APPENDICES

APPENDIX A

DOWNWIND AIR CONCENTRATIONS AND DEPOSITION AMOUNTS OF PESTICIDES FROM AERIAL SPRAY DRIFT.

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Predicted Air Concentrations of Selected Pesticides Using AgDRIFT® 2.0.05 for Agricultural Applications

AUTHOR

David M. Esterly

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For:
Eastern Research Group
110 Hartwell Avenue
Lexington, MA 02421

By:

Environmental Focus, Inc.
2801 Bexley Ct.
Wilmington, DE 19808

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EXECUTIVE SUMMARY

The Nevada Department of Human Resources, Nevada State Health Division, identified an increase in the incidence rate of leukemia in children in the Fallon area. Fallon is a small city located within Churchill County, Nevada. In March 2001, the state of Nevada requested the Agency for Toxic Substances and Disease Registry (ATSDR) to assist the local and state health and environmental agencies in evaluating possible environmental factors that could be associated with the higher than expected rate of leukemia. ATSDR discovered that residents were concerned about the potential health effects from pesticide and herbicide applications to control pests on crops and to control mosquitoes in the Fallon area.

As part of ATSDR's environmental evaluation, a spray drift model was used to estimate the potential exposure of area residents to agricultural pesticide applications. ATSDR identified several mathematical models that could be used to evaluate pesticide spray drift. The model selected for use in this study is AgDRIFT®, which was developed as part of a cooperative research agreement among the U.S. Environmental Protection Agency, U.S. Department of Agriculture, and the Spray Drift Task Force. The AgDRIFT® model was used to estimate the potential exposure of area residents to agricultural pesticide applications. Two "worst case scenarios" were developed for applications to alfalfa, which is the most common crop in the Fallon area. The scenarios considered downwind air concentrations resulting from the aerial application of two common pesticides: 1) paraquat dichloride (Gramoxone® Extra) and 2) ethyl parathion (Parathion 8 EC).

The overall conclusions from the results of the agricultural spray drift model are provided below:

- The air concentration predicted by the AgDRIFT® model at a location 500 feet down wind from the spray field for the herbicide Gramoxone Extra was 22.6 nanograms per liter. This concentration was predicted with a wind speed of 5 miles per hour assuming a "fine" drop size distribution.

- The maximum down wind air concentration predicted by the AgDRIFT® model for the pesticide Parathion 8 EC was 4.5 nanograms per liter. This concentration was predicted at a distance of 500 feet downwind with a wind speed of 10 miles per hour and assuming a "fine" drop size distribution.

- The difference in predicted concentrations between Gramoxone Extra and Parathion 8 EC is a function of the concentration of the product being applied and the different application rates. Gramoxone Extra is a relatively dilute application and parathion 8 EC is considered a concentrated application. The different application rates combined with the different levels of product dilution affect the dispersion.

- The results of the spray drift model show that regardless of how dilute or concentrated the product used, the greatest potential for pesticide exposure will be within short distances (i.e., less than 500 feet) downwind of the target area or application zone. The further down wind from the application zone the more dilute the air concentration of the pesticide, even though the total mass (amount) of pesticide aloft remains relatively constant.

- The total amount of pesticide in the air down wind from the application zone is not heavily influenced by the wind speed. Wind speed does not have as large an impact on downwind concentrations as the drop size distribution or the product being applied (i.e., dilute or concentrated).

- According to the model results, there is approximately a four-fold reduction in the air concentrations when applying the pesticide product with a medium spray (i.e., drop size distribution class) compared with a fine spray.

1.0 INTRODUCTION

A spray drift modeling study was conducted to predict the downwind air concentration of two pesticides applied aerially and used for the control of weeds and insects on alfalfa crops. The herbicide and insecticide products used in the model were represented by Gramoxone® Extra, which a relatively dilute application, and Parathion 8 EC, which is considered a concentrated application. The drift was predicted using the AgDRIFT® 2.0.05 model (Teske et. al. 2001) employing site-specific inputs. This set of regional conditions was then systematically modified to reflect the range of meteorological conditions one would expect in the Fallon, Nevada area during the normal application season.

The model evaluation considered aerial applications under the following spray conditions: “fine,” “fine to medium,” and “medium” spray drop size distribution classified according to the American Society for Agricultural Engineers (ASAE) S571 spray droplet size standard. The selected drop size distributions represent the majority of aerial applications from fixed winged aircraft.

2.0 BACKGROUND

In July 2000, the Nevada Department of Human Resources, Nevada State Health Division (NSHD), identified an increase in the incidence rate of leukemia in children for Churchill County, Nevada. A majority of the leukemia cases have been identified within the city of Fallon, located within Churchill County. Fallon is the largest population center in the county with approximately 7,540 residents. Approximately 23,980 people live in the surrounding unincorporated parts of Churchill County, which includes just less than 4,930 square miles of land (US Census Bureau 2000).

In response to this unexplained increase in leukemia, resources from local, state, and federal agencies were mobilized to provide scientific and technical expertise in hopes of better understanding the cause of the leukemia cluster. In March 2001, the state of Nevada requested the Agency for Toxic Substances and Disease Registry (ATSDR) to assist the local and state health and environmental agencies in evaluating historical contaminant releases and potential exposure pathways that could potentially contribute to the increase in leukemia within Churchill County. As part of the agency's efforts to assist NSHD, ATSDR has attended meetings in Fallon, participated in public availability sessions, conducted site visits within Churchill County (e.g., Nevada Department of Agriculture and Churchill County Mosquito Abatement District), met with state agencies (e.g., NSHD and Nevada Division of Environmental Protection [NDEP]) and gathered information about potential environmental exposures, and recorded community environmental health concerns.

During these site visits and discussions with members of the community, ATSDR discovered that residents were concerned about the potential health effects from agricultural pesticide and herbicide spray drift as well as spraying to control mosquitoes and other pests in the Fallon area. As part of ATSDR's environmental evaluation, a review of the agricultural spray drift literature was conducted and models that have been used to evaluate spray drift were identified. The model selected for use in this study is AgDRIFT®, which was developed as part of the cooperative research agreement among the US Environmental Protections Agency (EPA), US Department of Agriculture, and the Spray Drift Task Force (SDTF).

The AgDRIFT® model was used to estimate the potential exposure of area residents to agricultural pesticide applications. AgDRIFT® is known for its ease of use, consistent reporting, comprehensive input descriptions, and extensive database support for meteorological conditions, aircraft setup, and atomization parameters. AgDRIFT® is the model used by most pesticide regulatory authorities, including the EPA, to estimate deposition and air concentration of pesticides during and shortly after application.

For purposes of this study, two "worst case scenarios" were developed for applications to alfalfa, which is the most common crop in the Fallon area and accounts for approximately 75 percent of the agricultural acreage (USDA 1997). The scenarios considered downwind air concentrations resulting from the aerial application of two common pesticides: 1) paraquat dichloride (Gramoxone® Extra) and 2) ethyl parathion (Parathion 8 EC)[1]

The “worst case” model approach is a common strategy that allows the selection of model inputs that maximize drift potential and allows extrapolation results to other application scenarios. For example, SDTF studies have shown that drift is independent of the amount and type of active ingredient, but is a function of initial concentration of non-volatile components of the spray tank mixture (SAP 1997). Thus the model prediction for a Gramoxone® tank mix of 0.74 lbs./acre, diluted with 5 gals./acre of water can be applied to any pesticide of similar spray tank composition by scaling the Gramoxone® results based on the ratio of non-volatile concentration in the tank mix.

The AgDRIFT® model has been verified by examining data from 180 aerial field study treatments performed by the SDTF and numerous studies conducted by the US Forest Service. EPA conducted a Scientific Advisory Panel (SAP) review in December 1997 to evaluate the SDTF aerial data and the AgDRIFT model (Bird 2001;SAP 1997). All validations have shown the usefulness of AgDRIFT® for predicting pesticide deposition as a function of distance from the application zone.

1 Ethyl parathion is no longer registered for use in the United States.

3.0 OBJECTIVE

The objective of this study is to predict the off-target air concentration of pesticides used in Fallon, Nevada. The modeling was designed to be a conservative, but realistic representation of the potential exposure when applied to common agricultural crops. The model parameters are based on the maximum label use rate and site-specific application conditions. Model inputs not specified by the pesticide label are based on local agricultural practices and equipment.

4.0 MODELS AND METHODS

The AgDRIFT® Aerial model is a special case of the AGDISP (US Forestry Service Model) (Bilanin 1989). Both models assume a Lagrangian particle trajectory to track droplets in the turbulent flow fields near the application area. AgDRIFT® has been specially modified to evaluate downwind deposition and air concentrations. For this assessment of an aerial application, AgDRIFT® was used to calculate the downwind vertical pesticide mass profile or flux plane. The flux plane can be viewed as an imaginary vertical filter placed down wind of the application area. As the pesticide plume moves across the plane, the cumulative amount of product that passes through the flux plane is computed at each incremental distance above the ground. This mass flux is then converted to air concentration based on the vertical wind speed profile at the corresponding height above the ground. For the typical agricultural application scenario (release height of 7 to 10 feet) the AgDRIFT® model predicts a maximum mass flux at 2 to 3 meters above the ground and maximum air concentration at 2 meters above the ground (i.e., typical breathing level). Air concentrations at other elevations can be retrieved from the model output files. For purposes of this study, however, only the maximum air concentration is reported.

The AgDRIFT® model inputs are grouped into four categories: meteorological (section 4.1), equipment setup ((section 4.2), application parameters (section 4.3), and product physical properties (section 4.4). The modeling focused on the input parameters that have been shown to have the greatest effects on pesticide drift. These key inputs are selected based on the "worst case" scenario concept and are set to reflect upper limits of allowable or reasonable operating conditions. The remaining, lesser, parameters are based on regional best management practices, or model defaults. A summary of the model inputs is listed in Table 1. The model procedures are outlined in section 4.5.

