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MEMORANDUM

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DATE: September 27, 2018

SUBJECT: EFFECTS OF TANK-MIX PROPERTIES ON PESTICIDE OFF-SITE DRIFT FROM AERIAL APPLICATIONS

Executive Summary

AGricultural DISPersal model (AGDISP) is a near-wake Lagrangian model used to estimate downwind pesticide drift from aerial applications. Both U.S. Environmental Protection Agency (US EPA) and California Department of Pesticide Regulation (DPR) use AGDISP to assess residential bystander pesticide exposure from aerial applications. Pesticides are often diluted at different rates and applied at different volumes per acre, therefore understanding the effects of tank-mix properties and application rates on AGDISP drift estimates is critical to interpret AGDISP results for assessing the health risk associated with potential human exposure to pesticide through spray drift.

In this study, we developed 13 application scenarios, each of which has a different tank-mix pesticide percentage, additive content, spray volume rate, and/or spraying droplet size distribution (DSD). Based on these scenarios, we employed AGDISP for generating outputs including downwind horizontal depositions and air concentrations for evaluating the effects of tank-mix.

The analysis shows that application rate is not the only factor determining downwind horizontal drift deposition and air concentration. Although the horizontal deposition of all tested scenarios decreases with increasing distance downwind, the rate of the decrease is different among application scenarios. For instance, at 26.25 ft downwind, the deposition from the tank-mix with 12% pesticide is 21.44% of the application rate, which is higher than 21.00% from the tank-mix with 3% pesticide. However, at 748.02 ft downwind, the deposition from the 3% tank-mix is higher than 12%. Pesticide and additive percentage in a tank-mix also affect the downwind

pesticide air concentration. Regression fittings of the deposition curves to a mathematical equation indicate that within 100 ft, the difference of deposition potential between 1-12% tank-mixes is not statistically significant. However, the difference becomes greater with further downwind distance, and tank-mix with greater pesticide content shows faster decrease of deposition potential.

The above discussion revealed both downwind ground deposition and air concentration do not change linearly in response to the change of application rates. AGDISP is a recommended model by USEPA to estimate residential bystander pesticide exposure from spray drift, emphasizing the importance of conducting an appropriate AGDISP modeling run when performing the exposure assessment. For instance, if assuming bystander exposure due to a 6 lb/ac application is one third of the exposure of a 2 lb/ac application (Scenario 1 in Table 1), both adult and child exposure from 2 lb/ac application at 1000 ft downwind will be overestimated by >180% for dermal, incidental oral and inhalation routes. This result emphasizes the necessity of conducting individual AGDISP runs of specific application tank mix.

Background

AGricultural DISPersal model (AGDISP) was first developed by U.S. Forest Service and is currently used by both U.S. Environmental Protection Agency (US EPA) and California Department of Pesticide Regulation (DPR) to estimate pesticide drift potential from aerial applications. As a first-principle model, AGDISP algorithms employ physics based mathematical equations instead of empirical functions developed from experimental data to calculate the spray drift (Barry, 2017). Users can define values for various parameters, including tank-mix properties, weather and field conditions. AGDISP then processes these inputs to estimate drift, i.e., the amount of pesticides transported off-site.

Bystanders located downwind could be exposed to pesticide from application spray drift. AGDISP is the recommended model to assess this exposure (USEPA, 2017). In 2012, US EPA published "*Standard Operating Procedures for Residential Pesticide Exposure Assessment*" and later in 2013, the Agency published an addendum to the 2012 Standard Operating Procedures "*Addenda 1: Consideration of Spray Drift*" which guides the use of the 2012 Residential SOP and AGDISP for assessing human exposure to pesticide from spray drift (USEPA, 2013). To assess residential bystander exposure to pesticide spray drift, US EPA proposed using a standard 50 ft-wide turf to receive off-site pesticide spray drift; the residential bystanders, including adults and children, are assumed to experience pesticide exposure from performing physical activities (walking, running and playing) on this turf. To quantify the amount of pesticide deposited on the turf, US EPA proposed a "deposition fraction" method that expressed the amount of pesticide drift as a fraction of the application rate on the target field. US EPA generated various deposition fraction values for the standard 50 ft-wide turf at various downwind distance, and suggested using these values as "*screening level scenario recommended for risk assessment*" (USEPA, 2013).

