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Kansas State Agricultural College

Departments of Entomology and Botany

INSECTS AND PLANT DISEASES ATTACKING GARDEN CROPS

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CALENDAR FOR THE CONTROL OF INSECT PESTS AND PLANT DISEASES

<i>Crop attacked</i>	<i>Insect pest</i>	<i>Plant disease</i>	<i>What to do</i>	<i>When to do it</i>
Beans Peas	Aphids (Plant lice that suck sap from the leaves)		Use nicotine sulphate: (a) 3/4 pint to 100 gallons of water plus 3 or 4 pounds of soap (b) 1 teaspoonful to 2 quarts of water plus a small piece of soap. Use soapy spray: 1 pound of laundry soap to 6 gallons of soft water	When insects first appear
Beans		Pod-spot or anthracnose (Causes reddish-brown sunken spots on pods)	Use disease-free seed Do not touch the plants while wet Use bordeaux mixture, 4-5-50 (See explanation for making bordeaux mixture)	Spray plants at intervals of 10 days throughout rainy seasons
Beets Chard Spinach	Webworm (Worm which eats and ties the leaves)		Use arsenate of lead: 3 pounds of lead arsenate paste to 50 gallons of water (must be applied with force)	As soon as insects appear
Cabbage Cauliflower Turnip Radish	Cabbage worms (Soft bodied worms which devour the leaves and ruin the heads)		Use arsenate of lead: As a liquid-- 3 pounds of lead arsenate paste to 50 gallons of water As a dust-- 1 heaping teaspoonful of paris green or powdered arsenate of lead to 1 quart of flour or hydrated lime	As soon as the plants are set. Continue until heads are half formed (Dust when plants are dry)
	Cutworms (Fleshy worms which cut off young plants at surface of ground)		Use poisoned bran mash (See explanation for making poisoned bran mash)	As soon as the damage is noticed (Sow it broadcast in the evening so that the amount recommended will cover 4 or 5 acres)

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Cabbage Cauliflower Turnip Radish	Harlequin cabbage bug (A triangular orange and black bug that sucks the sap)		Hand-pick bugs and eggs	As soon as they appear
	Aphids (Plant lice that suck sap from the leaves)		On cabbage and cauliflower, use sprays given under beans and peas and wet the aphids. On turnip and radish, use only nicotine sulphate with 3 or 4 pounds soap to 100 gallons of water, or 1 ounce soap to 1 gallon of water	When they become numerous
Cabbage		Wilt or "yellows" (Young plants turn yellow and die. Leaves fall off from older plants, leaving bare stalks)	Plant clean seed Disinfect all seed before planting: 1/4 pint of formaldehyde to 7 gallons of water. Soak 15 minutes; wash in clean water and dry. Burn diseased plants Rotate crops for 3 years Remove all diseased plants as soon as noticed Don't throw diseased plants in the manure pile.	
		Black rot (Heads small, rot and have bad odor)	Use disease-free seed Rotate crops for 4 or 5 years Disinfect seed as for "yellows" Burn all rotted plants Don't allow wild mustard to grow on cabbage land Control insects Grow cabbage, rape, turnips and radishes on new soil or only after rotation	
Celery		Early blight (Causes leaf-spot on young plants)	Select only healthy plants for transplanting Use bordeaux mixture, 4-5-50 (See explanation for making bordeaux mixture)	Spray when plants are set out and at 7 to 10 day intervals throughout the season if necessary
		Late blight (Causes leaf-spot in field and rot in storage)	Use bordeaux mixture, 4-5-50 (See explanation for making bordeaux mixture) Practice rotation Pick off diseased foliage before storing plants	Spray every 10 days if season is rainy

