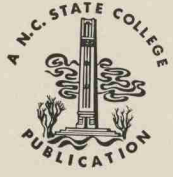
Chemicals

for control of

Plant Diseases

in North Carolina



HOWARD R. GARRISS AND J. C. WELLS
PLANT PATHOLOGY EXTENSION
NORTH CAROLINA STATE COLLEGE

Reprinted from 1957 Pesticide Manual
North Carolina State College

PESTICIDE RESIDUE TOLERANCES UNDER PUBLIC LAW 518

The Miller Pesticide Residue Amendment to the Federal Food, Drug and Cosmetic Act (Public Law 518) was enacted July 22, 1954. The Miller Amendment was enacted to protect the public from the danger of consuming products containing excess residues of poisonous materials.

Under legislation provided by the above act and the Federal Insecticide, Fungicide and Rodenticide Act, the U. S. Food and Drug Administration has been establishing certain tolerances in terms of parts per million (ppm) of pesticide residues allowable on or in edible products. In determining these residue tolerances the number of applications, dosage used and interval between the last application and harvest have been important factors. It is likewise important that farmers and other users consider these factors when applying pesticides. Improper use may result in seizure of the grower's product in shipment.

Be Sure of Correct Usage—Read Labels. When users of pesticides follow the printed instructions on labels of a pesticide which has been accepted for registration by the U. S. Department of Agriculture, the amount of residue left on a product should be within the established tolerance.

IN CASE OF POISONING

SHOULD ACCIDENTAL POISONING OCCUR FROM HANDLING AND APPLYING PESTICIDES OR FROM BEING TAKEN INTERNALLY, MEDICAL AUTHORITIES SHOULD BE CONTACTED AT THE DUKE HOSPITAL POISON CONTROL CENTER, DUKE HOSPITAL, DURHAM, N. C. (TELEPHONE: DURHAM 9011) OR U. S. PUBLIC HEALTH SERVICE, DR. WAYLAND J. HAYES, SAVANNAH, GEORGIA (TELEPHONE: OFFICE, SAVANNAH 3-7741; HOME, SAVANNAH 2-7618.

THE BEST THING TO DO ABOUT POISONING IS DON'T LET IT HAPPEN. ALWAYS FOLLOW PRECAUTIONS IN HANDLING, APPLYING AND STORING PESTICIDES.

North Carolina State College
Plant Pathology Information Note No. 1 (Revised 1957)

CHEMICALS FOR CONTROL OF PLANT DISEASES IN NORTH CAROLINA

The following chemicals are among those commonly used as fungicides or soil fumigants for plant disease control:

Copper fungicides—Bordeaux mixture (made of copper sulfate, lime and water), basic copper sulfate, copper oxides, copper carbonate, copper naphthenate, copper dusts.

Sulfur fungicides—Liquid lime-sulfur, dry lime-sulfur, wettable sulfurs, sulfur dusts.

Mercury fungicides—Mercuric chloride, phenyl mercury acetate and related organic mercury compounds.

Fumigants—Methyl bromide, carbon disulfide, chloropicrin, sulfur, formaldehyde, D-D, ethylene dibromide, urea. Some of these are effective against fungus and nematode diseases while others are mainly effective against nematodes.

Organic fungicides—Several of the organic fungicides have been given short common names for the active fungicidal chemical:

Some Trade Names of Some Commercial Preparations Containing Fungicides	*Active Fungicidal Chemical*	*Common Name*
Fermate, Ferradow, Nu Leaf Karbam, Carbamate	ferric dimethyl dithiocarbamate	ferbam
Zerlate, Methasan, Zincate, Opalate White	zinc dimethyl dithiocarbamate	ziram
Dithane D-14 (liquid), Parzate (liquid) Thiodow	disodium ethylene bisdithiocarbamate	nabam
Dithane Z-78, Parzate, Ortho Zineb	zinc ethylene bisdithiocarbamate	zineb
Arasan, Panoram, Tersan, Thiram 50 Dust, Thiram Naugets	tetramethyl thiuram disulfide	thiram
Spergon, Spergon SL	tetrachloro para benzoquinone	chloronil
Orthocide, Captan 50-W	N-trichloromethylthio tetrahydrophthalimide	captan
Crag Fruit Fungicide 341	2-Heptadecyl glyoxalidine acetate	glyodin
Phygon, Phygon XL	2,3-Dichloro-1,4 naphthoquinone	dichlone
Manzate, Manzate 75, Dithane M22	manganous ethylene bisdithiocarbamate	maneb

Compiled by H. R. Garriss and J. C. Wells, Plant Pathology Extension.

The following examples may serve to simplify the usage of common names for active fungicidal chemicals in active ingredient statements used in labeling. Let us consider two of the trade name products recommended for tobacco blue mold control, Dithane Z-78 and Fermate.

1. *Dithane Z-78* contains 65% zinc ethlylene bisdithiocarbanate or 65% zineb (common name)
2. *Fermate* contains 76% ferric dimethyl dithiocarbamate or 76% ferbam (common name)

Materials such as these containing 65% zineb or 76% ferbam are used in preparing spray mixtures for spray treatments.

Recommendations for dust treatments call for use of a dust mixture containing 6.5% zineb (10% Dithane Z-78, Parzate, etc.) 11.4% ferbam (15% Fermate, Ferradow etc.). Therefore, the label on packages of dust mixtures for tobacco blue mold control should show the active ingredient to be 6.5% zineb or 11.4% ferbam.

A 10% Dithane Z-78 dust contains 6.5% zineb; a 15% Fermate dust contains 11.4% ferbam.

Precautions and Antidotes

Mercury compounds:

Mercury compounds are poisonous and should be handled with care. Avoid inhaling vapors and contact with eyes and skin. In case of poisoning by swallowing, give raw eggs or milk immediately, then a tablespoon of salt in a glass of warm water and repeat until vomit fluid is clear. In case of contact, remove all contaminated clothing and flush skin or eyes with plenty of water. Keep material away from small children and animals.

Soil fumigants:

Fumigants containing either dichloropropene (D-D, Telone) or ethylene dibromide (Dowfume W-85, Soilfume 85) or a mixture of these materials (Dorlone) are toxic to humans and animals, but with proper handling they can be used without risk. The vapors of these materials have sufficient odor to give warning of their presence. Avoid prolonged breathing of the vapors. Prolonged inhalation may cause diffculty in breathing. If this occurs, call a physician and remain quiet. Avoid contact with the skin. These fumigants may cause inflammation, burns and even blisters if left in contact with the skin too long. Affected areas should be washed thoroughly with soap and water. If contact results in a persistent redness of the skin, a physician should be consulted. Contaminated shoes and clothing should not be worn until it is certain they are free of all of these chemicals. Affected leather shoes are difficult to clean and should be destroyed. Prevent splashing of the fumigants in the eyes by wearing goggles when

pouring these materials. If the eyes are accidentally contaminated, they should be flushed with flowing water for at least 15 minutes and then consult a physician. Never attempt to siphon fumigants by mouth suction since swallowing the materials may have serious consequence. If the fumigants are accidentally swallowed, produce vomiting (take a tablespoonful of salt in a glass of warm water or drink soapy water). Repeat until vomit fluid is clear. Call a physician and remain still and quiet. D-D and ethylene dibromide are toxic to living plants. Avoid using near living plants or planting too soon after fumigation.

Methyl bromide and chloropicrin are dangerous chemicals and special precautions should be taken when using them. They are harmful by inhalation of vapors, by prolonged or repeated contact with the skin and by oral intake. Injuries from methyl bromide and chloropicrin can be prevented by following a few simple rules. When using these chemicals, always make sure that ventilation is adequate. Do not breathe the vapors. When removing cover from plant bed or dispensing the gas, have the wind at your back, if possible, so the vapors will be blown away from you. If a person is overcome by vapors, he should be removed immediately to fresh air. If breathing has stopped, use artificial respiration. Keep the patient quiet and get medical attention immediately.

If the chemicals are spilled on clothing or shoes, remove immediately and air thoroughly before reuse. If spilled on skin, wash the affected area immediately with soap and water, otherwise severe blistering will occur. Direct contact of liquid methyl bromide with the eye or eyelids may cause serious injury to either or both. If the eyes are accidentally contaminated, they should be flushed with flowing water for at least 15 minutes and then consult a physician. (Methyl bromide is packed under pressure so *do not* use an ordinary can opener to open the can—special equipment is available for this.)

NOTE:

In order to compile a usable listing of fungicides it is frequently necessary to use trade names either together with or instead of complicated chemical terms. Sometimes it is unavoidable that similar products on the market may not be named. No endorsement is implied for products named in this listing and no criticism is intended for reliable products not mentioned.

Following is an index to fungicidal recommendations which should aid in more quickly locating particular uses of materials on the pages that follow:

Index to Fungicidal Recommendations

CHEMICAL SOIL TREATMENTS FOR CONTROL OF NEMATODES AND OTHER SOIL-BORNE DISEASES

Trade Name (List may not be complete)	Active Ingredient	Approximate dosage		Relative effectiveness against:					
				Nematodes			Fungus diseases	Bacterial diseases	Weed seeds
		per acre broadcast*	per 100 sq. yds. in plant beds	root knot	meadow	stunt			
D-D	dichloropropene-dichloropropane mixture	20 gals.**	½ gal.	good	good	fair to good	poor	poor	poor
Telone	dichloropropene	16 gals.	½ gal.	good	good		poor	poor	poor
Dowfume W-40 Soilfume 40	ethylene dibromide	18 gals.**	½ gal.	good	poor to fair	exc.	poor	poor	poor
Dowfume W-85 Soilfume 85 Soilfume N. C.-12		4½ gals.	1 pt.	good	poor to fair	exc.	poor	poor	poor
Dorlone	dichloropropene plus ethylene dibromide	12 gals.	3 pts.	good	good	good	poor	poor	poor
Larvacide Picfume	chloropicrin	28 gals.	½ gal.*	good	good	good	good	good	fair
Dowfume MC-2 Pestmaster Bed-Fume N. C.-10 Bed Gas	methyl bromide 98% chloropicrin 2%		9 lbs. tobacco 18-27 lbs. vegetables***	exc.	exc.	exc.	good	good	good
Nu-Green	urea (field grade)	2400-4800 lbs.	50-100 lbs.	fair to good	fair to good	fair to good	fair	fair	fair to good
Several	allyl alcohol plus dichloropropene-dichloropropane mixture		2 gals.	satisfactory					good
Bedrench	allyl alcohol plus ethylene dibromide		1½ gals.	satisfactory					

NOTES: For use of soil treatments in vegetable crops: See N. C. Ext. Circ. No. 337 and U.S.D.A. Farmers' Bul. No. 2048.
For treatment of tobacco plant bed soil: See N. C. Ext. Folder No. 363 (revised).
For other uses of the above materials follow manufacturers' directions.