US EPA used AgDRIFT, which contains a previous version of the AGDISP aerial algorithm to calculate chlorpyrifos spray drift document (USEPA, 2012a). The Agency assumes that the deposition fractions are constants among different application rates. However, this assumption is not discussed or confirmed, and it is unknown whether these values used represent the worst-case spray drift scenario. In addition, the relationship between downwind air concentrations and pesticide application rate is not discussed in the US EPA document.

In this study, we used AGDISP (version 8.28) to quantify the effects of different tank-mix contents on pesticide drift. The effects of changing these input values on pesticide downwind horizontal deposition and air concentration estimates were quantified. The goal of this analysis is to explore pesticide drift potential in relation to certain tank-mix properties and whether horizontal deposition and air concentrations are proportional to the application rate across all downwind distances.

Method

<u>Modeling Approach Development</u>

Pesticide horizontal deposition and air concentrations from aerial application were estimated using AGDISP version 8.28. This analysis evaluated a total of 13 application scenarios with different spray volumes (2, 4 or 8 gal/ac), pesticide percentage in tank-mixes (1, 1.5, 3, 6 or 12%), non-volatile additive percentage (0, 6 or 11%), and spray droplet size distribution (DSD, American Society of Agricultural and Biological Engineers (ASABE) Fine to Medium, Medium or Coarse, Table 1). These values were selected as they represent common practices in California pesticide aerial applications. Other AGDISP input values selected are similar to those used by US EPA (Table 2). However, input weather conditions of 90 ºF air temperature (instead of 86 ºF) and relative humidity at 20% (instead of 50%) were chosen to represent typical weather conditions in California central valley counties (Table 2, Barry, 2017). Surface roughness was selected at 0.12 ft to represent applications on crops instead of bare soils.

Table 1. Summary of tank-mix properties in 16 application scenarios tested in this study

AGDISP scenario	Droplet size distribution	Spray volume rate (gal/ac)	% of active ingredient	% of nonvolatile additive	Application rate equivalent to Scenario 1	Total% of nonvolatile fraction in the tank mix
1	ASABE Medium	2	12	0	1	12
2	ASABE Medium	2	6	0	0.5	6
3	ASABE Medium	2	3	0	0.25	3
4	ASABE Medium	2	1	0	0.083	1
5	ASABE Medium	2	6	6	0.5	12
6	ASABE Medium	2	1	11	0.083	12
7	ASABE Medium	4	6	0	1	6
8	ASABE Medium	4	6	6	1	12
9	ASABE Medium	8	3	0	1	3
10	ASABE Fine to Medium	2	6	0	1	12
11	ASABE Fine to Medium	2	1	0	0.083	1
12	ASABE Coarse	2	6	0	1	12
13	ASABE Coarse	2	1	0	0.083	1

Table 2. Comparison of other AGDISP input values between this document and US EPA

Parameter	Input value	US EPA[a]
Aircraft	AT401	AT401
Release height (ft)	10	10
Spray lines	50	20
No. of nozzles	42	42
Wind speed (mph)	10	10
Wind direction (degree)	90	90
Temperature (°F)	90	86
Relative humidity (%)	20	50
Atmosphere stability	Overcast	Overcast
Swath displacement (ft)	18.7	18.7
Swath width (ft)	60	60
Surface roughness (ft)	0.12 (low crops)	0.0246 (bare soil)

[a] US EPA Tier II modeling inputs (Barry, 2017).

Data processing

This study presents analysis of two AGDISP outputs, i.e., pesticide downwind horizontal deposition and air concentrations.

Horizontal deposition. AGDISP generates horizontal deposition estimates at discrete downwind distance (e.g., 52.49 ft, 98.42 ft, etc.) up to 2604.96 ft. These estimates are expressed as fraction of application rate, and we use the direct outputs from AGDISP without any approximations to the nearest integer distance, which facilitates the comparison between scenarios with different application rates.

Air concentrations. AGDISP estimates air concentrations for specific downwind distances. For each distance, the estimates are provided at different heights above ground. To assess human exposure to the airborne pesticide, two heights were selected, i.e., 1.9875 and 5.3000 ft (rounded to 2.0 ft and 5.3 ft, respectively), due to their close approximation to child and adult breathing zone heights (1.7 and 5 ft respectively). The air concentration estimates are divided by pesticide application rate to facilitate comparisons between scenarios with different application rates.

