Files

Illinois

Custom Spray Operators'

School

Outlines of Presentations

Urbana, Illinois

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PUMPS FOR SPRAYERS (REPAIR AND MAINTENANCE)

By B. J. Butler

1. Rotary or gear type

   a. construction - bronze
   b. pressure range - 0-150 P.S.I.
   c. volume range - 0-20 G.P.M. depending on pump size and pressure
   d. uses of pump
   e. maintenance

2. Piston type

   a. construction - steel
   b. pressure range - 0-600 P.S.I.
   c. volume range - 0-20 G.P.M.
   d. uses of pump
   e. maintenance

3. Impeller type

   a. construction - bronze with rubber impeller
   b. pressure range - 0-45 P.S.I.
   c. volume range - 0-20 G.P.M. depending on size and pressure
   d. uses of pump
   e. maintenance

4. Centrifugal type

   a. construction - bronze
   b. pressure range - 0-20 P.S.I. - higher at higher speeds
   c. volume range - 0-30 G.P.M. at low P.S.I.
   d. uses of pump
   e. maintenance

5. Turbine type

   a. construction - bronze
   b. pressure range - 0-150 P.S.I.
   c. volume range - 0-20 G.P.M. at low P.S.I.
   d. uses of pump
   e. maintenance

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NOZZLES, RATE OF APPLICATIONS AND PRESSURES OF SPRAYERS

By A. R. Ayers

Nozzles

1. Three general types

   a. flat fan
   b. hollow cone
   c. full cone

2. Effect of pressure on nozzles

   a. high
   b. low

3. Nozzle setups

   a. weed
   b. corn borer
   c. insect
   d. hand boom

4. Nozzle height, spacing, and pressure

   a. effect of height on coverage
   b. effect of spacing on coverage
   c. effect of pressure on coverage

Figure 1.

5. Calibration of boom-type sprayers

   a. preliminary test--to determine gallons per minute of a sprayer.

$$\text{Gallons per acre} = \frac{1.65 \times \text{gallons per minute}}{\text{nozzle spacing (inches)} \times \text{M.P.H.}}$$

$$\text{M.P.H.} = \frac{\text{Distance travelled (feet)}}{88 \times \text{time (minutes)}}$$

$$\text{M.P.H. for 40-rod distance} = \frac{7.5}{\text{time}}$$

Figure 2.

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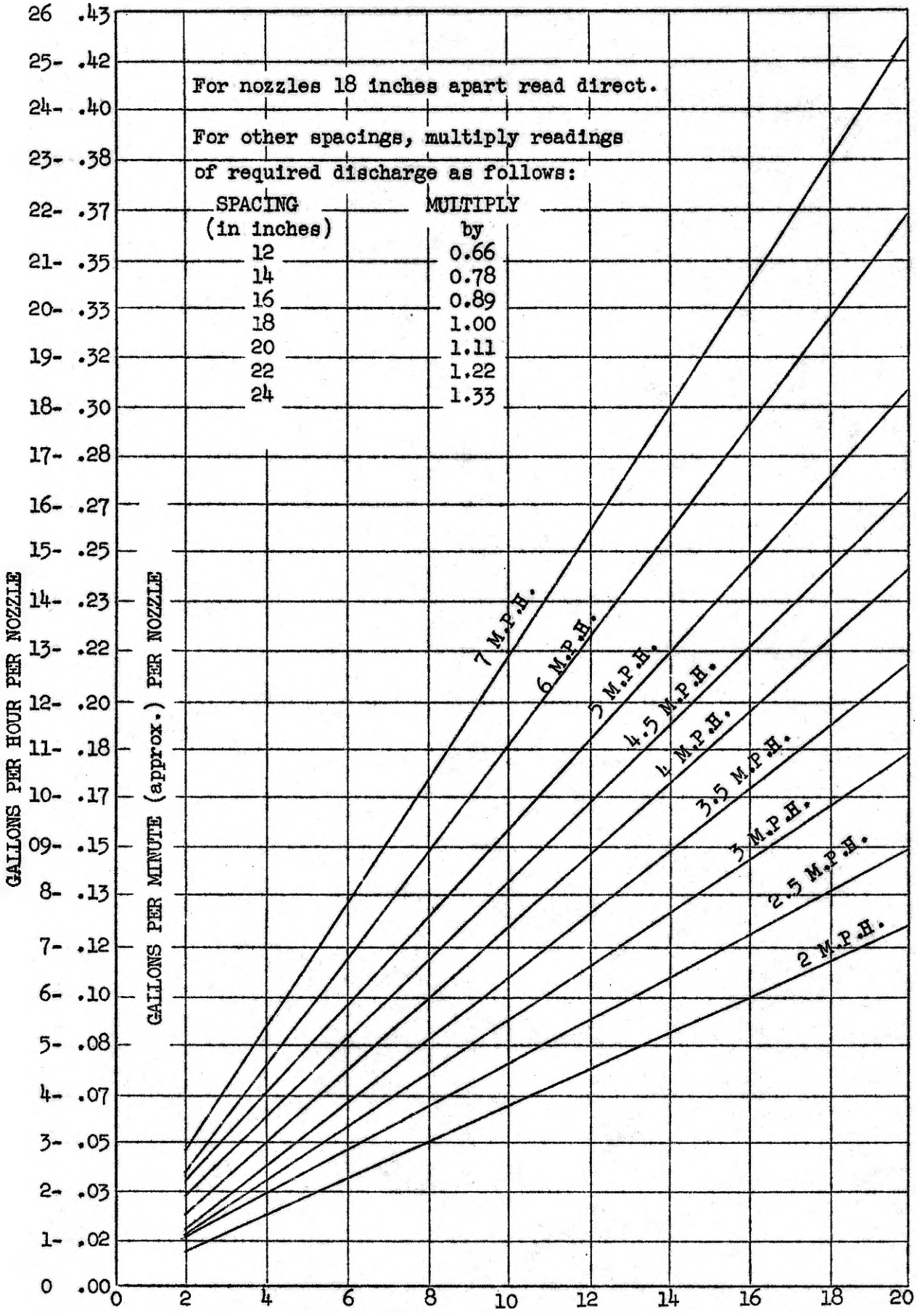
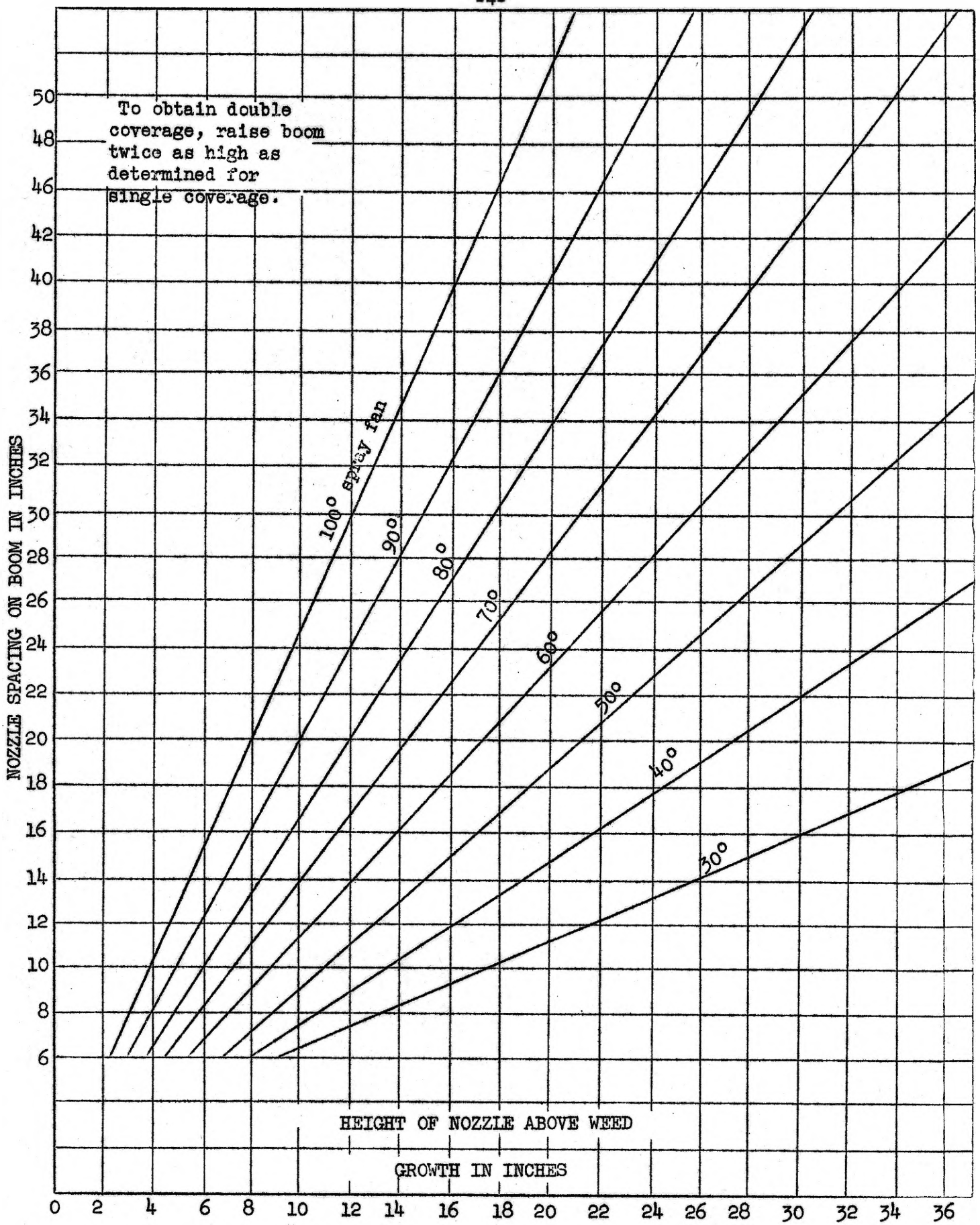


