

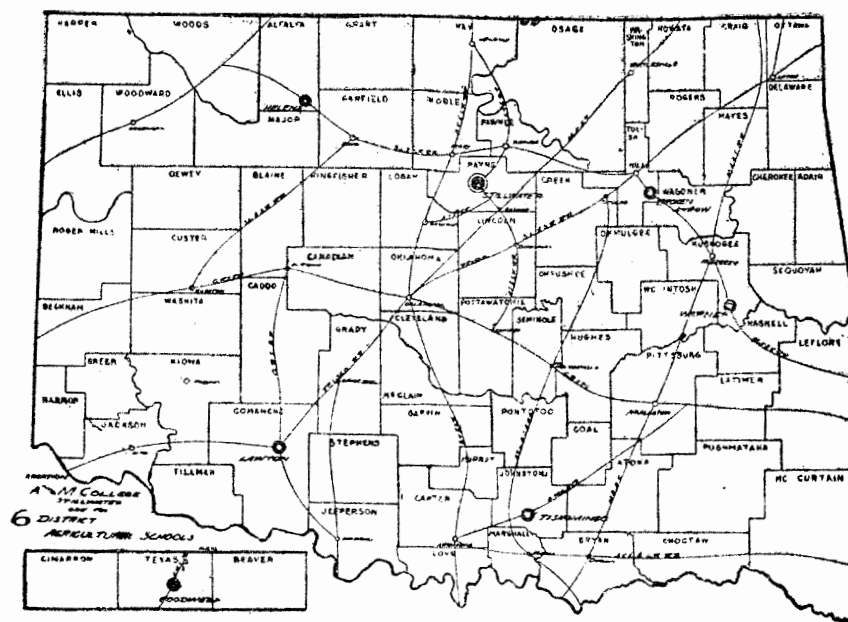
OKLAHOMA AGRICULTURAL EXPERIMENT STATION

BULLETIN NO. 92

APRIL, 1911

SPRAY CALENDAR

ENTOMOLOGY



LOCATION OF THE A. & M. COLLEGE AND THE SIX SCHOOLS OF AGRICULTURE

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SPRAY CALENDAR

A. L. LOVETT.

The frequent requests for information concerning spray mixtures and their application, has made necessary the publication of this spray calendar. This is not put out as a complete spray calendar, but will cover most common troubles. It is intended to be merely suggestive.

Good Farming a Great Insecticide. Let us understand first that good farm practices; the rotation of crops; fall and winter plowing; clean cultivation; and the general cleaning of all trash and fence corners in early spring are a big step in the right direction, in the control of our insect pests.

Spraying Not a Cure-All. Spraying is absolutely essential to the production of first class fruit and truck crops in Oklahoma; but spraying alone will not remedy all the troubles arising from neglect and abuse. To keep crops in a thrifty growing condition is certainly the initial step.

Spraying. 1. Be sure to use the right proportions in mixing the materials, and mix thoroughly. The thorough mixture is best obtained by pumping the solution back into itself.

2. The necessity of keeping the mixture thoroughly agitated while spraying cannot be too strongly emphasized. See to it that your spray pump is provided with a practical agitator.

3. Thoroughness is the keynote of success. Don't continue to spray until the material runs from the plant,—stop when it is covered; practice will make any one efficient.

4. The spray is best thrown as a fairly fine mist, and a considerable pressure should be maintained for best results.

Spraying Machinery. In choosing your spraying machinery care should be taken to obtain the type that will render the most efficient services for the work in hand. Those who are growing truck crops or orchards in a commercial way can afford the big power sprayers, and should have them. For the ordinary individual with a variety of crops, the barrel type of spray pump will recommend itself. Then we have the knapsack and compressed air spray pumps fitted up for a variety of purposes and mighty handy and practical in a small way.

The general purpose spray pump should have the working parts of brass or be brass lined, as certain spraying solutions will corrode other materials.

After using a spray pump, always wash out thoroughly by running clean water through it, this will leave it in first class condition for the next time it is wanted.

