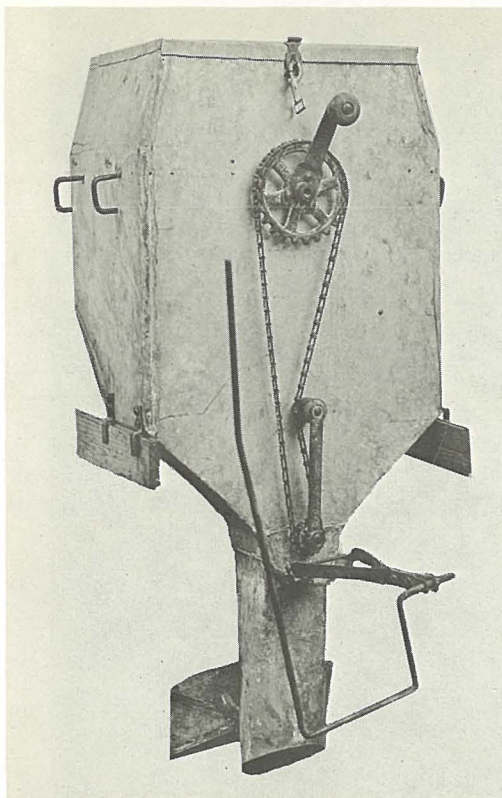




EARLY DUSTING EXPERIMENTS

By BRIAN R. BAKER

The original dust hopper design by Etienne Dormoy of McCook Field. This was constructed at the Delta Laboratory for use in combating the boll weevil in the earliest experiments by the U. S. Dept. of Agriculture.

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During August of 1921 a series of tests was made to combat an infestation of catalpa sphinx larvae (caterpillars) which was defoliating a catalpa grove near Dayton, Ohio.¹ Under the direction of C. R. Neillie and J. S. Houser, a

Curtiss JN-6H biplane was modified by the installation of lead arsenate dust dispensing equipment.² The first hopper used in these tests was constructed to hang over the right side of the rear cockpit. It was operated by the air-





In later experiments the aerial dusting method was compared with other ground based machinery. In this photograph the Huff Daland Duster is caught with, in order from left, horse or mule drawn equipment with single, quadruple or double nozzle sprays, tractor

craft observer, who had to stand up in the cockpit and turn a handcrank which actuated the dust dispensing mechanism. The tests were moderately successful.³

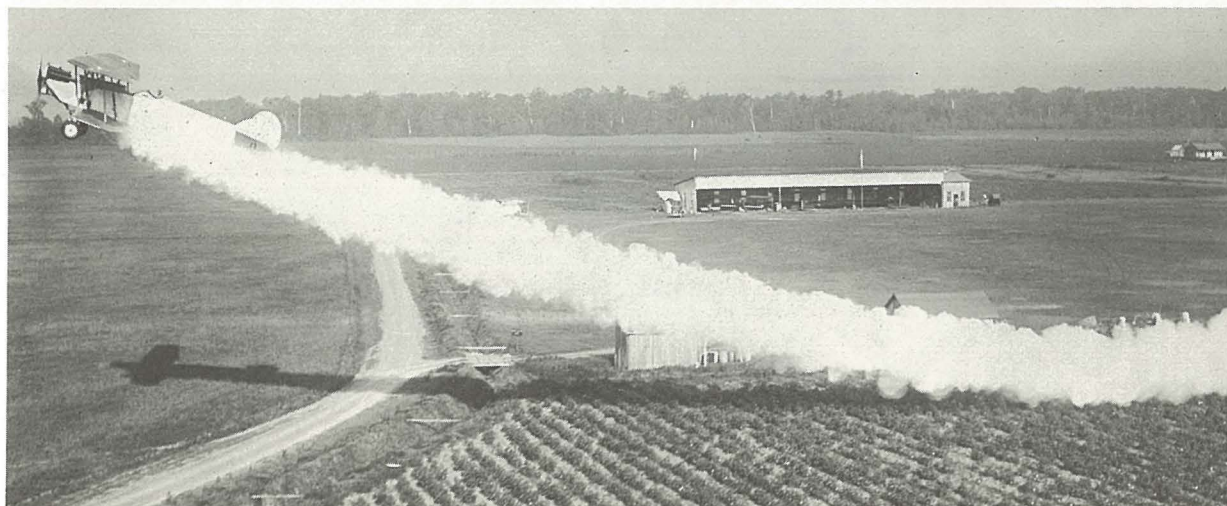
At the same time, Department of Agriculture scientists were investigating the possibilities of developing ground mounted spraying equipment for the application of calcium arsenate to combat cotton boll weevil in the American Southern States. Hearing of the Ohio Experiments, Dr. B.R. Coad, of the Bureau of Entomology and Plant Quarantine and Entomologist-in-Charge of the U. S. D. A. Delta Laboratory at Tallullah, Louisiana, became interested in the possibilities of using aircraft in cotton dusting. He

