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MEMORANDUM

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SUBJECT: PRELIMINARY MONITORING RESULTS OF THE FIFTH SPINOSAD
AERIAL APPLICATIONS FOR MEXICAN FRUIT FLY ERADICATION IN
VALLEY CENTER, SAN DIEGO COUNTY (STUDY 216)

The Department of Pesticide Regulation (DPR) conducted the fifth monitoring in a series of spinosad aerial applications to eradicate the Mexican fruit fly in Valley Center on March 5-6, 2003. During this application, DPR staff collected deposition, surface water, air, fruit, and tank samples. Deposition samples were taken at 23 sites with an average concentration of 1.40 $\mu\text{g}/\text{ft}^2$, 43% of the 3.26 $\mu\text{g}/\text{ft}^2$ target application rate, and lower than the 57% average of the previous four applications. Deposition samples were also collected at three sites within the Keys Creek buffer zone. Spinosad was quantified in two of three samples at 0.18 and 0.22 $\mu\text{g}/\text{ft}^2$ and a trace amount was detected in the third site. None of the surface water and air samples contained detectable residues of spinosad. Background fruit samples from one site contained trace to 0.034 parts per billion (ppb) spinosad residue, and none detected on the other site. All fruit samples collected after the application contained trace to 0.019 ppb residue. Tank mix concentrations were 0.0078% to 0.0093% (0.0084% average) versus a target concentration of 0.0080%. No organophosphates, carbamates, and chlorinated hydrocarbons were detected in the tank mix sample.

Introduction

The California Department of Food and Agriculture (CDFA) is conducting aerial applications with spinosad to eradicate the Mexican fruit fly infestation in the Valley Center area of San Diego County. The application area consists of 28 square miles (mi^2), of which 23 mi^2 are treated using aerial applications and five square miles are treated using ground applications. CDFA plans to aerially apply spinosad once every two weeks and as the temperature increases, change to once every ten days for two life cycles of the pest to effectuate eradication. The fifth application was conducted two weeks after the fourth application.



Materials and Methods

The pesticide product and application method used in this application was the same as the previous applications, using GF-120 NF Naturalyte Fruit Fly Bait (U.S. Environmental Protection Agency Registration Number 62719-498), containing 0.020% spinosad by weight (mixture of spinosyn A and spinosyn D) as the active ingredient. For the application, GF-120 NF was diluted with water to a tank mix target concentration of 0.0080% (by weight) of spinosad or 0.363 grams per gallon. The spinosad target application rate was 3.26 $\mu\text{g}/\text{ft}^2$ (0.142 g/acre, or 35.1 $\mu\text{g}/\text{m}^2$). The fifth application started on March 5 at 8:00 p.m. and ended on March 6 at 5:10 a.m. The applications were made using three fixed-wing aircraft, with a swath width of 100 feet (ft) each, sprayed in east and west directions at an altitude of approximately 500 ft. CDFA established buffer zones around several water bodies that are excluded from the aerial application.

Spinosad residues were measured in deposition, surface water, air, fruit, and spray tank mixture samples. Deposition samples were collected using one ft^2 mass deposition sheets. Deposition sheets were set at 23 sampling sites dispersed throughout the treatment area (Figure 1). In addition, three deposition sites were sampled within the buffer zone around Keys Creek. The sheets were set at sampling sites before application and collected after each application. Background water samples were collected from Keys Creek (Figure 1) before application on March 5 and water samples were also collected after application on March 6.

Air samples were collected from four sites (Figure 1) using XAD-2/glass-fiber filter tubes (SKC#226-30-16) and personal air sampling pumps (SKC#224-PCXR8) at a constant flow rate of approximately 3000 ml/min. At each of the four sites, a single sampler was set approximately four to six feet above the ground and protected from direct application. Background air samples were taken for approximately 24 hours before application; application samples were collected for the duration of application; and post-application samples were taken for 24 hours after application.

Fruit samples were collected from two orchards (Figure 1). At each sampling site, two grapefruit trees were randomly picked (the same trees are being used for the duration of the treatment program) and two samples were collected, one from the upper and the other from the lower portions of the trees at randomly chosen compass directions. For each sample, two grapefruit were collected from each of the two trees placed into a stainless steel bucket, and covered with a stainless steel lid. Background fruit samples were collected prior to application and application samples were collected 4-5 hours after application.