*Row treatments usually require approximately ½ the dosage as that shown for broadcast treatment.

**These dosages have consistently given good control of nematodes in tobacco. Dosages as low as 15 gals. per acre have been profitable but not as effective as the rates shown in table.

***Results of tests on pepper, eggplant, lettuce and tomato show that the 9 lb. rate used for tobacco does not adequately control damping-off. On heavy soils or where excessive organic matter such as sawdust is used in vegetable plant beds the methyl bromide treatment sometimes has caused delayed emergence and stunting of these crops: See Plant Pathology Information Note No. 37.

TOBACCO—BLUE MOLD AND ANTHRACNOSE

Materials	Active Ingredients	Method	Time and Number of Applications	Rate
Dithane Z-78 or Parzate	zineb 65%	spray or dust	1st application when plants are about the size of a dime. Following applications twice per week until plants free of blue mold are assured for transplanting—(usually 8-12 applications).	**For Spray:** Use 65% zineb at the rate of 3 lbs. to 100 gals. water (2½ level tablespoonfuls per gal.) **For Dust Treatment:** Mixture containing 6.5% zineb with talc or pyrophylite.
Fermate Nu Leaf Ferradow	ferbam 76%	spray or dust	Same as above.	**For Spray:** Use 76% ferbam at the rate of 4 lbs. per 100 gals. water (5 level tablespoonfuls per gal.) **For Dust Treatment:** mixture containing 11.4% ferbam with talc or pyrophyllite.
Dithane M-22 Manzate	maneb 70%*	spray or dust	Same as above.	**For Spray:** Use 70% maneb at the rate of ½ lb. per 100 gals. water (1 level teaspoonful to 1 gal. water). **For Dust Treatment:** mixture containing 1.4% maneb with talc or pyrophyllite.

* Maneb fungicides have the advantage of being cheaper but have the disadvantage of not being as safe. Therefore, growers using maneb fungicides should be sure to use only the **recommended rates.**

WILDFIRE CONTROL IN BURLEY PLANT BEDS

Materials	Active Ingredients	Method	Time and Number of Applications	Rate
3-4-50 Bordeaux mixture	copper sulfate plus hydrated lime	drench	2-3 applications 1st treatment when plants are through the ground; 2nd application 10 days later. If beds are hand weeded make another application immediately after weeding.	3 lbs. of copper sulfate, 4 lbs. of hydrated lime, 50 gals. water. (25 gals. mixture will cover 100 running ft. of bed 9 ft. wide or 150 running ft. of bed 6 ft. wide.)
or Basic copper sulfates containing approximately 50% metallic copper, such as Microgel, Tri-basic Copper and COCS		Same as above	Same as above.	1½ lbs. to 50 gals. water (25 gals. mixture will cover 100 running ft. of bed 9 ft. wide, or 150 running ft. of bed 6 ft. wide.)
Streptomycin sulfate		drench	5 applications Start when plants are in 2-leaf stage & put on 1 application a week for 5 weeks.	Use a 100 PPM* drench & apply at the rate of 10 gals. per 9 x 100 ft. bed. Follow manufacturer's suggestions in determining amount required to give 100 PPM dilution.
		spray	Same as above.	Use a 200 PPM spray & apply at the rate of 5 gals. per 9 x 100 ft. bed. Follow manufacturer's suggestions in determining amount required to give 200 PPM dilution.

* PPM is an abbreviation for "parts per million".

SPRAY MATERIALS FOR STRAWBERRY DISEASE CONTROL

Leaf spot and scorch can be controlled by sprays of Bordeaux mixture 8-8-100 *or* yellow cuprous oxide (83% copper) 1½ lbs.-100 gallons of water, *or* Tribasic Copper Sulfate (53% copper) 4 lbs.-100 gallons applied in November or December, in latter half of February or early March, and repeated at approximately two-week intervals until a week before the first picking. So far, the Albritton variety, even with no sprays, has been affected very little with leaf spot or scorch. Massey, Dixieland, and Pocahontas are affected quite badly at times.

Gray mold or Botrytis rot of the berries has been partially controlled by sprays of captan (50%) 2 lbs. to 100 gallons of water or 7.5% captan dust at 30 to 40 lbs. per A. applied at one-week intervals from the time the plants started to grow actively in the spring until a week before the first picking.

RASPBERRY AND DEWBERRY DISEASE CONTROL

Raspberry and dewberry plants are commonly damaged by fungus diseases called anthracnose, leaf spot and cane blight. Affected plants often are severely weakened and produce low yields of poor quality berries. Therefore, the following control measures are suggested:

1. Set disease-free plants.
2. Set plants as far as possible from other cultivated or wild raspberries, dewberries or blackberries.
3. Before setting plants, cut off and burn any old stems attached to young plants.
4. *In pruning raspberries just after harvest,* remove and burn all old fruiting canes and all heavily diseased ones.
   In pruning dewberries just after harvest, cut off and burn all old and new canes just at or slightly below the soil line.
5. Keep weed growth away from base of plants to promote rapid drying off of plants.
6. Spray the plants thoroughly with materials and at time indicated below. Better wetting of canes and leaves with spray results if a spreader, such as Triton B1956 Spread-Sticker or Dreft is used at 2 or 3 ounces per 100 gallons.

RASPBERRY and Dewberry Fungicidal Spray Programs

When to Spray		Materials and Amounts to use:		
Raspberry	Dewberry		For 2½ gals.	for 100 gals.
In late winter or early spring when new growth is less than ½ inch long	In late winter or early spring just after the canes are tied up and before new growth is ½ inch long	Liquid lime-sulfur or Dry lime-sulfur or Bordeaux mixture made with copper sulfate plus hydrated lime or Elgetol or Krenite	1 qt. 12 oz. 3 oz. 3 oz. 1/5 pt.	10 gals. 30 lbs. 8 lbs. 8 lbs. 1 gal.
Just before first blooms open	Just before first blooms open	ferbam (76%) fungicide, such as Fermate, Ferradow, etc.	6 tablespoonfuls	2 lbs.
Apply to new canes when 1½ to 2 feet high	Just after bloom	ferbam (76%) fungicide, such as Fermate, Ferradow, etc.	6 tablespoonfuls	2 lbs.
Just after harvest	After harvest and when new growth is about 1 to 1½ ft. long	ferbam (76%) fungicide, such as Fermate, Ferradow, etc.	6 tablespoonfuls	2 lbs.

VEGETABLE SEED TREATMENT

Crop	Disease Controlled	Materials	Active chemical	Method	Dosage
Bean (lima)	Seed decay, pre-emergence damping-off	Spergon or Arasan or Thiram 50 Dust	chloronil 98% thiram 50%	dust	1 tsp. per lb.* 1/3 tsp. per lb.
Beet **Swiss chard**	Seed decay, pre-emergence damping-off	Cuprocide **or** Spergon	Yellow cuprous oxide containing 83% metallic copper chloronil 98%	dust dust	1 tsp. per pound 1 tsp. per pound
Broccoli **Brussels sprouts** **Cabbage** **Cauliflower** **Collard** **Kale** **Kohlrabi** **Mustard** **Radish** **Turnip** **Tendergreen**	Seed decay, pre-emergence damping-off	Buy hot water treated seed and treat with Semesan **or** Zinc Oxide	hydroxymercurichlorophenol 30% (mercury equivalent 19.0%) zinc oxide	dust dust	½ tsp. per pound 1 tsp. per pound
Cantaloupe **Cucumber** **Pumpkin** **Squash** **Watermelon**	Seed decay, pre-emergence damping-off, anthracnose (cantaloupe, watermelon, cucumber), angular leaf spot (cucumber).	Bichloride of Mercury	mercuric chloride containing 74% metallic mercury	soak	1oz. per 7 gals. water (one-8-grain tablet per pt. water). Soak seed in solution for 5 min., rinse thoroughly and dry and treat with thiram, according to mfr. directions.
Carrot	Seed decay, pre-emergence damping-off	Cuprocide **or** Semesan	yellow cuprous oxide containing 83% metallic copper hydroxymercurichlorophenol 30% (mercury equivalent 19.0%)	dust dust	1½ tsp. per pound ½ tsp. per pound
Eggplant	Seed decay, pre-emergence damping-off	Spergon or Cuprocide		dust	1 tsp. per pound
Lettuce **Romaine**	Seed decay, pre-emergence damping-off	Cuprocide **or** Spergon	yellow cuprous oxide containing 83% metallic copper chloronil 98%	dust dust	1-1/3 tsp. per pound 2/3 tsp. per pound
Parsley **Parsnip**	Seed decay, pre-emergence damping-off	Semesan	hydroxymercurichlorophenol 30% (mercury equivalent 19.0%)	dust	¼ tsp. per pound

Vegetable Seed Treatment—(continued)

CROP	Disease Controlled	Materials	Active Chemical	Method	Dosage
Pea (Garden)	Seed decay, pre-emergence damping-off	Spergon or Semesan	chloronil 98% hydroxymercurichlorophenol 30% (mercury equivalent 19.0%)	dust dust	1 tsp. per pound ½ tsp. per pound
Pepper	Bacterial spot and other seed-borne diseases	Bichloride of Mercury	mercuric chloride containing 74% metallic mercury	soak	1 8-grain tablet per qt. of water. Soak seed in solution for 5 min., rinse thoroughly & dry.
	Seed decay, pre-emergence damping-off	Arasan or Thiram 50 Dust	thiram 50%	dust	Treat according to manufacturers' directions after soaked seed are dry.
Sweet potato	General	Semesan Bel	12% hydroxymercurinitrophenol plus 2% hydroxymercurichlorophenol	soak	1 lb. to 7½ gals. water. Soak potatoes for bedding in solution 1 min., dry (in shade) and bed without washing.
Tomato	Seed decay, pre-emergence damping-off	Buy hot water treated seed and treat with Cuprocide or Spergon		dust	1 tsp. per pound.

