extremely numerous on under sides of leaves.	Spray thoroly as recommended for thistle aphid after foliage is out. Use pressure and material sufficient to wet thru mealy covering.	When infestation occurs.
PEACH BORER—	See under "Peach."	
PEACH TWIG BORER—	See under "Peach."	
SAN JOSE SCALE—	See under "Apple."	

PRUNE—(Continued)

Disease or Insect	Recommendations	Time of Control
SNOWY TREE CRICKET—Green or yellowish crickets that eat upper surfaces of leaves until prunes begin to ripen and then eat holes in fruit. Idaho Exp. Sta. Bul. 155.	Dust with pure calcium arsenate at rate of one pound to 8 trees or spray with lead arsenate, 2 pounds and 1 pound calcium caseinate to 100 gallons water.	After crickets begin to feed on leaves and before they attack the fruit. From July 15 to 25 approximately.
THISTLE APHID—Green plant lice that curl leaves in the early spring, and form sticky honey-dew. They cause small prunes and excessive fruit drop. Idaho Exp. Sta. Cir. 26.	Infestations are of little importance in orchards sprayed in the dormant period with oil emulsion at 3% oil strength. After foliage is out spray with nicotine sulfate and ½% oil. (In cool weather use ½ pint nicotine sulfate to 100 gallons water; in hot weather use ¼ pint to 100 gallons.)	Control must be obtained early. This spray with nicotine and oil is entirely satisfactory and safe if applied just as leaves are appearing. Control can be obtained even after leaves are curled by use of much material at high pressure but expense is heavy and injury for the year has then already been done.

PRUNE—COMBINATION SPRAYS

Disease or Insect	Recommendations	Time of Control
San Jose scale and brown mite or European fruit mite.	Spray with oil as for scale.	Delayed dormant period.
San Jose scale and peach twig borer.	Use lime-sulfur as for scale. Oil not effective against twig borer.	Dormant or delayed dormant period.

RADISH

Disease or Insect	Recommendations	Time of Control
RADISH MAGGOT—(Cabbage maggot).	See under "Cabbage."	
WESTERN CABBAGE FLEA BEETLE—	See under "Cabbage."	

RASPBERRY

Disease or Insect	Recommendations	Time of Control
COMMON RED SPIDER—Minute creatures, light or translucent green. Winter in soil and migrate to foliage in spring. Spin dense web on under side of leaves. Leaves turn brown and become dry.	Spray with 10 teaspoonfuls commercial oil emulsion in 1 gallon water or with 1 part lime-sulfur to 40 parts water. Be sure to cover under side of leaves at good pressure.	As soon as mites are observed in the spring or at least by second week in June.
CROWN GALL—	See under "Apple."	
FOUR SPOTTED TREE CRICKET—Eggs laid in canes and egg punctures injure canes, causing them to break over. Punctures appear as series of holes up and down stem, usually in a spiral.	Prune out infested canes to reduce infestation for succeeding years.	In early spring.
	In severe infestation spray bushes with lead arsenate, 2 pounds per 100 gallons water.	After berry crop is harvested.
LEAF CURL—Leaves small, arched and wrinkled, margins curled inward. (virus)	Secure disease-free plants. Remove and destroy any which may develop the disease.	

RASPBERRY—(Continued)

Disease or Insect	Recommendations	Time of Control
MOSAIC—Causes mottling of leaves and dwarfing of canes. May often cause destruction of entire planting. (virus)	Same as for "Leaf curl".	
ROSE SCALE—Snow-white, nearly circular scales on canes.	Prune out infested canes.	In early spring.
	See also under "Rose."	
RUST—Large bright orange-colored patches on leaves. Canes also sometimes affected. (fungus)	All affected canes should be removed and burned at once.	
SPUR BLIGHT or GRAY BARK—Chocolate-brown spots appear on the canes. Spurs often killed back. Later outer bark becomes grayish in color and begins to peel off. (fungus)	Spray with Bordeaux 3-3-50 with 2½ pounds of resin-fish-oil soap for sticker. Remove and burn all old fruiting canes when berries are picked.	Apply to young canes, (1) when 8-10 inches high, (2) two weeks later, (3) two weeks after second spray.