Taken from article "Equipment for the Application of Herbicides" printed in Agricultural Engineering, September, 1948.



Taken from article "Equipment for the Application of Herbicides" printed in Agricultural Engineering, September, 1948

A SPRAY SCHEDULE FOR HOME ORCHARDS

By Dwight Powell

1. Important fruit pests

   a. Insects: codling moth, curculio, oriental fruit moth, scale, apple maggot, aphids, mites, peach tree borer, bark beetles, canker worm.

   b. Diseases: apple scab; brown rot on cherries, peaches, plums, apricots; peach leaf curl; anthracnose; black knot on plums; black rot on grapes.

2. Methods of control

   a. Sanitation: destroy old leaves, dropped fruit and mummies, prune

   b. Chemical treatment

      (1) PDB crystals--in ring around peach, cherry or apricot tree each fall during period of September 15 to October 15. For lesser peach borer and bark beetles, dissolve 2 lb. PDB crystals in 1 gallon "Dendrol," dilute to 2 gallons with water. Paint infected areas.

      (2) Spray schedules:

	Materials in 100 gallons of water	Time to apply	Fruits to spray: Apple Pear	Peach Apricot Plum	Cherry	Grape	Bramble
1.	Liquid lime sulfur, 12 gallons --or	Early spring when trees are dormant	*	*	*	*	*
2.	Lead arsenate, 3 lb. "Fermate," 1/2 lb. Wettable sulfur, 3 lb.	When apple fruit buds are pink	*	*			*
3.	Same as 2	When 3/4 of apple petals have fallen	*	*	*	*	*
4.	Same as 2	10 days after 3	*	*	*	*	*
5.	Lead arsenate, 3 lb. "Fermate," 1/2 lb. Wettable sulfur, 3 lb. DDT, 1 lb. 50% wettable	10 days after 4	*	*		*	
6.	Same as 5	15 days after 5	*	*		*	
7.	Wettable sulfur, 8 lb.	2 weeks before peaches ripen		*			
8.	Same as 7	1 week before peaches ripen		*			
9.	"Fermate," 1 1/2 lb.	After fruit is picked			*		*

References, Illinois Extension Circular 524 - Growing Fruit for Home Use
" " Circular 634 - Pest Control in Commercial Fruit Plantings

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FLIES AND THEIR CONTROL
By W. N. Bruce

I. Species of flies and their breeding places.

A. House fly - decomposing organic matter

B. Stable fly - mostly under feed racks, etc.

C. Horn fly - fresh cow manure.

D. Horse fly - aquatic & semiaquatic.

II. Sanitary measures for fly control.

A. House fly

B. Stable fly

C. Others

III. Treatments of resting sites of flies for their control.

A. House flies - mostly interior treatments

B. Use 1 pound 50% water-wettable powder in 3 gallons of water, and apply to 1000 sq. ft.

IV. Extend treatment for chicken lice and mite control. Treat hoghouse, bedding and hogs (0.25% DDT on hogs or in case of mange use 0.25% of BHC).

