AERIAL APPLICATION OF FUNGICIDES FOR POTATOES

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We can apply today's pesticides by air to most crops with results as good, and sometimes better than are possible with ground equipment. Furthermore tremendous improvements in aerial application are likely in the next few years. During some twenty years I have seen many successful uses of airspray and I have seen some failures. Most of the failures, aside from bad judgment in timing and dosage, have been the result of poor design and adjustment of the spray distribution system rather than from the type or operation of the aircraft itself.

The use of dusts is declining rapidly. Liquid sprays because of their versatility, offer the big potential in aerial application of pesticides.

ADVANTAGES OF AERIAL APPLICATION

1. Better timing or wet fields after rain or irrigation. This is especially critical for early blight.

2. Faster coverage. An aircraft can do about as much work in one hour as a ground rig can in a day. This is important during disease epidemics and is the only feasible way to treat vast acreages of grain or other crops.

3. Eliminates sprayer wheel damage and soil compaction.

4. Concentrated airspray droplets resist weathering and redistribute more efficiently than dilute spray films. Sustained redistribution and the buildup of the pesticide deposit with re-application to new growth is largely responsible for the control of fungous disease.

5. Less water required.

6. Less capital investment in equipment.

7. Less labor, worry and bother for the farmer.

8. Progressive aerial applicators are employing technically trained pesticide specialists to whom the farmer can delegate the supervision of this increasingly complicated job.

DISADVANTAGES OF AERIAL APPLICATION

1. Operations are limited by wind, other climatic factors or darkness.

2. Greater out-of-pocket cost.

3. Coverage may be inadequate on some crops but not potatoes, beets or row crops.

4. Greater drift hazard.

Most of these disadvantages can be avoided or overcome. Improvements in formulations, adjuvants and operating techniques or night flying can overcome many of the problems caused by unfavorable climatic factors. Costs are relative but, in general, aerial application is getting cheaper whereas owning and operating ground spray equipment is becoming more expensive. Coverage can be improved with changes in the design and operation of the equipment; more systemic pesticides will minimize this problem in the future.

CHECK THE EQUIPMENT

As with any other farm implement, we have found it desirable to measure the performance of an aircraft before use. Actual tests of the spray pattern are necessary. This can be done quite simply with dye or the chemical itself and paper. Swath width, droplet size, and any major irregularities in droplet distribution or uniformity of overlap are quickly detected.

AIR-BORNE, AIR-BLAST SPRAYERS

Agricultural aircraft are air-borne, self-propelled, air-blast sprayers. Both fixed-wing aircraft and helicopters develop a fast stream of spiraling air which carries the fungicide to the crop with a minimum amount of liquid. The air frame itself is not as important as the design, adjustment, and operation of the spray distribution system. In general, the new model planes, with the standard factory installed booms, are capable of producing a good spray pattern. But we often see very poor jobs from modern ag planes because of poorly designed and ill-conceived adaptations in the boom and nozzle arrangement. Properly adjusted, every make and model of ag aircraft, old or new, has been used satisfactorily for the application of our products.

AIR STREAM DISTORTION

The spray plane in flight does not produce a smooth, uniform stream of air. Major distortion comes from the propeller and the wing-tip vortices with minor disturbances from wheels, pumps, and the fuselage itself. Uniform spacing of nozzles across the boom will result in uneven distribution of spray at low level flight with biplanes and low-wing monoplanes. A concentration of nozzles to the right of the fuselage is required to counteract the torque of the "prop wash". The placement of nozzles at other strategic points along the boom to achieve a uniform spray pattern must be determined by actual tests of the spray pattern. Nozzles too close to the wing tips release too much spray into the vortices where it may be lost through evaporation and drift. This is not satisfactory for the type of precision spraying required for protective fungicides. Nozzles

can be moved in as much as two feet from the wing tips without reducing the effective swath width. Although these principles have been known for a long time, there are still many aircraft in actual use that have improperly spaced nozzles.

DROPLET SIZE

In general, the droplets should be as fine as can be handled without excessive loss from evaporation or drift. Sprays that are too fine drift away, are wasteful and may be hazardous. Coarse sprays streak easily, give poor coverage and are also wasteful. Droplet size is regulated by pressure, orifice diameter and other factors but the most important single factor is the angle of the nozzle in relation to the air stream. The droplet size can be changed from very coarse to very fine by rotating the nozzles into the wind. The standard nozzle produces a wide spectrum of droplet sizes. At any setting some will be too fine, others too coarse. An average of about 200 to 300 microns is probably optimum for our fungicides under most operating conditions. It is essential that the droplet size be checked with actual tests of the pattern. Fine droplets should be avoided in the low humidity areas of the Western States.