ROSE

Disease or Insect	Recommendations	Time of Control
COMMON RED SPIDER—	See under "Raspberry."	
LEAF CUTTER BEES—Bees cut large circular holes in leaves at margins. Affected bushes have ragged, unsightly appearance.	Spray with Bordeaux mixture 4-4-50 or lime-sulfur 1-40 as repellant.	When first eaten leaves are observed. Later applications if necessary.
POWDERY MILDEW—Grayish white mildew growth on leaves and stems. (fungus)	Dust with fine dusting sulfur beginning as soon as mildew appears. Prune out affected parts in fall.	
ROSE APHID—Pink or green plant lice that cover stems, buds and young leaves and secrete sticky honey-dew.	Spray with 1 teaspoonful nicotine sulfate in ¾ gallon water in which is first dissolved lump of laundry soap size of large walnut.	When aphids are first observed and as often thereafter as needed.
ROSE CURCULIO—Red snout beetle that punctures buds so that flower petals, when they unfold, are riddled with holes.	Spray with Bordeaux mixture 4-4-50 to repel beetles.	Keep flower buds covered in spring and early summer.
ROSE LEAF HOPPER—Small, slender, greenish-yellow or pale yellow insect that feeds on lower leaf surface causing white flecking and mottling of leaf.	Mix 10 teaspoonfuls of commercial oil emulsion in ¾ gallon water and add 1 teaspoonful nicotine sulfate. Spray thoroly on undersides of leaves.	As soon as first insects are observed or white flecks appear on the leaves. For best results repeat in a week or 10 days.
ROSE SCALE—Snow-white, nearly circular scales on the stems.	Spray with lime-sulfur, 1 part in 9 parts water.	Just as buds are showing green in spring.
SAN JOSE SCALE—	Spray as for rose scale.	

SNAPDRAGON

Disease or Insect	Recommendations	Time of Control
COMMON RED SPIDER—Very injurious at times.	See under "Raspberry."	

SNOWBALL

Disease or Insect	Recommendations	Time of Control
SNOWBALL APHID—Bluish colored plant lice that attack leaves in early spring, causing curled, deformed leaves and small, inferior blossoms.	Mix 10 to 15 teaspoonfuls commercial oil emulsion in ¾ gallon water and add 1 teaspoonful nicotine sulfate. Drench bushes thoroly, paying particular attention to tips .	When first leaves begin to show green in spring.

STRAWBERRY

Disease or Insect	Recommendations	Time of Control
ANTS—Sometimes eat holes into ripening berries.	Destroy nests by placing 1 ounce calcium cyanide 6 inches deep in nest and covering.	In evening.
LEATHERJACKETS—Tough, slate colored, tapering worms with a scalloped "hood" at one end. Feed on berries and leaves and rest under protection of leaves in daytime.	Cultivate ground thoroly near plants. Examine under leaves and hand pick larvae. Scatter poisoned mash around crowns of plants. See under "Poisoned bran mash," page 51.	During the spring.
SLUG—Slimy, shiny, dark green or gray creatures resembling snails that damage berries where they come in contact with the ground. Oregon Exp. Sta. Bul. 170.	Keep soil only moderately moist and well aerated. Scatter small heaps of poisoned bait made by mixing together chopped lettuce, 16 parts by weight, and 1 part calcium arsenate. Place the bait under the plants.	As soon as injury is noticed or when slugs are observed before they cause injury.
STRAWBERRY CROWN MOTH—Dirty white, brown headed larvae, burrow in crowns and cause plants to wilt and die.	Pull up and destroy injured plants to reduce infestation.	
STRAWBERRY LEAF ROLLER—Small green caterpillars feed on upper leaf surface. Roll leaves and destroy surface until leaves turn brown and die.	Spray vines thoroly with lead arsenate, 3 pounds in 100 gallons water, to cover leaves with poison so new caterpillars will be killed before they can roll leaves.	When moths begin flying in spring which is about time of blossoming or when berries begin to set.