V. For stable fly control extend treatment to out-of-doors roosting places of the stable fly. Pay close attention to treatment of trees in and around the lot or any tree under which cows fight flies. Spray outside surfaces of barns, under feed rack, etc. Spray animals - 1 pint of 1% DDT per cow per week. Can substitute Methoxy DDT or Chlordan for DDT.

VI. Horn fly control--spray cows monthly with 0.5% DDT (8 lb. of 50% DDT water-wettable powder per 100 gal.) BHC, Chlordan, Toxaphene and Methoxy DDT may be used - shorter residual life. Substitution will be justified when and if resistant strains are encountered. Don't confuse resistance with fly migration from a nearby farm.

VII. Horse fly control - not satisfactory on beef unless they can be sprayed twice weekly. Spray dairy cattle during outbreak period - dilute one part 40-1 Pyrenone in 15 parts H_2O and use 1 quart per animal twice weekly or as needed.

VIII. Wallcoats - none available that is satisfactory.

A. Residually active at a low toxicity level.

B. An experimental wall coat that is several times as effective as available commercial preparations.

1. + 3 gallons of 25% DDT emulsion concentrate.
2. + 100 lb. of cherokee clay or other suitable diluent.
3. + 5 lb. of soy flour or other sticking agent.
4. + 100 gallons water.
5. Use 4 gallons per 1000 sq. ft. or enough to cover wall.

IX. Tifa fogging.

A. Limitations and hazards.

1. Confined spaces and recreational areas.
2. Are they practical in farm applications?
3. Fire hazards and feed contamination.

X. City spraying.

A. Difficulties - cooperation, sanitation, residues.

B. Structural treatments.

1. fogging.
2. spraying.

XI. Resistant strains of flies and newer insecticides.

A. DDT resistant.

B. Other insecticides.

Methoxy DDT - Fair-to-good substitute.
Chlordan - Good but short-lived (1 mo.)
Heptachlor - " " " " (1 mo.)
Toxaphene - Fair & long-lived
118 - Toxic and short-lived (1 mo.)
497 - " and long-lived
Pyrenone - Good, expensive, short-lived (1 mo.)
BHC - Good and short-lived (1 mo.)
Rothane D_3 - No good

C. Characteristics of resistant flies.

1. Resistance is not immunity - relative term.
2. DDT still effective on resistant flies.
3. Laboratory studies.

XII. Factors affecting longevity of insecticides.

A. rain

B. air-currents

C. temperature

D. surfaces

WNB:al
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CHEMICAL CONTROL OF WOODY VEGETATION

By L. B. Culver

I. Some basic considerations in selecting a chemical for control work.

A. Adability to available equipment for application

B. Effectiveness in producing desired results

C. Qualities poisonous, or otherwise hazardous, to humans, preferred animal life and desired plant growth

D. Justification of costs by results

II. Significant chemicals that have been used

A. Sodium arsenite

1. Not adapted to spraying equipment as generally applied

2. Effective generally with species that do not sucker

3. Deadly poisonous to humans and warm-blooded animals

B. Sodium chlorate

1. Adapted to spraying equipment

2. Kills or injures all plant growth to which applied--not selective; sterilizes soil

3. Hazardous because of

a. Fire danger
b. Exposure of soil in critical soil erosion situations

C. Ammonium sulfamate

1. Adapted to spraying equipment except in stump applications

2. Kills or injures all plant growth to which applied--not selective; sterilizes soil somewhat

3. Hazardous when heavily applied in critical soil erosion situations because of soil exposure

D. 2,4-D

1. Sodium and amine salts

a. Adapted to spraying equipment
b. Kills a relatively small number of native woody species--selective
c. Hazardous to susceptible desired plant growth subjected to drift or possibly volatilization

2. Ester formulations

a. Adapted to spraying equipment
b. Isopropyl ester kills or seriously injures a relatively large number of native woody species. (Ash, basswood, blackberry and maple are reported as being definitely resistant.) Selective
c. Hazardous to plant growth of susceptible species where subjected to drift or volatilization

E. Other chemicals

III. Control work

A. Principal situations in need of treatment

1. Agricultural

a. Drainage ditches and stream beds
b. Depressional areas in fields to be drained
c. Pastures overgrown with brush
d. Certain fence rows

2. Non-agricultural

a. Utility and certain highway right-of-ways
b. Cemeteries
c. Parks
d. Camping and other recreational areas

B. Equipment

1. Power spray rigs adapted principally to larger brush areas as may occur in depressional areas, certain pastures and accessible drainage ditches

2. Knapsack spray outfits adapted to spot spraying as may occur in many pastures, along some fence rows, in patches of poison ivy, and as used in certain stump treatments

3. A nozzle that delivers a flat fan-shaped spray is recommended for economy

4. Coarse sprays are required in application of ester formulations of 2,4-D to prevent drift

C. Treatment

1. Woody vegetation under four feet in height

a. Season for spraying: Early summer after plants are in full leaf; follow up as required later in season or the next year
b. Chemical materials
(1) Ester formulations of 2,4-D for species susceptible to foliage sprays where drift and volatility are <u>not</u> a problem. Concentration: 2,000 parts per million (0.2 percent)

(2) In mixed stands that include species not susceptible to 2,4-D follow up with ammonium sulfamate at strength of one pound per gallon of water
(3) Ammonium sulfamate, one pound per gallon of water, for species not susceptible to 2,4-D or for situations where 2,4-D may be hazardous

2. Woody vegetation four feet or more in height

a. Cut to low stump height (and dispose of cut material)
(1) Reduces amount of leaf surface; hence less spray material
(2) Reduces amount of food stored in plant; hence greater effectiveness in treatment
(3) Reduces opportunity for drift to desirable vegetation
(4) Makes physical removal of woody growth easier--green stems are easier to cut than are dead, dry ones

b. Chemical materials
(1) Ester formulations of 2,4-D in kerosene or equivalent applied to stumps immediately after cutting to wet cut surfaces and bark. Will kill some shrubs and trees resistant to foliage sprays. Concentration: Not less than five percent.
(2) Or applications according to treatments for woody vegetation under four feet in height as soon as resulting sprouts are 12 to 18 inches high in full leaf.

c. Winter cutting and stump treatments should generally be as effective and less dangerous from drift and volatilization than treatment at other seasons.