GALLONAGE

I have been revising my ideas downward on the optimum spray gallonage for the last twenty years. Uniformity of distribution is more important than the total gallonage. Coverage to other parts of the plant with any concentrate spray is achieved through redistribution by dew and rain and through repeated application.

A well designed spray system on an aircraft as with a ground airblast sprayer utilizes air instead of liquid as the carrier. Only enough liquid is needed to keep the spray fluid until it hits the plant. Volume should be sufficient to overcome evaporation in flight and to provide enough mass to achieve penetration if the foliage is dense. With boom nozzle systems on fixed-wing aircraft and helicopters we prefer a spray volume of 5 to 10 gallons per acre for fungicides on field and vegetable crops. We suggest 10 gallons for most orchard work.

I classify aerial spray volumes as follows:

Normal or High volume-5 to 10 gallons per acre.
Low volume-2 to 5 gallons per acre.
Ultra-low volume-less than 1 gallon per acre.

Ultra-low volume is gaining a lot of attention and is satisfactory for certain insecticides for the control of mobile or well exposed insects. At present it is not being recommended for the application of protective fungicides or residual miticides.

MICRONAIR ROTARY ATOMISER

These units are growing in popularity. They utilize a ro-

tating wire mesh cage which breaks up the spray into more uniform droplet sizes than conventional nozzles. This improves efficiency and uniformity of distribution and a considerable reduction in liquid is possible with the Micronair compared to the conventional boom nozzle sprayers. Potatoes are being sprayed with Dithane at 2 to 3 gallons per acre. The Micronair imparts its own rotation to the spray and this added to the normal spiral motion, initiated by the aircraft, improves coverage to vertical stems and the undersides of leaves.

HELICOPTERS

The Helicopter is an excellent piece of equipment for aerial application, It may be more expensive to purchase, maintain and operate. The down draft while hovering is impressive but at normal operating speeds of 45 to 65 mph the penetration of foliage is about the same as most fixed-wing aircraft. The spray pattern is quite uniform but does require relocation of certain nozzles to take care of minor distrotions in the air stream. The helicopter also imparts a desirable, entrained rotational movement to the spray from the vortices created by the rotor blades. As with fixed-wing aircraft, this rotational movement, repeated several times, improves the coverage and deposit to all the plant surfaces. The effective swath width for a helicopter is only slightly more than the length of the boom and the rotor blades. We recommend 5 to 10 gallons per acre for fungicedes with helicopters, the same as with fixed-wing boom-nozzle systems.

CONTROL OF EARLY BLIGHT

Aerial application of fungicides is highly satisfactory for the control of early blight of potatoes. The important factors needed are:

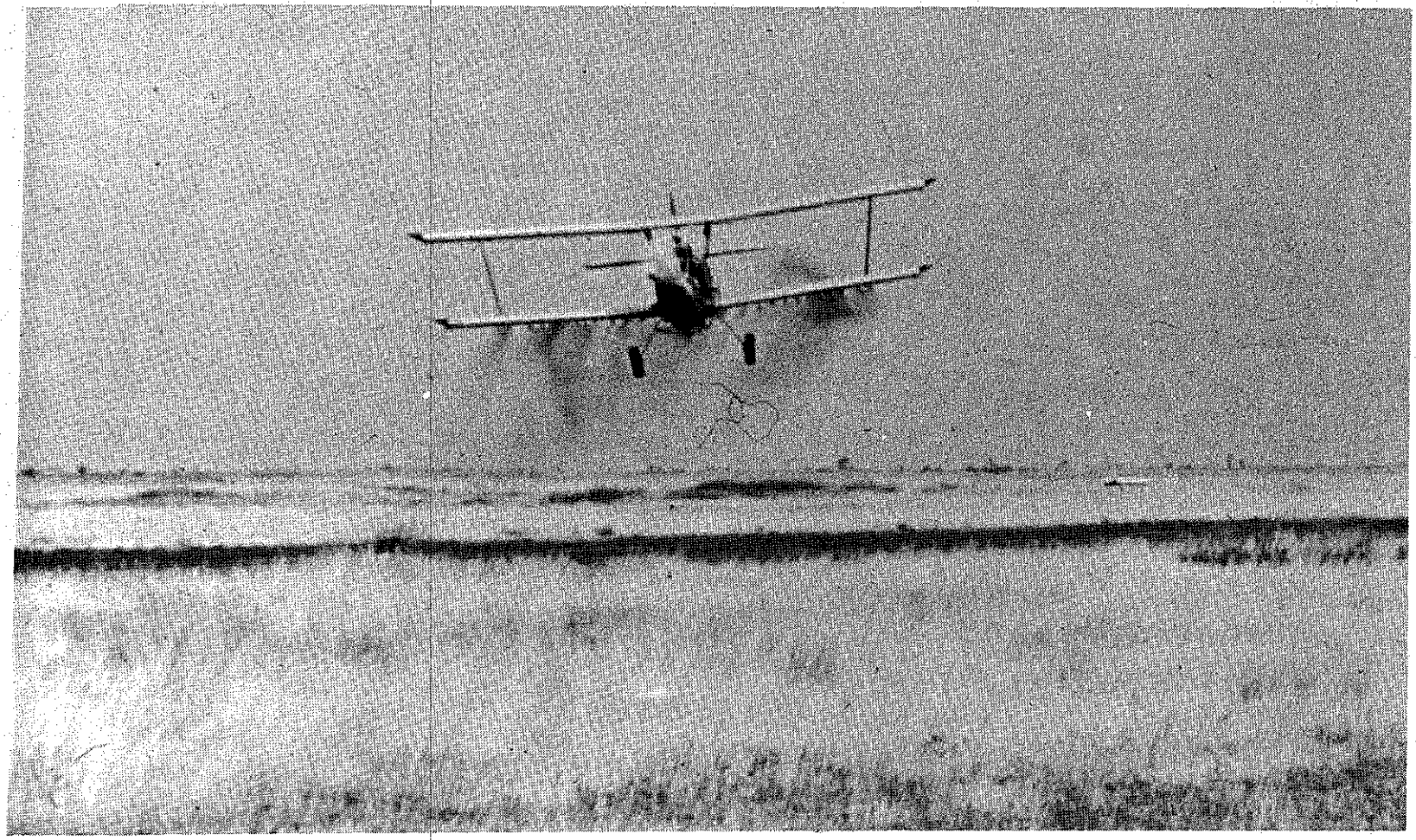
1. Uniform coverage.
2. Regular spray program.

All aircraft should be carefully checked for swath width, droplet size and most expecially uniformity of spray distribution, free of streaks and irregularities.