STRAWBERRY—(Continued)

Disease or Insect	Recommendations	Time of Control
STRAWBERRY ROOT WEEVIL—Small, brown, snout beetle that hides in the plants and feeds on berries and leaves. Grubs feed on roots and cause death of plants. Wash., Exp. Sta. Bul. 199.	Scatter poisoned bait at rate of 70 pounds per acre. Bait prepared by thoroly stirring together 95% ground dried apples and 5% magnesium arsenate or zinc arsenite.	Broadcast bait over strawberry plants just at close of berry harvest to kill adults and reduce infestation for following year.
WHITE GRUBS—Larvae of the carrot beetle, June bugs and the 10-lined beetle. Large, brown-headed grubs that eat off the roots below soil surface. Affected plants wilt and soon die.	Pull affected plants and destroy grubs to prevent their reaching sound plants.	When wilting plants are first observed.

SUGAR BEET

Disease or Insect	Recommendations	Time of Control
BEET LEAF HOPPER—Tiny sucking insect that sucks sap on sugar beets and related plants and on tomato, squash, beans, spinach, etc. It transmits from one infected plant to another a disease known as curley-top. Idaho Exp. Sta. Bul. 156.	Infestation and injury vary from year to year. The problem of avoiding loss is quite intimately connected with climate and condition of native host plants. The Idaho Station is cooperating with the U. S. Department of Agriculture in a study of the problem. No practical control methods yet known.	

SUGAR BEET—(Continued)

Disease or Insect	Recommendations	Time of Control
CURLY-TOP—Characterized by inward curling of leaves, checked growth and abundance of hairy roots. (virus) Idaho Exp. Sta. Bul. 156.	A virus disease carried by sugar beet leaf hopper. No satisfactory control known.	
CUTWORMS—	See under "Garden insects."	
DAMPING OFF—Young plants dies just as they come thru the ground, the stem of the plant rotting at the surface of the ground. (fungus)	Keep the soil loose and allow no crust to form on the surface after planting until after beets are well up.	
SPOTTED BLISTER BEETLE—	See under "Potato."	
SUGAR BEET WEB WORM— Yellowish to olive green worms that destroy the leaves. Young worms observed on underside of leaf or hanging from under side by web.	Keep down weeds in and near beet fields. Spray with Paris green, 4 pounds per acre or lead arsenate, 8 pounds per acre. With lead arsenate use dissolved laundry soap, 4 pounds per 100 gallons water.	As soon as eggs are observed or as the larvae make their appearance.

SWEET PEA

Disease or Insect	Recommendations	Time of Control
COMMON RED SPIDER—	See under "Raspberry."	
PEA APHID—Green plant lice that sometimes become very abundant on leaves and stems.	Spray with nicotine sulfate 1 teaspoonful to ¾ gallon water in which is first dissolved lump of laundry soap size of large walnut.	Drench vines and especially under side of leaves when infestation is observed.

TOMATO

Disease or Insect	Recommendations	Time of Control
BLOSSOM END ROT—Dry rotting of blossom end of tomatoes while still green or when partly ripe. (non-parasitic)	Caused by lack of available moisture. Increasing moisture supply will prevent this trouble.	
CUTWORMS—	See under "Garden insects."	
MOSAIC—Symptoms similar to potato mosaic.	Virus overwinters on weeds of tomato family especially night-shade. All such weeds should be destroyed.	
SLUGS—	See under "Strawberry."	
TOMATO WORM—Large green worm with a "horn" on rear end of body.	Hand pick and destroy worms or in extreme cases spray vines with lead arsenate, 2 pounds in 100 gallons water.	When worms are noticed.
TOMATO YELLOWS or WESTERN YELLOW TOMATO BLIGHT—Leaves first turn purple and roll upward, then the whole plant turns yellow and finally dies. (virus)	Caused by same virus as curly-top of sugar beet. Shading plants helps to control. Selection for resistance promising.	
WESTERN POTATO FLEA BEETLE—Tiny, shiny, black beetles that hop. Eat holes in leaves and often kill small plants.	Recommendations same as for western cabbage flea beetle.	In hot beds and immediately after setting out plants. Apply dust or spray to ground close around plants as well as on plants.