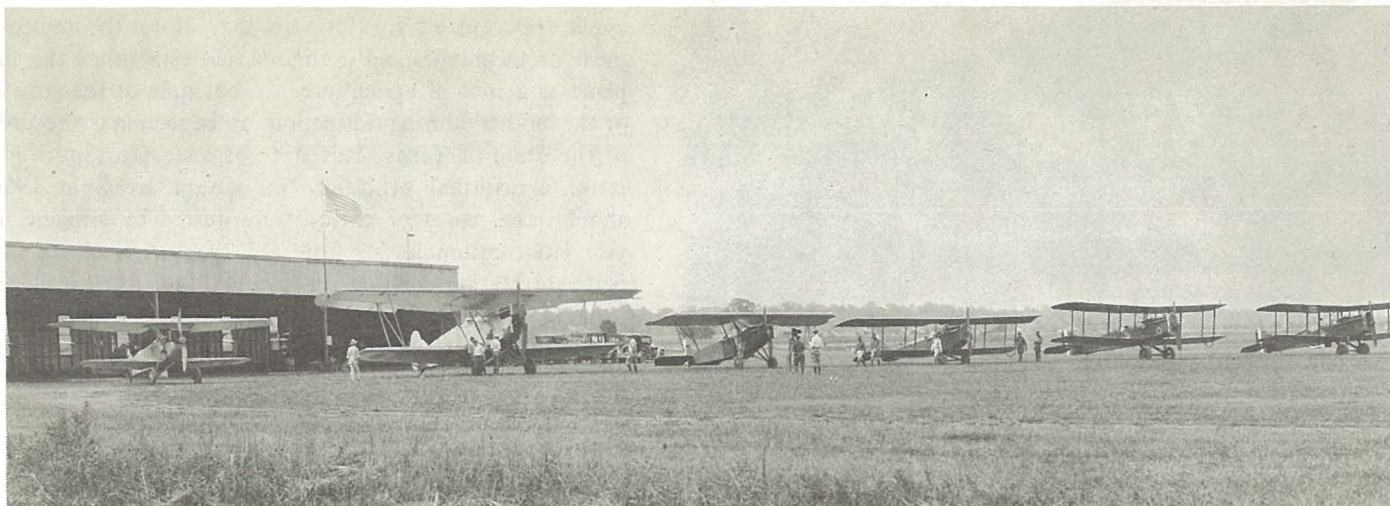
driven multiple spray, and manually carried light dusting equipment. It was observed that the "speed of operation" was vastly increased. Below, the H-D Duster over a cotton field adjacent to the agriculture experiment station.

arranged for a series of tests to determine the feasibility of using airplanes for this task.

The work was carried out under his supervision at the Delta Laboratory, using two Curtiss Jenny biplanes flown by Army Air Service pilots supplied by the War Department. Use was made of the results of the Ohio Experiments, and Dr. Coad reported that "the speed of operation was at least a hundred times faster than the best mule drawn machines."

Dr. Coad observed the need for better equipment during these tests. The hoppers built at the Delta Laboratory were mounted inside the airplanes. The early models were





Lineup of the dusting experiment aircraft. L. - r., the Huff-Daland Petrel "4," Huff-Daland Duster, Huff-Daland Monoplane, JN-6 and two DeH-4's bearing the insignia of the 22nd Aero Sqdn. A photo grapher with motion picture camera is in front of the H-D Monoplane. Army Air Service personnel in attendance.

mounted in the front portion of the rear cockpit and required an operator to stand behind the unit and turn a feeder crank which caused the dust to be discharged through an opening in the bottom of the fuselage. This mechanism worked perfectly during ground tests, but when the airplane was airborne, the airflow across the dust discharge tube interfered with the dust delivery. A funnel was installed ahead of the opening and the air it collected was directed into a slot in the front of the discharge tube. This was the first attempt to use the Venturi principle in the spreading of dust materials through a dispenser.⁴ This worked successfully in that it prevented the clogging of the materials and aeriated the dust, giving improved distribution.⁵

A number of devices were tested in attempts to improve the efficiency of the hopper and distribution equipment. Air suction, ram air and the conducting of engine exhaust across the discharge tube outlet in order to improve the distribution of dust were tested and discarded.⁶

Some improved equipment was developed as a result of the tests conducted at the Delta Laboratory, and some of it is still in use in essentially the same form. The devices include the mechanical agitator which prevents clogging of dust in the hopper, feed gates that equalled the width of the fuselage of the applicator aircraft and funnels or spreaders mounted underneath the fuselage and dust hopper to mix the dust with air and improve the uniformity of distribution of the materials. The progress made under the supervision of Dr. Coad at the Delta Laboratory established aerial application of pesticides as a practical process.