Results and Discussion

Effects of tank-mix properties

Pesticide drift potential was affected by its percentage in the tank-mix. In Scenario 1-4 the tank-mixes contain the pesticide at 1-12% and the application rates are 0.17-2.0 lb/ac. As shown in Table 3 and Figure 1, at <100 ft downwind, tank-mixes with a higher pesticide percentage show slightly greater deposition, and the deposition also decreases slightly slower along the downwind distance (Table 3). For instance, for 12% tank-mix, the deposition at 52.49 ft was 17.02% of the application rate, which is higher than 15.97% for 1% tank-mix (Table 3).

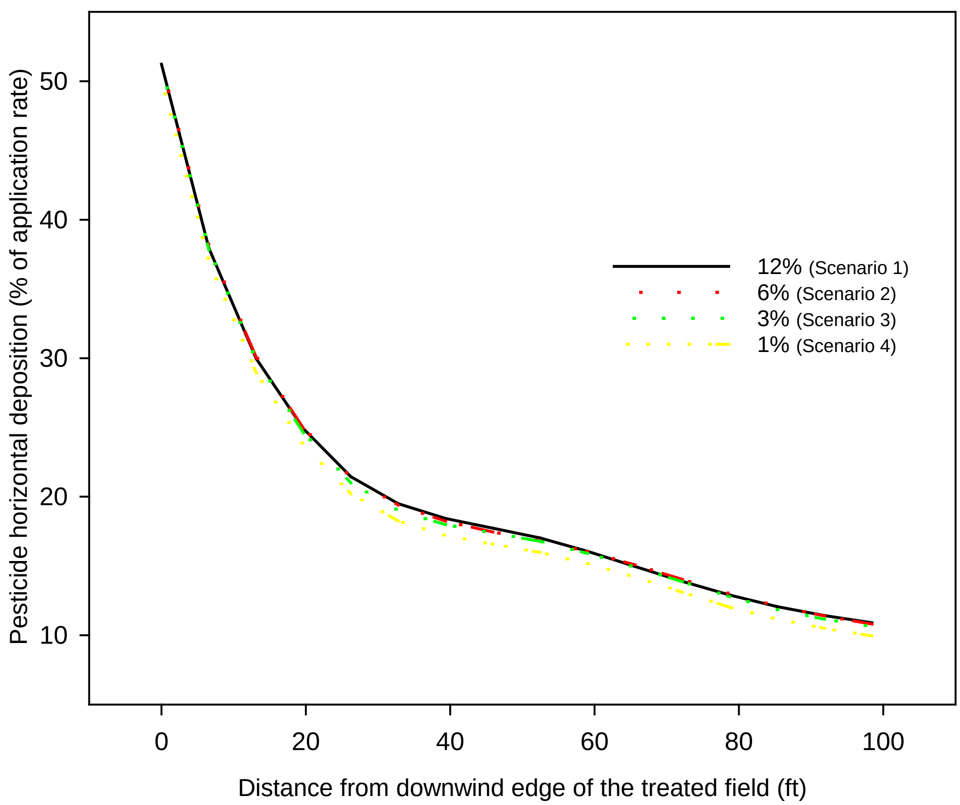

Figure 1. Estimated pesticide horizontal deposition at <100 ft downwind distance. The tank-mixes contain 1-12% pesticide. The spray volume is 2 gal/ac, and the droplet size distribution is ASABE Medium. There is no additive in these tank-mixes.

Table 3. Pesticide horizontal deposition at selective downwind distance between 0 and 98.42 ft. The tank-mixes contain 1-12% pesticide. The spray volume is 2 gal/ac, and the droplet size distribution is ASABE Medium. There is no additive in these tank-mixes. A complete list of deposition at different downwind distances is provided in the Appendix A.

Downwind distance (ft)	12%	6%	3%	1%
0	51.23[a]	51.16	50.95	50.03
26.25	21.44	21.38	21.00	20.20
52.49	17.02	16.82	16.76	15.97
72.18	13.89	14.02	13.85	13.09
98.42	10.90	10.80	10.61	9.95

[a] The horizontal deposition is expressed as percentage of the application rate. The spray volume is 2 gal/ac, and the droplet size distribution of the nozzles is ASABE Medium. No additive was added to the tank-mix.

To better visualize the pattern described above, the <100 ft portion of the deposition curve from the tank-mixes containing 1%, 3%, 6% or 12% pesticide were fit to a first-order decay curve (Equation 1)

$$Y = a\mathrm{e}^{-bX} \qquad \text{Eq. 1}$$

where
X: represents the square root of downwind distance in feet;
Y: represents pesticide deposition, as expressed as percentage of application rate;
a and b: represent parameters for the first-order decay equation. b value represents the rate of decline along the downwind distance.