TURNIP

Disease or Insect	Recommendations	Time of Control
WESTERN CABBAGE FLEA BEETLE—	See under "Cabbage."	

VIOLET

Disease or Insect	Recommendations	Time of Control
COMMON RED SPIDER—Very injurious to violet and pansy.	See under "Raspberry."	

VIRGINIA CREEPER

Disease or Insect	Recommendations	Time of Control
LEAF CUTTER BEES—	See under "Rose."	
LEAF HOPPERS—	See under "Rose."	
PULVINARIA SCALE—Large brown scale beneath which protrudes white, fluffy mass. Late in spring infested vines are covered with these white masses and vines are sometimes killed.	Spray vines thoroly with summer type oil emulsion, using 20 teaspoonfuls commercial oil emulsion to 1 gallon water. See page 51.	Last week of June or first of July.

WHEAT

Disease or Insect	Recommendations	Time of Control
BUNT or STINKING SMUT—Black balls of smut with characteristic fishy odor form in place of the kernels of wheat. (fungus)	Copper carbonate dust treatment 2 or 3 ounces to the bushel, formaldehyde or bluestone treatment. See page 54.	
DRY-FARM FALSE WIREWORM—Large, yellow worms that destroy planted kernels and sprouts. Adults are the large black "stinkbugs" that are frequently abundant in dry-farmed wheat areas. Idaho Exp. Sta. Research Bul. 6.	Scatter poisoned mash along fence rows, road sides, among rocks and in waste places where beetles congregate in the fall before going into hibernation. See information for poisoned bran mash page 51 but use only Paris green, 4 pounds, to 100 pounds bran.	From about first to fifteenth of September. Repeat applications for two successive seasons. By thoroly carrying out recommendations for two successive seasons in an entire community infestations are reduced so that false wireworms are of little importance for years afterward.
LOOSE SMUT—This disease appears when heads just out of boot. Destroys the whole head, the powdery smut spores being blown away by the wind until the stalk is bare. (fungus)	Not controlled by the ordinary methods of seed treatment. Hot water only satisfactory method known. Better to secure clean seed. Seed treatment advised only for treating small lot of seed for seed plot. Write for directions.	

PREPARATION OF POISONED BRAN MASH

Formula I

		small amount
Coarse bran	100 lbs.	10 lbs.
Sodium arsenite (liquid)	1 pt.	12 tsp.
Salt	5 lbs.	8 oz.
Cheap molasses	2 gal.	1.5 pt.
Amyl acetate	3 oz.	2.5 tsp.
Water, to moisten, about	9 gal.	7 pt.

Dissolve the salt in the water and then add the sodium arsenite, molasses, and amyl acetate. Pour the liquid mixture slowly over the bran and stir until every particle of the bran is moistened. It is important that just enough water be used to form a moist, crumbly mash that will scatter when broadcasted. If sodium arsenite is not available, see Formula II.

Formula II

		small amount
Coarse bran	100 lbs.	10 lbs.
White arsenic or Paris green	4 lbs.	6 oz.
Salt	5 lbs.	8 oz.
Cheap molasses	2 gal.	1.5 pt.
Amyl acetate	3 oz.	2.5 tsp.
Water, to moisten, about	9 gal.	7 pt.