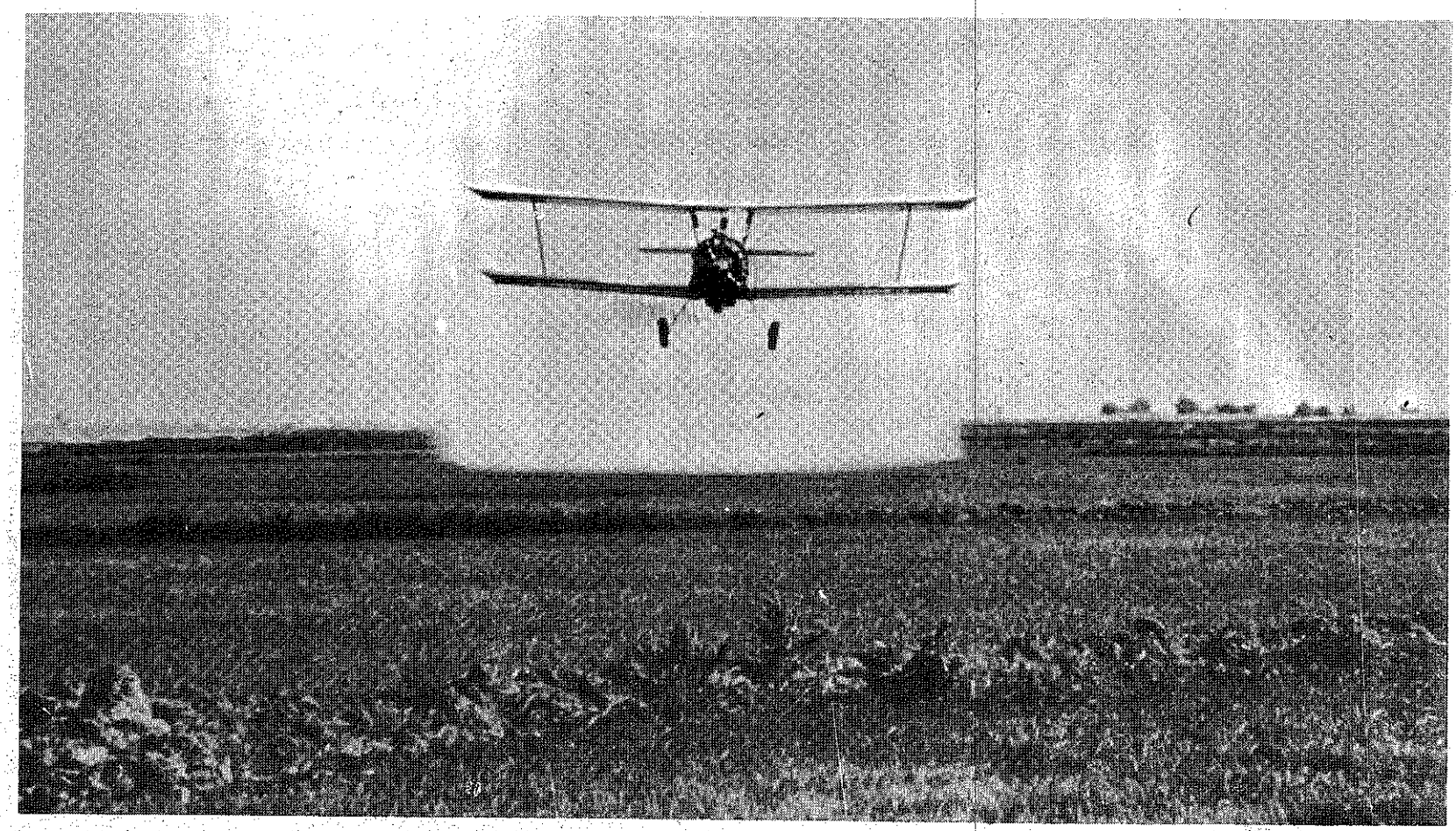
The fungicides in use today are protective materials used to prevent the establishment and spread of the disease. The program must be started when the plants are small and before disease is prevalent. Sprays should be repeated every 7 to 14 days or with every irrigation cycle. This builds up and maintains a residual spray deposit in the lower part of the plant and keeps the new growth covered. The number of sprays per season may vary from 3 to 6 or more depending upon the disease severity, the irrigation cycle and the length of the growing season. Early blight tuber rot is best prevented by controlling the infection on the foliage.

AGRICULTURAL USE TO INCREASE

We can expect a marked increase in the use of helicopters and fixed-wing aircraft for agricultural purposes. In addition to pesticide application, aircraft offer fast, efficient and sometimes more economical ways of broadcast seeding small grains, soybeans, forage and cover crops. They are being used increasingly for fertilizing and top dressing. Minor but unique uses are for frost protection, drying fileds or orchards and patrolling destructive bird and wildlife populations.