Parameter values from the equation fittings for each scenario are summarized in Table 4. It shows tank-mixes with higher pesticide content have slightly higher pesticide deposition as indicated by the greater parameter “a” value (Figure 2). But this difference is not statistically significant, which is determined as the overlapped ranges of mean ± 2 times standard deviation (Figure 2). In addition, tank-mix with higher pesticide content also shows a slightly smaller parameter “b” value (not statistically different), suggesting the deposition decreases only slightly slower along the downwind distance.

Table 4. Parameter values were derived from fitting the <100 ft portion of the deposition curve to a first-order decay equation ($Y = a\mathrm{e}^{-bX}$). The tank-mixes contain 1-12% pesticide. The spray volume is 2 gal/ac, and the droplet size distribution is ASABE Medium. There is no additive in these tank-mixes. Y is the deposition as a percent of application rate, and X is the square root of downwind distance (ft).

Scenario	% of Pesticide	a[a]	b	R^2
1	12	52.1499 ± 1.0261	0.1585 ± 0.0041	0.9891
2	6	52.1375 ± 1.0727	0.1588 ± 0.0043	0.9881
3	3	51.9225 ± 1.1213	0.1601 ± 0.0046	0.9871
4	1	51.0703 ± 1.1248	0.1644 ± 0.0047	0.9869

[a] Values of a and b were expressed as mean ± standard deviation. Equation fitting was performed using SigmaPlot 13.0.