* tsp. means one level teaspoonful.

NOTE: For the simple dust treatments, such as Arasan, Cuprocide, Semesan, Spergon, and zinc oxide, place the seed to be treated in a tight jar or other container, spread the required amount of dust over the seed, close the lid and shake or rotate until all the seed are thinly coated. (Never have the container more than ½ full of seed for any one operation.)

In treating small quantities of seed, such as a 10-cent paper packet, tear off one corner of the packet and place a "pinch" of the dust (about twice as much as can be picked up on the first ½ in. of the flattened end of a toothpick) in the package with the seed. Shake the seed and dust together for several minutes and remove from the packet. All seed should be thinly coated.

Care should be used in handling these materials because some of them are poisonous.

For most crops, only one or two of the most commonly recommended materials are listed. However, in some cases, materials which are recommended only for certain crops may also be used on others, according to manufacturers' directions.

FIELD CROP SEED TREATMENT

Crop	Disease Controlled	Materials	Active Chemical	Method	Dosage
Cotton	Damping-off, seed decay, angular leafspot, anthracnose	Ceresan M	ethyl mercury p-toluene sulfonanilide 7.7%	dust	3 oz. per 100 lbs. reginned seed
		2% Ceresan	ethyl mercury chloride 2%	dust	6 oz. per 100 lbs. reginned seed
		Dow 9B	zinc tri-chlorophenate 50%	dust	4 oz. per 100 lbs. reginned seed
		Panogen 15	methyl mercury-dicyandiamid 2.2%	liquid	3 oz. per 100 lbs. reginned seed
		Ceresan 100	ethyl mercury acetate and ethyl mercury 2,3 dihydroxy propyl mercaptide (Hq 2.3%)	liquid	3 oz. per 100 lbs. reginned seed
		Orthocide 75	captan 75%	dust or slurry	2 oz. per 100 lbs. regineed seed
Wheat	Seed decay, stinking smut, seed-borne seedling blight and root rot	Ceresan M	ethyl mercury p-toluene sulfonanilide 7.7%	dust	½ oz. per bu.
		Ceresan M-2X	ethyl mercury p-toluene sulfonanilide 15.4%	slurry	according to mfr. directions
		Ceresan 75	ethyl mercury acetate and ethyl mercury 2,3 dihydroxy propyl mercaptide (Hq 2.1%)	liquid	according to mfr. directions
		Ceresan 100	ethyl mercury acetate and ethyl mercury 2,3 dihydroxy propyl mercaptide (Hq 2.3%)	slurry or liquid	according to mfr. directions
		Ceresan 200	ethyl mercury acetate and ethyl mercury 2,3 dihydroxy propyl mercaptide (Hq 2.3%)	slurry	according to mfr. directions
		Panogen 42	methyl mercury-dicyandiamid 6.3%	slurry	¾ oz. per bu.
		Panogen 15	methyl mercury-dicyandiamid 2.2%	liquid	
Oats	Seed decay, seedling blight, loose and covered smut	Same as for wheat			
Barley	Covered smut, black loose smut, seed-borne scab, seedling blight, stripe	Same as for wheat			

Field Crop Seed Treatment—(continued)

Crop	Disease Controlled	Materials	Active Chemical	Method	Dosage
Corn	Seed decay, seedling blight, seedling root rot	Thiram 50 Dust Arasan 75	thiram 50% thiram 75%	dust	1 oz. per bu.
		Arasan SFX Arasan SFM Thiram Nauguets Panoram	thiram 75%	slurry	according to mfr. directions
		Phygon XL	dichlone	dust slurry	1 oz. per 100 lbs. seed 1 lb. per 1 gal. water
		Orthocide 75	captan 75	dust slurry	¾ oz. per bu. according to mfr. directions
Peanuts	Seed decay	Thiram 50 Dust Arasan 75	thiram 50% thiram 75%	dust	3 oz. per 100 lbs. of seed 2 oz. per 100 lbs. of seed
		2% Ceresan	ethyl mercury chloride 2%	dust	4 oz. per 100 lbs. of seed
		Yellow Cuprocide	yellow cuprous oxide containing 83% metallic copper	dust	4 oz. per 100 lbs. of seed
		Spergon	chloronil 98%	dust	4 oz. per 100 lbs. of seed
Soybeans	Seed decay, damping-off	Thiram 50 Dust Arasan 75	thiram 50% thiram 75%	dust	2 oz. per bu. 1 1/3 oz. per 100 lbs.
		Orthocide 75	captan 75	dust slurry	1½ oz. per bu. according to mfr. directions
Cowpeas	Seed decay	Thiram 50 Arasan 75 Spergon	thiram 50% thiram 75% chloronil 98%	dust	1 1/3 oz. per 100 lbs. 2 oz. per bu.
Sorghum	Seed decay, seedling blight, loose and covered kernel smut	Arasan 75 Panoram 75 Arasan SFM* Arasan SFX	thiram 75%	dust slurry slurry	1 1/3 oz. per bu. of seed according to mfr. directions
		Ceresan M	ethyl mercury p-toluene sulfonanilide 7.7%	dust or slurry	½ oz. per bu. according to mfr. directions
		Panogen 42 Panogen 15	methyl mercury-dicyandiamid 6.3% methyl mercury-dicyandiamid 2.2%	slurry liquid	according to mfr. directions ¾ oz. per bu.
Grasses	Seed decay, damping-off	Thiram 50 Dust Arasan 75 Panoram 75	thiram 50% thiram 75% thiram 75%	dust dust dust	8 oz. per 100 lbs. of seed 5 1/3 oz. per 100 lbs. of seed 5 1/3 oz. per 100 lbs. of seed

DUSTING PEANUTS FOR LEAFSPOT CONTROL

Materials	Active Ingredients	Method	Time and Number of Applications	Rate of Application
Copper-Sulfur Dust	4% metallic copper from either tribasic copper sulfate or cuprous oxide mixed with 325-mesh sulfur	dust	3 to 4 applications, 1st application last week in June, not later than July 10. Following applications at 14-day intervals.	1st—15 lbs. per A. 2nd—18 lbs. per A. 3rd—20 lbs. per A. 4th if neded—20 lbs. per A.
325-mesh Dusting Sulfur	325-mesh dusting sulfur	dust	3 to 4 applications, 1st application last week in June, not later than July 10. Following applications at 14-day intervals.	1st—15 lbs. per A. 2nd—18 lbs. per A. 3rd—20 lbs. per A. 4th if neded—20 lbs. per A.

SOUTHERN STEM AND ROOT ROT CONTROL IN PEANUTS

Pentachloronitrobenzene commonly known as PCNB, available under the trade name Terrachlor, is recommended on a trial basis for the control of southern stem and root rot in peanuts. This material gave excellent control when applied as a landplaster-Terraclor mixture the first week in July at the rate of 400 lbs. of the mixture per acre. Fifteen pounds of Terraclor was mixed with 385 pounds of landplaster to formulate the 400-lb. mixture applied per acre.

DISEASE CONTROL RECOMMENDATIONS FOR FLORAL CROPS

Crop	Diseases	Material	Active Ingredient	Method	Concentration	Schedule
Azalea (See Ext. Circ. 246)	Ovulinia petal blight	Dithane Z-78 or Parzate	zineb 65% zineb 6%	spray dust	1 lb./100 gal. 6% dust	3 times each week during bloom.
	Exobasidium leaf and bud gall	Bordeaux (For average home garden garden: Control by hand picking and destruction of galls.)	copper	spray	6-2-100	For extensive planting 1 to 2 applications 10 to 14 days apart, beginning when galls are first evident.
	Phytophthora root rot	Formalin	formaldehyde	soil drench	1 part commercial formalin in 49 parts water	½ gal. per sq. ft. of soil well in advance of planting.
Camellia (See Ext. Circ. No. 246)	Sclerotinia flower blight	Fermate, Nu-Leaf or Ferradow + Dreft 325-mesh sulfur (Pick up and destroy all fallen flowers; remove old litter and replace with clean pine straw.)	ferbam 76% sulfur	soil drench dust evenly	6 lbs./1000 sq. ft. 1 lb./180 sq. ft.	Late December or early January. Late December or early January.
	Exobasidium leaf and bud gall	(See under Azalea)				
	Phytophthora root rot	(See under Azalea)				
	Glomerella die-back	Bordeaux paste (prepared) Bordeaux powder mixed with water to the consistency of white wash	copper	Apply to cut surfaces after removal of blighted twigs and branches—all affected tissue must be eliminated.		
Carnation	Alternaria blight	Fermate, Nu-Leaf or Ferradow Bordeaux	ferbam 76% copper	spray spray	1½ lbs./100 gals.+ spreader 4-4-100+spreader	7 day intervals
	Bacterial leaf spot	Tag Fungicide, Quicksan, Orchard Brand, Green Cross Erad	phenyl mercuric acetate 10%	spray	½ pint/100 gals.+ spreader	
		Puratized apple spray	phenyl mercuric monoethanol ammonium acetate 11.5% (Avoid splashing water)	spray	½ pint/100 gals.+ spreader	
Chrysanthemum	Heterosporium fairy ring spot	Fermate, Nu-Leaf or Ferradow	ferbam 76%	spray	1½ lbs./100 gals.+ spreader	7-10 day intervals
	Leaf rust	Fermate, Nu-Leaf or Ferradow	ferbam 76% (In early infections pick off leaves and destroy)	spray	1½ lbs./100 gals.+ spreader	When scattered rust pustules are evident

Disease Control Recommendations for Floral Crops—(continued)

