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A PROGRESS REPORT ON THE AGRICULTURAL
TESTS WITH THE BESLER AEROSOL GENERATOR

by

H. E. Morrison and W. B. Rasmussen

~~DISCARD~~

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Considerable interest has developed in the possible use of mechanical aerosol generators for the application of insecticides. Machines of this type were developed during the war for generating fog screens to conceal troop and naval movements. Subsequent developments saw the incorporation of DDT into the fog for control of mosquitoes and other noxious insects in the Pacific Islands.

The principle of the generator is simple. Water is pumped through a series of coils and heated by a flame. Superheated steam, generated at a pressure of 200 or more pounds produces temperatures from 200 to 900 degrees F. Regulation of the temperature by means of a thermostat controls the size of the fog particles. DDT or other insecticides are atomized into the steam at the nozzle. This produces a fog composed of very small particles.

Preliminary trials with aerosol generators were carried on in various localities of the United States during the summer of 1945 against a number of agricultural pests. The Oregon Hop Control Board, cooperating with the Entomology Department of Oregon State College, obtained a generator on loan last year and completed a number of tests with it. The results of these tests were as follows:

Tests on Agricultural Crops

Hops

Approximately 130 acres of hops were under test during 1945 near Salem, Oregon, in which various insecticides were used in the generator for either hop aphid or red spider mite control. The most outstanding results were obtained with nicotine sulfate and fish oil soap. A 25-acre block was treated with 10 pounds of nicotine sulfate in 18 minutes (Formula 1). Very effective kills of the hop aphid were measured, but 10 days were required to effect complete kill. The adult aphid remained functional during this time and were able to deposit living young before dying. However, the adults did become discolored (a symptom of nicotine toxicity on hop aphid) within 24 hours after treatment. Later tests using 20 pounds of nicotine sulfate on 17 acres of hops (Formula 2) resulted in more rapid kills of the hop aphid.

The above tests were made while attempting to learn how to use the aerosol generator. Uncertainty of formulations on plant tolerance prevented the use of oil in combination with nicotine. The use of oil makes a more satisfactory fog than water or water and soap.

DDT (5%) in fuel oil (Formula 3) was later tested against the hop aphid. The results were inconclusive but DDT did not appear to offer as much promise as nicotine sulfate against the hop aphid. The use of free nicotine (Formula 4) in water resulted in fair kill of the hop aphid within 100 feet of the point of application. Lethane 440 (Formula 5) as used did not give control of either red spider or hop aphid.

Corn

5% DDT solution (Formula 4) was used against the 11-spotted cucumber beetle and results were very satisfactory. Later tests with 5% DDT and 5% hexachlorethane (Formulas 6 and 7 respectively) were used against the corn earworm.

Weather conditions during the corn earworm trials were very unsatisfactory and the applied materials were immediately dispersed by the wind. There was some indication of control within 10 feet of the point of application. The heavy white oil used in these formulations did not work well in this generator.

Tests on Household Pests

Two homes, the Corvallis Community Cannery, the west wing of the Memorial Union Building at Oregon State College, several laboratories of the Food Products Building, the carpenter shop of Oregon State College and 29 housing units of Oregon State College were treated with the generator for control of various household pests. 5% DDT solution was used in most of the above applications (Formula 8). Flies, mosquitoes, fleas, spiders, sowbugs, the German cockroach and silverfish were successfully controlled. The permanency of control of the German cockroach by this method has not been determined, but the pests were difficult to find after three months.

One very nicely furnished home at Hillsboro, Oregon, was fogged with 5% DDT (Formula 9) with no apparent injury to paint, wallpaper, furniture or clothing. Several highly polished articles of furniture were covered with a bluish scum, but this was readily removed with wax. Applications directed against the powder post beetle (probably *Lyctus planicollis*) with formula 10 did not give control.

Mosquito Control

A campground used by hop pickers on the property of Wilfred Weathers of Salem, Oregon, was treated for mosquito control. This camp was located beside a slough and estimated at 5 acres in size. It was heavily populated with both flies and mosquitoes. Countless flies, mosquitoes, tree crickets, wasps and other insects began falling from the trees several minutes after completion of the application. A number of flies were noted to have deposited living young before death. Fifteen gallons of DDT solution (Formula 3) were applied to this and adjoining areas in this test. The application resulted in very efficient cleanup of flies and mosquitoes for the remainder of the season. Campers in the area did not register any discomfort during the operation.