4.1 Meteorological Inputs

The AgDRIFT® model includes three meteorological inputs considered to have the greatest influence on drift. Sensitivity studies have shown wind speed to be the most significant of these meteorological inputs. Most pesticide products limited the application conditions to less than10 miles per hour. However, applicators normally make applications in the early morning hours when wind speeds are at a minimum. Since wind speed is considered a critical input and can have a significant range of values, this study compared the expected air concentrations at wind speeds of 5 and 10 miles per hour.

The combined inputs of temperature and relative humidity control the rate of evaporation. For many application scenarios evaporation rate is not a dominant factor. However, in the desert surrounding Fallon, NV, the evaporation rate is a greater concern. Therefore, the selected model inputs for temperature and relative humidity represent the mean (i.e., average) values for the months of April and June in Fallon, NV (NCDC 2002). April and June were selected as representative months because most of the pesticides are applied to alfalfa crops in Churchill County in the spring (Personal communications with Jerry Frey, Pesticide Aerial Applicator, November 2001).

4.2 Equipment Setup

During the initial phase of this evaluation, ATSDR conducted an interview with the applicator that performs most of the agricultural spraying in the Fallon area. Based on the interview, it was determined that the Cessna Ag Truck 188 was the predominant aircraft used for agricultural applications. It was also determined that the aircraft was not highly modified and used the standard boom and nozzle arrangement supplied by the manufacturer. The Cessna aircraft is included in the AgDRIFT® Aerial Equipment Database developed by the U.S. Forest Service. This modeling study used the default aircraft configuration model and set the "spray boom" to 80 percent of the aircraft wingspan. The 80 percent boom length is considered to be maximum length for good pesticide coverage.

4.3 Application Parameters

The application parameters describe the conditions controlled by the applicator during the spray operation. These parameters include the spray release height, drop size distribution, aircraft speed, and spray swath. Of these model inputs, the release height and drop size distribution have a significant influence on the potential drift. The release height was set equal to the model default value of 10 feet above the crop, considered to be the maximum desirable release height for most applications.

Three different drop size distributions, as defined by ASAE standard S571, were evaluated in this study to simulate the range of drop sizes expected for aerial application for both insecticides and herbicides. The statistical descriptions of the three spray drop distributions are listed in Table 2. Atomization studies conducted by the Spray Drift Task Force, U. S. Forest Service, and other researchers show that most nozzles used in aerial application produce a Fine to Medium classification as defined by the ASAE standard. Many factors contribute to the drop size distribution including, the nozzle type, pump pressure, nozzle orientation, spray tank physical properties, etc. Since the applicator can adjust these parameters to achieve the desired drop size distributed, this study assumes the applicator sets the application parameters to produce a fine spray (insecticides) to a medium spray (herbicides). The AgDRIFT model was run using three different input values for drop size distribution; 1) fine, 2) fine-medium, and 3) medium (see Table 2 for specific parameters corresponding to each drop size). Coarse spray classifications can be achieved for aerial applications, but they would not be considered "worst case" scenario inputs for spray drift evaluations.

4.4 Product Physical Properties

The physical properties of the spray tank mixture can affect both the drop size distribution and the evaporation rate. The drop size distributions are addressed in Section 4.3 above (Application Parameters). Restricting the model drop size distribution (e.g., fine, fine-medium, and medium) to a standard size class such as the ASAE standard, allows the study to compare multiple products at similar conditions, but assumes the applicator is informed on spray methods and techniques such as nozzle selection and nozzle orientation to achieve the desired spray quality.

In most cases the evaporation is controlled by the water concentration of the tank mixture and limits the evaporation to the amount of water in the droplet. When all the water is evaporated from the droplet, the droplet size approaches the size of an aerosol spray. The movement of aerosol sprays is controlled more by their gaseous diffusion than by gravity and droplet deposition approaches zero, while the total mass of pesticide in the air remains constant.

This study attempts to investigate the maximum drift potential, which occurs when the drop sizes are at their smallest and have the highest concentration active product. The model simulates maximum evaporation rates by setting the tank mix water content to the lowest amount specified by the label. Low water content and the selection of low relative humidity and warm temperatures tend to accelerate evaporation to the point of dryness (the smallest droplets), which in turn increases the drift potential and the air concentration down wind of the application area.

4.5 Model Procedures

The model was run for each of the sample products, Parathion 8 EC and Gramoxone® Extra. The two models include the Cessna 188 Ag Truck, regional meteorological conditions, and spray material definitions for Parathion or Gramoxone. All major inputs are summarized in Table 1. The complete AgDRIFT® input summary for the two products is provided in Appendix A. The models were run to determine the following:

1. The air concentration of Parathion 8 EC and Gramoxone® Extra, as a function of downwind distance from a given application area. The air concentration for dilute sprays (Gramoxone®) and concentrated sprays (Parathion 8EC) were compared.

2. The effect of drop size distribution on air concentration using the three drop size distributions typically found in aerial applications.

3. The effect of wind speed on drift and air concentration. Increased wind speed increases the drift (fraction of the application aloft or not deposited) and increases the dilution of the application that is airborne. The combined effect is evaluated by comparing the air concentration (Tables 3a–3d) and the fraction aloft (Tables 5a–5d).

4. The effects of field size on drift and air concentrations. The fine and medium drop size distributions at wind speeds of 5 and 10 miles per hour were compared for each baseline model to evaluate the relationship between field size and potential air concentrations.

The AgDRIFT® model limits the maximum distance of the vertical flux plane to 2,500 feet. To investigate the air concentration beyond this distance, the air concentrations were extrapolated to 5,000 feet and 10,000 feet[2] The AgDRIFT® model does not limit the fraction aloft prediction to 2,500 feet. Several extrapolation method were tested and power function of the form

2 As with any extrapolating method, the results are untested and should be used with the appropriate precautions

$Y = a * X^b$ provided the most consistent results (see Figure 1).

$$Y = a * X^b$$

where: Y is the expected air concentration X feet down wind.

X is the distance down wind from the field edge in feet.

a and b are constants developed for each case.

The constants "a" and "b" are the individual curve fit parameters and were calculated using the "Microsoft® Excel 2000" Trend Line option. Appendix B contains a table of the power functions for each model case.

5.0 RESULTS

The results are summarized in Tables 3a to 3d, Table 4, and Tables 5a to 5d. The maximum air concentration was estimated for each wind speed and each product for the three drop size distributions (fine, fine-medium, and medium). The results of the spray drift model show that regardless of how dilute or concentrated the product used, the greatest potential for pesticide exposure will be within short distances (i.e., less than 500 feet) downwind of the target area. The consistency of the model results support the EPA's SAP conclusions regarding the applicability of AgDRIFT® for predicting pesticide deposition as a function of distance from the application zone.

Tables 3a–3d present the maximum one-hour time-weighted concentrations at the point in the spray plume where maximum concentrations are expected to occur. As shown in Tables 3a–3d, there is about a four-fold reduction in the air concentration for a medium spray versus a fine spray. This result is consistent with the Spray Drift Task Force field data and the findings of other researchers (Matthews 1992). The air concentration was also compared for two common field sizes of ¼ section and a full section of 640 acres (Table 4)[3]

The model demonstrates that at down wind distances of ¼ mile or more, most of the pesticide has deposited on the ground. The integration of the Pesticide Flux Profile (the amount of pesticide passing through a plane at a selected distance from the application zone) yields the total mass of pesticide aloft at that distance. This value divided by the total pesticide applied is defined as the fraction aloft or not deposited. Tables 5a to 5d presents the fraction aloft predicted for each of the model scenarios, expressed as the total mass to spray plume as the plume moves down wind (also see Figures 2a to 2d for graphical representation). Except for the ASAE fine

3 The spray tank capacity of the Cessna 188 is about 280 gallons sufficient volume to spray 140 acres at 2 gallon per acre. To spray a full section would require four or more tank loads of material. Although the field size does not change the mass of the pesticide lost to the local environment, it does affect the resulting air concentration due to the time period between each application load. This field size comparison is for reference only since it does not correct for the time require to refill the aircraft.

spray cases, the fraction aloft is less than one percent of the total amount applied within 0.5 mile (2,500 ft) of the application zone. The fraction aloft decreases to less than 0.5 percent of the total mass applied within 1 mile (5,000 ft) of the application zone.

6.0 DISCUSSION (Model Validity and Issues of Uncertainty)

6.1 Model Validation

The AgDRIFT® 2.0 model was evaluated by Bird et. al. using 180 field studies conducted by the SDTF. Bird et. al. reports that the AgDRIFT® model consistently over predicted the measured deposition. For example, when evaluating the far-field (i.e., beyond 600 feet from the edge of the field) distances AgDRIFT® over predicted the measured deposition by a factor of two, 80 percent of the time. Several explanations have been proposed as to why AgDRIFT® consistently over predicts in the far field (e.g., incomplete recovery of application product or differences in evaporation rates at or near the spray nozzle). However, from a public health perspective the tendency for the model to consistently over predict deposition may be considered an additional margin of safety (Bird et. al. 2001).

6.2 Predicted Air Concentrations

Based on the "worst case" scenario approach, the results presented in this report should represent a conservative estimate of air concentrations adjacent to and down wind from the spray block. AgDRIFT® calculates the air concentration by "time integration" of the total pesticide passing through the flux plane and divides the mass by the total air volume that would pass through the same point in space over a period of one hour. The air concentration is a function of both height and wind speed. The air concentrations reported in this study are the peak or maximum concentrations, which occur at a height of 3 to 6 feet above the ground.

As the droplets travel down wind they will evaporate. AgDRIFT® tracts the droplet size, concentration, and its position in space as it moves down wind. However, AgDRIFT® does not assume the droplets will collide or be removed by any surface other than the ground. In the real environment both man-made and natural structures likely remove a portion of the spray plume. Not accounting for this factor results in an over prediction of ground level pesticide concentrations down wind.