D. Physical and biological aspects needing consideration in evaluating a spraying job

1. Effects on near-by plant life--crops, ornamental trees and shrubs, stands of timber

2. Effects on food supplies and cover for wildlife

3. Effects of removal of vegetation on stream bank erosion and sheet and gully erosion

4. Efficient long-time use of the land

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NEW INSECTICIDES, THEIR USES AND LIMITATIONS

By Carl J. Weinman

Introduction: The term "new insecticides" has been used to mean DDT and compounds developed since DDT became available. In this discussion, more emphasis will be placed on the insecticides and miticides which are newer than DDT.

I. Chlorinated Hydrocarbons

- A. Chemistry and familiar representatives of the class.
- B. DDT and DDT analogues.
- C. Benzene hexachloride
- D. Chlordane
- E. Chlorinated camphene (Toxaphene)
- F. New, experimental chlorinated hydrocarbons

II. Organic Phosphates

- A. Chemistry and familiar representatives of the class
- B. Hexaethyl tetraphosphate (HETP)
- C. Tetraethyl pyrophosphate (TEP)
- D. Parathion
- E. New, experimental, organic phosphates

III. Miticides

- A. Dinitro compounds
- B. Oils
- C. Sulfur
- D. Organic phosphates
- E. New, experimental miticides

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1/5/49

NEW CHEMICALS FOR WEED CONTROL
By Fred Slife

There are many new weed killing chemicals under experimentation and some of these seem to have possibilities in commercial work. It is doubtful if any new chemical will be as spectacular as 2,4-D, but some of these new chemicals may have features that will adapt them to widespread use.

2,4-5 T. (TRICHLOROPHENOXYACETIC ACID) is a chemical with properties similar to 2,4-D. It has proved to be particularly effective against woody plants, even more so than the esters of 2,4-D. At present it is expensive to manufacture. It can be mixed in equal parts with 2,4-D ester and the results indicate that control with this mixture is about as good as with 2,4-5 T ester alone and much better than 2,4-D ester alone. 2,4-5 T has not proved to be any more effective against ordinary weeds than 2,4-D and in most cases it has given poorer results. 2,4-5 T should be used at about the same rate as 2,4-D ester for woody plants or one-half 2,4-5 T and one-half 2,4-D can be used.

TCA (TRICHLOROACETATE) is a relatively new chemical that is effective against grasses. Quack grass has been eliminated with this material at the rate of 100 pounds per acre. Since this material is not pure, acid equivalent per acre should be used. Annual grasses can be controlled at lower rates than this, but more experimentation needs to be done before definite recommendations can be made. It is more desirable than older chemicals such as sodium chlorate because it does not sterilize the soil, and it is not dangerous to handle.

PCP (PENTACHLOROPHENOL) is another organic chemical that has been used extensively in the islands of the tropic regions for weed control. Experiments in this region have not proved it to be extremely promising, but further work is in progress.

MCP (2 - METHYL - 4 - CHLOROPHENORYACETIC ACID) is a chemical similar to 2,4-D in its reaction to weeds. Experiments to date have not proved it to be any better than 2,4-D.

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INSECT AND DISEASE CONTROL ON SHADE TREES AND SHRUBS

By J. C. Carter

Information on insects was supplied by Dr. L. L. English, Entomologist, I.N.H.S.

Sprays should not be applied as an annual program but after a pest has appeared or at the proper time previous to its predicted appearance.

All commercial pesticides should be used as recommended by the manufacturer.

Season	Plant	Pest	Materials in 100 gallons of water	No. of sprays	No. days between sprays
Feb.-March	Trees & shrubs	Scale	Dormant oil sprays	1	
March-May	Sycamore	Anthracnose	Puratized Ag. Sp. 1 pt.	3-5	7
April	Hawthorn, crab, etc.	Fire blight	Bordeaux mixture 2-6-100	1-2	5
"	"	Rusts	Fermate 1/2 lb., wettable sulfur 3 lb.	4-5	7-10
"	Junipers	"	Elgetol 1 gal. or Bordeaux 8-8-100	1-2	7
April-May	"	Twig blight	Bordeaux 8-8-100	5	10
"	Pine, spruce, Douglas fir	Tip blight	Bordeaux 4-4-100	3	10-14
May-June	Horsechestnut	Leaf blight	Bordeaux 8-8-100	3	10-14
"	Oak	Anthracnose	"	2	10-14
"	Evergreens	Red spider	Parathion 2 lb. (15% wettable powder)	2	10-14
"	Elm	Spring canker worm	Lead arsenate 3 lb., soybean flour 4 oz.	1	
June	Evergreens	Bagworm	Parathion 2 lb. (15% wettable powder)	1	
"	Lilac, etc.	Oystershell scale	"	1	
"	Evergreens	Soft scales	"	1	
June-July	Elm	Black leaf spot	Bordeaux 8-8-100, or commercial sulfur sprays	2	14
June-Aug.	Elm, etc.	Tussock moth	Lead arsenate 3 lb., soybean flour 4 oz.	2	50-60
"	Elm	Leafhopper	Special DDT formulation (inquire for folder)	2	35-40
July-Aug.	Junipers	Rusts	Fermate 1/2 lb., wettable sulfur 3 lb.	3	21-28
July-Sept.	Walnut	Datana	Lead arsenate 3 lb., soybean flour 4 oz.	1	
"	Evergreens	Mealy Bug	Parathion as for red spider	2-3	10-14
July	Trees & shrubs	Aphids	" or Tetraethyl pyrophosphate or nicotine sulfate 1 pt. plus soap 4 lb.	1	

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GRASSHOPPER CONTROL
By G. C. Decker

Outlook 1949. Outbreak comparable to that of 1948 possible but by no means certain.

Ecology. Most economic pest grasshoppers deposit eggs in uncultured soil, preferably sod. Weather conditions at hatching time in May-July largely determines extent of each year's infestation. Therefore, watch road sides, fence rows and meadows in central and western Illinois for newly hatched hoppers during late May, June and July.

Damage. Grasshoppers feed on practically all types of crops. Because it may take 10 to 20 or more hoppers per square yard to defoliate or seriously damage some crops, many growers tend to ignore lower populations. Two to three hoppers per square yard, however, may produce serious crop losses by attacking fruits, blooms or seed heads.