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Cucumbers Muskmelons Squashes Pumpkins Watermelons	Squash bugs (Brown bugs which suck sap from under side of leaves)		Hand-pick bugs and eggs and trap with chips and small pieces of board Use soapy spray: 1 pound of soap to 3 gallons of soft water. Bug must be actually wet with spray.	When insects appear
	Striped cucumber beetle (Small yellow and black striped beetles which attack young plants)		Protect young plants with screens Dust with tobacco, lime, or sulphur Apply arsenate of lead liberally, using 3 pounds of lead arsenate paste to 50 gallons of water.	When insects appear Repeat once a week until danger is past
	Aphids (Plant lice that suck sap from leaves)		Nicotine sulphate and soapy spray used for bean aphids. Spray under sides of leaves so as to reach insects	As soon as insects appear
Cucumbers Muskmelons Watermelons Squashes		Bacterial wilt (Plants wilt and die when young or nearly full grown)	Cover plants, especially cucumbers, with screens Keep plants free of insects, especially the striped cucumber beetle Use bordeaux mixture, 4-5-50, plus 3 pounds of lead arsenate paste (See explanation for making bordeaux mixture)	Spray at frequent intervals to keep insects away. For cucumbers, spray as soon as plants appear
		Rind rot (anthracnose) (Causes sunken, pink spots on the rind of the fruit)	Practice rotation Destroy diseased fruit and vines Use bordeaux mixture, 4-5-50 (See explanation for making bordeaux mixture)	Spray when vines begin to run. If season is rainy, spraying every 10 days is necessary
Onions	Onion thrips (small sucking insects causing white spots on plant)		Sprayas for aphids, using high pressure	When insects appear
		Onion smut (Causes tops and bulbs to turn into a black, sooty mass)	Remove and burn all smutted plants Apply 75 to 125 bushels of ground stone lime per acre	Apply before seeding on freshly prepared soil. If broadcasted, harrow it in, otherwise apply with drill

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Potatoes Eggplants Peppers	Potato beetles (Thicked striped beetles, reddish larvae; eat the leaves)		Use as a liquid: 4 pounds of lead arsenate paste to 50 gallons of water or Paris green.....1 lb. Freshly slaked lime.....1 lb. Water.....50 gals. Use as a dust: 1 heaping tablespoonful of powdered arsenate of lead or paris green to 1 quart of flour or hydrated lime	Spray ewhen insects are attacking plants Dust by means of perforated can or cloth bag while the dew is still on plants
	Flea beetles (small jumping beetles which perforate the leaves)		Use arsenate of lead and bordeaux mixture. Spray under side of leaves	Spray when insects appear
Potatoes		Early blight (Causes target-board-like spots on leaves which later dry up)	Use bordeaux mixture, 4-5-50 (See explanation for making bordeaux mixture)	Spray when plants are 6-8 inches tall and at intervals of 7-10 days up to maturing stage. Spraying very important in rainy seasons
		Dry rot or "wilt" (Plants roll their leaves and wilt before they reach maturity. Tubers have black streaks inside at stem end)	Treat seed with formaldehyde: 1 pint to 30 gallons water (Soak seed for 2 hours) Remove and destroy diseased plants; don't let them form tubers, otherwise diseased plant is produced Rotate crops for 3 or 4 years	Treat uncut seed before planting. Don't use any seed with black discoloration inside
		Blackleg (Plants die when 6 to 8 inches high. The underground stem turns black. Tubers rotten inside at stem end)	Treat seed with corrosive sublimate solution, 4 ounces to 30 gallons water, for 1 1/2 hour. Formaldehyde may be used as in scab but this solution is not recommended for best results	Treat uncut seed before planting. Don't use any seed with black discoloration inside Remove all suspicious plants as soon as they appear
		Common scab (Causes rough, "scabby" spots on the potato)	Treat seed with formaldehyde, 1 pint to 30 gallons of water. Soak seed for 2 hours or use corrosive sublimate, 3 ounces to 30 gallons of water. Soak seed for 1 1/2 hour	Treat uncut seed before planting.