It should also be noted that although the AgDRIFT® model is likely to provide conservative estimates of downwind pesticide air concentrations; there are certain application exposures that the model may not account for. For example, the model does not account for active product that evaporates after being deposited on the intended target (i.e., alfalfa). The model also assumes that standard safe application practices are being followed by the applicator. If such practices are not followed, a greater portion of the product may be distributed away from its intended target and the model would consequently under predict exposures.

The model findings also indicate that down wind air concentration are not as dependent on wind speed as might be expected. Although this may appear to conflict with the concept that drift increases with wind speed, it shows the basic difference between drift and deposition. At large distances down wind the larger drops have time to deposit on the ground, leaving only the smaller droplets to reach the down wind vertical flux plane[4]. Although increased wind speeds keep a greater fraction of the spray particles aloft, thus increasing concentration, the higher wind speeds also transport greater volumes of air through the spray cloud, which acts to decrease concentration.

4 The number of droplets that reach the flux plane is proportional to the number of small drops (<100μ) in the initial drop size distribution and number of small droplets formed by evaporation. Although increasing wind speed increases the dispersion, the total pesticide in the air is a function of the number of small droplets and the concentration is thus more a function of dispersion time and distance down wind. As the distance increases the deposition approaches zero and the total mass of the product applied in the air is composed of small aerosol size droplets, which tend not to deposit but continue to be suspended and dispersed in the air. Thus the fraction aloft or total mass aloft remains constant, while the air concentration decreases due to dispersion of the pesticide as what remains in the air is transported down wind.

The deposition near the application area is often proportional to the application area. Table 4 shows that by increasing the application area by a factor of 4 the down wind air concentration increases by less than two-fold. This result reflects the increase in dispersion as one moves farther down wind from the application.

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Table 1: Recommended input values and rationale for developing two exposure scenarios for agricultural spray drift

Description of: AgDRIFT Model Inputs	Recommended Input Values for two spray drift exposure scenarios Scenario 1 (Gramoxone Extra)	Scenario 2 (Parathion 8 EC)	Rationale for Selecting Values
Equipment Setup			According to the primary spray applicator in the Fallon area, Jerry Frey, most of the agricultural spraying in the Fallon area is conducted with the Cessna AgTruck 188.
Aircraft Type	Cessna 188 Series	Cessna 188 Series	
Weight of Aircraft	2,768 lbs (average)	2,768 lbs (average)	
Wing Semi-span	20.8 feet	20.8 feet	
Flight Speed	115 mph	115 mph	
Swath Width	60 feet (COV 35%)	60 feet (COV 35%)	The Swath width is determined by the aircraft type Boom length and wind speed.
Swath displacement	22 feet (50% application rate)	22 feet (50% application rate	The swath displace in determined by wind speed.

Table 1: Recommended input values and rationale for developing two exposure scenarios for agricultural spray drift Continued

Application Parameters			
Number of Nozzles	34 (typical boom design)	34 (typical boom design)	
Nozzles type	3 sub cases see note	3 sub cases see note	The angle of the nozzle (e.g., horizontal and vertical offset) in relation to the direction and speed of travel affects droplet size. The droplet size is an important component of spray drift potential. Three drop size distributions based of the ASAE standard 571 will be model to evaluate the rage of expected drop sizes for aerial applications. The three ranges: fine VMD = 180μ, fine to medium VMD = 255μ, and medium VMD = 294μ are based on solid stream and CP nozzles used in the majority of aerial applications. The fine spray, represent the worst-case scenario and would not be typical of herbicide applications.
Vertical Offset	Aircraft default	Aircraft default	
Horizontal Offset	Aircraft default	Aircraft default	
Boom Span	80% of semi-span (common)	80% of semi-span (common)	
Spacing (even)	1 foot (typical boom design)	1 foot (typical boom design)	
Release Height	10 feet	10 feet	The release height of Gramoxone Extra is recommended not to exceed 10 feet. According to the primary applicator of pesticides in the Fallon area, most releases are lower than 10 Feet (generally ranges from 3 - 10 feet).

Table 1: Recommended input values and rationale for developing two exposure scenarios for agricultural spray drift continued

Meteorological Inputs			
Wind Speed (At 2 meters)	5 and 10.0 mph	5 and 10.0 mph	NOAA SAMSON Database Tonopah, NV
Wind Direction	Perpendicular to the spray path	Perpendicular to the spray path	Default Case
Surface Roughness (ft)	0.3	0.3	Surface Roughness 1–1.5 ft high grass
Stability	Stable conditions	Stable conditions	AgDRIFT limit
Relative Humidity	25 percent	25 percent	NOAA SAMSON Database Tonopah, NV
Temperature	60 degrees	60 degrees	NOAA SAMSON Database Tonopah, NV
			All meteorology conditions represent the 75th percentile April through June day light hours conditions.
Product Physical Properties			
Specific Gravity	0.9 to 1.0	0.9 to 1.0	The values entered for the nominal application rate are based on information reported in the Nevada Department of Agriculture's pesticide application registry database. The rates for each product listed are the maximum application rates that were identified for each product.
Nominal Application Rate	0.74 lbs/ac (label maximum)	0.4 lbs/ac (label maximum)	
Swath Width	60 feet	60 feet	
Nonvolatile Fraction	5.32 % (label mixing inst.)	31.2 % (label mixing inst.)	
Number of Flight Lines	20 model default (typical field size)	20 model default (typical field size)	To test case were investigate the effects on air concentration versus field size.

Table 2: Characteristics Associated With Drop Size Distributions

Parameter	ASAE standard S571 Classification		
	Fine	Fine to Medium	Medium
DV_{10} (μ)	76.2	113.8	131.2
DV_{50} (μ)	179.6	254.7	294.1
DV_{90} (μ)	366.5	443.7	517.9
Relative Span	1.6	1.3	1.3
Percent < 141 (μ)	34.0	15.9	11.7

Key:
[1] DV10 (μ) -The drop diameter (in microns) at which 10 percent of the spray volume is in drops smaller than this value, and 90 percent is in drops larger than this value.

[2] DV50 (μ) -The drop diameter (in microns) that divides the spray volume into two equal parts. For example, a DV50 of 150 microns means that 50 percent of the spray volume is in drops smaller than 150 microns, and the remaining 50 percent is in drops larger than 150 microns.

[3] DV90 (μ) - The drop diameter (in microns) at which 90 percent of the spray volume is in drops smaller than this value, and 10 percent is in drops larger than this value.

[4] Relative Span - A parameter representing the breadth of the drop size distribution, $(DV_{90}\text{-}DV0_{10})/DV0_{50}$.

[5] Percent < 141- Percentage of volume in drop sizes less than or equal to 141 microns. Droplets greater than 141 microns are generally considered to have little or no drift potential.

Table 3a: Down wind Air Concentration Gramoxone Extra 5 m/h wind speed

Gramoxone Extra --- 5 miles per hour wind speed			
Max Air Concentration ?g/l			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	22.583	8.308	5.736
1,500	7.840	2.732	1.781
2,500	4.491	1.589	0.990
5,000*	2.297	0.788	0.470
10,000*	1.151	0.387	0.221

* Downwind distances of 5,000 and 10,000 feet are extrapolated values.

Table 3b: Down wind Air Concentration Gramoxone Extra 10 m/h wind speed

Gramoxone Extra --- 10 miles per hour wind speed			
Max Air Concentration ?g/l			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	19.762	7.453	5.222
1,500	8.831	3.057	2.081
2,500	4.601	1.583	1.174
5,000*	2.718	0.888	0.569
10,000*	1.479	0.463	0.288

* Downwind distances of 5,000 and 10,000 feet are extrapolated values.

Table 3c: Down wind Air Concentration Parathion 8 EC 5 m/h wind speed

Parathion 8 EC --- 5 miles per hour wind speed			
Max Air Concentration ?g/l			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	3.592	1.299	0.815
1,500	1.112	0.445	0.243
2,500	0.614	0.253	0.132
5,000*	0.292	0.128	0.161
10,000*	0.137	0.064	0.080

* Downwind distances of 5,000 and 10,000 feet are extrapolated values.

Table 3d: Down wind Air Concentration Parathion 8 EC
10 m/h wind speed

Parathion 8 EC --- 10 miles per hour wind speed			
Max Air Concentration ?g/l			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	4.487	1.631	1.091
1,500	1.140	0.422	0.245
2,500	0.669	0.265	0.147
5,000*	0.284	0.114	0.058
10,000*	0.124	0.052	0.024

* Downwind distances of 5,000 and 10,000 feet are extrapolated values.