Crop	Diseases	Material	Active Ingredient	Method	Concentration	Schedule
Chrysanthemum (Continued)	Bacterial blight	Agri-mycin, Phyto-mycin, Agristrep	streptomycin	Dip for clean cuttings prior to rooting		
	Foliar nematodes	Wettable Parathion 15%	parathion 15%	spray	1½-3 lbs./100 gal.	7-10 day intervals
	Mycosphaerella ray blight	Dithane Z-78 or Parzate	zineb, 65%	spray	1 lb./100 gal.+ spreader	2-3 times per week as flowers begin to open
	Rust	Fermate, Nu-Leaf or Ferradow	ferbam, 76%	spray	1½ lbs./100 gals.+ spreader	7-10 day intervals
	Septoria leaf spot	Fermate, Nu-Leaf or Ferradow	ferbam, 76%	spray	1½ lbs./100 gals.+ spreader	7-10 day intervals
Dogwood	Anthracnose leaf and flower spot	Orthocide 50 or Captan, 50W	captan, 50%	spray	2 lbs. 100 gal.	1st delayed dormant 2nd petal fall 3rd mid-summer 4th pre-dormant (after flower buds are well formed)
Gladiolus (See Ext. Circ. No. 373 and Plant Path. Inf. Note No. 22	Botrytis foliage blight	Dithane Z-78 or Parzate	zineb, 65%	spray	1½-2 lbs./100 gals. +spreader	Every 7-10 days during normal weather, every 2-3 days during wet periods.
	Curvularia leaf spot	Dithane Z-78, Parzate or Dithane M-22, Manzate	zineb, 65% maneb, 70%	spray	1½-2 lbs./100 gals. +spreader	Same as for Botrytis
	Corm rots-Pre storage (Fusarium, Botrytis, Curvularia)	Dowicide B	sodium trichloro-phenate 85%	steep	1¾-2 lbs./100 gal.	Treat for 20-30 min. within a few days of harvest
	Corm and cormel rots-pre-planting (Fusarium, Curvularia)	New Improved Ceresan	ethyl mercury phosphate, 5%	steep	2 lbs./100 gal.	Treat for 15 minutes just before planting.
Iris (See Pl. Path. Info. Note No. 22)	Heterosporium	Dithane Z-78 or Parzate	zineb, 65%	spray	2 lbs./100 gal.+ spreader	Every 10-14 days.
	Bulb and stem nematode	Formalin	formaldehyde	long steep	2 qts./100 gal. 110-111°F for 3 hrs.	2 hr. pre-steep in water 75°F + Vatsol O. S. at 8 oz./100 gals. Bulbs must be treated before root development begins; this is usually 3-4 weeks following early harvest.
Narcissus	Bulb and stem nematode	Formalin	formaldehyde	long steep	2 qts./100 gal. 110-111°F for 4 hours	2 hr. pre-steep in water 75°F + Vatsol O. S. at 8 oz./100 gal. Treat planting 3 weeks following harvest.

Disease Control Recommendations for Floral Crops—(continued)

Crop	Diseases	Material	Active Ingredient	Method	Concentration	Schedule
Narcissus (Continued)	Basal Rot Pre-storage	Mersolite-W	phenyl mercury acetate, 96.5%	steep	1 lb./400-600 gal.	Treat for 5-15 min. within 1-3 days after harvest.
	Basal Rot Pre-planting	Mersolite-W **or**	phenyl mercury acetate 96.5%	steep	1 lb./600 gal.	Treat 5-15 min. just prior to planting.
		New Improved Ceresan	ethyl mercury phosphate	steep	2 lb./100 gal.	Treat 2-5 min. just prior to planting.
	Stagonospora leaf scorch: Foliage	Bordeaux	copper	spray	8-8-100+spreader	Every 10-14 days after 4-6 inches of foliage growth.
	Dormant bulbs	Formalin	formaldehyde	steep	2 qts./100 fal.	Treat for 2½-4 hrs. at temperature of 110-111.5°F.
Rose (See Ext. Circ. 200, revised)	Black spot	Fermate, Nu-Leaf **or** Ferradow	ferbam, 76% ferbam, 10%	spray dust	2 lbs./100 gal. 10%	apply every 7-10 days and twice each week during rainy periods.
		Orthocide 50 Captan 50	captan, 50% captan, 50%	spray	2 lbs./100 gal.	
	Powdery mildew	Wettable sulfur, 325-mesh sulfur or finer	sulfur sulfur	spray dust	4 lbs./100 gal. thorough coverage	Ferbam and sulfur may be applied together when necessary. Sulfur should not be used when temperature approaches or exceeds 90°F.
	Rust	Fermate, Nu-Leaf **or** Ferradow	ferbam, 76% ferbam, 10%	spray dust	2 lbs./100 gal. thorough coverage	Schedule usd for black spot should prove adequate.
Snapdragon	Anthracnose	Bordeaux	copper	spray	8-8-100	
		Fermate, Ferradow, Nu-Leaf	ferbam, 76%	spray	1½ lb./100 gal.	
		Dithane Z78, Parzate	zineb, 65%	spray	1½ lb./100 gal.	
		(Maintain dry atmosphere in greenhouse)				
	Phyllosticta blight	Bordeaux (Clean up all debris of snapdragon plants in fall; for greenhouse culture, surface watering and temperatures below 60°F are recommended)	copper	spray	8-8-100	Every 10-14 days.
	Rust	Dithane Z-78 **or** Parzate	zineb, 65%	spray	1½ lb./100 gal.	Every 10-14 days.
Tulip	Botrytis blight	Fermate, Nu-Leaf **or** Ferradow	ferbam, 76%	spray	1½-2 lbs./100 gal.	Begin when foliage is 2-4 inches tall; spray at 7-10 day intervals. 4 successive applications should be plentiful.
Zinnia	Alternaria leaf & flower spot	Bichloride of mercury	mercury	seed	1 oz./7½ gals.	Treat 5-10 min. and rinse thoroughly.
		Cuprocide	cuprous oxide 90%	seed treatment		Coat seeds thoroughly and eliminate excess powder prior to planting.
	Mildew	Wettable sulfur 325-mesh sulfur or finer	sulfur sulfur	spray dust	4 lbs./100 gals. thorough coverage	

SPRAY AND DUST SCHEDULE FOR SOME VEGETABLE CROP DISEASES

CROP		Materials	Active Ingredients	Method	Time & No. of applications	Rate of Application
Cabbage	Downy mildew (in plant beds)	Wettable Spergon **or** Non-wettable Spergon	chloronil 48% chloronil 98%	spray dust	4 lbs./100 gals. Apply every 3 to 4 days. 10%—Apply at 3-day intervals. (See Extension Folder No. 89)	
Cantaloupe	Downy mildew	Tribasic copper sulfate dust containing 5% metallic copper	5% metallic copper	dust	Apply once every 10 days after each rain beginning around June 10. It may be necessary to move this date up 7-10 days in wet years or it may be moved back 7-10 days in dry years.	15-20 lbs. per acre early in season. 35-50 lbs. per acre when plants are larger.
Cucumbers (spring crop)	Downy mildew	Tribasic copper sulfate dust containing 5% metallic copper	5% metallic copper	dust	Same as above.	Same as above.
(fall crop)	Downy mildew & anthracnose	Manzate Dithane M-22 **or** Dithane Z-78 Parzate	maneb zineb	dust or spray	According to manufacturer's directions.	According to manufacturer's directions.
Irish potatoes	Late and early blight	1. Bordeaux mixture (8-6-100)	8 lbs. copper sulfate, 6 lbs. hydrated lime, 100 gals. water	spray	When late blight appears and at weekly intervals thereafter for Piedmnot and Coastal counties; or when plants are 6 to 8 inches high in Mountain counties	150-200 gals. per acre when vines are fully grown.
		2. Tribasic copper copper sulfate Copper A 3. C.O.C.S.	53% metallic copper tetra copper calcium oxychloride (45% metallic copper) copper oxychloride sulfate (55% metallic copper)	spray or dust (dust should contain 7% metallic copper)		**Spray:** 4 lbs of these materials in their concentrated form (around 45% metallic copper) to each 100 gals. water. Apply 150-200 gals. per A. **Dust:** 7% metallic copper and apply at 30-40 lbs. per acre.
		4. Dithane Z-78 **or** Parzate	zineb 65%	spray or dust		As recommended by manufacturer.
Lima beans	Stem anthracnose	Dithane Z-78 **or** Parzate	zineb 65%	spray	1st application when disease is first noticed or when plants are started to blossom. Repeat at 5-7 day intervals until 7 days before harvest.	1½ lbs. 65% per 100 gals. water. Apply at rate of 100 gals. per acre per application. (See N. C. Agr. Exp. Sta. Spec. Circ. No. 11.)

Spray and Dust Schedule—(continued)

CROP	Disease Controlled	Materials	Active Ingredients	Method	Time and Number of Applications	Rate of Application
Lettuce	Damping-off (plant beds)	Fermate, Nu Leaf, Ferradow	ferbam 76%	drench	1st application immediately after seeding, following applications at 10-day intervals until plants are ready to set.	½ lb. to 50 gals. water used at rate of ½ gal. per sq. yd. 2 lbs. to 100 gals water used at rate of ½ gal. per sq. yd.
		Captan 50-W Orthocide 50W	captan 50%			
Pepper & Eggplant	Damping-off (plant beds)	Semesan	hydroxymercurichlorophenol 30% (mercury equivalent 19.0%).	drench	According to manufacturer's directions	
		Captan 50W Orthocide 50W	captan 50%	drench	2 lbs. per 100 gals. apply ½ gal. per sq. yd. at 10-day intervals.	
Squash (summer—Mt. area)	Scab	Dithane Z-78 Parzate	zineb 65%	spray	According to manufacturer's directions.	
Tomato	Late blight	Fixed copper compounds: 1. Tribasic Copper Sulfate	metallic copper 53%	Fixed coppers may be used as dusts or sprays. Mixed dust should contain 7% (not less than 6.5%) metallic copper & sticking agent should be added.	**Western N. C.**—Make 1st application as soon as the plants are growing off well after transplanting & repeat not less than once each week. In addition dust treatments should be repeated after each rain that is heavy enough to wash the dust off. **Eastern N. C.**—Apply fungicides to summer crops not less than once every 10 days starting as soon as fruit sets. For fall crops start as soon as cool weather prevails & repeat once each week. Repeat dust treatments after heavy rains.	100-150 gals. of spray **or** 35-45 lbs. of dust per acre per application. (See revised Ext. Cir. No. 331.)
		2. Copper A	tetra copper calcium oxychloride (45% metallic copper)			
		3. Yellow Cuprocide	yellow cuprous oxide (83% metallic copper)			
		4. C.O.C.S.	copper oxychloride sulfate .55% metallic copper)			
	Early blight Gray Leafspot	Manzate **or** Dithane M-22	maneb	According to manufacturer's directions.		