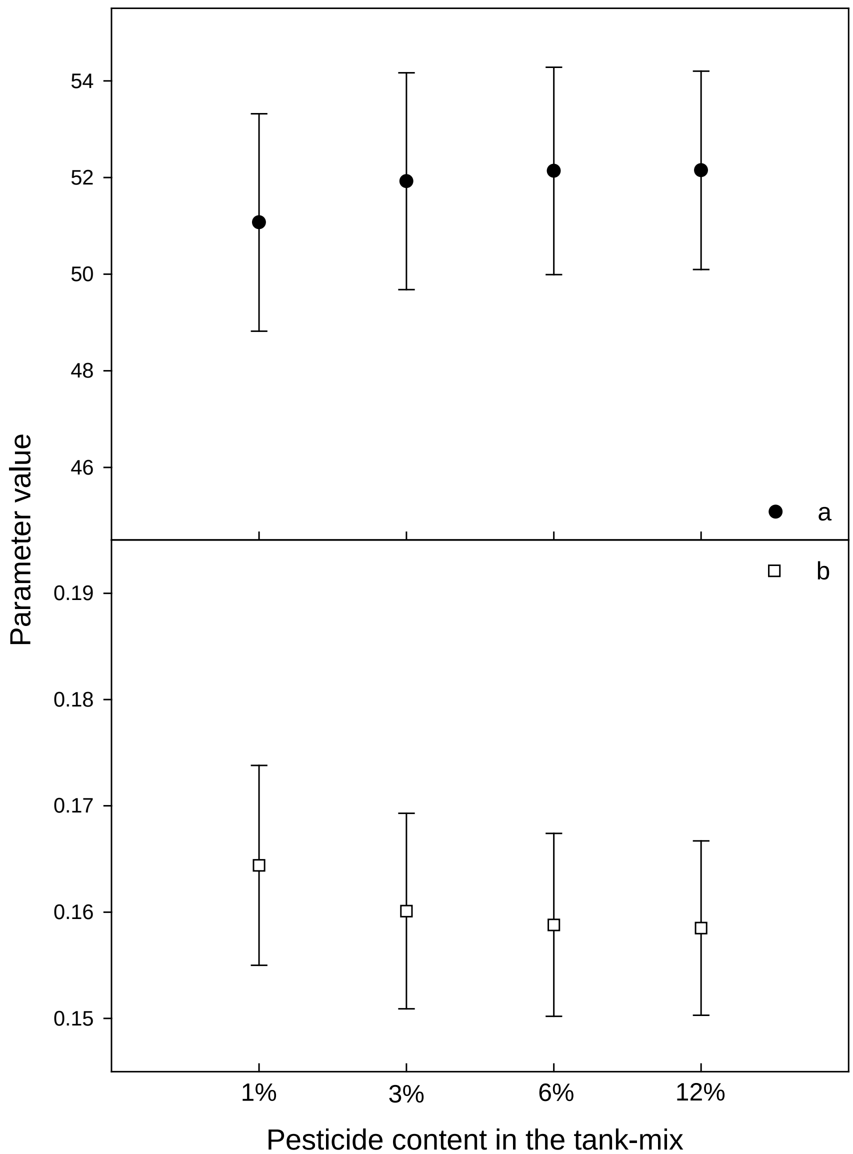

Figure 2. Parameter values of a and b (mean ± 2 times standard deviation) are derived from fitting the <100 ft portion of the deposition curve to a first-order decay equation ($Y = a\mathrm{e}^{-bX}$). The tank-mixes contain 1-12% pesticide. The spray volume is 2 gal/ac, and the droplet size distribution is ASABE Medium. There is no additive in these tank-mixes. Y is the deposition as a percent of application rate, and X is the square root of downwind distance (ft). Mean ± 2 times of standard deviations defines the range of 95% confidence interval within which a or b value lies in a normal distribution.

The pattern of greater deposition with higher tank-mix percentage changes as the distance extends to downwind far-field, as the highest tank-mix percentage may no longer possess the greatest deposition potential (Figure 3, Table 5). For instance, at 196.85 ft, the highest deposition potential (6.07% of the application rate) is from 6% tank-mix instead of 12% tank-mix. At 249.34 ft, 3% tank-mix shows the highest deposition potential (4.93% of the application rate). From 1400 ft and beyond, the highest deposition potential is from 1% tank-mix. This change of deposition patterns could also be demonstrated by individually fitting the 100-500 ft and >500 ft portion of the deposition curves to the same Equation1. The parameter values from the fitted curve are summarized in Table 6 and 7. Unlike the <100 ft portion where highest “b” value is from 1% tank-mix, highest “b” values are from 12% tank-mix for both 100-500 ft and >500 ft, indicating that a tank-mix with higher pesticide percentage has a faster decrease in deposition downwind (Figure 4 and 5). At 100-500 ft, the deposition rate of 12% tank-mix, as quantified by the b value, is about 20% higher than that of 1% tank-mix. At >500 ft, the b value of 12% tank-mix is 3 times higher than 1% tank-mix. As discussed above, 12% tank-mix has the greatest deposition fraction values < 100 ft. The much faster decrease of its deposition at further downwind makes its deposition fractions the lowest among Scenario 1-4 at 275 ft and beyond.

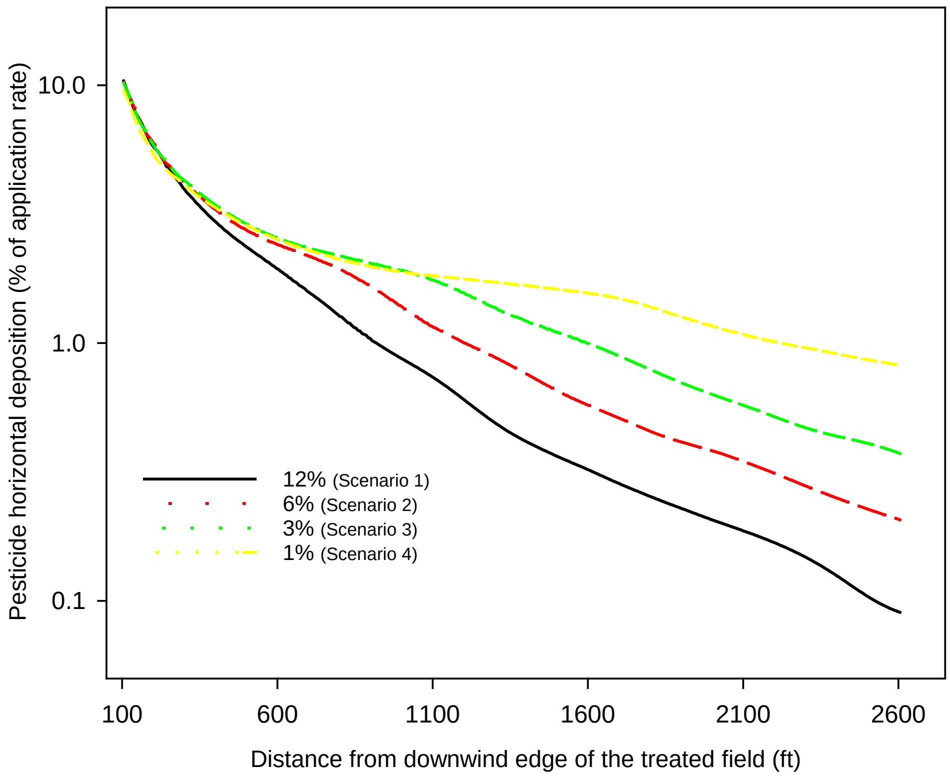

Figure 3. Estimated pesticide horizontal deposition at >100 ft downwind distance. The tank-mixes contain 1-12% pesticide. The spray volume is 2 gal/ac, and the droplet size distribution is ASABE Medium. There is no additive in these tank-mixes.