Table 4: Down wind Air Concentration comparison of field size

		Gramoxone Extra	Parathion 8 EC
Drop Size Distribution	Field Size	2500 ft down wind 5 m/h Concentration in ng/l	
Fine	1/4 section 160 acres	4.49	0.61
	1 section 640 acres	7.74	1.04
Medium	1/4 section 160 acres	0.99	0.13
	1 section 640 acres	1.68	0.22

Table 5a: Fraction Aloft Gramoxone Extra
5 m/h wind speed

Gramoxone Extra --- 5 miles per hour wind speed			
Fraction Aloft			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	0.030	0.011	0.008
1,500	0.012	0.004	0.003
2,500	0.006	0.002	0.001
5,000	0.002	<0.001	<0.001

Table 5b: Fraction Aloft Gramoxone Extra
10 m/h wind speed

Gramoxone Extra --- 10 miles per hour wind speed			
Fraction Aloft			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	0.063	0.024	0.016
1,500	0.038	0.014	0.009
2,500	0.027	0.009	0.006
5,000	0.016	0.005	0.003

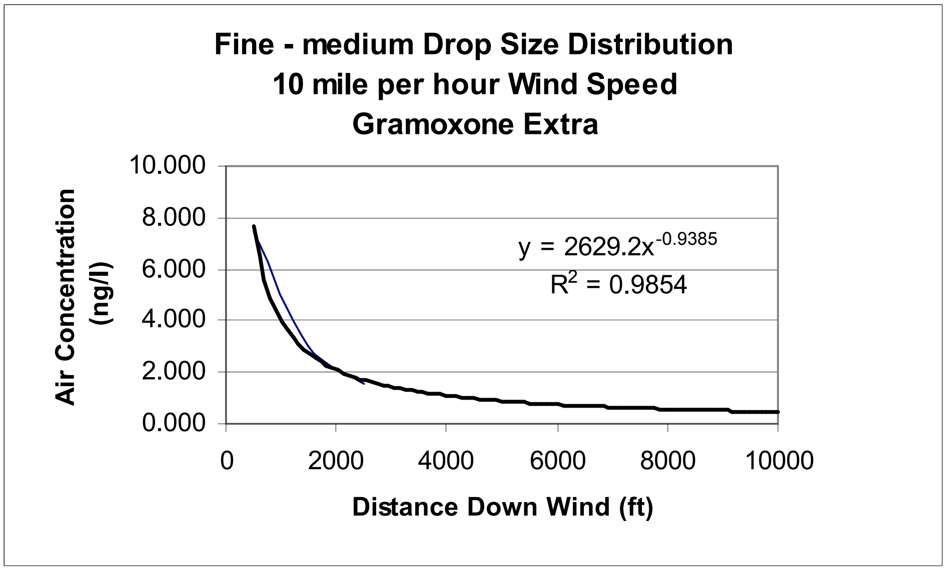
Table 5c: Fraction Aloft Parathion 8 EC
5 m/h wind speed

Parathion 8 EC --- 5 miles per hour wind speed			
Fraction Aloft			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	0.010	0.003	0.002
1,500	0.004	0.002	<0.001
2,500	0.002	<0.001	<0.001
5,000	<0.001	<0.001	<0.001

Table 5d: Fraction Aloft Parathion 8 EC
10 m/h wind speed

Parathion 8 EC --- 10 miles per hour wind speed			
Fraction Aloft			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	0.025	0.009	0.006
1,500	0.010	0.004	0.003
2,500	0.007	0.003	0.002
5,000	<0.001	<0.001	<0.001

Figure 1 Example—Air Concentration Extrapolation method



Note: The extrapolation equations for other model scenarios used in this report are presented in Appendix B

Figure 2a Fraction Aloft for Gramoxone Extra at a Wind Speed of 5.0 m/h

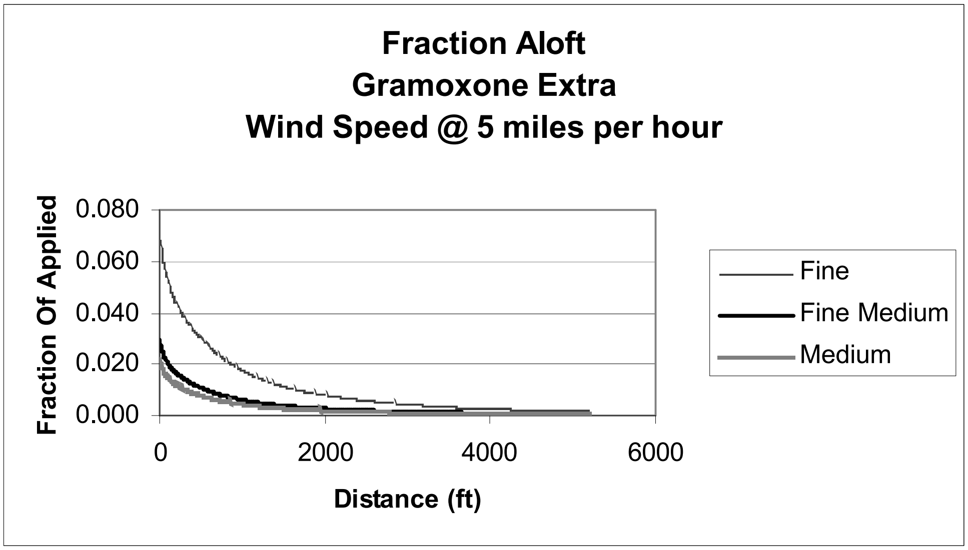


Figure 2b Fraction Aloft for Gramoxone Extra at a Wind Speed of 10.0 m/h

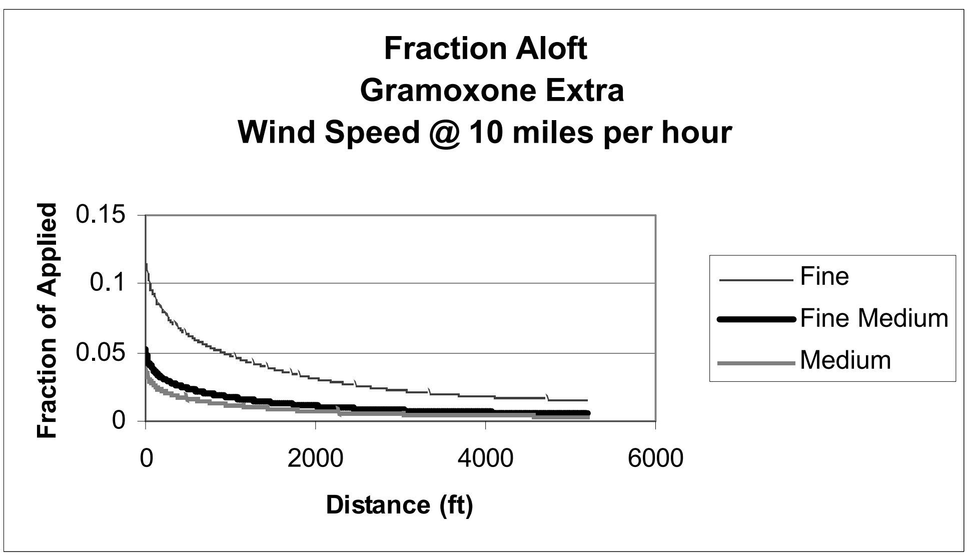


Figure 2c Fraction Aloft for Parathion 8 EC at a Wind Speed of 5.0 m/h

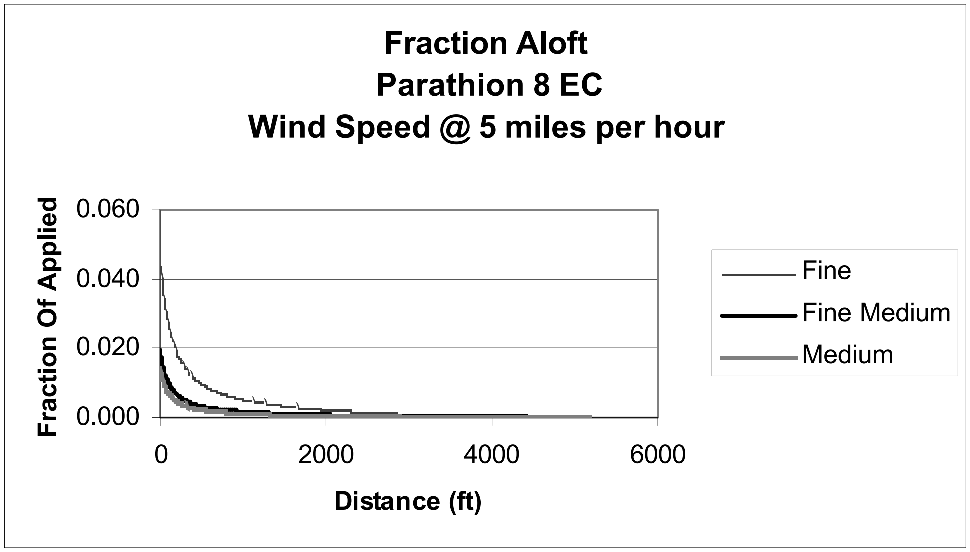
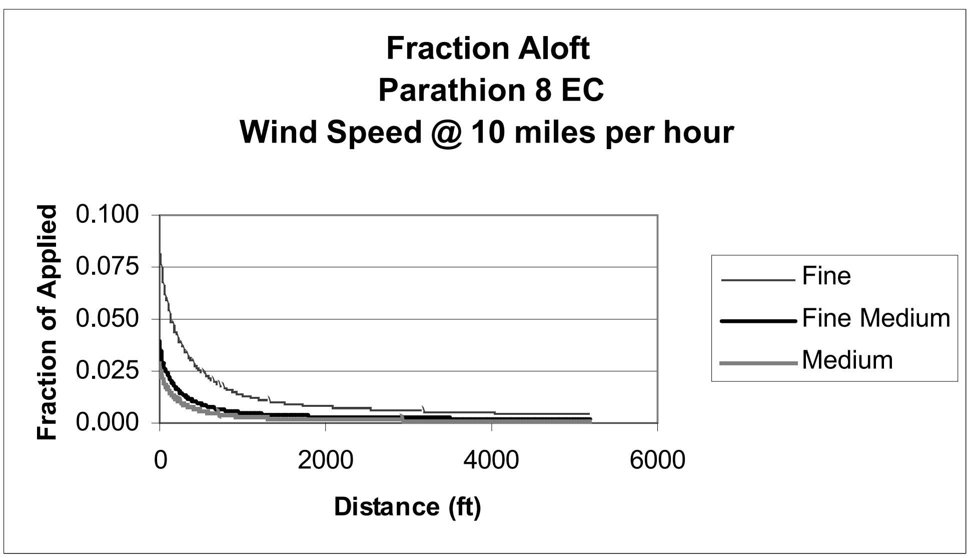


Figure 2d Fraction Aloft for Parathion 8 EC at a Wind Speed of 10.0 m/h



Appendix A

Input Summaries for AgDRIFT® Model Runs

AgDRIFT® Input Data Summary

--General--
Tier: III
Title: scenario one Fallow NV Gramoxone Extra
Notes:

Calculations Done: Yes
Run ID: AgDRIFT® sc_1 fallon fine 5.agd 2.0.05 07-10-2002 10:26:45

Default values appear when they differ from the Current values.