Time of Spraying. NO PLANT SHOULD BE SPRAYED WHILE IT IS IN BLOOM. The time for spraying as given must be more or less arbitrary, and one is expected to use his judgment in the matter. Keep a sharp lookout for insects and diseases, but understand that at all times prevention is better, and in the case of insect troubles decidedly cheaper than cure. Certain of these common pests are sure to be with us and the spray should be applied whether you see the trouble is present or not. In the spray calendar under "Remarks," one will find those exceptions where spraying is to be done only when the trouble is present.

Commercial Spray Mixtures. The majority of our spraying mixtures are now put up in a commercial form. Those mixtures manufactured by reliable firms are usually very good and are as efficient as the well-mixed, home-made solution. They recommend themselves to the small grower because they save the time and trouble necessary to prepare them at home; and because they are standard materials in the proper proportions.

SPRAY SOLUTIONS.

The solutions given are not all that may be used, but are those which in our estimation are best suited for the purpose employed. The formulæ given are for the standard solutions. Here again it is very urgent that one use judgment, and in the case of tender plants dilute the mixture to proportions in keeping with the delicate foliage.

The Roman numeral is used in the spray calendar proper to designate the spray to be used. Each spray formula is given a Roman number. The numeral in the spray calendar corresponds to the number of the spray formula; thus, if under "The spray" we have "IV", the meaning is, use Whale oil soap, as this formula is so numbered.

In the mixing of spraying materials, wooden, glass or earthenware vessels should be used.

I.

KEROSENE EMULSION.

Kerosene oil.....	2 gals.
Soap.....	½ lb
Water.....	1 gal.

Add common laundry soap, finely shaved, to water over fire. When solution comes to a boil, remove from fire and add kerosene. Agitate mixture until it assumes a creamy consistency and does not separate on standing. This forms a stock solution, and should be diluted from 9-20 times, depending on the foliage.

II.

BLACK LEAF.

Black Leaf.....	1 gal.
Water.....	70 gals.

Place Black Leaf in few gallons of water first and mix thoroughly, then add to the rest of water with constant stirring. (Black Leaf is sold by the Kentucky Tobacco Product Co., Louisville, Ky.)

III.

APHINE.

Aphine.....1 gal.
Water.....40 gals.

A great preparation for the control of aphids. For mixing see directions for "Black Leaf." (Sold by Aphine Manufacturing Co., Madison, N. J.)

IV.

WHALE OIL SOAP SOLUTION.

Whale oil soap.....1 lb.
Water.....1 gal.

Agitate thoroughly to obtain a perfect emulsion. Dilute for tender foliage.

V.

PARIS GREEN.

Paris green.....1 lb.
Lime—fresh stone lime.....4 lbs.
Water.....100 gals.

Make a thin paste of Paris green and add to solution of water and lime, with constant stirring. Spray pump should be provided with an agitator, or occasional stirrings of solution given to keep material in suspension.

VI.

LEAD ARSENATE.

Lead arsenate..... 4 lbs.
Water.....100 gals.

Ditto above.

This mixture is more adhesive than Paris green, is not as likely to burn foliage, and is in many cases the superior material.

VII.

BORDEAUX MIXTURE.

Copper sulfate..... 4 lbs.
Lime..... 5 lbs.
Water.....50 gals.

Suspend the copper sulfate in gunny sack at top of barrel in 25 gallons of water. Slake the lime in small quantity of water and make up to 25 gallons of solution. Pour the two solutions simultaneously through a strainer into a third vessel or spray tank. Stir vigorously as the two solutions fall into vessel or tank. Good fresh lime must be used, and it should always be in excess. Only wooden vessels should be used in handling the Bordeaux mixture. The pump should have brass parts or be brass lined throughout.

VIII.

LIME SULPHUR SOLUTION.

Sulphur.....15 lbs.
Lime.....15 lbs.
Water.....50 gals.

Place the lime with enough water to slake it in vessels for cooking. Sift the sulphur through a sieve to remove the lumps and make into a thin paste and add to slaking lime. Sufficient water should be added

from time to time to allow the boiling to continue and to prevent calking in the bottom of the kettle. The boiling should continue for an hour or until the solution passes from a safron yellow to an amber or cherry color. The solution should then be made as thin as convenient and filtered through a strainer into the spray tank and made up to fifty gallons.