SOUTHERN STEM AND ROOT ROT CONTROL IN PEPPER AND TOMATO

Pentachloronitrobenzene commonly known as PCNB, available under the trade name Terraclor, is recommended on a trial basis for the control of southern stem and root rot in tomatoes and peppers. This material gave excellent control when applied as a transplant solution at the time of setting. Three pounds 75% Terraclor to 100 gallons water makes up the transplant solution. Use at the rate of ½ pint per plant. Agitate the solution often to assure proper dosage to each plant.

SWEET POTATO STORAGE HOUSE STERILIZATION

Materials	Active Ingredients	Dosage	Method and Requirements
Larvacide	cholorpicrin (tri-chloronitro-methene)	½ lb./1000 cu. ft. space.	(Fumigation)—See footnote. Follow manufacturer's directions.
Sulfur	sulfur	1 lb./1000 cu. ft. space.	(Fumigation—See footnote. (1) Distribute several metal or earthenware containers throughout the house, placing them on bricks or similar material to avoid fire. Don't use containers with soldered bottoms. (2) Place the required amount of sulfur over crumpled paper in each container and set paper afire. (3) Close door tightly for 24 hrs. Air house thoroughly before storing potatoes. Disinfect cleaned crates by leaving them in the house during fumigation.
Formaldehyde plus potassium permanganate	formaldehyde 40% plus potassium permanganate (purple in color)	3 pt. of commercial formaldehyde and 23 oz. of potassium permanganate for each 1000 cu. ft. space.	(Fumigation)—See footnote. (1) Equally distribute about the house containers that will hold liquid. (2) place required weight of dry potassium permanganate crystals in each container. (3) Place beside these containers the liquid formaldehyde in open glass jars. (4) Start furtherest from door quickly pour formaldehyde liquid over crystals of potassium permanganate, work rapidly but carefully as the fumigating gas soon forms and will irritate the eyes. (5) Tightly close door for 24 hours. (6) Air house until the smell of formaldehyde is gone before storing potatoes. Disinfect cleaned storage containers by leaving them in the house during fumigation.
Copper sulfate solution	copper sulfate (metallic) copper 25%	1 lb. copper sulfate (blue-stone) to each 10 gals. water.	(Spray or Drench)—(1) Remove crates from house. (2) Mix materials in the proportions recommended and spray all inside parts of house thoroughly. (3) Dip or thoroughly spray crates inside and out with the solution. (4) Dry out house before storing potatoes.

NOTE: Rot producing germs will live over for a long period of time on the walls and floor of the storage house and on crates. If these germs are not killed they may start rotting of the new crop. Either of the above treatments may be used with success after the house and surroundings have been thoroughly cleaned of all rotted potatoes, dirt and other trash.

House must be "air" tight and moist with water for satisfactory results with fumigation treatments. Maintain temperaures of 70° F. or above during fumigation.

HOW TO COLLECT, PREPARE AND SHIP PLANT DISEASE MATERIAL FOR IDENTIFICATION

A plant disease identification service is available to every citizen in North Carolina. Farmers, gardeners, nurserymen and others may submit disease specimens to the Plant Disease Clinic either through their County Agent or Vocational Agriculture teachers, personally or directly by mail.

Each year an average of 1,400 diseased specimens are received for identification and recommendations. Unfortunately, many of these arrive in such poor condition that positive identification is impossible. Specimens arriving unnamed, with no information, wilted, dry, crushed or in advance stages of decay represents time wasted for you and the Clinic. When sending specimens for examination *please read and follow instructions for collecting, packaging* and mailing specimens.

Collecting:

1. Get all parts of plants, including roots where practicable—above-ground symptoms may be caused by a root trouble. Dig out (don't pull up) plants and carefully remove soil. Roots of fleshy fruits and vegetables need special attention. Select fresh specimens showing young symptoms; do not send fleshy fruits and vegetables in advance stages of decay. When sending in cankers on shrubs and trees, select canker or twig specimen from recent infections. Send in entire cankered portion with some of the healthy wood beyond the canker. Branches and twigs that have been dead for several months are useless for disease identification.
2. Collect several specimens showing various stages of the trouble and especially specimens showing early stages of disease. Collect also a healthy specimen if feasible. Be sure to include enough material for examination.
3. Wrap specimens immediately in wet paper, cloth or sacks and keep plants cool until shipped.

Packing:

1. Wrap plants in moistened paper and cover with waxed paper—don't overcrowd or crush plants. Fleshy vegetable and fruit specimens should be wrapped separately in waxed paper—do not pack in wet toweling as adding moisture to diseased fruits and vegetables hastens decay in transit.
2. Pack in sturdy container to prevent crushing in transit.
3. Identify package with both outside and inside labels—don't put inside label in contact with moisture.

4. Address package to Plant Disease Clinic, Box 5397, State College Station, Raleigh, N. C.

Information:

Describe the condition that you observed in the affected area and state whether or not you are concerned with some condition on the leaves, stems or roots. Give as much information about the conditons under which it was grown as possible, such as acreage involved, per cent plants affected, per cent loss, occurrence (whether occasional, scattered, small areas, large areas, whole field), as well as rotation, history of field, fertilizer, whether or not soil fumigation or weed killers were used, seed treatment, date of planting, whether dust or sprays were used.

EXPERIMENT STATION AND EXTENSION PUBLICATIONS DEALING WITH PLANT DISEASE CONTROL AVAILABLE FROM THE PLANT PATHOLOGY EXTENSION OFFICE, N. C. STATE COLLEGE

Tobacco

1. Tobacco Blue Mold and Anthracnose Control—Ext. Circ. No. 397
2. Methyl Bromide for Weed & Nematode Control—Ext. Folder No. 101
3. Experiments on Tobacco Blue Mold Control—Exp. Sta. Tech. Bul. No. 111
4. Chemical Treatment for the Control of Weeds and Diseases in Tobacco —Expt. Sta. Tech. Bul. No. 119
5. Treatment of Tobacco Plant Bed Soils with Methyl Bromide—Expt. Sta. Tech. Bul. No. 399
6. Mosaic Control in Tobacco—Ext. Folder No. 128
7. Wildfire Control in Burley Tobacco—Ext. Circ. No. 401
8. Soil Fumigation for Nematode Control in Tobacco—Ext. Circ. 402
9. Sore Shin of Tobacco—Plant Pathology Inf. Note No. 5
10. Stem Rot of Tobacco—Plant Pathology Inf. Note No. 6
11. Black Shank of Tobacco—Plant Pathology Inf. Note No. 7
12. Hollow Stalk of Tobacco—Plant Pathology Inf. Note No. 8
13. Southern Stem & Root Rot of Tobacco—Plant Pathology Inf. Note No. 9
14. Granville Wilt of Tobacco—Plant Pathology Inf. Note No. 10
15. Lightning Injury of Tobacco—Plant Pathology Inf. Note No. 12

Peanuts

1. Peanut Seed Treatment—Expt. Sta. Spec. Circ. No. 14
2. Peanut Leafspot Control—Expt. Sta. Spec. Circ. No. 16
3. Nematode Diseases of Peanuts—Ext. Folder (In press)
4. Peanut Production Guide—Ext. Circ. No. 257

5. Control of Peanut Leafspot Diseases—Plant Pathology Inf. Note No. 2
6. Southern Stem Rot of Peanuts—Plant Pathology Inf. Note No. 26
7. Peanut Root Knot—Plant Pathology Inf. Note No. 27

Cotton

1. Why & How To Treat Cotton Seed—Ext. Folder No. 39
2. Cotton Diseases—How To Recognize & Control Them—Reprint Cotton Gin & Oil Mill Press, April, 1953
3. Some Notes On Cotton Disease Control—Plant Pathology Inf. Note No. 3

Small Grain

1. Small Grain Diseases—Ext. Circ. No. 347
2. Loose Smut Causes Heavy Damage To Barley Crop—Plant Pathology Inf. Note No. 4
3. Mosaic Disease of Wheat—Plant Pathology Inf. Note No. 25
4. Brown Loose Smut of Barley—Ext. Folder (In press)

Vegetable Crops

1. Control Stem Anthracnose of *Lima Beans*—Exp. Sta. Spec. Circ. No. 11
2. *Cabbage* production Guide—Ext. Folder No. 89
3. Dusting *Cucumbers* to Control Downy Mildew—Exp. Sta. Bul. 362 (Revised)
4. *Cucurbit* Diseases in North Carolina and Their Control—Exp. Sta. Bul. 380
5. *Cucurbit* (Cucumber, Cantalope, Watermelon, Squash) Disease Control—Plant Pathology Inf. Note No. 23
6. *Tomato* Wilt Diseases—Ext. Folder No. 92
7. Control *Tomato* Late Blight—Ext. Circ. No. 331 (Revised)
8. Two Wilt Diseases of *Tomato*—Plant Pathology Inf. Note No. 13
9. Treat *Lettuce* Seed for Better Stands—Ext. Circ. No. 269
10. Growing *Lettuce* in North Carolina—Ext. Circ. No. 349
11. *Pepper* Diseases in North Carolina & Their Control—Plant Pathology Inf. Note No. 34
12. The *Irish Potato* Late Blight Story—Ext. Circ. No. 368
13. Ways to Fight *Potato* Late Blight—Reprint, Research & Farming, 1951
14. Grow Quality *Sweet Potatoes*—Ext. Circ. No. 353
15. Scab of Summer *Squash*—Expt. Sta. Spec. Circ. No. 18
16. Some Important Diseases of *Vegetable* Crops in N. C.—Plant Pathology Inf. Note No. 24