--Aircraft--	----------Current-----------	----------Default-----------
Name	Cessna AgTruck 188	Air Tractor AT-401
Type	Library	Basic
Boom Height (ft)	10	
Flight Lines	20	
Wing Type	Fixed-Wing	
Semispan (ft)	20.8	24.5
Typical Speed (mph)	114.99	119.99
Biplane Separation (ft)	0	
Weight (lbs)	2768	6000
Planform Area (ft²)	206	294
Propeller RPM	2850	2000
Propeller Radius (ft)	3.6	4.5
Engine Vert Distance (ft)	-1.2	-1.2
Engine Fwd Distance (ft)	11.9	11.9

-Drop Size Distribution 1-		----------Current-----------		----------Default-----------	
Name			ASAE Fine		ASAE Fine to Medium
Type			Basic		
Drop Categories	#	Diam (um)	Frac	Diam (um)	Frac
	1	10.77	0.0013	10.77	0.0010
	2	16.73	0.0008	16.73	0.0003
	3	19.39	0.0012	19.39	0.0007
	4	22.49	0.0015	22.49	0.0003
	5	26.05	0.0025	26.05	0.0007
	6	30.21	0.0035	30.21	0.0010
	7	35.01	0.0040	35.01	0.0010
	8	40.57	0.0048	40.57	0.0020
	9	47.03	0.0082	47.03	0.0033
	10	54.50	0.0140	54.50	0.0053
	11	63.16	0.0210	63.16	0.0067
	12	73.23	0.0288	73.23	0.0090
	13	84.85	0.0362	84.85	0.0133
	14	98.12	0.0470	98.12	0.0223
	15	113.71	0.0597	113.71	0.0330
	16	131.73	0.0707	131.73	0.0393
	17	152.79	0.0863	152.79	0.0480
	18	177.84	0.1033	177.84	0.0647
	19	205.84	0.0953	205.84	0.0830
	20	238.45	0.0860	238.45	0.1147
	21	276.48	0.0867	276.48	0.1283
	22	320.60	0.0827	320.60	0.1380
	23	372.18	0.0623	372.18	0.1127
	24	430.74	0.0347	430.74	0.0640
	25	498.91	0.0238	498.91	0.0440
	26	578.54	0.0168	578.54	0.0317
	27	670.72	0.0112	670.72	0.0203
	28	777.39	0.0047	777.39	0.0093
	29	900.61	0.0005	900.61	0.0010
	30	1044.42	0.0003	1044.42	0.0007
	31	1210.66	0.0002	1210.66	0.0003

--Nozzle Distribution--	#	Current DSD	Current H(ft)	Current V(ft)	Current F(ft)	Default DSD	Default H(ft)	Default V(ft)	Default F(ft)
Boom Length (%)					76.3				
Nozzle DSD & Locations	1	1	-16.5	0	0	1	-18.7	0	0
	2	1	-15.5	0	0	1	-17.79	0	0
	3	1	-14.5	0	0	1	-16.87	0	0
	4	1	-13.5	0	0	1	-15.96	0	0
	5	1	-12.5	0	0	1	-15.05	0	0
	6	1	-11.5	0	0	1	-14.14	0	0
	7	1	-10.5	0	0	1	-13.22	0	0
	8	1	-9.5	0	0	1	-12.31	0	0
	9	1	-8.5	0	0	1	-11.4	0	0
	10	1	-7.5	0	0	1	-10.49	0	0
	11	1	-6.5	0	0	1	-9.58	0	0
	12	1	-5.5	0	0	1	-8.66	0	0
	13	1	-4.5	0	0	1	-7.75	0	0
	14	1	-3.5	0	0	1	-6.84	0	0
	15	1	-2.5	0	0	1	-5.93	0	0
	16	1	-1.5	0	0	1	-5.02	0	0
	17	1	-0.5	0	0	1	-4.1	0	0
	18	1	0.5	0	0	1	-3.19	0	0
	19	1	1.5	0	0	1	-2.28	0	0
	20	1	2.5	0	0	1	-1.37	0	0
	21	1	3.5	0	0	1	-0.456	0	0
	22	1	4.5	0	0	1	0.456	0	0
	23	1	5.5	0	0	1	1.37	0	0
	24	1	6.5	0	0	1	2.28	0	0
	25	1	7.5	0	0	1	3.19	0	0
	26	1	8.5	0	0	1	4.1	0	0
	27	1	9.5	0	0	1	5.02	0	0
	28	1	10.5	0	0	1	5.93	0	0
	29	1	11.5	0	0	1	6.84	0	0
	30	1	12.5	0	0	1	7.75	0	0
	31	1	13.5	0	0	1	8.66	0	0
	32	1	14.5	0	0	1	9.58	0	0
	33	1	15.5	0	0	1	10.49	0	0
	34	1	16.5	0	0	1	11.4	0	0

--Swath--	----------Current----------	----------Default----------
Swath Width	60 ft	
Swath Displacement	0.3702 x Swath Width	
Half Boom	No	

--Spray Material--	----------Current----------	----------Default----------
Name	Gramoxone Extra	Water
Type	User-defined	Basic
Nonvolatile Rate (lb/ac)	2	0.501
Active Rate (lb/ac)	0.74	0.2505
Spray Volume Rate (gal/ac)	5	2
Specific Gravity	1	
Evaporation Rate (µm²/deg C/sec)	84.76	

--Meteorology--	----------Current----------	----------Default----------
Wind Speed (mph)	5	10
Wind Direction (deg)	-90	
Temperature (deg F)	60	86
Relative Humidity (%)	25	50

--Transport--	----------Current----------	----------Default----------
Flux Plane (ft)	2500	0

--Terrain--	----------Current-----------	----------Default-----------
Surface Roughness (ft)	0.3	0.0246

--Advanced--	----------Current-----------	----------Default-----------
Wind Speed Height (ft)	6.56	6.56
Max Compute Time (sec)	600	
Max Downwind Dist (ft)	5200	2608.24
Vortex Decay Rate (mph)	1.25	1.25
Aircraft Drag Coeff	0.1	
Propeller Efficiency	0.8	
Ambient Pressure (in hg)	29.91	29.91

AgDRIFT® Input Data Summary

--General--
Tier: III
Title: Fallow NV base case Parathion 8 EC
Notes:

Calculations Done: Yes
Run ID: AgDRIFT® sc_2 fallon 5.agd 2.0.05 07-29-2002 12:37:21

Default values appear when they differ from the Current values.

--Aircraft--	----------Current-----------	----------Default-----------
Name	Cessna AgTruck 188	Air Tractor AT-401
Type	Library	Basic
Boom Height (ft)	10	
Flight Lines	20	
Wing Type	Fixed-Wing	
Semispan (ft)	20.8	24.5
Typical Speed (mph)	114.99	119.99
Biplane Separation (ft)	0	
Weight (lbs)	2768	6000
Planform Area (ft²)	206	294
Propeller RPM	2850	2000
Propeller Radius (ft)	3.6	4.5
Engine Vert Distance (ft)	-1.2	-1.2
Engine Fwd Distance (ft)	11.9	11.9

-Drop Size Distribution 1-		----------Current-----------		----------Default-----------	
Name			ASAE Fine		ASAE Fine to Medium
Type			Basic		
Drop Categories	#	Diam (um)	Frac	Diam (um)	Frac
	1	10.77	0.0013	10.77	0.0010
	2	16.73	0.0008	16.73	0.0003
	3	19.39	0.0012	19.39	0.0007
	4	22.49	0.0015	22.49	0.0003
	5	26.05	0.0025	26.05	0.0007
	6	30.21	0.0035	30.21	0.0010
	7	35.01	0.0040	35.01	0.0010
	8	40.57	0.0048	40.57	0.0020
	9	47.03	0.0082	47.03	0.0033
	10	54.50	0.0140	54.50	0.0053
	11	63.16	0.0210	63.16	0.0067
	12	73.23	0.0288	73.23	0.0090
	13	84.85	0.0362	84.85	0.0133
	14	98.12	0.0470	98.12	0.0223
	15	113.71	0.0597	113.71	0.0330
	16	131.73	0.0707	131.73	0.0393
	17	152.79	0.0863	152.79	0.0480
	18	177.84	0.1033	177.84	0.0647
	19	205.84	0.0953	205.84	0.0830
	20	238.45	0.0860	238.45	0.1147
	21	276.48	0.0867	276.48	0.1283
	22	320.60	0.0827	320.60	0.1380
	23	372.18	0.0623	372.18	0.1127
	24	430.74	0.0347	430.74	0.0640
	25	498.91	0.0238	498.91	0.0440
	26	578.54	0.0168	578.54	0.0317
	27	670.72	0.0112	670.72	0.0203
	28	777.39	0.0047	777.39	0.0093
	29	900.61	0.0005	900.61	0.0010
	30	1044.42	0.0003	1044.42	0.0007
	31	1210.66	0.0002	1210.66	0.0003