This solution can be applied only to trees in a dormant condition as the caustic effects will burn any foliage.

IX.

SELF BOILED LIME SULPHUR.

Lime--fresh stone lime.....	8 lbs.
Sulphur.....	8 lbs.
Water.....	50 gals.

This appears about the correct strength for most fungus troubles. In mild cases of peach brown rot and scab, a weaker solution consisting of 6lbs. of each sulphur and lime to fifty gallons of water may give satisfactory results. The results are more satisfactory where fairly large quantities are prepared at a time, say enough to make a 200-gallon solution. This would give a formula 32 lbs. each of sulphur and lime, cooked with a small quantity of water (8-10 gal.) and diluted in pump to 200 gallons.

Place lime in barrel, add enough water (warm water preferred) to almost cover. Run the sulphur through a sieve to remove lumps and add as soon as lime begins to slake. Add more water as needed to form a thick paste; stir constantly. The lime will furnish sufficient heat to boil the mixture several minutes. As soon as it is well slaked, add sufficient water to cool. The mixture is now ready to be strained into spray tank, diluted and applied.

X.

AMMONIA COPPER CARBONATE.

Copper carbonate.....	5 oz.
Ammonia.....	3 pints.
Water.....	50 gals.

Dissolve copper carbonate in ammonia and dilute to 50 gallons. To be used when fruit is maturing in place of Bordeaux.

XI.

COMBINATION SPRAYS.

Bordeaux mixture.....	50 gals.
Paris green.....	1/2 lb.
or	
Lead arsenate.....	2 lbs.

XII.

Self boiled lime sulphur.....	50 gals.
Lead arsenate.....	2 lbs.

In the preparation of these combination sprays, the arsenate is added to the solution just the same as if the latter were water.

XIII.

GOVERNMENT WHITEWASH.

Lime.....	1/2 bushel.
Boiling water to cover.....	
Salt.....	1 lb.
Milk.....	1 gal.

XIV.

PAINT FOR PEACH BORERS.

White lead
Raw linseed oil.

XV.

RESIN LIME MIXTURE.

For plants such as cabbage and some of our shade trees to which the ordinary solutions will not adhere readily:

Stock solution:

Pulverized resin.....5 lbs.
Concentrated lye.....1 lb.
Fish oil soap or any cheap animal oil
except tallow.....1 pint.
Water.....5 gals.

Place the oil, resin, and one gallon of hot water in vessel for cooking. Heat until the resin is softened; add the lye solution made as for hard soap; stir thoroughly and add four gallons more of hot water. Boil for about two hours or until mixture will unite with cold water making a clear amber colored liquid. Add sufficient hot water to replace that lost by evaporation. This stock solution may be kept until needed. In using it, for every gallon of stock solution add sixteen gallons of water (do this first), three gallons of thin whitewash and $\frac{1}{4}$ lb. of Paris green.

XVI.

DUST SPRAYS.

(a) Lime.

Dry lime is sometimes used as a repellent and for combatting insects with soft, sticky bodies, such as the slugs.

(b) Tobacco dust.

Manufactured in a commercial way; very good for combatting certain groups of insects. Especially good for root lice, as the woolly aphid; acting also as a fertilizer.

(c) Paris green.

Paris green.....1 lb.
Flour.....20 lbs.

Mix thoroughly. Especially good for very small plants where spraying seems impracticable.

XVII.

(a) POISON VEGETABLE BAIT.

Spray a small patch of alfalfa, pigweed, or some useless succulent plant with Paris green,—two pounds to 150 gallons of water,—mow and place in small heaps about infested field. This should be done preferably in the evening, as plants will keep fresh longer.

(b) POISON BRAN MASH.

Bran.....16 lbs.
Paris green.....1 lb.
Salt..... $\frac{1}{2}$ lb.
Cheap molasses.....1 gal.
Water to make a thick mash.....

Sow broadcast or place in small heaps about the field.