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Potatoes (<i>Concluded</i>)		Rhizoctonia (Causes very small black specks on tuber. Diseased plants die when a few inches tall)	Treat seed in corrosive sublimate, 4 ounces to 30 gallons of water. Soak seed for 1 1/2 hour Avoid heavy soil Rotate crops and use legumes in rotation	Treat uncut seed before planting.
			NOTE.—Although formaldehyde is commonly used for blackleg and scab, it is not an effective solution for rhizoctonia (black scurf). Potato growers in Kansas are advised to use corrosive sublimate for treating their seed in place of formaldehyde for all tuber diseases	
Eggplants		Fruit rot (causes fruit to turn into soft rot)	Keep fruit off the ground Do not allow diseased fruit to hang on plants	Destroy rotten fruit as soon as it appears
Sweet corn	Corn ear-worm (worm found eating the kernels of corn in the ear)		Apply 3 parts powdered arsenate of lead to 1 part of sulphur or flour	Dust with cheesecloth bag, perforated can, or powder gun when silks first appear and repeat every 4 or 5 days while corn is in silk
Sweet potatoes		Stem rot or "wilt" (Young plants die when set out; old plants turn yellow, wilt more or less; stem end of potato shows blackened streaks inside)	At digging time select seed Plant disease-free seed in <i>new</i> soil in hotbeds Transplant only healthy plants in disease-free fields Select only healthy seed from healthy hills Rotate crops for at least 4 years	
		Black rot (Causes blackened, more or less circular sunken spots showing metallic luster. Diseased potatoes have bad taste when cooked)	At digging time select seed Plant clean seed in new soil in the hotbed Sturdy, healthy plants should be used for transplanting in disease-free field Practice rotation	

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Sweet potatoes		Soft rot and ring rot (These two diseases are similar, occurring in storage. Potatoes become soft in storage; later a moldy growth appears)	Great care is necessary in handling sweet potatoes. Do not bruise them, especially at time of storing. They should be stored in crates rather than in bins. Regulate temperatures carefully: Provide proper ventilation. Keep potatoes at 80° F during "sweating" process. Regular storage temperature, 55° F.	When potatoes are placed in storage
Tomatoes	Aphids (Plant lice that suck sap from seeds)		Use nicotine sulphate (see beans)	When insects appear
Tomatoes		Leaf blight (Causes leaves to dry on vine)	Where practical, keep plants trained and staked Use bordeaux mixture, 4-5-50 (See explanation for making bordeaux mixture)	Begin spraying about the 1st of June. Careful and frequent sprays 10 days apart are necessary. From 3 to 5 applications should be given
		Wilt (Plants turn yellow, wilt, and die)	Rotate crops for 3 years	As soon as noticed, wilted plants should be removed and burned
		Blossom-end rot (Causes blackened, tough areas on the blossom end when the tomatoes are about half grown)	Give the plants all the water that is possible.	During dry seasons, use this treatment as soon as disease is noticed
		Blossom-drop (The plants bloom freely, but the flowers drop and do not set fruit)	No special treatment can be recommended Keep plants in a healthy, growing condition by proper attention	
Any garden truck liable to be attacked	Grasshoppers		Use poisoned bran mash as recommended for cutworms (See explanation for making poisoned bran mash)	Sow broadcast in the morning so that the amount recommended will cover 4 or 5 acres

For further information on any of the above-mentioned subjects, write to the Agricultural Experiment Station, Manhattan, Kansas.

SPRAYS, SOLUTIONS FOR SEED TREATMENT, AND OTHER MIXTURES

BORDEAUX MIXTURE

This spray is composed of copper sulphate (bluestone), stone lime and water. The formula 4-5-50 means that it consists of 4 pounds of copper sulphate, 5 pounds of stone lime, in 50 gallons of water. Sometimes the 2-2-50 or 3-4-50 formulas are recommended for certain plant diseases in place of the 4-5-50 strength, but it should be remembered that the first figure stands for the copper sulphate, the second for lime, and the third for the quantity of water. The composition of 4-5-50 bordeaux mixture is indicated by the following:

Copper sulphate (bluestone).....	4 pounds
Stone lime of good quality.....	5 pounds
Water.....	50 gallons

Any quantity of spray can be made that is desired. If 25 gallons are needed, divide the above quantities by 2; if 12 1/2 gallons are wanted, divide by 4; if 100 gallons are desired, multiply by 2; etc.

Dissolve the copper sulphate by suspending it in a gunny sack near the surface of a few gallons of water. Use only wooden or earthen vessels and do not allow metal to come in contact with the solution for it "eats" through iron, tin, and similar metals. If warm water is used, the dissolving of the copper sulphate will be hastened.