--Nozzle Distribution--	#	Current DSD	Current H(ft)	Current V(ft)	Current F(ft)	Default DSD	Default H(ft)	Default V(ft)	Default F(ft)
Boom Length (%)					76.3				
Nozzle DSD & Locations	1	1	-16.5	0	0	1	-18.7	0	0
	2	1	-15.5	0	0	1	-17.79	0	0
	3	1	-14.5	0	0	1	-16.87	0	0
	4	1	-13.5	0	0	1	-15.96	0	0
	5	1	-12.5	0	0	1	-15.05	0	0
	6	1	-11.5	0	0	1	-14.14	0	0
	7	1	-10.5	0	0	1	-13.22	0	0
	8	1	-9.5	0	0	1	-12.31	0	0
	9	1	-8.5	0	0	1	-11.4	0	0
	10	1	-7.5	0	0	1	-10.49	0	0
	11	1	-6.5	0	0	1	-9.58	0	0
	12	1	-5.5	0	0	1	-8.66	0	0
	13	1	-4.5	0	0	1	-7.75	0	0
	14	1	-3.5	0	0	1	-6.84	0	0
	15	1	-2.5	0	0	1	-5.93	0	0
	16	1	-1.5	0	0	1	-5.02	0	0
	17	1	-0.5	0	0	1	-4.1	0	0
	18	1	0.5	0	0	1	-3.19	0	0
	19	1	1.5	0	0	1	-2.28	0	0
	20	1	2.5	0	0	1	-1.37	0	0
	21	1	3.5	0	0	1	-0.456	0	0
	22	1	4.5	0	0	1	0.456	0	0
	23	1	5.5	0	0	1	1.37	0	0
	24	1	6.5	0	0	1	2.28	0	0
	25	1	7.5	0	0	1	3.19	0	0
	26	1	8.5	0	0	1	4.1	0	0
	27	1	9.5	0	0	1	5.02	0	0
	28	1	10.5	0	0	1	5.93	0	0
	29	1	11.5	0	0	1	6.84	0	0
	30	1	12.5	0	0	1	7.75	0	0
	31	1	13.5	0	0	1	8.66	0	0
	32	1	14.5	0	0	1	9.58	0	0
	33	1	15.5	0	0	1	10.49	0	0
	34	1	16.5	0	0	1	11.4	0	0

--Swath--	----------Current----------	----------Default----------
Swath Width	60 ft	
Swath Displacement	0.3702 x Swath Width	
Half Boom	No	

--Spray Material--	----------Current----------	----------Default----------
Name	Parathion 8 EC	Water
Type	User-defined	Basic
Nonvolatile Rate (lb/ac)	5	0.501
Active Rate (lb/ac)	0.4007	0.2505
Spray Volume Rate (gal/ac)	2	2
Specific Gravity	1	
Evaporation Rate (µm²/deg C/sec)	84.76	

--Meteorology--	----------Current----------	----------Default----------
Wind Speed (mph)	5	10
Wind Direction (deg)	-90	
Temperature (deg F)	86	
Relative Humidity (%)	50	

--Transport--	----------Current----------	----------Default----------
Flux Plane (ft)	2500	0

--Terrain--	----------Current-----------	----------Default-----------
Surface Roughness (ft)	0.3	0.0246

--Advanced--	----------Current-----------	----------Default-----------
Wind Speed Height (ft)	6.56	6.56
Max Compute Time (sec)	600	
Max Downwind Dist (ft)	5200	2608.24
Vortex Decay Rate (mph)	1.25	1.25
Aircraft Drag Coeff	0.1	
Propeller Efficiency	0.8	
Ambient Pressure (in hg)	29.91	29.91

Appendix B

Extrapolation Expressions

Table A1a: Extrapolation Expressions Gramoxone Extra
5 m/h wind speed

Gramoxone Extra Wind Speed @ 5 miles per hour				
Drop Size Class	"A"	"B"	R^2	Expression
Fine	11193	-0.997	0.9991	$y = 11193x^{-0.9971}$
Fine-Medium	4872	-1.025	0.9999	$y = 4872.1x^{-1.0251}$
Medium	4969	-1.088	0.9996	$y = 4968.9x^{-1.0875}$

Table A1b: Extrapolation Expressions Gramoxone Extra
10 m/h wind speed

Gramoxone Extra Wind Speed @ 10 miles per hour				
Drop Size Class	"A"	"B"	R^2	Expression
Fine	4816	-0.8782	0.9963	$y = 4815.5x^{-0.8782}$
Fine-Medium	2629	-0.9385	0.9925	$y = 2629.^{2x-0.9385}$
Medium	2382	-0.9792	0.9938	$y = 2382.2x^{-0.9792}$

Table A1c: Extrapolation Expressions Parathion 8 EC
5 m/h wind speed

Parathion 8 EC				
Wind Speed @ 5 miles per hour				
Drop Size Class	"A"	"B"	R2	Expression
Fine	3222	-1.0929	0.9963	$y = 3222.1x^{-1.0929}$
Fine-Medium	694	-1.0091	0.9925	$y = 693.5x^{-1.0091}$
Medium	899	-1.0126	0.9938	$y = 899.05x^{-1.1263}$

Table A1d: Extrapolation Expressions Parathion 8 EC
10 m/h wind speed

Parathion 8 EC				
Wind Speed @ 10 miles per hour				
Drop Size Class	"A"	"B"	R^2	Expression
Fine	7327	-1.1927	0.9983	$y = 7327.3x^{-1.1927}$
Fine-Medium	1970	-1.1455	0.9956	$y = 1969.7x^{-1.1455}$
Medium	2755	-1.2647	0.9953	$y = 2755x^{-1.2647}$

Appendix C
Ground Deposition

An additional review of the model was conducted for each of the sample products, Parathion 8 EC and Gramoxone® Extra.

The model output for the two products used in the study was reviewed to evaluate the down wind ground deposition. The model output for each product was sorted by wind speed (5 or 10 miles per hour), distance downwind (500, 1,000, 2,500, 5,000, and 10,000 feet), and drop size distribution (fine, fine-medium, and medium). All major inputs are summarized in Table 1 of the Study Report.

The AgDRIFT® 2.0 model is only designed to predict the ground deposition to 5,000 feet from the down wind edge of the field. To extend the model's range the predicted depositions were extrapolated to 10,000 feet using the procedure similar to air concentration profiles in the primary study. However, the deposition profile was best fit with the exponential function shown below.

For each case, the ground deposition was extrapolated to 10,000 feet using an exponential function of the form:

$$Y = a * e^{-bX}$$

where: Y is the expected ground deposition
X is the distance down wind from the field edge
a and b are constants developed for each case.

Figures 1a, 2a, 3a, and 4a illustrate this procedure for each of the two products and the two wind speed (5 and 10 miles per hour) combinations.

The model predictions are summarized in Tables 1, 2, 3, and 4 of this appendix. Each table has three parts:

Part "a", lists the deposition as fraction of the applied rate. For example, if the intended application was 0.5 pounds per acre and the predicted fraction of applied is 0.01at 500 feet down wind, then the deposition at 500 feet from the edge of field is 1 percent of the application rate or 0.005 pounds per acre.

Part "b" lists the absolute deposition in mg/cm^2 based on the modeled use rates (Gramoxone Extra = 0.74 pounds per acre and Parathion 8 EC = 0.4 pounds per acre).

Part "c" lists the Deposition Expression Coefficients used to extrapolate the deposition profiles to 10,000 feet.

In addition to the tables, Figures 1b, 2b, 3b and 4b compare the relative deposition for the three drop-size distributions for the four total product and wind speed combinations.

The figures and table show that the deposition near the field (500 ft) can be as much as five percent for a fine drop-size spray. However, at longer distances from the field edge, and when applied with a fine-medium or fine drop-size spray the deposition is expected to be less than 1/100th of one percent of the application rate.

Table 1a Down Wind Deposition Gramoxone Extra 5 miles/hour
Deposit Expressed as Fraction of the Application.

Gramoxone Extra --- 5 miles per hours wind speed			
Ground Deposition Fraction of Applied			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	0.04080	0.01670	0.01200
1500	0.01040	0.00400	0.00266
2500	0.00042	0.00135	0.00097
5000	0.00049	0.00013	0.00010
10000	0.00002	0.00001	0.00001

Table 1b Down Wind Deposition Gramoxone Extra 5 miles/hour
Deposit Expressed in mg/cm^2

Gramoxone Extra --- 5 miles per hours wind speed			
Ground Deposition ($mg/cm^{2)}$)			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	3.35E-04	1.37E-04	9.85E-05
1500	8.54E-05	3.28E-05	2.18E-05
2500	3.45E-06	1.11E-05	7.96E-06
5000	4.02E-06	1.07E-06	8.21E-07
10000	1.65E-07	6.86E-08	4.96E-08

Table 1c Down Wind Deposition Gramoxone Extra 5 miles/hour
Deposition Expression Coefficients

Deposition Expression Coefficients Gramoxone Extra Wind Speed @ 5 miles per hour				
Drop Size Class	"A"	"B"	R^2	Expression
Fine	0.05990	-0.00100	0.9690	$y = 0.0599e^{-0.001x}$
Fine-Medium	0.02490	-0.00110	0.9603	$y = 0.0249e^{-0.0011x}$
Medium	0.01800	-0.00110	0.9575	$y = 0.018e^{-0.0011x}$

Figure 1a Example ---Ground Deposition Extrapolation Method for Gramoxone Extra 5 miles/hour, Fine Drop Size Distribution.

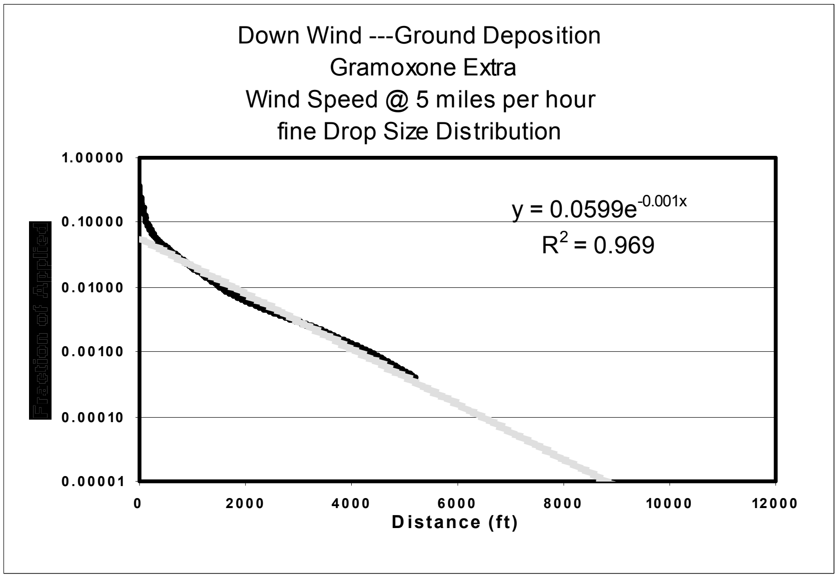


Figure 1b Comparison ---Ground Deposition for Gramoxone Extra at 5 miles/hour, Fine Fine-Medium and Medium Drop Size Distribution.