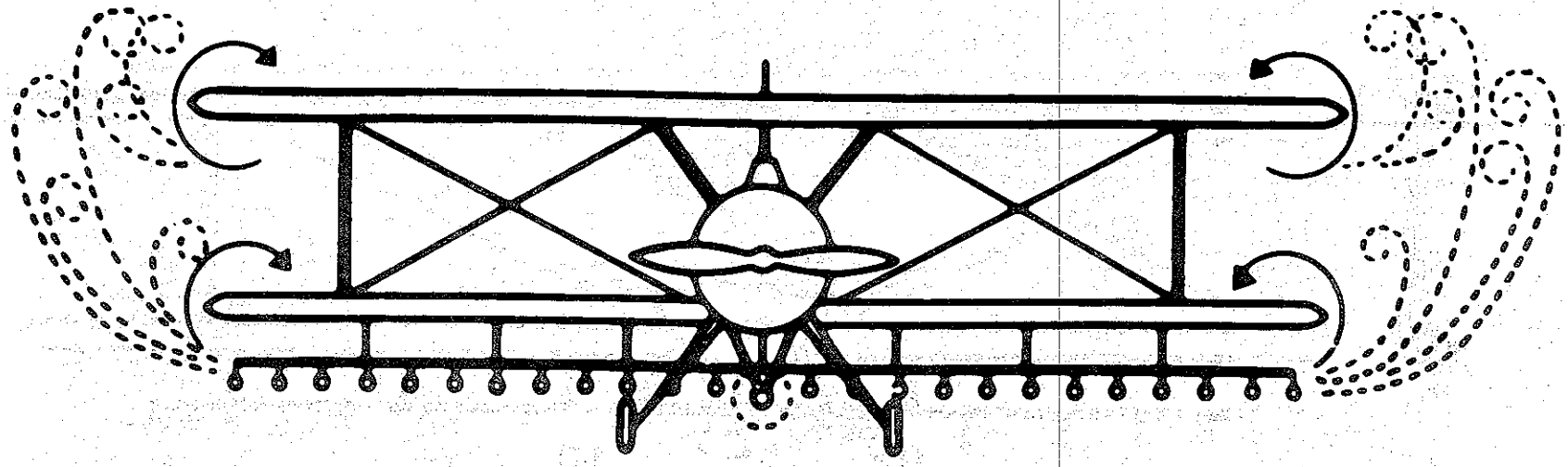


Uneven spray pattern as a
result of poor nozzle placement.

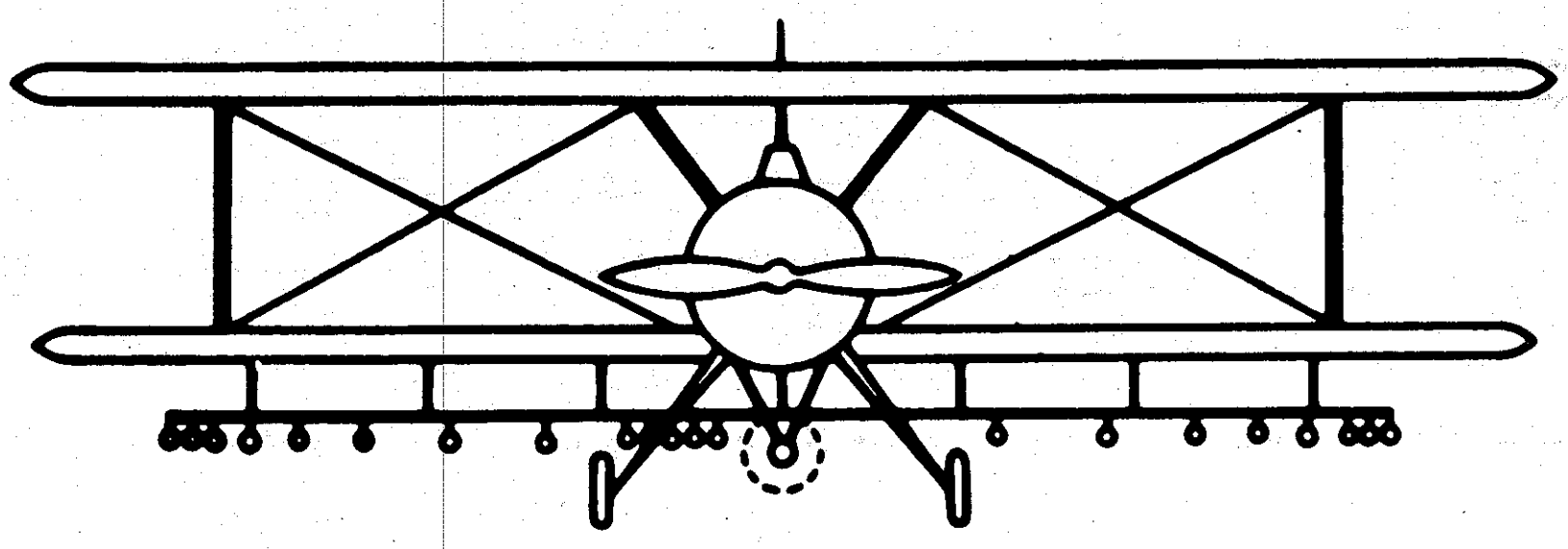


Same aircraft after relocation of nozzles to produce uniform spray pattern.

Streaked spray pattern from
improperly placed nozzles



Regular spacing of nozzles will produce streaked spray pattern. Nozzles near wing tip cause loss of spray and excessive drifting of fine droplets.



Asymetrical arrangement of nozzles compensates for distortion of the airstream by the propeller and wing tip vortices and produces an even spray pattern.