Table 5. Estimated pesticide horizontal deposition at selective downwind distances between 150.92 and 2604.96 ft. The spray volume is 2 gal/ac, and the droplet size distribution is ASABE Medium. There is no additive in these tank-mixes. A complete list of deposition at different downwind distances is in Appendix A.

Downwind distance (ft)	12%	6%	3%	1%
150.92	7.56[a]	7.58	7.45	6.90
196.85	5.87	6.07	5.97	5.49
249.34	4.73	4.90	4.93	4.61
498.68	2.37	2.75	2.90	2.86

748.02	1.43	2.06	2.26	2.20
997.36	0.87	1.39	1.91	1.89
1246.70	0.55	0.94	1.46	1.75
1502.61	0.36	0.65	1.10	1.61
1751.95	0.27	0.48	0.84	1.43
2001.29	0.21	0.38	0.63	1.16
2250.63	0.16	0.29	0.49	0.98
2499.97	0.10	0.23	0.41	0.86
2604.96	0.09	0.21	0.37	0.82

[a] The deposition is expressed as a fraction of the application rate.

Table 6. Parameter values are derived from fitting the 100-500 ft portion of the deposition curve to a first-order decay equation ($Y = a\mathrm{e}^{-bX}$). The spray volume is 2 gal/ac, and the droplet size distribution of the nozzles is ASABE Medium. No additive was added to the tank-mix. Y is the deposition as a percent of application rate, and X is the square root of downwind distance (ft).

Scenario	% of Pesticide	a[a]	b	R^2
1	12	36.2553 ± 0.6789	0.1268 ± 0.0013	0.9943
2	6	31.3083 ± 0.7921	0.1145 ± 0.0017	0.9873
3	3	29.0555 ± 0.8575	0.1091 ± 0.0020	0.9811
4	1	25.1356 ± 0.8879	0.1033 ± 0.0024	0.9701

[a] Values of a and b were expressed as mean ± standard deviation. Equation fitting was performed using SigmaPlot 13.0.