Control. Chlordane, chlorinated camphene, or benzene hexachloride applied as sprays or dusts are rapidly replacing poison baits for grasshopper control in many areas. This is particularly true where grasshoppers must be controlled on lush or dense vegetation, in inaccessible areas, and under small field conditions where the use of mechanical bait spreaders is impractical.

Benzene hexachloride sprays and dusts produce a spectacular kill in a few hours but residual effectiveness is limited to one or two days. Chlordane and chlorinated camphene on the other hand are slow in their action but remain residually effective 5 to 14 days depending on prevailing environmental conditions.

Dosages usually recommended fall within the following ranges:

Gamma isomer benzene hexachloride	0.3-0.5 pound per acre
Chlordane	0.5-1.5 pounds per acre
Chlorinated Camphene	1.0-2.5 pounds per acre

In general, sprays are more effective than dusts and in many states the dosage rate is increased when dusts are used. Results obtained with dusts are reportedly erratic particularly when rain occurs within 24 to 48 hours, whereas sprays retain most of their effectiveness if the spray mixture has become dry before the rain.

The lowest dosage rates suggested are effective on newly hatched to half grown hoppers, but the dosage should be increased as the grasshoppers mature or when applied on unpalatable or partly defoliated plants.

Baits made according to state or federal recommendations still have a place in grasshopper control where extensive treatment is required.

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CLOVER SEED PRODUCTION AND INSECT CONTROL

By John M. Wright

I. Foliage feeding insects

A. Chewing insects that eat leaves, stems, and buds, include grasshoppers, clover leaf weevil, lesser clover leaf weevil, clover root curculio, grape colaspis, and others

B. Piercing-sucking insects that take the sap only. Feeding of pea aphids and leafhoppers causes plant to wilt, become dwarfed, the leaves have a mottled, whitened appearance due to many fine white feeding spots

II. Seed infesting insects

A. Piercing-sucking insects

1. Plant bugs cause blasted buds, flower drop and shriveled seed by sucking sap from terminal growth and developing seeds

B. Chewing insects

1. Clover seed midge and clover head caterpillar cause heads to develop unevenly with only a part of the florets opening by eating florets or green seeds

2. Clover seed chalcid larvae develop inside the seed, eating out the contents

III. Insecticidal treatments

A. Chlordane and chlorinated camphene will control grasshopper, but under Illinois conditions have had little effect on other clover insects. DDT at the rate of 1 to 1.5 pounds of actual DDT per acre has given good control of leafhoppers, leaf weevils, and grape colaspis.

B. Seed infesting insects have been controlled with DDT at the above rates and seed yield increases of 13 to 50 percent were obtained in 1948.

C. Spraying has given slightly better results than dusting although insect controls and seed yield increases obtained by dusting have been good.

D. Some of the other new insecticides are being tested but no recommendations can be made at present.

IV. Pollinating insects

A. Too little is known about the effect of these new insecticides on honey bees and wild bees in the field. There is evidence, however, that when treatments are applied before there is any appreciable bloom, these insecticides have little effect on pollinating insects.

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LEGAL ASPECTS OF CUSTOM SPRAYING
By H. W. Hannah

I. "Servant" or independent contractor?

If you contract to produce a result and your employer reserves no right of control over the essential details of the spray job, you are an "independent" contractor. Most if not all of you would be classed as independent contractors.

II. As an independent contractor, what is your relation to the farmer who employs your services?

A. Contract

1. May be written or unwritten. If unwritten it may be subject to Statute of Frauds, depending on amount involved, time of performance, and other facts.

2. What provisions should there be agreement on? (a) time or times; (b) area; (c) spraying or dusting; (d) number of coverages; (e) air or ground; (f) cost, or basis for determining and rate charged; (g) when payment due; (h) will farmer furnish anything? water supply? spray materials? assistance? who mixes spray or dust? (i) spray or dust to be used, strength of mixture and concentration of the application; (j) other?

3. You have no "lien" for your services.

B. Liability

1. To you and your employees: (a) negligent acts of the farmer or his employees; (b) condition of premises; (c) failure to warn.

2. To the farmer: (a) your negligent acts; (b) damage to his property; (c) damage to his livestock; (d) damage to his person or to members of his family and employees.

III. What is your liability to third parties--neighbors of your employer?

A. When you are negligent

B. When you are not negligent

C. When you are not in fact negligent, but have violated a rule of either State or Federal aeronautics authorities or of another agency.

D. Consumers of products you have sprayed.

IV. What are the Illinois laws on weeds?

V. What laws are there on insects? Spray tolerances?

VI. Other legal aspects

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INSECTICIDAL CONTROL OF THE CORN BORER
By G. C. Decker

Outlook. For the state as a whole the present infestation is comparable to that of one year ago; however, the threat is somewhat reduced in the counties north of U. S. highway 30 and somewhat higher south of U. S. highway 6. The area of heaviest infestation lies between U. S. highway 6 and State highway 10. There is very little possibility of serious infestation developing south of highway 10, but a very favorable season could necessitate the use of at least some insecticide in every county north of that highway.

The Natural History Survey entomologists will attempt to keep you advised on seasonal developments through press and radio releases.

Biology. Corn borer moths emerging in June select fields of the largest or most advanced corn for egg laying. "The early corn gets the worms." Because of the inherent difference in their respective rates of development, various types of corn planted the same day in late April or early May would receive eggs and become infested in the following order: Early market garden corn, hybrid field corn, canning corn, (golden cross or later).

Moths appearing in August select the latest, greenest corn for egg laying. Unusually early corn may need protection in June and unusually late corn may need insecticides in August or September. Intermediate plantings may escape serious infestation by either generation and rarely if ever will the same field require treatment for both generations.

Borer control requirements. Borer control in market corn must approach perfection whereas field corn needs no more than protection against a serious loss in yield. This means different treatments and treatment schedules may be employed.

General observations. Spraying is generally more effective than dusting.

Applications with good ground equipment more effective than airplane treatments.

Proper timing of treatments often more important than method or materials.

DDT and Ryania are approved and recommended in most states.

Parathion considered promising but experimental.

Timing of treatments and number of applications to be made will vary with intensity of infestation, geographic location, type of corn (field, market, canning), and maturity of crops.