THE APPLE

The Trouble.	The Spray.	Time of Application.				Remarks.
		First Spraying.	Second Spraying.	Third Spraying.	Subsequent Treatment	
Bud moths, canker worms, case bearers, leaf rollers, crumplers, curculios, codling moths, scab, canker, leaf spot and orange rust.	XI	Just before the blossoms open.	Just after petals fall.	10-15 days later.		These applications are absolutely necessary for the production of clean fruit. A fourth spraying is often necessary later. In the case of orange rust, destroy cedar trees adjacent to orchard.
Apple Aphids.	I or II	When insects appear.				
Woolly Aphis.	II	When observed.				Expose roots and spray with solution 1-100 or tobacco stems may be used.
Borers, flat headed.	IV	In early March	Renew if needed.		Cut out borers where once attacked.	Get spray well up main limbs. Head the tree low, keep in healthy, growing condition with cultivation.
Borers, round headed.	XIV or IV	In early March	Renew if needed.		Ditto above.	If IV is used, add 1 pint of crude carbolic acid to 10 gallons of mixture.
Borer, Twig.						Cut out infested twigs.
Fruit Bark Beetle.						See Peach.
San Jose scale.	VIII	In fall after tree is dormant.	In spring before buds open.		Prune back severely.	To be sprayed for only when known to be present.
Scurfy scale, oyster shell bark louse, Forbes' scale.	I or IV	Late May.				Ditto above.
Fall webworm.	V or VI	Second week in July.				
Apple blight.						Cut out and burn diseased portions. (See pear blight.)

THE PEAR

The Trouble.	The Spray.	Time of Application.				Remarks.
		First Spraying.	Second Spraying.	Third Spraying.	Subsequent treatment.	
Canker worms, bud moths, case bearers, crumplers, etc.	XI	Just before blossoms open.	Just after petals fall.	10-15 days later.		
Scab, leaf blight, leaf spot, codling moth.	XI	Ditto above.	Ditto above.	Ditto above.		
San Jose scale, oyster shell bark louse.						See apple.
Pear Psylla, blister mite.	VIII	In early spring while trees are dormant.				
Twig girdler.						Gather girdled twigs and burn.
Pear blight.						Cut out all infested twigs and wood, taking care to cut well below where there is any indication of trouble. Disinfect knife and wound with solution of corrosive sublimate 1:1000. Later paint over wound with white lead.

The program recommended for the apple may be followed where the same insects attack the pear.

THE PLUM

The Trouble.	The Spray.	Time of Application.				Remarks.
		First Spraying.	Second Spraying.	Third Spraying.	Subsequent treatment.	
Plum curculios, canker worms, etc.	XII	Just before the blossoms open.	Just after blossoms fall.	10-15 days later.		These three sprayings are absolutely necessary and will control most ordinary troubles.
Brown rot and scab.	XII	Ditto above.	Ditto above.	Ditto above.		See above.
Buffalo tree hopper.					Cut out twigs showing infestation and burn.	Keep down all growth of weeds and vegetation about the base of trees, cultivate.
Fruit bark beetle.						See Peach.
Plum louse.	VIII	Before buds swell in the spring.			Where lice are present spray with II diluted 1-70.	Spraying with VIII in early spring will kill the eggs of the louse and aid materially in the control of brown rot.
Flat headed borer.						See treatment under Apple.
San Jose scale and tofers.						Ditto above.
Lecanium scale and soft scales.	IV	Late in growing season.	During the dormant season.			
Canker.					Slit outer bark longitudinally, taking care not to injure inner growing tissue.	Cut away gummy exudation and all diseased wood. Paint wound with Bordeaux and later with white lead. See that soil is drained and that the roots are uninjured by plow or otherwise.

THE PEACH

The Trouble.	The Spray.	Time of Application.				Remarks.
		First Spraying.	Second Spraying.	Third Spraying.	Subsequent treatment.	
Leaf curl, brown rot, scab, and curculios.	XII	Just before blossoms open.	Just after petals fall.	10-15 days later.	10-15 days later if rot or curculios are bad.	Bordeaux injury to the stone fruits has made the self boiled lime-sulphur its successor.
Fruit bark beetle, peach tree bark beetle.	XIII	April 5-12.	August 5-15.		Cut out and burn all dead or dying trees and limbs.	Keep the trees in a thrifty, growing condition by thorough cultivation and care.
Peach tree borer.	XIV	In June.			Cut out all borers in the wood.	The spray recommended is to be used only on the older trees. For very young trees use XIII, renewing when necessary.
Peach twig borer.	I	During winter and early spring.				Cut out infested twigs.
San Jose scale and soft scales.						See treatment under Apple.
Canker.						See Plum.