17. Leafspot Diseases of *Turnip Greens*—Plant Pathology Inf. Note No. 11
18. Methyl Bromide For Treating Vegetable Plant Beds—Plant Path. Inf. Note No. 37

Home Vegetable Garden

1. A Guide for controlling diseases in the vegetable garden—Ext. Circ. No. 265
2. Farm & Home Garden Manual—Ext. Circ. No. 231
3. Garden Guide—Ext. Circ. No. 365
4. Control Root Knot in the Vegetable Garden—Ext. Circ. No. 337

Forage Crops

1. Diseases of Annual Legumes Grown for Soil Improvement in the Southeastern United States—Plant Pathology Inf. Note No. 17
2. Forage Crop Diseases—Ext. Circ. No. 361
3. The Crown & Stem Rot Disease of Forage Legumes—Plant Pathology Inf. Note No. 40
4. Purple Stain of Soybeans—Ext. Circ. No. 257
5. Soybean Production in North Carolina—Ext. Circ. No. 381
6. Annual Lespedezas in North Carolina—Ext. Circ. No. 387
7. Stem Nematode of Alfalfa—Ext. Folder No. 133

Fruits and Small Fruits

1. Apple Spray Information—Ext. Circ. No. 406
2. Apple Spray Information—Plant Pathology Inf. Note No. 30
3. Three Rust Diseases of Apple—Plant Pathology Inf. Note No. 33
4. Fire Blight of Apple and Pear—Plant Pathology Inf. Note No. 28
5. Peach Spray Information—Ext. Circ. No. 407
6. Spray Program for Bunch Grapes in North Carolina—Plant Pathology Inf. Note No. 29
7. Black Knot of Plum and Cherry—Plant Pathology Inf. Note No. 20
8. Cherry Leafspot and Sprays for its Control—Plant Pathology Inf. Note No. 21
9. Scorch and Leafspot of Strawberries—Ext. Circ. No. 336 (G)
10. Raspberry and Dewberry Disease Control—Plant Pathology Inf. Note No. 32

Ornamentals

1. Growing *Gladiolus* in North Carolina—Ext. Circ. No. 373
2. Azaleas and Camellias—Ext. Circ. No. 246
3. Stromatinia Neck Rot of Gladiolus—Ext. Leaflet
4. Successful *Rose* Culture—Ext. Circ. No. 200 (Revised)

5. Diseases of Some *Floral Crops* in North Carolina—Plant Pathology Inf. Note No. 22
6. *Azalea* and *Camellia* Leaf Gall—Plant Pathology Inf. Note No. 35
7. *Camellia* Flower Blight—Plant Pathology Inf. Note No. 36
8. Spot anthracnose of flowering *Dogwood*—Plant Pathology Inf. Note No. 39
9. Lawn Disease Control—Ext. Folder No. 135

Miscellaneous

Chemicals for Control of Plant Diseases in North Carolina—Plant Pathology Inf. Note No. 1 (Revised)

SPRAY PROGRAM FOR BUNCH GRAPES IN NORTH CAROLINA

C. N. CLAYTON, H. R. GARRISS AND B. B. FULTON

Spray No.	Diseases & Insects To Control	Spray Materials to Use		Time to Spray
		In 100 Gallons of Water	In 3 gals.	
1.	Anthracnose	Copper sulfate (bluestone) ..... 8 lbs. or Liquid lime-sulfur ..... 10 gals. or Dry lime-sulfur ..... 30 lbs.	¼ lb. 2½ pts. 1 lb.	Late in spring on dormant vines before buds start to open.
2.	Black rot Anthracnose Mildews Dead arm	Bordeaux mixture:[a] Copper sulfate ..... 8 lbs. Fresh hydrated lime ..... 8 lbs. or 76% ferbam, sold as Fermate, NuLeaf, Ferradow, etc. ..... 2 lbs.	 ¼ lb. ¼ lb. 1 oz.	When new shoots are 1 to 2 inches long.
3.	Black rot Mildews Anthracnose	Same as in Spray No. 2	Same as in Spray No. 2	When new shoots are 7 to 10 inches long.
4.	Black rot Mildews Anthracnose Berry moth Leaf hopper	Same as in Spray No. 2 plus DDT (50% wettable powder) .... 2 lbs. or Methoxychlor (50% wettable powder) ..... 2 lbs.	As No. 2 plus 1 oz. or 1 oz.	Just before the blossoms open.
5.	Black rot Mildews Anthracnose Berry moth Leaf hopper	Same as in Spray No. 2 plus DDT (50% wettable powder) .... 2 lbs. or Methoxychlor (50% wettable powder) ..... 2 lbs.	As No. 2 plus 1 oz. or 1 oz.	Just after bloom (petalfall)
6.	Black rot Mildews Anthracnose Berry moth Leaf hopper	Bordeaux mixture as in No. 2 plus DDT (50% wettable powder) .... 2 lbs. or Methoxychlor (50% wettable powder) ..... 2 lbs.	As No. 2 plus 1 oz. or 1 oz.	About 10 days after Spray No. 5
	Black rot Mildews Ripe rot Bitter rot	Bordeaux mixture:[a] Copper sulfate ..... 4 lbs. Fresh hydrated lime ..... 4 lbs.	 2 oz. 2 oz.	At intervals of approximately 2 weeks until 2 to 3 weeks before harvest.

[a] Bordeaux mixture can be prepared by: (1) slowly adding finely powdered copper sulfate to water in the spray tank; (2) during vigorous agitation, adding the lime. Add insecticide last. Keep mixture agitated until used.

APPLE DISEASE AND INSECT CONTROL

CARLYLE N. CLAYTON
Plant Pathology

GEORGE F. TURNIPSEED and CLYDE F. SMITH
Entomology

Apple Spray Program—Through Bloom

(For more detailed information concerning materials or pests— See N. C. Ext. Circ. No. 406)

Name and Time of Spray	To Control	Materials for 100 gallons of spray	
		Fungicides	Insecticides
LATE DORMANT—before visible growth starts	Aphids, mites, scales	None	Oil, 2 gallons plus dinitro paste, 1 quart **OR** Oil, 2 gallons plus dinitro powder, 1 lb.
Note: Important spray. Apply in all orchards Do not apply after new growth starts.			
DELAYED DORMANT—when blossom buds show ¼ to ½ inch new growth	Scab, mildew	Liquid lime-sulfur, 8 qts.	None
Note: Do not apply within 3 weeks after Oil-dinitro spray.			
PRE-PINK—when center buds first show pink	Scab, mildew, leaf spot, apple rust, quince rust	Liquid lime-sulfur, 6 qts. **OR** Paste sulfur (70%), 6 lbs. plus Ferbam (76%), 12 oz.	None
PINK—just before bloom	Scab, mildew, leaf spot, apple rust, quince rust aphids, mites, Oriental fruit moth	Paste sulfur (70%), 8 lbs. **OR** Paste sulfur (70%), 6 lbs. plus Ferbam (76%), 12 oz.	Parathion (15%), 1½ lbs. **OR** Malathion (25%), 4 lbs. (Either can be used with either fungicide)

Notes: When rusts are a problem use ferbam plus sulfur. Use sulfurs of small particle size, such as Flotation Sulfur Paste, Magnetic "70" Sulfur Paste, Mike Sulfur, etc., at a rate to give approximately 6 lbs. actual sulfur per 100 gallons or 4 lbs. actual sulfur if used with ferbam.
If bloom period will be 10 to 12 days or longer, apply extra bloom spray of sulfur 4 lbs. plus ferbam 12 oz. with no insecticide. Do not spray for 2 or 3 days during peak of bloom.
For fire blight control, streptomycin can be used. See section on streptomycin on page 30.

For Apple Spray Program—After Bloom, See next page.

For Alternate Spray Program—After Bloom, See pg. 31.

Apple Spray Program—After Bloom

Note: Observe all Precautions with Parathion

Name and Time of Spray	To Control	Materials for 100 gallons of spray	
		Fungicides	Insecticides
PETAL FALL — when most of petals have dropped Note: Use captan on sulfur-ferbam on Golden Delicious and Rome.	Scab, rusts, leaf spot, mildew, black rot	Sulfur paste (70%), 6 lbs. plus Ferbam (76%), 12 oz. **OR** Captan (50%), 2 lbs.	None
FIRST COVER—10 days after petal-fall	Scab, rusts, mildew, rots, blotch; aphids, codling moth, leaf roller, mites, Oriental fruit moth	Sulfur paste (70%), 6 lbs. plus Ferbam (76%), 12 oz. **OR** Captan (50%), 2 lbs.	Parathion (15%), 1½ lbs. **OR** Malathion (25%), 4 lbs. (Either can be used with either fungicide)
SECOND COVER — 2 weeks after first cover	Scab, rots, blotch, fruit spot, sooty blotch, fly speck; Oriental fruit moth, codling moth	Captan (50%), 2 lbs.	Parathion (15%), 1½ lbs. **OR** Malathion (25%), 4 lbs.
THIRD COVER—2 weeks after second cover	Same as above plus apple seed chalcid	Same as in Second Cover	
FOURTH COVER — 2 weeks after third cover	Same as above	Same as in Second Cover	
FIFTH COVER—2 weeks after fourth cover	Same as above	Same as in Second Cover	
SIXTH COVER—2 to 3 weeks after fifth cover	Same as above	Same as in Second Cover	

Notes: Rome Beauty apples should be kept sprayed with a **fungicide** until after the middle of August, even if it takes an extra spray.
Parathion must not be used later than 2 weeks of harvest.
Malathion must not be used later than 3 days of harvest.

Malathion may be used to control practically all of the apple insects. It is safer to use than parathion; however, precautions printed on the container should be followed. It is an effective miticide and aphicide when used at the rate of 2 pounds 25% w.p. per 100 gallons of spray. It should be applied in 2 applications, one week to 10 days apart. Malathion at 4 pounds 25% w.p. will control codling moth and Oriental fruit moth.

