FINAL REPORT

FOR 2005-2006 FISCAL YEAR

FROM

CALIFORNIA AGRICULTURAL AIRCRAFT ASSOCIATION

TO

ALMOND BOARD OF CALIFORNIA

PROJECT NUMBER: **05-RS-01**

PROJECT TITLE: Deposition Testing and Pattern Refinement for Spray Swath Analysis and Drift Minimization

PROJECT LEADER: Richard Stoltz

INTRODUCTION

When applying agricultural chemicals to crops, whether by ground or air, pattern variability and drift are important. The less variable the spray pattern, the more even the crop production chemical is applied. This minimizes streaking and lack of efficacy. Additionally, by increasing efficacy, fewer applications may be needed. Fewer applications reduce cost and puts less chemicals into the environment. Also, pattern anomalies at the outside edges of the pattern indicate wing tip vortices that created conditions suitable for off target movement. By minimizing drift, adjacent crops, dwellings, and environmentally sensitive areas are not impacted by unwanted pesticide contamination.

The California Agricultural Aircraft Association (CAAA), through its Aerial Deposition Alliance Program (ADAP), has an ongoing program to work with aerial applicators of crop production products. The program is designed to minimize drift, ensure even distribution of products, maintain use of products for aerial use, minimize product performance issues, meet regulatory requirements, and to meet specific label requirements. Also, analysis helps to ensure that agricultural aircraft are applying almond pest management products in the most efficient, cost effective, and environmentally sound manner possible.

To meet these objectives, CAAA employees the CAAA Digital Field Fluorometer, the WRK DropletScan, and the WRK Drift Tower. With the use of these apparatus and software, CAAA and ADAP can monitor and adjust aircraft to meet the goals and objectives necessary for proper application of agricultural crop production products.

MATERIALS AND METHODS

Pattern and droplet analysis. Twenty four aircraft were studied. They were all aircraft that have been used in applying almond crop production products. All were fixed winged aircraft. They were radial and turbine powered Ag Cats and mono winged Thrush and Air Tractor models. All were set up to meet physical requirements used to mitigate drift. That is, the booms on the airplanes were no longer than 75% of the wing span. All aircraft were set up to apply ten gallons per acre.

Each aircraft was supplied with 100 gallons of water and 8 ounces of Rhodamine dye. The dye fluoresces and can be read by the Fluorometer.

A string fed system was set up perpendicular to the wind and was 125 feet in length. Three passes were made with each aircraft flying into the wind. The string was wound up after each pass and before the third pass was made, Syngenta water sensitive cards were placed along the string at 5 foot intervals starting 20 feet left of center and continuing to 20 feet to the right of center. After the third pass, the cards were also collected.

The cards were placed on a flat bed scanner and analyzed using the WRK DropletScan System. These were analyzed for Volume Median Diameter (VMD), volume diameter 0.1

(Vd 0.1), volume diameter 0.9 (Vd 0.9), and percent of spray volume < 200 microns and < 150 microns. VMD indicates that ½ the spray volume is made up of droplets smaller and ½ the spray volume is made up of droplets that are larger then VMD. Vd 0.1 indicates that 10% of the spray volume is made up of droplets that are smaller and Vd 0.9 indicates that 10% of the spray volume is made up of droplets that are larger. The string was placed on the CAAA Digital Field Fluorometer and each pass was analyzed for coefficient of variation (C.V.) for both a race track and back and forth spray pattern and observations made for indications of wing tip vortices.

RESULTS AND DISCUSSION

Pattern analysis. For optimum patterns in aerial applications, the C.V. should be 20% or less for herbicide applications while 25% to 30% C.V. is acceptable for applications of insecticides and fungicides. This data may be found in Table 1.