THE CHERRY

The Trouble.	The Spray.	Time of Application.				Remarks.
		First Spraying.	Second Spraying.	Third Spraying.	Subsequent treatment.	
Carculios, brown rot, leaf spot, etc.	XII	Just before blossoms open.	Just after petals fall.	10-15 days later.	10-15 days later if needed for rots and leaf spot.	Spraying will aid the cherry in retaining its foliage and is very necessary.
Canker worms, leaf crumplers, case bearers.	XII	Ditto above.	Ditto above.	Ditto above.		
12 Borers, flat-headed.						See Apple.
Fruit bark beetles.						See Peach.
Cherry aphids.						Same as for apple aphids.
San Jose scale and other scales.						See Apple.
Canker.						See Plum.

THE GRAPE

The Trouble.	The Spray.	Time of Application.				Remarks.
		First Spraying.	Second Spraying.	Third Spraying.	Subsequent treatment.	
Anthracnose.	VII	Before buds open in spring.				Necessary only when trouble is present.
Flea, beetles, mildew, black rot, birds' eye rot, berry worm, curculios, root worm, leaf folder.	XI	When buds are swelling in spring.	Just before blossoms open.	Just after the fruit sets.	10-15 days later.	Some of these troubles are sure to be present. If the flea beetle is very numerous, increase the arsenate of lead to 5 pounds to 50 gallons of Bordeaux.
Rose Chaffer.						Very difficult insect to control. Cultivate soil to a depth of two inches from April 12-30 to destroy pupae. Hand pick adults, or where very bad spray with solution of 3 pounds arsenate of lead, 25 pounds glucose to 100 gallons of water.
Grape blossom midge, grape leaf hopper.	II	late April.				To be used against the leaf hopper at any time it appears in injurious numbers.
Grape scale.						See San Jose under Apple.

THE SHADE TREES

Tree Attacked.	The Trouble.	The Spray.	Time of Application.	Remarks.
Ash	Lace wing bug.	I.	When discovered.	Dilute 1-20. Burn trash about tree in early spring.
	Leaf-eating larvae.	V or VI	When larvae appear.	
Black Locust	Locust borer.	IV or XIII	August 10-15.	Inject carbon-bi-sulfid into tunnels with a spring-bottom oil can, closing tunnel with grafting wax. N. B. Remember carbon-bi-sulfid is highly inflammable.
	Locust leaf miner.	VI	When leaves are well out.	
Catalpa	Catalpa bud gnats.			Collect and burn infested twigs.
	Catalpa sphinx.	VI	When larvae appear.	Gather egg masses and freshly hatched larvae. Plow in July to destroy pupae.
Evergreens	Lace wing bugs			See Ash.
	Bag worm.	V	When worms appear.	Hand-pick bags in winter.
	Red spider.			Dust dry sulphur on leaves.
Elm	Elm leaf beetles, rust.	XI	When trees are in full foliage; 10-15 days later.	If beetles are bad, use four pounds of arsenate of lead to 50 gallons of Bordeaux.
	Lace wing bugs	I	See ash.	
	Fussock moth.	VI	Early in season, again if larvae appear.	Collect egg masses by hand or dampen them with kerosene. Wrap base of tree with some sticky material.
Maple	Spiny elm caterpillar.	VI	When larvae appear.	The larvae feed in clusters, while small, and may be collected and destroyed.
	Maple borer.	XIII	nearl y spring; renew later.	Cut out borers in infested tree, paint over wound.
	Bag worm.			See evergreen.
	Cottony maple scale.	I	nearl y spring	Use only when insect is present.
	Fussock moth.	VI		See elm.
Poplar	Cecropia and other leaf eating larvae.	VI	When larvae appear.	Collect cocoons of cecropia.
	Poplar borer.	XIII	See maple borer.	
Sycamore	Leaf eating insects.	VI	When pest appears.	
	Borers.	XIII	See maple.	
All	Web worms, leaf eating insects.	VI	When pests appear.	
	San Jose scale, scurfy bark louse and other scales.	VIII	See treatment under apple.	
	The soft scales, terrapin scales etc.	I	During dormant season.	Use this very strong from 22-26 per cent kerosene.