Streptomycin is effective in control of fire blight. It is suggested for trial at rates to give 50 to 100 p.p.m. (parts per million) streptomycin in sprays applied at 5-day intervals through bloom. The 100 p.p.m. rate is more effective than the 50 p.p.m. but costs twice as much. Apply the first spray in the late pink stage before many of the center blooms open. Leaves and blooms should be thoroughly sprayed but avoid overspraying for it increases leaf injury.

Alternate Apple Spray Program—After Bloom

Name and Time of Spray	To Control	Materials for 100 gallons of spray	
		Fungicides	Insecticides
PETAL-FALL — when most of petals have dropped	Rusts, scab, leaf spot, black rot, mildew; codling moth, Oriental fruit moth, leaf roller.	Sulfur paste (70%), 6 lbs. plus Ferbam (76%), 12 oz. **OR** Sulfur paste (70%), 8 lbs. plus Hydrated lime, 3 lbs. **OR** Captan (50%) 2 lbs.	Lead arsenate, 3 lbs. (Use with either fungicide)
Note: For **fungicide**, use **captan** on **Golden Delicious** and **sulfur-ferbam** on **Rome.**			
FIRST COVER—10 days after petal-fall.	Same as above	Same as in petal-fall	DDT (50%), 2 lbs.
SECOND COVER—about 2 weeks after first cover	Same as above plus fruit spot, bitter rot, blotch.	Copper sulfate, 2 lbs. Hydrated lime, 4 lbs **OR** Captan (50%), 2 lbs. **OR** Ferbam (76%), 2 lbs.	Lead arsenate, 3 lbs. (Use with either fungicide)
Note: Do not change from copper sulfate to captan or from captan to copper sulfate.			
THIRD COVER—about 2 weeks after second cover	Same as above	Copper sulfate, 3 lbs. Hydrated lime, 6 lbs. **OR** Captan (50%), 2 lbs. **OR** Ferbam (76%), 2 lbs.	Lead arsenate, 3 lbs. (Use with either fungicide)
FOURTH COVER—about 2 weeks after third cover	Same as above	Same as above	DDT (50%), 2 lbs.
Note: Do not use DDT later than 1 month before harvest.			
FIFTH COVER—about 2 weeks after fourth cover	Same as above	Same as above	Lead arsenate, 3 lbs.
Note: Do not use lead arsenate later than 1 month before harvest.			
SIXTH COVER—about 3 weeks after fifth cover	Same as above	Copper sulfate, 3 lbs. Hydrated lime, 6 lbs. **OR** Captan (50%), 2 lbs.	Parathion (15%), 1½ lbs **OR** Malathion (25%), 4 lbs. (Parathion may be used with either fungicide; malathion should not be used with copper sulfate-lime mixture)
Note: If copper sulfate-lime mixture is used, increase the rate of parathion to 2 lbs. per 100 gallons.			

PEACH INSECT AND DISEASE CONTROL 1957

CLYDE F. SMITH and CARLYLE N. CLAYTON
Entomology and Plant Pathology

PEACH SPRAY PROGRAM

OBSERVE ALL PRECAUTIONS WITH PARATHION

Name and Time of Spray	Pests to Control	Materials per 100 gals. of Spray
DORMANT—After all leaves are off and before buds begin to swell in late winter	Scale	Dormant oil spray 3% actual oil (dilute according to manufacturer's directions) **OR**
	Leaf curl	Liquid lime-sulfur 6 gals. **OR**
	Leaf curl; scale	Oil (3%) plus Bordeaux 2-4-100

Do not spray if freezing temperatures are expected within 4 hours.
Point No. 1: Dormant spray for scale can be omitted if parathion is used in the complete schedule for plum curculio. Point No. 2: If San Jose or Forbes scale is the major pest, oil or lime-sulfur (12 gal.) may be used. To control white peach scale, two dormant oil sprays applied two weeks apart are necessary. Leaf curl is controlled by a dormant application of lime-sulfur or Bordeaux, but not by oil.

BLOSSOM	Blossom blight caused by the brown rot fungus	Liquid lime-sulfur (32° Baume) 1 gal. **OR** Wettable sulfur (sulfur 80% or more) 6 lbs.

Several sulfur sprays at 2 to 3 day intervals during bloom may aid in reducing blossom blight. Wettable sulfurs with less than 80% sulfur may be used at rates to give at least 5 lbs. actual sulfur in 100 gals.

PETAL-FALL—After all petals are off and before peach is showing	Plum curculio, Catfacing insects, Brown rot	Wettable sulfur 6 lbs. **OR** Captan (50%) 2 lbs. **PLUS** Parathion (15%) 2 lbs.

Thorough spraying is absolutely necessary if good control is expected.
If captan is not used throughout the season, wait until 6-weeks-before-harvest before you start using it. Parathion dust (1.5% parathion and 80-85% sulfur) at 25-40 lbs. per acre is suggested as a supplementary or emergency measure to control plum curculio. Parathion dust will not give satisfactory control of scales or peach tree borers.

SHUCK-FALL or **FIRST COVER**—¾ shucks off	Catfacing insects, Plum curculio, Brown rot, Scab	Same as Petal-fall

Spray thoroughly trunks and larger limbs in addition to spraying tops of trees **in each cover spray** to aid in control of lesser peach tree borers.

SECOND COVER—7-10 days later	Plum curculio, Brown rot, Scab	Same as Petal-fall
THIRD COVER—12-14 days after second cover Use parathion only where curculios are present.	Plum curculio, Brown rot, Scab	Same as Petal-fall
FOURTH COVER—2 weeks after third cover	Brown rot, Scab	Wettable sulfur 6 lbs. **OR** Captan (50%) 2 lbs.
6 - WEEKS - BEFORE - HARVEST—Of each variety	Plum curculio, Oriental fruit moth, Brown rot	Same as Petal-fall
4 - WEEKS - BEFORE - HARVEST—Of each variety	Plum Curculio, Oriental fruit moth, Brown rot	Same as Petal-fall
2 - WEEKS - BEFORE - HARVEST—Of each variety	Plum Curculio, Oriental fruit moth, Brown rot	Same as Petal-fall
PRE-HARVEST—7-10 days before harvest of each variety	Brown rot	Wettable sulfur 6 lbs. **OR** Liquid lime-sulfur 2 to 3 qts. **OR** Dusting sulfur (80%) or more actual sulfur

Additional sulfur, preferably as dusts, should be applied before and during harvest if brown rot is present or rainy, humid weather occurs. Under certain conditions liquid lime-sulfur may cause injury, particularly to the leaves.

Alternate (Lead Arsenate—Wettable Sulfur) Peach Spray Program

Name and Time of Spray	Pests to Control	Materials per 100 gals. of Spray
DORMANT After all leaves are off and before buds begin to swell in late winter	Scale	Dormant oil spray, 3% actual oil (dilute according to manufacturer's directions) **OR**
	Leaf curl	Liquid lime-sulfur, 12 gals. **OR**
	Leaf curl; Scales	Oil (3%) plus Bordeaux 2-4-100
Do not spray if freezing temperatures are expected within a few hours. If San Jose or Forbes scale is the major pest, oil or lime sulfur may be used. To control white peach scale, two dormant oil sprays two weeks apart are necessary. Leaf curl is controlled by a dormant application of lime-sulfur or Bordeaux, but not by oil.		
BLOSSOM	Blossom blight caused by the brown rot fungus	Liquid lime-sulfur (32° Baume) 1 gal. **OR** Wettable sulfur (sulfur content 80% or more) 6 lbs.
Several sulfur sprays at 2 to 3 day intervals during bloom may aid in reducing blossom blight. Wettable sulfurs with less than 80% sulfur may be used at rates to give at least 5 lbs. actual sulfur in 100 gals.		
PETAL-FALL 2/3 of petals have fallen	Plum curculio, Brown rot	Wettable sulfur, 6 lbs. Zinc sulfate (36%), 4 lbs. Spray lime, 8 lbs. Acid lead arsenate, 2 lbs.
This is 36% monohydrate zinc sulfate. If pentahydrate zinc sulfate is used, 8 lbs. instead of 4 will be necessary. In mixing, add zinc sulfate, lime, sulfur and lead arsenate to tank in order named. Where catfacing insects occurred last year or where legume cover crop is growing, add DDT (50%) 2 lbs. in the petal-fall spray. Certain commercial "one-package" combinations of lead arsenate, wettable sulfur and basic zinc sulfate have proved satisfactory. Captan plus lead arsenate are not safe on leaves and branches.		
SHUCK-FALL or **FIRST COVER** ¾ shucks off	Plum curculio, Brown rot, Scab	Same as Petal-fall
SECOND COVER Two weeks after first cover	Plum curculio, Brown rot, Scab	Same as Petal-fall
Pick up and destroy all drops at intervals of 4-5 days.		
THIRD COVER Two weeks later	Brown rot, Scab	Wettable sulfur, 6 lbs. **OR** Dusting sulfur (80%+)
Pick up and destroy all drops at intervals of 4-5 days.		
4 - WEEKS - BEFORE - HARVEST	Plum curculio, Oriental fruit moth, brown rot	Wettable sulfur, 6 lbs. Zinc sulfate (36%), 4 lbs. Spray lime, 8 lbs. Acid lead arsenate, 2 lbs.
This application is necessary on varieties ripening with Hiley or Southland, or later. Oriental fruit moth can be controlled with parathion at 5 and 3 weeks before harvest. There may be danger of excessive residue of DDT if used this near harvest.		
7-10 DAYS BEFORE HARVEST Of each variety	Brown rot	Wettable sulfur, 6 lbs. **OR** Liquid lime-sulfur, 2 to 3 qts. **OR** Dusting sulfur (80% sulfur or more)
Additional sulfur, preferably as dusts, should be applied before and during harvest if brown rot is present or rainy, humid weather occurs. Under certain conditions liquid lime-sulfur may cause injury, particularly to the leaves.		