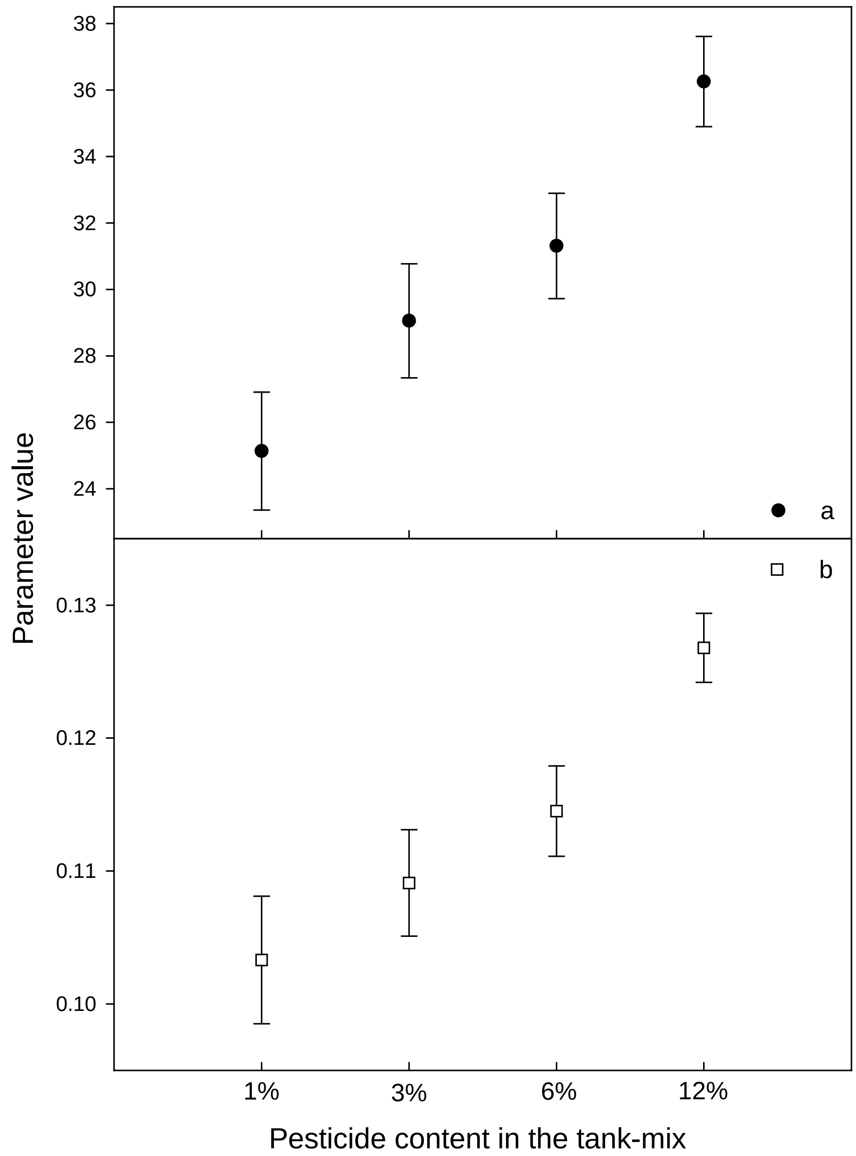

Figure 4. Values of a and b (mean ± 2 times of standard deviation) are derived from fitting the 100-500 ft portion of the deposition curve to a first-order decay equation ($Y = a\mathrm{e}^{-bX}$). The spray volume is 2 gal/ac, and the droplet size distribution of the nozzles is ASABE Medium. No additive was added to the tank-mix. Y is the deposition as a percent of application rate, and X is the square root of downwind distance (ft). Mean ± 2 times of standard deviations defines the range of 95% confidence interval within which the values of a or b lie, if assuming a normal distribution.

Table 7. Parameter values from fitting the >500 ft portion of the deposition curve to a first-order decay equation ($Y = ae^{-bX}$). The spray volume is 2 gal/ac, and the droplet size distribution of the nozzles is ASABE Medium. No additive was added to the tank-mix. Y is the deposition as a percent of application rate, and X is the square root of downwind distance (ft).

Scenario	% of Pesticide	a[a]	b	R^2
1	12	30.7734 ± 0.2277	0.1131 ± 0.0003	0.9989
2	6	22.2798 ± 0.3894	0.0894 ± 0.0003	0.9902
3	3	13.4797 ± 0.2863	0.0653 ± 0.0007	0.9736
4	1	6.3764 ± 0.0835	0.0377 ± 0.0004	0.9703

[a] Values of a and b were expressed as mean ± standard deviation. Equation fitting was performed using SigmaPlot 13.0.