Slake the stone lime with care. Regulate accurately the amount of water used. Do not allow the lime to "burn." Be careful not to "drown it out" before the slaking is completed. Gradually add sufficient water to make the milk of lime.

After the copper sulphate is dissolved, add enough water to the copper sulphate solution to make 25 gallons. Do the same with the milk of lime, adding enough to make 25 gallons of lime solution. Pour these two solutions at the same time into a vat, barrel, or spray tank, so that equal quantities of the solutions enter the barrel or spray tank at the same time. Strain out all coarse materials in order to prevent clogging the

spray nozzles. The resulting mixture should be sky blue in color.

This spray should be used immediately, observing carefully the practices found necessary to insure a proper application of bordeaux mixture.

STOCK SOLUTIONS--Sometimes it is more convenient to make what is known as "stock solutions." This saves frequent dissolving and mixing of chemicals. To make a stock solution, dissolve 2 pounds of copper sulphate in every gallon of water used. Slake 2 pounds of stone lime for every gallon of water used. Keep in separate containers and be careful to prevent evaporation. Use these stock solutions when making bordeaux mixture. If it is desired to make a 4-5-50 bordeaux mixture, take 2 gallons of the copper sulphate stock, add 23 gallons of water, and place in one container. Use 2 1/2 gallons of lime stock, place in a separate container, and add 23 gallons of water, stirring it thoroughly so as to have all the lime in suspension. The two liquids are then ready to be combined as before mentioned.

FORMALDEHYDE OR "FORMALIN" SEED TREATMENT

POTATO SEED TREATMENT--Use 1 pint (approximately 1 pound of commercial formaldehyde (formalin) for every 30 gallons of water. Place the uncut seed in gunny sacks and soak in this solution for two hours. Remove, dry, and cut the seed.

CABBAGE SEED TREATMENT--When treating cabbage seed, dissolve one-fourth of a pint of formaldehyde in 7 gallons of water. Thoroughly wet the seed and allow them to soak for 15 minutes. Remove and dry.

CORROSIVE SUBLIMATE OR BICHLORIDE OF MERCURY SEED TREATMENT

POTATO SEED TREATMENT--Dissolve 4 ounces of corrosive sublimate in 1 pint of warm water, using a jar or bottle. After it is thoroughly dissolved pour it into 30 gallons of water. Immerse the uncut potato seed (in sacks) in this solution for 1 1/2 hour, remove, dry, and cut. Do not use one solution more than three or four times. This solution corrodes metal; therefore, it must not be placed in metal containers. *It is a deadly poison when taken internally.* Keep it away from all animals. It does not injure the hands.

ARSENATE OF LEAD MIXTURE

Arsenate of lead may be obtained as a paste or as a powder. The paste is adapted for use only in a liquid spray. The powdered form may be used in a liquid spray or as a dust. The powdered form contains twice as much arsenic content as the paste. Therefore, whenever 3 pounds of paste are called for in a liquid spray, 1 1/2 pound of the powdered form may be substituted.

To prepare either the paste or the powder for use as a liquid spray, water should be slowly added and the mixture constantly stirred until it has all formed into a solution, after which it should be poured into the amount of water required to make the proper dilution.

POTATOES-- To kill potato beetles, use the liquid spray or a powder prepared by mixing 1 heaping tablespoonful of the arsenate powder with 1 quart of water or hydrated lime. Dust the plants while the dew is on by means of a perforated can or cheesecloth bag.

SWEET CORN--When used as a dust on sweet corn, mix 3 parts of powdered arsenate of lead with 1 part of flour or sulphur. Dust this mixture on the fresh silks every 4 or 5 days by means of a perforated can, cheesecloth bag, or powder bellows.

PARIS GREEN

Paris green may be used either as a liquid spray or as a dust. Owing to its high arsenic content, it is a very efficient insecticide. The greatest objection to its use is that it is apt to injure the foliage of tender plants. This fault is overcome by adding an equal amount of fresh stone lime or by using it in combination with bordeaux mixture. Slake the lime, add enough water to make a lime milk, and strain through a burlap cloth or fine strainer to remove grit.