THE VEGETABLE AND TRUCK GARDEN

Crop Attacked.	The Troublc.	The Spray.	Time of Ap- plication.	Remarks.
All.	Cut worms.	XVII	About the time the plants are expected to appear through ground.	Scatter in small heaps about the field or about the base of the plants.
	Grasshoppers.	XVII (b)	When pest appears.	Ditto above.
A variety of crops.	Flea beetles, leaf beetles.	XI	When pest appears.	Dilute for tender plants. For very small plants dust with XVIIc. Fall and winter plow the fields, burn all trash about field and in fence corners.
Bean.	Various weevils and stored grain pests.	Carbon bisulfide.	While beans are stored.	Place in tight bin and for every 10 cu. ft. of space use 1 pound of material, placing in open vessel above grain.
Cabbage and other cruciferae.	Cabbage maggot.	XVIb	When plants are set.	Place small heap about base of plant.
	Cabbage worms, cabbage loopers, diamond back moth.	XV	When worms appear and again in two weeks.	This material is very adhesive; after plants are well headed use a dust, either XVI or one part pyrethrum powder to four parts flour.
	Harlequin cabbage bug.			Plant an early catch crop of mustard or radish and when insects collect here destroy them with their host. Clean culture and burning of trash about the field in early spring are important measures for this insect's control.
Cucumbers and other cucurbits as squashes, pumpkins.	Striped cucumber beetle, 12-spotted cucumber beetle.	XVI (b)	As soon as plants are through the ground, one a week afterward.	Place a large tablespoonful of this dust about each stem, dust over plants in morning while dew is on.
Cante lous, melons.	Melon louse.	II or III	Soon after second leaves appear, 10 - 12 days later.	A nozzle with a crooked shank to throw a spray up under the leaf is essential.
	Cut worms.			See above under "All."
	Flea beetles.			See above under "A variety of crops."
Pea.	Pea louse.			Same general treatment as for melon louse.
	Pea weevil and other stored grain pests.			See treatment under Bean.
Potato.	Colorado potato beetle, flea beetles, blight.	XI	When plants are 4-6 inches high, again some 3 weeks later, and a third spraying 15-19 days later.	This spray will give the plant a more vigorous appearance. If beetles are very bad the arsenate may be increased half.

There are many insect pests and a variety of crops we have made no attempt to treat in this bulletin. To the observant grower the suggestions given will aid in combatting other pests similar in structure or habits to those named.

We are always glad to receive material for identification and will give what advice we can for the control of any pest received. In sending material be sure to pack so that the insects will not be injured in the mails. Any notes you may give as to where the insects were found, whether they occur in destructive numbers, and the estimated amount of their depredations furnish valuable data.

Appendix

In the body of the bulletin it is remarked that commercial spray mixtures are on the market and may be employed to an advantage in many cases. There are many excellent brands on the market. The following dealers are considered among those thoroughly reliable: Grasseli Chemical Company, St. Louis, Mo.; Sherwin-Williams Company, Kansas City, Mo.; Henry Heil Chemical Co., St. Louis, Mo.; Merrimac Chemical Co., Boston, Mass.; Rex Company, Omaha, Neb.

Some of the dealers in spraying machinery are as follows: E. C. Brown & Co., Rochester, N. Y.; Cushman Power Sprayer Co., Lincoln, Neb.; The Deming Company, Salem, Ohio; John Deere Plow Co., Kansas City, Mo.; Field Force Pump Company, Elmira, N. Y.; Friend Manufacturing Company, Gasport, N. Y.; Goulds Manufacturing Company, Seneca Falls, N. Y.; Hardy Manufacturing Company, Hudson, Mich.; Lowell Manufacturing Company, Lowell, Mich.; F. E. Myers & Bro., Ashland, Ohio; Niagara Sprayer Company, Middleport, N. Y.; Phelps Manufacturing Company, Phelps, N. Y.; Spraymoter Company, Buffalo, N. Y.