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1/5/49

CONTROLLING CORN BORER ON MARKET CORN IN ILLINOIS

By G. C. Decker

Sweet corn planted in late April or early May will suffer most from corn borer attack. Any grower in the northern half of Illinois who plants this early should be prepared to use insecticides to reduce borer damage.

Insecticides

Dusts. Ryania and DDT dusts are suggested for use against the borer. Ryania is sold as a 40 percent dust. Apply it at the rate of 40 pounds an acre. Use 30 pounds of 5 percent DDT dust an acre. Apply DDT dust of different concentrations at a rate that will give at least 1.5 pounds of pure DDT an acre. Use at least two dust nozzles per row, and pay particular attention to the ears, once they start to develop. Before the ears develop, direct the dust into the whorl and upper leaf sheaths.

Sprays. DDT and Ryania can also be used in water sprays. This method is usually more effective than dusting. Apply between 100 and 150 gallons of spray per acre. Use three nozzles per row. Adjust the two side nozzles so that they will cover the ear zone on the plant.

DDT as an emulsifiable concentrate or a wettable powder can also be used in water sprays. Most emulsifiable concentrates contain 25 percent of DDT. Therefore you will need to use three quarts of the concentrate in whatever quantity of water you use per acre. Wettable DDT powder usually contains 50 percent of DDT; consequently three pounds of this material should be used.

Undiluted Ryania should be used at the rate of six pounds an acre. Because Ryania does not mix readily with water, you will need to add 1/2 pound of a wetting agent for every six pounds of Ryania.

Timing Applications

Whether you are trying to control first- or second-generation borer, start treatments with the first evidence of egg-hatching. To determine the right time to start, examine early corn at frequent intervals around June 15 and late corn about August 15. You can see the egg masses readily on the underside of the leaves, usually near the midrib. The eggs require only four of five days to hatch, so be ready to treat shortly after you find the first white eggs.

Repeat the applications at five day intervals until you have made a total of four applications. You may need five or six applications if you find over five egg masses per plant. However, the insecticides cannot be expected to kill borers that are more than half grown. Therefore more than four applications will increase the control only slightly.

Residues

DDT or Ryania will not leave any harmful residue on the husked ears of corn. The husks and leaves will, however, carry some DDT. Do not feed them to dairy cattle, as the DDT might contaminate the butterfat of the milk. Ryania residues on sweet corn silage will not affect dairy animals.

GCD:dl
1/5/49

INSECTICIDAL CONTROL OF CORN BORER - FIELD CORN
By J. H. Bigger

I. Decide whether to treat or not to treat

A. Determine whether potential damaging population exists.

1. Locate fields in relation to areas shown by surveys to be dangerous or not.

2. Check carefully on stage of plant growth as compared to both season and neighborhood. Tallest corn in neighborhood is most attractive. Corn approaching tassel stage is most susceptible.

3. Check on borer development in the area. Find out extent of moth emergence, egg deposition and egg hatch.

B. Determine whether crop value justifies treatment.

1. Will saving 4-6 bushels pay for treatment.

II. Decide when to treat

A. In general treating to control 1st generation is most practical.

1. Time depends on relation of plant development to borer development. Eggs on small plant are unimportant. Fewer eggs on larger plants are more important.

2. Usually one treatment sufficient.

3. Two treatments may be worthwhile on valuable material.

4. Second generation treatment may be justified on very late corn.

III. Determine whether to spray or dust

A. Depends on available equipment.

1. Spraying is generally superior to dusting.

2. Ground equipment has given results superior to those obtained with plane treatments.

B. Consideration must be given to area to be treated and necessity for rapid coverage.

IV. Decide on materials to use

A. DDT is available, effective and relatively inexpensive. Ryania is highly effective but not generally available.

V. Apply sufficient material

A. Sprays

1-1 1/2 pounds technical DDT per acre. (Safety margin)

2-4 gallons solution per acre by plane

Not less than 10 gallons solution per acre with ground machine.

B. Dusts

1 1/2-2 pounds technical DDT per acre

30-40 pounds of 5% dust per acre

VI. Spray pattern

A. Ground machinery with spray boom use 3 nozzles over row or one over row and 2 directed toward upper leaves

B. Planes with multiple-nozzle booms

JHB:dl
1/5/49

TOXICITY OF SPRAY RESIDUES

By R. W. Link

Chemicals which are toxic to insects are also toxic to higher forms of animal life, although the degree of toxicity may be lower. The Food and Drug Administration has made extensive surveys to determine the toxicity of spray residues on or in foods for human consumption. However, less work has been done on the toxicity of spray residues on feeds and water for animals, and on the toxicity of these agents when applied externally to the animals.

Lead and arsenic have been extensively used in sprays, but their residues are dangerous to animal life. Every precaution should be used to prevent poisoning of water in ponds where animals drink as well as forage and grains. Mercury and nicotine are also very dangerous. The newer insecticides are dangerous but do not seem to be as highly toxic as the older insecticides. Oily preparations of the newer ones seem much more toxic than aqueous solutions or dusts. Data obtained from experiments on laboratory animals will be presented to compare the toxicity of various insecticides.

RWLwl
1/5/49

THE INSTITUTE OF AERONAUTICS
By Leslie A. Bryan

1. The Institute, a unique pioneering venture, is now a going concern.

   A realistic program - by-passes some requirements

2. The Flight Program - combines functions of instruction, airport management, and aeronautical research.

   Opened May, 1946 with 24 students, has now trained 1,200 students.

3. Airport management - continuing the work which started with the construction of the University airport.

4. Aeronautical Research Activities - an administrative agency which may correlate educational and research activities related to aviation in all parts of the University.

5. Current problems in aerial applications of agricultural chemicals and where more research is needed.

   a. Control hazards

   b. Additional uses for equipment

   c. Economic study of types of aircraft, formulations of chemicals, etc.

   d. Effective pay loads

   e. Chemicals with desirable properties needed

   f. Mechanical problems of operation

   g. Effect of weather conditions

   h. More information on height, speed, coverage, etc.

   i. Business problems

LAB:dl
1/5/49

THE CROP DUSTER AND THE FARMER
By H. B. Petty

Public relations are a vital part of the crop duster's business. They should be observed closely and are largely dependent on three people.