As a dust, paris green is used by mixing 1 heaping tablespoonful with 1 quart of flour or hydrated lime and dusting it on the plants by means of a perforated can or cheesecloth bag.

"BLACK LEAF 40"

"Black Leaf 40" is a concentrated tobacco extract containing 40 percent nicotine sulphate. It is used at strengths varying from 1 to 800 to 1 to 1,600, according to the insects which are

to be controlled. It may be safely combined with any other spray material but if used alone 4 pounds of soap should be added to each 100 gallons of spray to increase the adhesiveness and to make it spread better.

SOAPY SPRAY

Dissolve thoroughly 1 pound of common laundry soap in 6 gallons of soft water. As this is a contact insecticide, it will be necessary to hit the insect with the spray in order to kill it.

POISONED BRAN MASH

The composition of poisoned bran mash is indicated by the following:

- Bran..... 20 pounds
- Paris green or white arsenic..... 1 pound
- Sirup..... 2 quarts
- Oranges or lemons..... 3
- Water..... 3 1/2 gallons

In preparing the bran mash, thoroughly mix the bran and paris green, or white arsenic, in a wash tub while dry. Squeeze the juice of the oranges or lemons into the water. Chop the remaining pulp and the peel to fine bits and add them to the water. Dissolve the sirup in the water and wet the bran and poison with the mixture, stirring at the same time so as to dampen the mash thoroughly.

SUPPLY MANUFACTURERS AND DEALERS
(PARTIAL LIST)

MANUFACTURERS OF SPRAYING MACHINES AND ACCESSORIES

- Bean Manufacturing Company, Cleveland, Ohio.
- Cushman Sprayer Company, St. Joseph, Mo.
- Deming Company, Salem, Ohio.
- Fairbanks, Morse & Company, Cleveland, Ohio.
- F.E. Meyers & Bro., Ashland, Ohio.
- Field Force Pump Company, Elmira, N.Y.
- Friend Manufacturing Company, Gasport, N.Y.
- Gould Manufacturing Company, Seneca Falls, N.Y.
- Hardie Manufacturing Company, Hudson, Mich.
- Hurst Manufacturing Company, Canton, Ohio.
- International Harvester Company, Kansas City, Mo.
- The New Way Motor Company, Lansing, Mich.
- Hayes Pump and Planter Company, Galva, Ill.

MANUFACTURERS OF DUSTING APPARATUS

Dust Sprayer Company, Kansas City, Mo.
Niagra Sprayer Company, Middleport, N.Y.
Legget & Bro., New York, N.Y.

MANUFACTURERS OF SPRAY MATERIALS

Niagra Sprayer Company, Middleport, N.Y.
Bowker Insecticide Company, Boston, Mass.
Corona Chemical Company, Milwaukee, Wis.
De Voe & Reynolds Company, Kansas City, Mo.
Dow Chemical Company, Midland, Mich.
Graselli Chemical Company, St. Louis, Mo.
Sherwin-Williams Company, Kansas City, Mo.
Rex Company, Omaha, Neb.
Thomsen Chemical Company, East St. Louis, Ill.
Vreeland Chemical Company, New Brunswick, N.J.

MANUFACTURERS OF NICOTINE SOLUTIONS

Kentucky Tobacco Product Company, Louisville, Ky.
Graselli Chemical Company, St. Louis, Mo.
Parke, Davis Company, Detroit, Mich.

FORMALDEHYDE DEALERS

WHOLESALEERS

Southwestern Drug Company, Wichita, Kan.
Potts Drug Company, Wichita, Kan.
Mallinckrodt Chemical Works, St. Louis, Mo.
United Chemical Companies, Kansas City, Mo.
Perth Amboy Chemical Company, New York, N.Y.

RETAILERS

Local Drug Stores
United Chemical Companies, Kansas City, Mo.
Arnold Drug Company, Topeka, Kan.
Mount-Mize Drug Company, Atchison, Kan.
Evans-Smith Drug Company, Kansas City, Mo.
Faxon & Gallagher Drug Company, Kansas City, Mo.