Mix thoroly together dry the bran and poison. If amyl acetate is not available lemons or oranges may be substituted at rate of 8 for each ounce of amyl acetate. Dissolve the salt in the water, add the molasses and amyl acetate (or fruits that have been ground in a food chopper) and then pour the liquid mixture over the dry mixture and stir until the entire mass is well mixed.

LIME-SULFUR

References to lime-sulfur in this bulletin are to commercial liquid lime-sulfur only, testing 32° Baume or higher. If home prepared liquid lime-sulfur is used it should be diluted only by hydrometer test. Use enough of the concentrate that the dilute spray in the tank tests 4 or 5° for San Jose scale or, for blister mite alone, 2½°.

If dry lime-sulfur is used, calculate the strength of the dilute solution on the basis of the chemical equivalent of the standard commercial liquid concentrate. Hydrometer test not reliable in determining strength of solution of dry lime-sulfur.

COMMERCIAL OIL EMULSIONS

There are a number of high grade commercial oil emulsions on the market most of which contain approximately 80% of oil and 20% of water and emulsifying material. An oil emulsion is simply oil that has been mechanically broken up into tiny globules which are coated with emulsifier that prevents the globules from running together. These small coated globules are then held in suspension in the water until sprayed out and the effect thus is to dilute oil with water so that free oil, which is injurious, is not sprayed on live plants. There are two general types of emulsions designated roughly as summer and winter oils. In this publication the cheaper or winter type is meant in every reference excepting where summer oil is specified. Winter type emulsions, under Idaho conditions, have proven safe to apply on foliage when dilutions are weak, as herein recommended, and their cost is reasonable.

HOME-PREPARED OIL EMULSIONS

Oil emulsions may be prepared at home. With proper precautions in preparation and use they are safe, effective and

usually less expensive than commercial emulsions. A stock emulsion containing 66 2/3% oil is prepared as follows:

Oil	2 gal.
Water	1 gal.
Calcium caseinate	4 oz.

Dissolve the calcium caseinate in the water, add the oil, stir all ingredients together and then pump the mixture thru the spray nozzle or gun under pressure four times. This forms a thick, creamy emulsion which is ready for dilution with water for final use. Commercial emulsions are prepared to stand for months; home-prepared emulsions should be used soon so it is advisable to prepare at one time amounts only large enough for one or two days' use.

Emulsions may be prepared in the spray tank diluted with water and used immediately. To do this, place the necessary water in the tank and in it dissolve the calcium caseinate. Then, with engine running and agitator going, add the oil and pump the whole mass thru the spray gun back into itself the equivalent of four times. Then, with agitator going, finish filling the tank and spray out the solution immediately. To illustrate this, suppose a 200-gallon tank is used and a dilute spray containing 3% oil is desired. In the tank place from 3 to 6 gallons of water and in it dissolve 12 oz. calcium caseinate (2 oz. for each gallon of oil). Then add 6 gallons of oil and pump under pressure as directed. (In tank preparation of small lots, equal amounts of water and oil may be used to assure enough of the mixture to pump well).

CALCULATING OIL SPRAY DILUTIONS

To determine the number of gallons of stock emulsion to use, multiply the number of gallons of dilute spray to be made by the percentage of oil desired in the dilute spray and divide the product by the percentage of oil in the stock emulsion. Suppose it is desired to prepare 200 gallons dilute spray containing 3% oil from stock emulsion containing 80% oil.

Example $$\frac{200 \times 3}{80} = 7.5 \text{ gallons}$$

PRECAUTIONS WITH OIL SPRAYS

Use only new oils of known quality. Follow directions carefully. Trouble will almost surely result if more than 2 gallons of oil are used for each gallon of water in preparing stock emulsion. When thru preparing stock emulsion, each time tank is filled, pump dilute solution thru hoses until all of the stock emulsion is cleaned out, otherwise severe damage will be done to first tree or two sprayed. When stock emulsion is prepared in advance, stir it each time before using.