1. Contractor - honest, sincere, well-informed, personable.

2. Pilot - trustworthy, accurate, informed.

3. Farmer - informed, cooperative, reasonable.

What the farmer has every reason to expect:

1. A well-timed and thorough application.

2. Promptness and courtesy.

3. A reasonably thorough job.

4. Some help in the need for treatment.

5. Effective and economical control.

HBP:dl
1/5/49

THE CROP DUSTER AND HIS SPRAYING PROGRAM
By Virgil Helgen

I. What kind of fellow has he been in the past?

II. What kind of fellow is he now?

III. Organizing a crop dusting company

A. Considerations before going into business. (1) field of operations; (2) amount of capital to invest; (3) what kind of services will be needed in his field of operation and how many of them he will offer; (4) selection of equipment; (5) connections with outside help; (6) sales ability; (7) permanent plans or temporary; (8) full time or side line; (9) competition; (10) base to operate from - repair service; (11) expect to replace one out of 3 to 5 planes a year; (12) can you get adequate insurance?

B. Getting started - organization. (1) management; (2) planes and other equipment; (3) maintenance, parts, and base to operate from; (4) pilots; (5) ground crew; (6) insurance; (7) salesmen; (8) office: (a) advertising; (b) correspondence; (c) obtaining current information - bulletins, etc. (d) keeping track of insect population trends; (e) keeping track of chemical supplies; (f) setting prices; (g) phone service; (h) mapping field of operations; (i) billing, maintaining payrolls, etc.

IV. Actual operations

A. Landing strips to operate from. (1) how to choose; (2) onlookers; (3) availability to roads, radius of operation; (4) safety factors.

B. Supplies on the job. (1) gas and oil; (2) chemicals; (3) parts and tools; (4) diluent.

C. Personnel. (1) pilot-boss on job; (2) loading crew; (3) flagman; (4) expeditor or coordinator.

D. Equipment in field. (1) plane; (2) loading pump; (3) tanks - mixing and storing; (4) truck; (5) gasoline handling equipment; (6) miscellaneous. Flags-planks-loading ladder, etc.

E. Routine of activities. (1) early to rise - pointers for pilots; (2) judging wind; (3) measuring dosages-checking accuracy-furnishing chemicals-checking coverage and droplet size (proper coverage for job intended); (4) loading; (5) snowballing acreage, field counts, creating interest on job; (6) collecting as you go--how to charge; (7) job tickets; (8) making promises; (9) keeping customers in turn; (10) enlisting aid of others; (11) plat books, township maps; (12) working for large canning companies, etc.; (13) look out for damage seekers; (14) safety precautions: (a) keeping plane in order, (b) keeping people out of danger, (c) know danger of chemicals both to yourself and to crops, (d) bees, (e) be sure you put chemicals on right fields; (15) contact with home base; (16) accidents.

V. Code of ethics, abuses

A. Responsibilities to yourselves, to customers, to other crop dusters.

B. Being an asset to community. (1) anticipate their actual needs and keep them informed; (2) don't operate contrary to advice of authorities.

C. Refrain from taking advantage of customers through excessive charges, unnecessary application, cheating on dosage, dumping, watch wind waste. Don't continue after insect cycle is passed.

D. Maintain insurance and protect insurance companies.

E. Learn to cooperate with legitimate competition.

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1/5/49

LARGE-AREA SPRAYING
By C. W. Kearns

During the war many occasions arose which required the application of insecticides to areas where conventional equipment could not be used. Some places needing insecticide treatment were occupied by the enemy. Others involved terrain which for the most part was unpenetrable. Airplane application was the obvious answer. The problems attendant to the use of the airplane for this purpose were numerous, and much needed information had to be hurridly gathered and put to use without ample time for evaluation. The critical nature of the situation stimulated studies which probably would not have otherwise been attempted, and as a result a number of interesting observations pertaining to the behavior of airplane-dispersed particles were obtained. Almost every conceivable drop size range between what might be called a light rain dispersion and aerosols and smoke was studied in respect to deposition, effective swath width and behavior in different types of terrain.

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1/5/49

EFFECTS OF AGRICULTURAL CHEMICALS ON AQUATIC LIFE
By George Bennett

1. DDT - toxic at concentrations between 0.05 p.p.m. and 0.10 p.p.m. DDT in oil solution is less toxic than DDT emulsions.

2. Chlorinated camphene - considerably more toxic to fish than DDT. Trout were killed at 0.005 p.p.m. and bluegills at 0.01 p.p.m.

3. Benzene hexachloride - less toxic than DDT. In aquaria, bluegills tolerated 0.45 p.p.m. Gamma isomer most toxic.

4. Chlordane - less toxic than DDT.

5. Tetraethyl pyrophosphate - comparable to DDT.

6. Parathion - slightly less toxic than DDT.

7. Rotenone - p.p.m. toxic to fish.

8. 2-4D - non-toxic to fish.

9. Sodium arsenite - not toxic at 1 to 4 p.p.m.

10. Trichlorobenzene - toxic to fish at levels which will kill aquatic underwater plants.

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1/5/49

AERIAL SPRAYING VS. AERIAL DUSTING
By G. C. Decker

The outcome of this headline sports event "Aerial Spraying vs. Aerial Dusting" may well determine the eventual fate of the aviation industry in the field of agricultural pest control.

History. Airplane dusting was born in 1921, and after a brief flurry of vigorous experimentation settled down to a position of mediocre competition with other control practices. The discovery of new and powerful insecticides that may be easily formulated in concentrate sprays has opened the way for aerial spraying and given the industry a new lease on life.

Aerial dusting, position and limitations. In general, dusting operations have not been as successful as spray operations in insect control, and aerial dusting is often less effective than ground dusting. Aerial dusting, therefore, has survived only where its competition was poor or where one of its advantages such as speed offset its lack of efficiency.

Aerial spraying. The development of concentrate sprays has given aerial spraying a tremendous impetus. While this line of attack is new and in part experimental, the basic developments to date appear to be sound and rapid progress seems to be practically assured.

Advantages favoring aerial spraying. Greater flexibility: Variations in types of aerial spray dispensing equipment makes spraying much more flexible than dusting which is practically limited to use of venturi.

With spray equipment, volume, droplet size, physical properties and chemical composition of spray, application can be varied independently.

More uniform treatment pattern: Practically all aerial dusting equipment tends to give very uneven distribution of the insecticide with excessive amounts in the center of the swath tapering to zero at the margins.

Released at a point under the fuselage, sprays show the same tendency; but through the use of spray booms and the proper placement of nozzles along the wing, rather uniform spray distribution can be attained.