Tank mix samples were collected from three aircraft. Each sample was a composite of subsamples from five nozzles on each aircraft. Tank samples were also collected from mixing tanks, loading manifold, and four lots of GF-120 concentrate (R. Segawa, D. Kim, and P. Wofford. 2003).

The samples for deposition, air, fruit, and surface water were stored on dry ice. Surface water duplicates and tank mix samples were stored on ice until delivery to the CDFA Center for Analytical Chemistry for analysis. All samples were analyzed for spinosyns A and D, as well as the breakdown product spinosyn B. The deposition samples were extracted with methanol and analyzed using a liquid chromatograph with a tandem mass spectrometer detector (LC/MS/MS), providing a quantitation limit of $0.1 \mu\text{g}/\text{ft}^2$. The water samples were extracted with methylene chloride and analyzed using LC/MS/MS, providing a quantitation limit of 0.05 (ppb). Air samples were extracted with methanol and methylene chloride, and analyzed using LC/MS/MS providing a quantitation limit of $0.5 \mu\text{g}/\text{sample}$ ($0.116 \mu\text{g}/\text{m}^3$). Grapefruit samples were extracted with acetonitrile and water, and analyzed using LC/MS/MS providing a quantitation limit of 1 ppb. Outer-surface of fruit and inner surface of sample containers were rinsed with methanol and analyzed using LC/MS/MS providing a quantitation limit of approximately 0.0034 ppb (ng/g fruit). The tank mix sample was extracted with acetone and analyzed using a high-performance liquid chromatograph and ultraviolet detector, providing a quantitation limit of one ppm (0.0001%). The tank mixture sample was also screened for organophosphates, carbamates, and chlorinated hydrocarbons.

Results

Results of the deposition samples are listed in Table 1. All 23 deposition samples had detectable amounts of spinosad, ranging from trace amount to $6.324 \mu\text{g}/\text{ft}^2$. Average concentration was $1.40 \mu\text{g}/\text{ft}^2$, 43% of the $3.26 \mu\text{g}/\text{ft}^2$ target application rate. This result was lower than the 57% average of the previous four applications (Figure 2). The deposition samples were collected between 5:07 and 7:37 am on March 6 and four samples were collected in direct sunlight, after sunrise.

Two of the three buffer zone deposition samples detected 0.18 and $0.22 \mu\text{g}/\text{ft}^2$ of spinosad and trace amount was detected in the third site (Table 2). Average of these results ($0.149 \mu\text{g}/\text{ft}^2$) was similar to the average of the previous four applications ($0.142 \mu\text{g}/\text{ft}^2$).

Spinosad was not detected in any of the surface water and air samples. These results were the same as the previous four applications.

Fruit samples collected before application (background) from one orchard contained no detectable spinosad residue and those from another orchard contained 0.034 ppb (ng/g) on the lower portion and trace amount on the upper portion of the sampled trees. All fruit samples collected after application contained trace amount to 0.019 ppb spinosad residues (Table 3). These results were comparable to those in the previous applications. The grapefruit samples collected for this application were not mature and, therefore, are unsuitable for determining legal compliance with the tolerance, although all application samples were less than the 300 ppb tolerance level for mature fruit.

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Spinosad concentrations for the aircraft tank mix samples were 0.0078% to 0.0093% with average of 0.0084% (Table 4). These concentrations were 98% to 116% of the target concentration, 0.0080%. In the fifth application, 5835 gallons of spinosad mix was applied over 14,847 acres for a nominal application rate of 3.28 $\mu\text{g}/\text{ft}^2$. This is 101% of the target rate of 3.26 $\mu\text{g}/\text{ft}^2$. Screening tests showed no detectable organophosphate, carbamate, or chlorinated hydrocarbon pesticides. Other results of tank samples collected from mixing tanks, loading manifold, and four lots of GF-120 concentrate are in a separate report (R. Segawa, D. Kim, and P. Wofford. 2003).

The fifth application occurred during a clear night with temperature 36-43° F, relative humidity 94-99%, and wind speed 0-1 miles per hour (<<http://cdec.water.ca.gov/queryCSV.html>>).