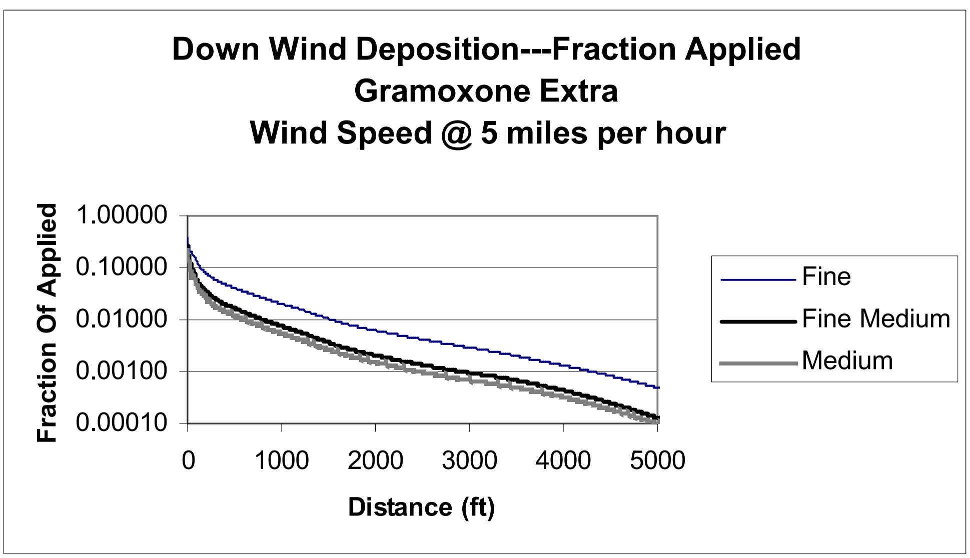


Table 2a Down Wind Deposition Parathion 8 EC 5 miles/hour
Deposit Expressed as Fraction of the Application.

Parathion 8 EC --- 5 miles per hours wind speed			
Max Air Concentration ng/l (ppt)			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	0.01867	0.00662	0.00469
1500	0.00336	0.00110	0.00073
2500	0.00130	0.00045	0.00027
5000	0.00018	0.00006	0.00003
10000	0.00010	0.00003	0.00002

Table 2b Down Wind Deposition Parathion 8 EC5 miles/hour
Deposit Expressed in mg/cm^2

Parathion 8 EC --- 5 miles per hours wind speed			
Ground Deposition ($mg/cm^{2)}$			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	8.31E-05	2.95E-05	2.09E-05
1500	1.50E-05	4.90E-06	3.25E-06
2500	5.79E-06	2.00E-06	1.20E-06
5000	8.01E-07	2.67E-07	1.34E-07
10000	4.23E-07	1.47E-07	1.02E-07

Table 2c Down Wind Deposition Parathion 8 EC 5 miles/hour
Deposition Expression Coefficients

Deposition Expression Coefficients Parathion 8 EC Wind Speed @ 5 miles per hour				
Drop Size Class	"A"	"B"	R^2	Expression
Fine	0.0141	-0.0009	0.9832	$y = 0.0254e^{-0.0011x}$
Fine-Medium	0.0049	-0.0009	0.9867	$y = 0.0049e^{-0.0009x}$
Medium	0.0034	-0.0010	0.9846	$y = 0.0034e^{-0.001x}$

Figure 2a Example ---Ground Deposition Extrapolation Method for Parathion 8 EC 5 miles/hour, Fine Drop Size Distribution.

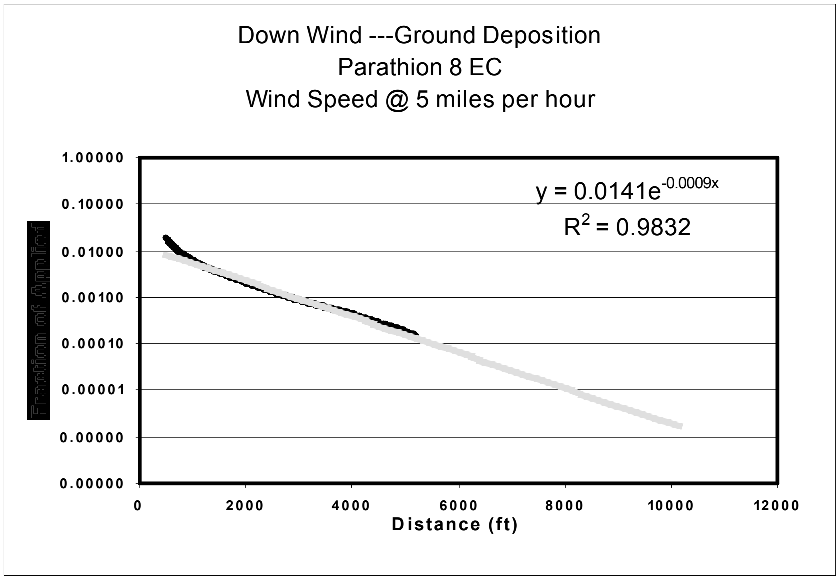


Figure 2b Comparison ---Ground Deposition for Parathion 8 EC at 5 miles/hour, Fine Fine-Medium and Medium Drop Size Distribution.

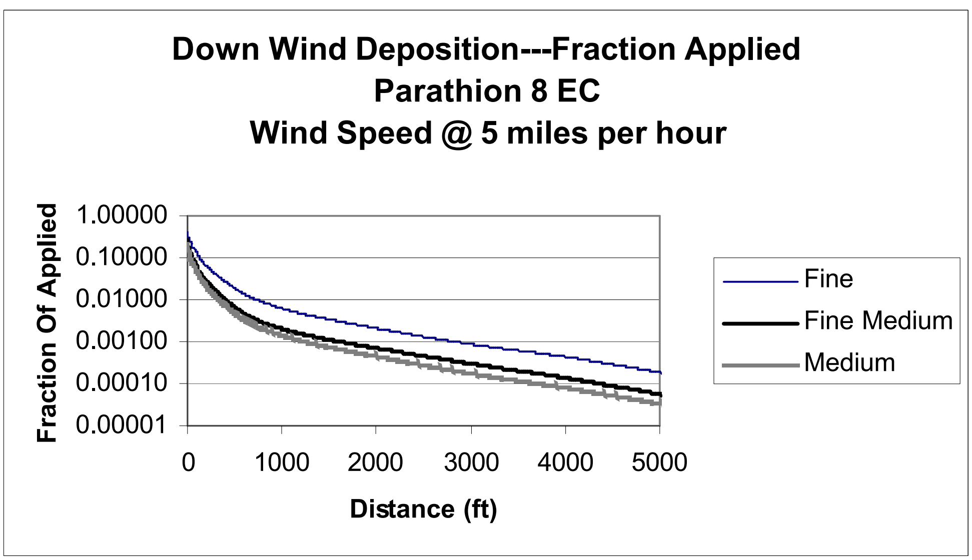


Table 3a Down Wind Deposition Gramoxone Extra 10 miles/hour
Deposit Expressed as Fraction of the Application.

Gramoxone Extra --- 10 miles per hours wind speed			
Ground Deposition Fraction of Applied			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	0.04800	0.02070	0.01540
1500	0.01900	0.00750	0.00530
2500	0.01030	0.00340	0.00250
5000	0.00180	0.00069	0.00048
10000	0.00002	0.00001	0.00001

Table 3b Down Wind Deposition Gramoxone Extra 10 miles/hour
Deposit Expressed in mg/cm^2

Gramoxone Extra --- 10 miles per hours wind speed			
Ground Deposition ($mg/cm^{2)}$)			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	3.94E-04	1.70E-04	1.26E-04
1500	1.56E-04	6.16E-05	4.35E-05
2500	8.46E-05	2.79E-05	2.05E-05
5000	1.48E-05	5.66E-06	3.94E-06
10000	2.01E-07	8.76E-08	6.47E-08

Table 3c Down Wind Deposition Gramoxone Extra 10 miles/hour
Deposition Expression Coefficients

Deposition Expression Coefficients Gramoxone Extra Wind Speed @ 10 miles per hour				
Drop Size Class	"A"	"B"	R^2	Expression
Fine	0.07290	-0.00080	0.9510	$y = 0.0729e^{-0.0008x}$
Fine-Medium	0.03180	-0.00080	0.9336	$y = 0.0318e^{-0.0008x}$
Medium	0.02350	-0.00080	0.9304	$y = 0.0235e^{-0.0008x}$

Figure 3a Example ---Ground Deposition Extrapolation Method for Gramoxone Extra 10 miles/hour, Fine Drop Size Distribution.

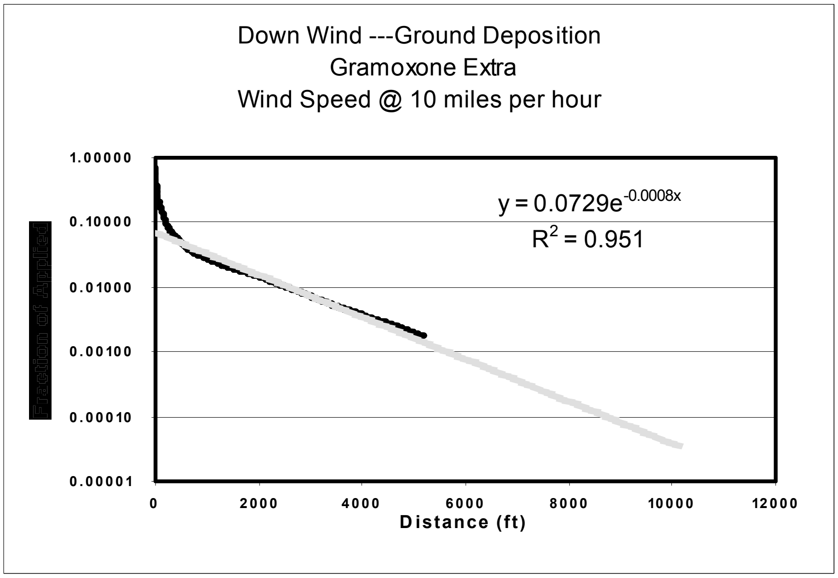


Figure 3b Comparison ---Ground Deposition for Gramoxone Extra at 10 miles/hour, Fine Fine-Medium and Medium Drop Size Distribution.