Tests on Animal Pests

Five barns of the David Hagg and Son Dairy of Reedsville, Oregon; two barns on the dairy farm of Ed Freudenthal at Hillsboro, Oregon; a barn belonging to John

Ramages at Woodburn, Oregon; and the veterinary barn, dairy barn, beef barn, bull barn, calf barn, hog barn, and poultry house and meat cutting room of Oregon State College were treated with 5% DDT solution (Formula 8) for fly control. Flies, sowbugs, spiders and cockroaches were very effectively controlled. Fly control was effective at least 64 days after treatment, the fly season ended before residual action could be fully measured. Aerosol treatment of both inside and outside of barns and manure pits paid noticeable dividends in reducing fly populations.

Effect on Livestock

No precautions were taken in the treatment of the dairy barn at Oregon State College and cows entered the barn within 20 minutes after treatment. They ate the feed in the troughs, which was estimated to have a deposit of 15 ppm of DDT on it. There was no visible effect on the health of these cows.

A number of animals (several cows, sheep, hogs, goats and chickens) were allowed to remain in the veterinary barn at the time of treatment, and all survived the experiment without signs of nervousness or impairment to health. Approximately 100 chickens were in the poultry house during the treatment, but there was no indication of toxicity to these birds. Control of the chicken mite was not conclusive. In the experiment on animals, lice on the goats were not controlled.

Five bulls and three calves were later treated in the bull barn at Oregon State College. The length of exposure in this instance approximated 2-1/2 hours. Twenty-five head of steers were later treated in the beef barn. In no instance did the various specialists detect any impairment to the health of these animals. The treated animals were in all instances remarkably free from flies for some time after treatment. It is indicated, however, that DDT residue will not last as long on livestock as it will on barn walls.

Adult grain moths, weevils, mealworm larvae and adults have been killed in great numbers by aerosol applications of DDT (Formula 8). The aerosol method, however, is not effective in the penetration of grain.

One of the most important features of the aerosol type applications in barns lies in the speed of application. Five minutes has been sufficient time to treat a large type of barn (165' x 40' x 10'). Material costs required to treat a barn of this size should not exceed \$2.50.

Need for Additional Work

The above report is a summary of the results obtained with the Besler Aerosol Generator. The data accumulated serve only to indicate the possibilities of this type of machine for pest control. Many basic facts have yet to be studied. Some of these include plant tolerance, particle size, formulations, amount and nature of deposit of the toxicant, the possible use of insoluble inorganic poisons, relationship of temperature of the steam or stability of materials, the aerosol application of fungicides, relationship of this type of application to bees and other beneficial insects and many other closely related agricultural problems.

A number of inquiries have been received regarding the practicability of using the aerosol generator for custom pest control. This phase of commercial work may offer some future possibilities. Both DDT and the aerosol generator are still in the experimental stage and time will be required to develop adaptable formulations. Custom pest control carries with it certain definite responsibilities on the part of the operator. Knowledge and experience of pest control should be acquired by individuals before undertaking such a venture.

Formulations Used to Date

Formula 1

Stove oil	1 gal.
10 lbs. fish oil in 5 gal. water	5 gal.
40% nicotine sulfate	10 lbs.
Water	10 gal.

Formula 2

Stove oil	2 gal.
16 lbs. fish oil in 8 gal. water	8 gal.
40% nicotine sulfate	20 lbs.
Water	14 gal.

Formula 3

DDT (technical grade)	5 lbs.
xyol	1-1/2 gal.
stove oil	12 gal.

Formula 4

Free nicotine (99%)	26 oz.
Water	12 gal.

Formula 5

Lethane 440	5 lbs.
Boiled fish oil	2 gal.
Vatsol O.T.C.	2-1/2 lbs.
Water	10 gal.

Formula 6

DDT (technical grade)	5 lbs.
xyol	1-1/2 gal.
White mineral oil	12 gal.

Formula 7

Hexachlorethane	5 lbs.
xyol	1-1/2 gal.
White mineral oil	12 gal.

Formula 8

DDT (technical grade)	5 lbs.
xyol	1-1/2 gal.
Odorless kerosene (standard base oil C)	12 gal.

Formula 9

DDT (technical grade)	5 lbs.
xyol	1-1/2 gal.
cleaning solvent	12 gal.

Formula 10

DDT (technical grade)	5 lbs.
Carbon tetrachloride	9 gal.
Kerosene (Standard base oil C)	3 gal.