SPECIAL NOTES

Peach Tree Borer. There are two species of peach tree borers in North Carolina. One is known as the lesser peach tree borer and usually feeds on the limbs or high up on the trunk of the tree. Trees with rough bark or those damaged by tractors or other machines are especially susceptible to attacks by the lesser peach tree borer. The second species, the peach tree

borer, also prefers trees with rough bark, but it usually causes damage near the base of the tree.

Trunk sprays with some of the new organic insecticides have been very successful in controlling both the peach tree borer and the lesser peach tree borer. The trees need three applications of either DDT (wettable powder or emulsifiable concentrate) at the rate of 4 lbs. actual DDT per 100 gallons of spray, parathion (15%) 2 to 3 lbs., or EPN-300 (25%) 2 to 3 lbs. Spray any of these on the peach tree trunks and bruised or damaged areas on the limbs July 1-5, August 1-10 and September 1-10.

The best way to control both species of borers is to use one of the materials mentioned above. You can control the peach tree borer with ethylene dichloride emulsion during November or with paradichlorobenzene (PDB) if it is applied between September 25 and October 15. The use of summer sprays is the only satisfactory means of controlling the lesser peach tree borer.

Dieldrin will control plum curculio when used at the rate of ½ lb. of 50% w.p. per 100 gallons of spray. It should not be used later than 30 days before harvest because of danger of residue on the fruit at harvest. Dieldrin will not control scale insects or Oriental fruit moth.

EPN 300 is a phosphate insecticide related to parathion. It has been effective in controlling the plum curculio when used at the rate of 1½ lbs. of 25% w.p. per 100 gallons of spray. It should not be used on peaches later than 3 weeks before harvest because of danger of residue.

Malathion is a phosphate insecticide which may be used in place of parathion. If malathion is used, it should be used at the rate of 4 lbs. of 25% w.p. per 100 gallons of spray or as a 3-4% dust at 25-40 lbs. per acre. Malathion is not as toxic as parathion to warm-blooded animals; however, precautions printed on the container should be followed.

Captan is a fungicide which may be used in place of wettable sulfur. Captan and parathion are compatible; however, captan and lead arsenate are not, for when used together severe arsenical injury results to the leaves and buds. Captan used at the rate of 2 lbs. of 50% wettable powder per 100 gallons of spray has controlled brown rot and peach scab as well or slightly better than wettable sulfur, and has resulted in somewhat less rot during the post-harvest ripening period. The appearance and finish of captan-sprayed peaches have been as good or better than that of sulfur-sprayed ones.

Recommendations should be followed carefully in order to avoid excess residues of any of the pesticides.

For more detailed information concerning peach spray information, see N. C. Ext. Circular No. 407.

SELECTION, ADJUSTMENT AND CARE OF SPRAYING AND DUSTING EQUIPMENT

J. C. Ferguson, Agricultural Engineering Extension Specialist

Three essentials of good spraying and dusting are:

1. Correct timing of application
2. Proper chemicals and rates
3. Proper equipment correctly used

A type or size sprayer, duster or fumigator is available today for practically every application of insecticide, fungicide or weedicide desired. Multiplicity of use is becoming an increasingly important factor in the selection of equipment. The following guiding principles regarding the selection and use of pesticide equipment should be considered:

1. Select equipment that will best fit the farming operation, considering acreage, crops and labor that will use it.
2. On farms having small irregular shaped fields, a large duster or sprayer would be impractical, contributing to frequent breakage of equipment and poor application. Three to four row equipment is generally more desirable on the medium to small size farm.
3. When chemical weed control work is planned as a routine farm practice, separate spray equipment should be provided for this purpose only. Too much time and risk is involved in cleaning such equipment for other uses.
4. Carefully adjust and calibrate equipment to apply recommended rates; otherwise, full potential benefits may not be realized.
5. Dusting, spraying and fumigation equipment is designed for specific types of application. While there is some degree of flexibility, a spray nozzle recommended for the application of an insecticide is not best suited for weed control work; or vice-versa.
6. Consideration should be given to selecting a sprayer or duster which is convenient to mount and dismount as well as to operate. Such features may mean a great deal to a busy farmer, in being able to make timely applications.
7. High clearance, self-propelled dusters and sprayers cannot be justified on small farms; however, they are more satisfactory than any other type on large acreage and are highly desirable for custom operation.

Dusters

While dusting has certain disadvantages, it is still the most popular method of applying insecticides, largely because of the ease and simplicity

of operation. However, proper adjustment and operation are important in dusting as well as in spraying. The dust hopper, fan, fan cage, flexible air lines, and nozzles should be kept free of caked material. Nozzles should be placed directly over the row and only a few inches above the growing plant. One rather critical item on many tractor mounted dusters is the V-belt drive. To maintain proper air volume and velocity, the belt should be kept in good alignment and reasonably tight. A nozzle velocity of approximately 5,000 feet per minute is desirable, so that good flotation may be accomplished with sufficient drive to carry dust materials through the foliage of the plant and rebound, to some extent, from the ground. With more diligence in regard to care, adjustment and operation, more effective dusting and better control may be accomplished with even less material than many farmers are now using.

Sprayers

The majority of field sprayers in use today are of the hydraulic type in which the spray pressure is built up by direct action of the pump on the spray mixture. One of the most essential and vital parts of a hydraulic sprayer is the pump. The pump should be of adequate capacity to deliver uniform pressure to all nozzles on the boom; and where hydraulic agitation is desired, pump capacity should be increased by at least 50 percent. Inevitable wear of the pump will gradually reduce its pumping capacity; therefore, a pump of two to three times minimum requirements is always a better buy. So-called inexpensive gear pumps are largely standard equipment on tractor mounted boom sprayers; but these pumps, if used for pumping suspensions of wettable powders, have a very short life and cannot be repaired. Therefore, where wettable powders are to be handled, a more expensive roller or diaphragm type pump is always preferable. Most tractor mounted sprayer pumps are directly attached to the power take-off shaft of the tractor and should be allowed to float freely on the shaft with a short length of chain attached between the pump housing and the drawbar to prevent rotation of the pump. If pumps are bolted down rigidly, unnecessary strain is placed on the pump bearing and a few hours of operation may seriously damage both bearings and seals, often times beyond repair.

Care and Storage

Cleaning and storage of pesticide equipment is another very important step in a good control program. Dusters, either hand operated or power driven, should be carefully cleaned and lubricated before storage. A very

good method for storing a tractor mounted boom duster is to arrange three overhead single sheave awning pulleys in the top of a machinery shed equipped with lightweight manila rope so the tractor can be driven underneath. Attach the three ropes to the duster, dismount, and hoist the entire unit to the roof of the shed. This places the equipment out of the weather where it does not interfere with ground storage of heavier equipment and where the boom will not accidentally be run over by a tractor wheel. To store a boom sprayer or fumigator, it should first be thoroughly flushed either with water or kerosene, depending on the nature of material that has been used in the equipment. Disassemble into about four units so it can be easily handled. Nozzles should be removed, screens and tips cleaned and stored in a quart can of lightweight motor oil. After the pump has been cleaned and lubricated, rotate the pump by hand and suck into the pump a small quantity of lightweight motor oil. If these simple things are done prior to storage, equipment will be in good condition for next season.

MEASURING AND DILUTION TABLES FOR MIXING PESTICIDES

H. E. SCOTT & H. R. GARRISS

A. *SIMPLE MEASURING TABLE*

3 teaspoonfuls=1 tablespoonful
2 tablespoonfuls=1 fluid ounce
4 tablespoonfuls—12 teaspoonfuls=¼ cupful=2 fluid ounces
1 cupful=16 tablespoonfuls=8 fluid ounces
2 cupfuls=32 tablespoonfuls=1 pint
2 pints=64 tablespoonfuls=1 quart
4 quarts=256 tablespoonfuls=1 gallon
1 oz.=approximately 2 tablespoonfuls dry weight.

B. *TABLES OF DILUTIONS FOR LIQUIDS AND DUSTS*

1. Equivalent quantities of liquid materials when mixed by parts.

Water	*1-400*	*1-800* *	*1-1600*
100 gals.	1 qt.	1 pt.	1 cup
25 gals.	1 cup	½ cup	¼ cup
5 gals.*	3 tbs.	5 tsp.*	2½ tsp.
1 gal.	2 tsp.	1 tsp.	½ tsp.

* Example: If a recommendation calls for 1 part of the chemical to 800 parts of water, it would take 5 teaspoonfuls in 5 gallons of water to give 5 gallons of a mixture of 1-800.

2. Equivalent quantities of dry materials (wettable powders) for various quantities of water:

Water	*Quantity of Material*					
100 gals.*	1 lb.	2 lb.	3 lb.	4 lb.*	5 lb.	6 lb.
25 gals.	4 oz.	8 oz.	12 oz.	1 lb.	1¼ lb.	1½ lb.
5 gals.*	3 tbs.	1½ oz.	2½ oz.	3¼ oz.*	4 oz.	5 oz.
1 gal.	1½ tsp.	2 tsp.	1 tbs.	4 tsp.	5 tsp.	2 tbs.

* Example: If a recommendation calls for a mixture of 4 lbs. of a wettable powder to 100 gallons of water, it would take 3¼ oz. (approximately 6½ tsp.) to 5 gallons of water to give 5 gallons of spray mixture of the same strength.

3. Equivalent quantities of liquid materials (emulsion concentrates, etc.) for various quantities of water:

Water	*Quantity of Material*					
100 gals.*	½ pint	1 pint	2 pints	3 pints	4 pints*	5 pints
25 gals.	2 fl. oz.	4 fl. oz.	8 fl. oz.	12 fl. oz.	1 pint	1¼ pint
5 gals.	1 tbs.	1 fl. oz.	2 fl. oz.	2½ fl. oz.	3 fl. oz.	4 fl. oz.
1 gal.*	½ tsp.	1 tsp.	2 tsp.	3 tsp.	4 tsp.*	5 tsp.

* Example: If 4 pints of a liquid concentrate is recommended to 100 gallons of water, 4 teaspoonfuls of the chemical to 1 gallon of water will give a mixture of the same strength.

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