Reference

R. Segowa, D. Kim, and P. Wofford. 2003. Malathion Contamination in the Spray Material Used for Mexican Fruit Fly Eradication in Valley Center, San Diego County. California Environmental Protection Agency, Department of Pesticide Regulation, Sacramento, California.

<<http://cdec.water.ca.gov/queryCSV.html>>. California Department of Water Resources, Division of Flood Management, Sacramento, California.

Results reported here are also available at DPR's Web site at <<http://www.cdpr.ca.gov/docs/mexfly/>>.

Table 1. Monitoring results for deposition samples. The amount of spinosad is sum of the individual spinosyns (A, D, and B). The target amount is 3.26 $\mu\text{g}/\text{ft}^2$.

Code	Spinosad ($\mu\text{g}/\text{ft}^2$)
1	0.460 ^a
2	3.221
3	1.261
4	2.430
5	0.939
6	1.229
7	3.669
8	0.627
9	2.449
10	1.301
11	0.530
13	0.519
14	1.815
15	0.582
16	Tr ^b
17	6.324
18	1.436
19	1.283
20	0.445
22	0.100
23	0.657
25	0.746
26	0.226
Average	1.404
Std. Dev.	1.443
Std. Error	0.301
Minimum	0.054
Maximum	6.324

^a Sum of detected spinosyns (A, D, and B), wherever none detected (less than a detection limit of 0.008, 0.020, and 0.028 $\mu\text{g}/\text{ft}^2$ for spinosyn A, D, and B, respectively) the quantity of 0 $\mu\text{g}/\text{ft}^2$ was used, and wherever trace amount (less than a quantitation limit 0.1 $\mu\text{g}/\text{ft}^2$ for each individual spinosyn A, D, and B) was detected, the quantity of (quantitation limit + detection limit)/2 $\mu\text{g}/\text{ft}^2$ was used to calculate the sum of spinosyns in this report.

^b Trace amount was detected.

Table 2. Monitoring results for buffer zone deposition samples. The amount of spinosad is sum of the individual spinosyns (A, D, and B).

Code	Spinosad ($\mu\text{g}/\text{ft}^2$)
12	0.175 ^a
21	0.219
24	Tr ^b

^a Sum of detected spinosyns (A, D, and B), wherever none detected (less than a detection limit of 0.008, 0.020, and 0.028 $\mu\text{g}/\text{ft}^2$ for spinosyn A, D, and B, respectively) the quantity of 0 $\mu\text{g}/\text{ft}^2$ was used, and wherever trace amount (less than a quantitation limit 0.1 $\mu\text{g}/\text{ft}^2$ for each individual spinosyn A, D, and B) was detected, the quantity of (quantitation limit + detection limit)/2 $\mu\text{g}/\text{ft}^2$ was used to calculate the sum of spinosyns in this report.

^b Trace amount was detected.

Table 3. Monitoring results for fruit samples. The total spinosad is sum of spinosyns (A, D, and B) in both fruit and rinse of fruit and container.

Site Code	Sampling Portion	Spinosad (ppb)	
		Background	Application
3	upper	Tr ^a	0.019 ^b
3	lower	0.034	0.003
27	upper	ND ^c	0.014
27	lower	ND	Tr

^a Trace amount (less than quantitation limits of 1 ppb for grapefruit and 5 ng/sample (~0.003 ppb) for rinse of fruit and container) was detected

^b Sum of detected spinosyns (A, D, and B) in fruit and rinse of fruit and container, wherever trace amount was detected in the rinse, the quantity of half quantitation limit was used to calculate the sum in this report.

^c None Detected, with a detection limit for fruit samples at 0.903, 0.716, and 0.959 ppb spinosyn A, D, and B, respectively, and a quantitation limit for rinse of fruit and container. Detection limit for rinse was not available.

Table 4. Monitoring results for tank samples. The amount of total spinosad is sum of the individual spinosyns (A, D, and B). The target tank mix concentration is 0.008%.