OILS TO USE

Good grades of lubricating or engine oils for dormant sprays and refined oils for foliage sprays. Several kinds are satisfactory. Knowledge of spray oils rapidly changing. For specific information consult Idaho Experiment Station.

NICOTINE DUST

Prepared nicotine dusts are stocked by some of the insecticide dealers. Nicotine dust rapidly deteriorates. Be sure to obtain fresh stock in unbroken packages.

Nicotine dust may be prepared fresh as needed. Procure a 10-gallon keg with both heads intact. Mount the keg on standards like a barrel-churn but with the pivots in the center of the heads. Allow one pivot to protrude beyond the standard and to it attach a crank. Cut a hole in the center of the side

of the keg thru which to put in and take out materials. Over the opening hinge a lid which is held tightly in place by a clasp. To make 10 pounds of dust of 2% nicotine strength place 10 pounds of hydrated lime in the keg, pour over it 2/5 pint of nicotine sulfate, close the lid and rotate slowly for 5 minutes. When placing materials in the keg, include about 5 pounds of smooth rocks about two inches in diameter which serve to help make a better mixture. Empty finished dust thru a screen to remove the rocks and store in tight containers. For large operations 50 pounds of nicotine dust may be prepared at one time by using a 50-gallon barrel and the material mentioned in like proportions.

BORDEAUX MIXTURE

Bordeaux mixture is a liquid spray made by combining in proper proportions copper sulfate (blue vitriol or bluestone) and milk of lime. The most common formula is 3-4-50, that is 3 pounds copper sulfate, 4 pounds lime and 50 gallons of water. Other proportions are often used.

Directions for mixing.—If stone lime is used, two stock solutions must be prepared, one of lime and one of copper sulfate. Each should be made up at the rate of 1 pound in a gallon of solution. If hydrated lime is used, one-half more by weight is needed and the amount required for each sprayerful should be stirred into enough water to make a thin paste. Suspend copper sulfate in small cheese cloth bag in the water until dissolved.

The copper sulfate and lime are now ready for mixing. First partly fill the sprayer with water and then add the lime thru a strainer, either 4 gallons of the stock solution of stone lime or 6 pounds of hydrated lime for each 50 gallons of spray. Continue to fill the sprayer with water until it is about two-thirds full. With the agitator going, add 3 gallons of copper sulfate solution for each 50 gallons of spray. Then add water to make up the final volume.

CARBON DISULPHIDE

Carbon disulphide is a clear liquid which evaporates on exposure giving off disagreeable smelling fumes heavier than air. Materials to be fumigated with it are placed in tight rooms or containers and shallow vessels containing the carbon disulphide are placed on top of them. Rooms or containers fumigated are kept tightly closed until evaporation is completed or for a period of twenty-four hours. The temperature should be well above 60° F. at fumigating time. When material to be fumigated covers the entire floor space use carbon disulphide at the rate of 1 ounce to 1 bushel of material in small quantities or 1 pound per 100 bushels in large quantities. When material does not entirely cover floor, determine dosage by calculating cubical content of container.

Fumes of carbon disulphide are extremely explosive. Allow no fire or light of any kind around the building or bin until after it has been well aired.

HOT FORMALDEHYDE

(For potato disinfection)

Potatoes to be treated should be wet with water, either by dipping the sacks or sprinkling with a hose, and covered, 48 hours before treatment. They should then be dipped in a solution of commercial formalin (37% formaldehyde), made up in the proportion of one pint of formalin to 15 gallons of water (1-120), heated to 125° F., for four minutes. Upon removal from this solution the potatoes should be covered with sacks or canvas for one hour. This solution does not lose strength and may be used repeatedly. Any accurate thermometer can be

used to determine the temperature of the solution. (An ordinary dairy thermometer will serve the purpose.) It is a good plan to raise the temperature of the solution, before dipping, to about five degrees above the required temperature. When the potatoes are then placed in the solution, the temperature will fall to about the required point.