One of the results of this research was the formation of a commercial crop dusting company in 1923. Heretofore, airplanes used for aerial application had been conversions of commercial or military aircraft. The Huff-Daland Company, with facilities located in Ogdensburg, New York, a manufacturer of bombing and training aircraft for the Army Air Service, introduced an experimental biplane developed especially for dusting operations. Fourteen of these airplanes were manufactured during 1925 for Huff-Daland

Dusters, Inc., a company which began dusting operations near Monroe, Louisiana. The airplanes, officially called Huff-Daland "Dusters," were named "Puffers" by their crews. They carried about 800 pounds of materials and had a cruising speed of about ninety miles per hour. These aircraft were later acquired by Delta Air Lines, Agricultural Division, and this firm continued to build, rebuild and operate them for twenty-five years.⁷

Thus, during the early nineteen-twenties, crop dusting had developed from a hit-or-miss proposition to a reasonably accurate and effective method of treatment against certain agricultural pests. If aerial application was not completely effective at this stage of development, it was apparently sound enough to be commercially practical.

During this period much research was conducted, not only in the field of aerial application, but in the use of chemical for insect control. Barber and Hayne conducted tests leading to the conclusion that Paris green, a mixture of organic lime and sulfur, was effective as a larvicide in the control of anopheline mosquito larvae.⁸ During 1923 and 1924, Bradley and King, working under the auspices of the U. S. Public Health Service, made tests in the swampy areas and lakes near Mound, Louisiana, which showed that applications of Paris green by airplane at a rate of one-half or more pounds per acre effectively controlled the anopheline larvae in that area. This work was carried out in conjunction with the Delta Laboratory, and the Army Air Service detachment stationed there assisted in the experiments, providing the airplanes and pilots.

One of the important findings was that the amount of chemical required for complete control varied with the type of terrain being treated. Open rice fields, for example, required smaller amounts of chemicals for adequate control than did lakes or swamps which were protected by trees and brush which any chemical had to penetrate before it could contact the water where it could become effective. Williams and Cook, also working with the Public Health Service during 1926, demonstrated that applications of Paris green by airplane on a large scale, at a rate of one pound per acre at weekly intervals, obtained good control



The Huff-Daland Petrel "4," possibly the duster prototype, at St. Louis, September 1923. Below, the "Puffer" at work.

of *Anopheles quadrimaculatus*, a type of mosquito. These tests were made on a military reservation near Quantico, Virginia.⁹

The use of Paris green in dust compounds remained the most common method used by aerial applicators in their efforts to control the anopheline mosquito larvae in inaccessible places. These materials proved ineffective, however, in attempts to control other species of mosquito larvae. The reason for the effective control of the anopheline larvae was the larval habit of feeding at the surface of the water where the particles of poison were floating. The success of the application of Paris green depended upon the length of time the particles would float on the water. The proper mixing of the chemical with the inert ingredients was of utmost importance in the effectiveness of the applications. Paris green compounds remained the principle mosquito larvicides used by aerial applicators until the introduction of DDT during World War II.

Aerial dusting in the control of insect pests in agricultural regions had become an established practice by 1930, when from twenty to thirty companies operated

about 100 airplanes for this purpose.¹⁰ It was the improvement of techniques and chemicals that established the airplane as a tool of agriculture. An example of the growth of the industry during this period can be seen in the records of the State of Texas. This state began a program to improve agricultural efficiency in certain areas. In 1926 about 3,000 acres of cotton were dusted by airplane. A year later, entomologists from the Texas Agricultural Experiment Station conducted a series of tests using airplanes to apply calcium arsenate for the control of all major cotton pests. By 1928, over 50,000 acres of cotton had been treated by aerial application companies, and that figure had increased steadily since that time.¹¹

1. Martin, Dial F., "Control of Insects Affecting Man." *Handbook of Aerial Application in Agriculture*. College Station, Texas; A&M College of Texas, 1956. Pg. 85..
2. The Curtiss JN-6H was a later development of the famous Jenny.
3. Isler, Davis A., "Aircraft in Agriculture." *Yearbook of Agriculture*, 1960. Washington: U.S. Gov't Printing Office, 1960. Pp. 157-163.
4. The venturi principle involves the movement of a fluid, in this case, air through a tube. The tube is shaped so that the center portion is narrower than either end, forcing the fluid to increase its velocity as it moves through. This decreases the pressure within the spreader, creating a suction effect. This, in turn, helps the dust flow out of the hopper and improves the speed and uniformity of distribution.
5. Isler, p. 157.
6. Ibid.
7. Ibid, p. 158. Operators of crop dusting companies generally perform a considerable amount of maintenance on their airplanes.
8. Martin, p. 85.
9. Ibid.
10. Weick, Fred E., "The Development of Agricultural Aviation and Its Future." A report to the Tenth Annual Texas Agricultural Aviation Conference, undated. P. 4.
11. Filler, F.M., Jr., "Problems in Insect Control." *Handbook on Aerial Application . . .*, p. 89.