Aircraft	Spinosad (%)	% of Target
N7OU	0.0093	116
N7136M	0.0078	98
N7198Y	0.0081	101
Average	0.0084	105

Figure 1. Sampling sites for the third and fourth aerial spinosad applications
(February 4-5 and February 18-19, 2003)

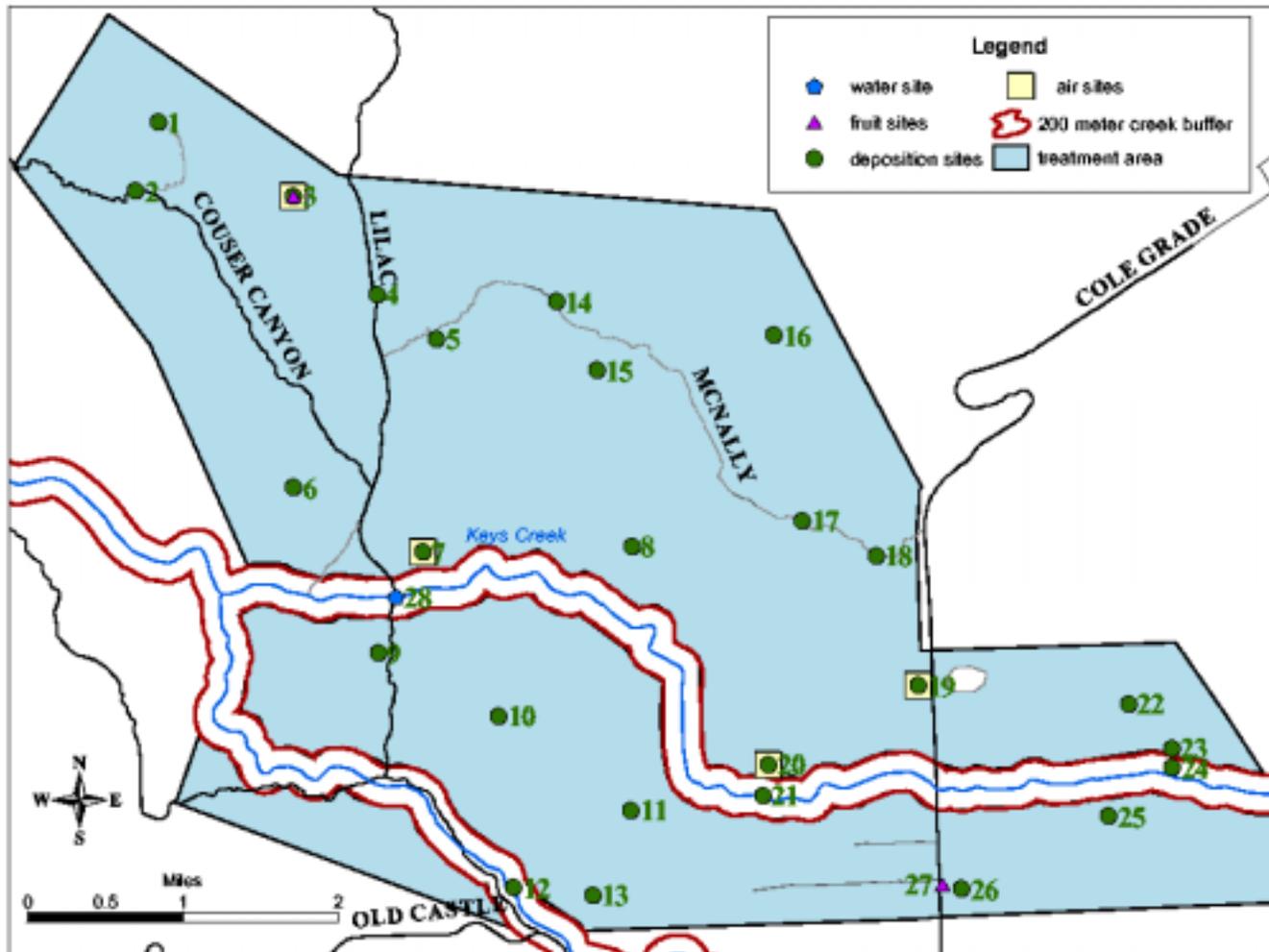


Figure 2. Comparison of average (± 1 standard error) deposition spinosad.