BLUESTONE TREATMENT

(For wheat only)

Add one pound of bluestone (copper sulfate) (blue vitriol) and one pound of salt to each five gallons of water. Suspend the bluestone in a small cheesecloth bag in the water until it is dissolved. Immerse wheat in the solution until every kernel is thoroly wet. Then dip seed at once in a lime bath made by slaking one pound of lime and making up to ten gallons by adding water. Dry and sow as soon as possible

This lime bath helps to prevent seed injury.

ORDINARY FORMALDEHYDE METHOD

(For all grains)

Add one pint of formaldehyde (37%-40%) to 40 gallons of water. This equals one ounce to two and a half gallons or four ounces to ten gallons. Use about one gallon of the solution for each bushel of wheat and a little over a gallon for each bushel of oats or barley. Wet all grain thoroly, either by sprinkling, by pouring loose into the solution, or by soaking ten minutes in gunny sacks filled one-third full. If treated loose, cover with disinfected sacks or canvas for two hours. Sacked grain should be drained and let lie spread out in the sack until sown. Sow as soon as possible.

CONCENTRATED FORMALDEHYDE METHOD

(For oats only)

Use one part of formaldehyde in ten parts of water. Spread the grain out on a clean floor, canvas, or wagon box. As the grain is shoveled from one pile to another, each shovelful is sprayed with a small quart hand sprayer held close to the grain. Two or three movements of the handle for each shovelful gives about the right amount. Use in the proportion of one quart of the solution to five bushels of oats. Cover grain with sacks or canvas which have been sprayed with the solution. Leave covered four hours.

COPPER CARBONATE DUST TREATMENT FOR THE CONTROL OF BUNT IN WHEAT

The copper carbonate dust method of seed treatment has been thoroly tested by the Idaho Agricultural Experiment Station both in experimental plots and in cooperation with a large number of farmers in various parts of the state. As a result of these tests, it has been found that when properly applied the treatment is practically as effective for stinking smut control as either the bluestone or formaldehyde methods of treatment.

The treatment is applied by thoroly mixing 2 or 3 ounces of the copper carbonate dust with each bushel of wheat. Several machines are on the market for applying the treatment, but many growers are using a home-made treating machine, a cement mixer or barrel churn with satisfactory results. Every kernel should be thoroly coated with the powder. Tests have shown that slightly better control is usually secured when the treatment is applied with a power-driven, continuous treating machine than when it is applied with a barrel churn.

Two ounces of the copper carbonate to the bushel is usually sufficient for spring wheat and for winter wheat in regions where the soil does not become infested with the smut spores. For winter wheat, where soil infestations take place and for all seed wheat which is badly smutted, three ounces to the bushel are recommended. These recommendations are for copper carbonate containing at least 50% copper and of sufficient fineness to pass thru a 200-mesh sieve. If the distended brands of copper carbonate are used, which contain less than 50% copper, three or four ounces per bushel should be applied.

This new dust method of seed treatment has certain distinct advantages over the dip methods. Among those may be mentioned the following:

1. It causes no injury to germination, and less seed can be used.
2. Wheat treated with copper carbonate will start quicker and grow more vigorously in its early stages than that treated with bluestone or formaldehyde.
3. The treatment is easier to apply than wet dips.
4. Grain treated with copper carbonate may be treated and stored indefinitely without injury.

The following precautions should, however, be observed when using copper carbonate:

1. Avoid inhaling copper carbonate. (Treat where there is a free circulation of air).
2. Avoid feeding treated grain to livestock.
3. Use as clean seed as can be obtained.

TABLE OF DILUTIONS

For preparing small amounts of spray mixtures.

1 pound = 16 ounces
1 pint = 128 teaspoonfuls
1 fluid ounce = 1/16 pint or 8 teaspoonfuls
1 bushel = 2150.42 cubic inches or 1.24 cubic feet