Table 1

Coefficient of Variation, Swath Analysis and Product Suitability

Aircraft	Race Track	Herbicides	Other pesticides	Back and Forth	Herbicides	Other pesticides
1	16	Y	Y	21	N	Y
2	11	Y	Y	14	Y	Y
3	21	N	Y	21	N	Y
4	17	Y	Y	14	Y	Y
5	20	Y	Y	38	N	N
6	27	N	Y	27	N	Y
7	6	Y	Y	10	Y	Y
8	10	Y	Y	14	Y	Y
9	4	Y	Y	3	Y	Y
10	9	Y	Y	9	Y	Y
11	35	N	N	35	N	N
12	10	Y	Y	17	Y	Y
13	21	N	Y	23	N	Y
14	12	Y	Y	14	Y	Y
15	19	Y	Y	19	Y	Y
16	17	Y	Y	17	Y	Y
17	6	Y	Y	10	Y	Y
18	11	Y	Y	10	Y	Y
19	19	Y	Y	18	Y	Y
20	10	Y	Y	12	Y	Y
21	17	Y	Y	19	Y	Y
22	18	Y	Y	24	N	Y
23	20	Y	Y	23	N	Y
24	14	Y	Y	17	Y	Y

Herbicide and other pesticide suitability. Y = Yes, N = No

Most aircraft met the requirements for herbicides when considering the race track application pattern. Those that did not, except in two cases, were acceptable for applications of products other than herbicides. For the back and forth application pattern, there were more aircraft that did not meet herbicide criteria, but again, only two did not meet criteria for other pesticides. The race track application pattern is the most common method used for fixed wing aircraft. In cases where aircraft did not meet minimum standards, they were adjusted and retested until minimums were met or exceeded.

Droplet Scan analysis. For drift minimization, the Vd.0.1 should be no lower than 200 microns and % of spray volume < 200 microns should not exceed 10%. Also, droplets less than 150 microns are considered to be driftable.   This information is found in Table 2.

Table 2

Droplet Spectra Analysis

Aircraft	%<150m	%<200m	VMD	Vd 0.1	Vd 0.9
1	3.5	7	388	215	574
2	4	9	437	206	662
3	2	5	534	249	820
4	3.1	7.3	573	217	854
5	1.6	2.8	516	266	692
6	2.5	7.5	429	224	616
7	3.4	9.6	424	206	653
8	2.9	7.4	450	218	663
9	2.5	6.0	480	235	704
10	2.8	6.8	397	224	590
11	2.4	7.0	451	230	671
12	1.0	5.3	448	247	653
13	2.1	3.9	559	259	789
14	3.0	10.0	413	204	653
15	1.2	3.5	595	298	836
16	2.1	6.8	539	232	832
17	2.4	8.0	419	218	618
18	2.5	9.0	389	216	599
19	1.1	6.0	469	246	640
20	4.0	10.0	376	192	578
21	2.0	7.2	458	235	683
22	1.7	6.1	477	256	663
23	3.5	6.5	441	226	651
24	3.6	6.2	406	222	598

All aircraft but one met or exceeded the minimum parameters for Vd 0.1. That aircraft did meet the criteria of % of spray volume less than 200 microns. All of the other aircraft also met the criteria for drift minimization of % of spray volume less than 200 microns. None of the aircraft had percentages of the spray volume less than 150 microns that would be considered abnormal.

CONCLUSIONS

From the aircraft studied, the potential for drift is minimal and the likelihood of a good, efficacious application is present. Also, these aircraft, as configured, are not likely to create a drift problem during application as long as other drift mitigating measures are employed. These measures would include applying when wind speed (3 to 10 mph), wind direction (away from sensitive areas), and application height (10 to 14 feet) are favorable, and avoiding applying during low level inversion conditions.

AKNOWLEDGEMENTS

The author would like to thank the Almond Board of California for providing continuing funding for these studies.

I would also like to thank the 18 aerial applicators and their pilots for their help and assistance in conducting these studies. Also to be acknowledged are Dow AgroSciences and Valent USA Corporation for their support of aerial deposition testing.