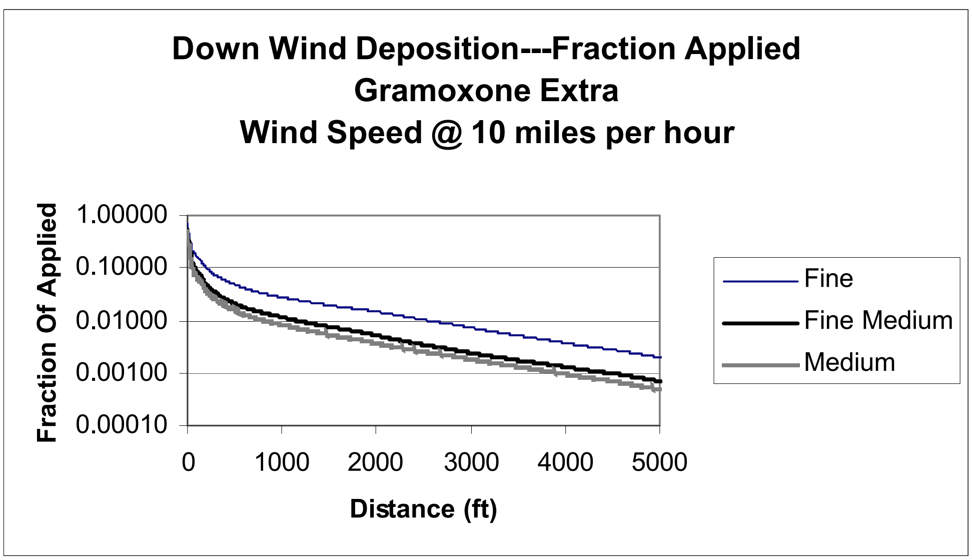


Table 4a Down Wind Deposition Parathion 8 EC 10 miles/hour
Deposit Expressed as Fraction of the Application.

Parathion 8 EC --- 10 miles per hours wind speed			
Max Air Concentration ng/l (ppt)			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	0.0449	0.0181	0.0129
1500	0.0058	0.0020	0.0013
2500	0.0022	0.0007	0.0004
5000	0.0006	0.0002	0.0001
10000	0.0001	0.0000	0.0000

Table 4b Down Wind Deposition Parathion 8 EC 10 miles/hour
Deposit Expressed in mg/cm^2

Parathion 8 EC --- 10 miles per hours wind speed			
Ground Deposition ($mg/cm^{2)}$			
Distance downwind (ft)	Drop Size Distribution Class		
	Fine	Fine - Medium	Medium
500	2.00E-04	8.05E-05	5.74E-05
1500	2.56E-05	8.68E-06	5.79E-06
2500	9.57E-06	2.98E-06	1.87E-06
5000	2.80E-06	9.79E-07	5.79E-07
10000	2.73E-07	8.40E-08	5.70E-08

Table 4c Down Wind Deposition Parathion 8 EC 10 miles/hour
Deposition Expression Coefficients

Deposition Expression Coefficients Parathion 8 EC Wind Speed @ 10 miles per hour				
Drop Size Class	"A"	"B"	R^2	Expression
Fine	0.0091	-0.0005	0.9808	$y = 0.0091e^{-0.0005x}$
Fine-Medium	0.0028	-0.0005	0.9659	$y = 0.0028e^{-0.0005x}$
Medium	0.0019	-0.0005	0.9655	$y = 0.0019e^{-0.0005x}$

Figure 4a Example ---Ground Deposition Extrapolation Method for Parathion 8 EC 10 miles/hour, Fine Drop Size Distribution.

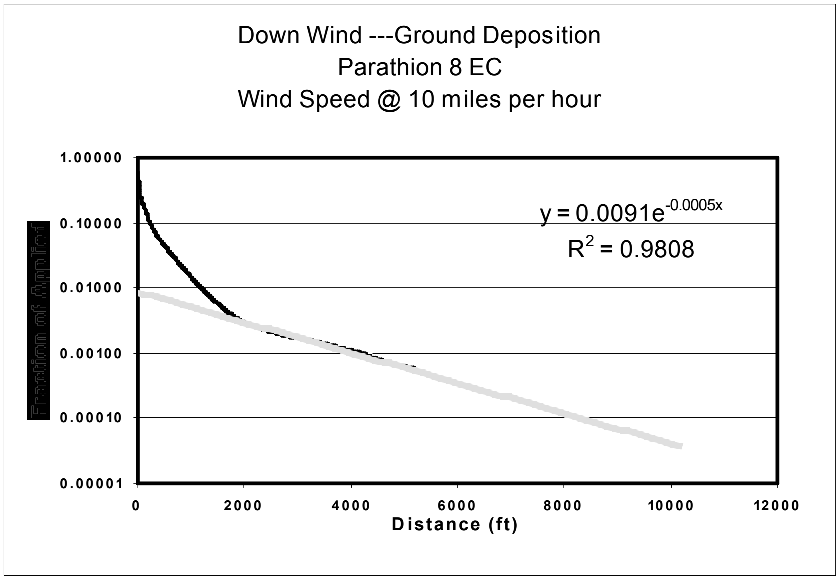
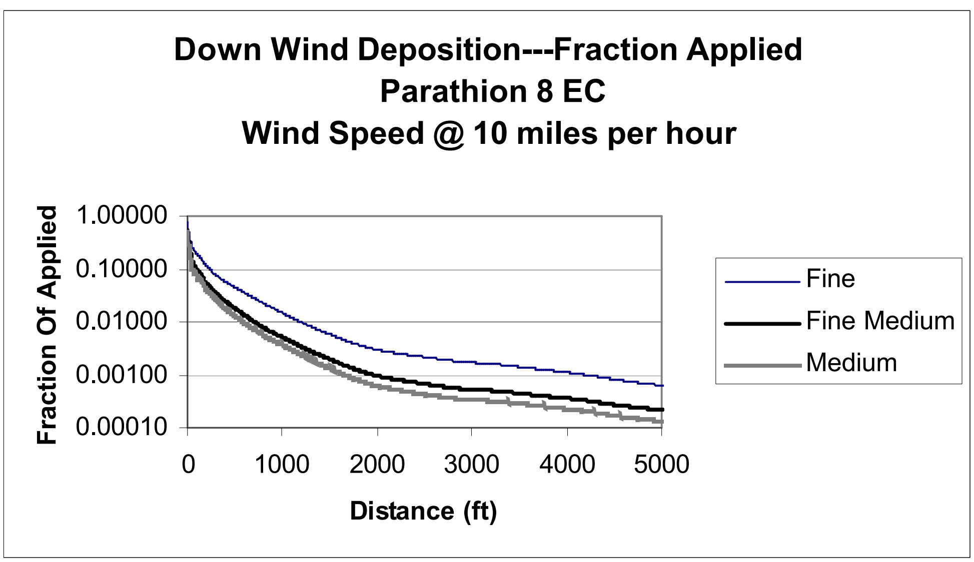


Figure 4b Comparison ---Ground Deposition for Parathion 8 EC at 10 miles/hour, Fine Fine-Medium and Medium Drop Size Distribution.



APPENDIX B

SOURCES OF INFORMATION ON REDUCING EXPOSURES TO PESTICIDE

APPENDIX B

SOURCES OF INFORMATION ON REDUCING EXPOSURES TO PESTICIDES

- Citizen's Guide to Pest Control and Pesticide Safety
  http://www.epa.gov/oppfead1/Publications/Cit_Guide/citguide.pdf

- Pesticides and Child Safety
  http://www.epa.gov/pesticides/factsheets/childsaf.htm

- Protecting Children from Pesticides
  http://www.epa.gov/pesticides/factsheets/kidpesticide.htm

- Integrated pest management for agriculture.
  http://www.epa.gov/pesticides/food/ipm.htm

- Pesticides in Indoor Air of Homes - General
  http://ace.orst.edu/info/npic/factsheets/air_gen.pdf

Tips to Protect Children from Pesticide and Lead Poisonings around the Home
http://www.epa.gov/oppfead1/cb/10_tips/

1. Always store pesticides and other household chemicals, including chlorine bleach, out of children's reach -- preferably in a locked cabinet.

2. Always read directions carefully because pesticide products, household cleaning products, and pet products can be "dangerous" or ineffective if too much or too little is used.

3. Before applying pesticides or other household chemicals, remove children and their toys, as well as pets, from the area. Keep children and pets away until the pesticide has dried or as long as is recommended on the label.

4. If your use of a pesticide or other household chemical is interrupted (perhaps by a phone call), properly reclose the container and remove it from children's reach. Always use household products in child-resistant packaging.

5. Never transfer pesticides to other containers that children may associate with food or drink (like soda bottles), and never place rodent or insect baits where small children can get to them.

6. When applying insect repellents to children, read all directions first; do not apply over

cuts, wounds or irritated skin; do not apply to eyes, mouth, hands or directly on the face; and use just enough to cover exposed skin or clothing, but do not use under clothing.

7. To minimize track-in from outdoor treated areas, remove your shoes before you enter the home or use an outdoor shoe cleaning device prior to entering the home, and limit pet access to treated areas (http://ace.orst.edu/info/npic/factsheets/air_gen.pdf).