Greater control over drift. In general, spray applications are of a droplet size that will minimize drift, but one dares not infer that sprays will not drift. In fact, with aerosols approaching the smoke range, some particles may drift for miles.

Probable trend. The use of aerial dusting is likely to show little gain or decline whereas aerial sprays will undoubtedly gain in popularity and use. If all cooperating agencies cannot improve and perfect aerial sprays to a point where they will largely replace dusts and can and will compare favorably with ground operations, aerial applications of agricultural chemicals is doomed.

ml
1/5/49

CAA REGULATIONS
By F. L. Lancaster

1. Installations must be approved by nearest C.A.A. office.

   Drawing or detailed sketch must be submitted.

2. C.A.A. approved dusting, spraying, and seeding installation kits available commercially.

3. Upon completion of installation, Form 337 must be filled out in duplicate.

4. After installation, must be inspected by C.A.A. inspector.

5. Check with licensed mechanic.

6. Comply with safety regulations.

7. Certificate of waiver necessary -- application, duration, special regulations.

C.A.A. publications:

Manual 18: "Maintenance, Repair, and Alteration of Certificated Aircraft, Aircraft Engines, Propellers, and Instruments"

Manual 3: "Airplane Airworthiness: Normal, Utility, and Restricted Purpose Categories"

Manual 4: "Airplane Airworthiness"

U.S.D.A. publications:

"Aircraft for Spraying and Dusting" EC-2, March, 1948

"Equipment for Dispersing Insecticides From Aircraft," October, 1948

Partial list of manufacturers of C.A.A. approved dusting and spraying installation kits:

Barrie Aeronautical Corporation
Lee Airport
Lockport, New York

Bell Aircraft Corporation
Niagara Falls, New York

Central Aircraft
Yakima, Washington

Goettl's Metalcraft Co.
2431 East Bucana
Phoenix, Arizona

Ong Aircraft Corp.
P.O. Box 214
Kansas City, Missouri

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EFFECTS OF AGRICULTURAL CHEMICALS ON WILDLIFE

By W. N. Wandell

I. Effects of specific chemicals on animals

A. DDT (dichlorodiphenyltrichloroethane)

1. Songbirds. DDT when applied at a concentration as low as 4.36 pounds per acre had a lethal effect upon the songbird population chiefly among ground and low-strata feeders. Applications at the rate of .6 pound per acre apparently had no effect upon songbirds. Concentrated sprayings in amounts equal to 5 pounds per acre had no effect upon the hatching of songbird eggs or the rearing of young.

2. Mammals. Applications at rates of 5 to 7.5 pounds per acre had decided effects upon small mammals, but these were not affected by treatments of one pound to the acre. An application of 4.36 pounds per acre caused no great noticeable effect upon larger mammals.

3. Bobwhite Quail. Vegetation sprayed at the rate of 5 pounds per acre and consumed by penned quail produced no noticeable effects. Dietary concentrations of 0.025 percent caused a 50 percent loss in young quail but only a 15 percent loss in adult birds.

B. DDD (dichlorodiphenyldichloroethane)

Bobwhite Quail. Consumption of vegetation sprayed at the rate of 5 pounds per acre caused no loss among 20 adult quail. Feedings of grain treated with 0.025 percent DDT for 44 days results in a 10 percent loss among birds tested.

C. Benzine Hexachloride

Bobwhite Quail. Quail eating vegetation sprayed at the rate of 5 pounds per acre showed no mortality. Feedings of a diet that included 0.025 percent of the same toxicant for 44 days killed one of 20 birds tested.

D. Toxaphene

Bobwhite Quail. Toxaphene sprayed on vegetation in pens at the rate of 5 pounds per acre caused no mortality among quail who consumed the vegetation. Feedings of 0.025 percent in the diet for 44 days caused only one loss among 20 birds, and the cause of this casualty was questionable.

II. Effects upon habitat

Destruction of herbacious and shrub cover on farms may seriously affect wildlife populations normally present. Indiscrimate use of 2,4-D and other plant-killers will have very unfavorable effects upon habitat

restoration plantings, particularly multiflora rose. Plantings of this type are rapidly increasing in importance on Illinois farms and warrant increased caution.

III. Recommendations for minimizing danger

A. Minimizing effect upon animals. Use chemicals only where needed, and in all cases apply on the minimum quantity necessary for control.

B. Control damage to habitat. Carefully apply chemicals only to areas containing plants to be controlled.

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AERODYNAMIC PROBLEMS OF AIRCRAFT USED FOR CROP DUSTING

By H. S. Stilwell

I. Introduction

Aircraft used for dusting operations are generally designed for some other purpose and are modified to fit the new requirements. Development costs may offset any advantages gained by specially designed aircraft for some time to come. Any modification of an aircraft should leave unchanged its primary aerodynamic and structural characteristics.

II. Control of aircraft weight and balance

A. Weight control

1. All aircraft are designed around some maximum weight. When the aircraft is modified, this weight should not be exceeded unless it can be demonstrated that the performance and strength will not be adversely affected.

2. Increased weight increases the stalling speed of the airplane and the loads applied to the airframe structure.

B. Balance control

1. The longitudinal stability of the aircraft is affected by the location of the center of gravity of the aircraft. The safe limits of movement of the center of gravity are fixed during the design and flight tests of the aircraft.

2. Dusting equipment must be installed so as to prevent the center of gravity moving beyond the limits during any period of operation. To exceed the limits may result in objectionable spin performance and inability of the normal trim devices to provide required trim.

III. Air flow in the vicinity of the airfoil

A. Stalls

1. An airfoil stalls when the angle of attack is sufficiently great to result in separation of the flow near the leading edge. When the angle of attack is increased rapidly, inertia of the air may delay separation resulting in a momentary increase in the stalling angle. An abrupt stall follows.

2. It is desirable to have stalls initiate near the root section of the wing. Wings tapered in planform tend to stall near the tip first. This may be corrected by the use of airfoil sections having larger stalling angles in the tip region, by twisting the wing, or by the addition of leading edge spoilers in the root region.

B. Optimum location for nozzles

1. The magnitude of the vertical velocity component of the air flowing off the wing is approximately constant across the span and is maximum near the trailing edge. Dust or spray ejected in this region, except in the vicinity of the propeller slip-stream and very near the wing tip, will receive the maximum initial benefit from this flow.

2. Vorticity may be produced in the flow of dust or spray constituents to obtain multi-directional approach to the target.

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