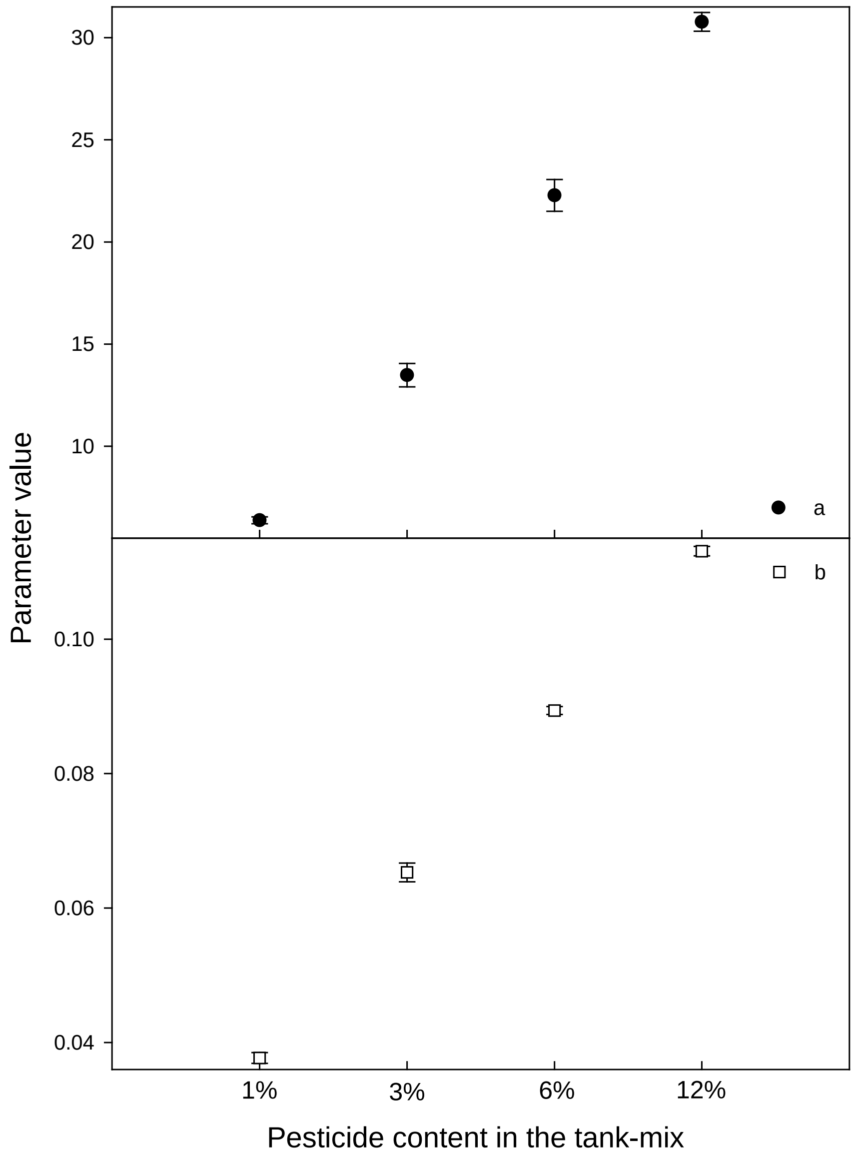

Figure 5. Values of a and b are derived from fitting the >500 ft portion of the deposition curve to a first-order decay equation ($Y = a\mathrm{e}^{-bX}$). The spray volume is 2 gal/ac and the droplet size distribution of the nozzles is ASABE Medium. No additive was added to the tank-mix. Y is the deposition as a percent of application rate, and X is the square root of downwind distance (ft). Mean ± 2 times of standard deviations defines the range of 95% confidence interval within which the values of a or b lie, if assuming a normal distribution.

Increasing tank-mix pesticide percentage increases the concentration in downwind air, but the air concentration increase is not directly proportional to tank-mix percentage increase. Table 8 and 9 respectively show air concentrations at different downwind distances for 2.0 and 5.3 ft above ground. Both heights show the change in air concentration do not parallel with the change in magnitude of tank-mix pesticide percentage. For instance, when increasing the tank-mix percentage from 3% to 12%, the 2.0 ft-high air concentration at 500 ft downwind was only increased from 7.36 to 13.74 ng/L.

To help visualize this effect, the air concentrations were normalized by the respective application rates (Figure 6). Figure 6 shows that the application rate-normalized air concentration is not a constant across different tank-mix percentages. The normalized air concentrations decrease as the pesticide tank-mix percentage increases, and the difference is more pronounced in the far-field distances.

Table 8. Air concentrations (ng/L) at 2.0 ft above ground for 0-1000 ft downwind distance.

Downwind distance (ft)	1%	3%	6%	12%
0	8.43	21.22	37.63	66.45
25	6.84	16.57	28.32	48.26
50	6.45	15.38	26.08	43.69
75	5.97	13.96	23.13	37.88
100	5.66	12.99	21.27	34.13
250	4.62	9.90	15.24	22.61
500	3.69	7.36	10.52	13.74
750	3.11	5.83	7.60	8.93
1000	2.70	4.57	5.44	6.19

[a] The spray volume is 2 gal/ac, and the droplet size distribution of the nozzles is ASABE Medium. No additive was added to the tank-mix.

Table 9. Air concentrations (ng/L) at 5.3 ft above ground for 0-1000 ft downwind distance.

Downwind distance (ft)	1%	3%	6%	12%
0	6.07	15.19	26.76	46.90
25	5.29	12.88	22.12	37.84
50	4.92	11.76	19.96	33.45
75	4.55	10.67	17.75	29.14
100	4.31	9.95	16.35	26.29
250	3.50	7.51	11.59	17.19
500	2.78	5.56	7.93	10.34
750	2.35	4.38	5.71	6.70
1000	2.03	3.43	4.08	4.63

[a] The spray volume is 2 gal/ac, and the droplet size distribution of the nozzles is ASABE Medium. No additive was added to the tank-mix.

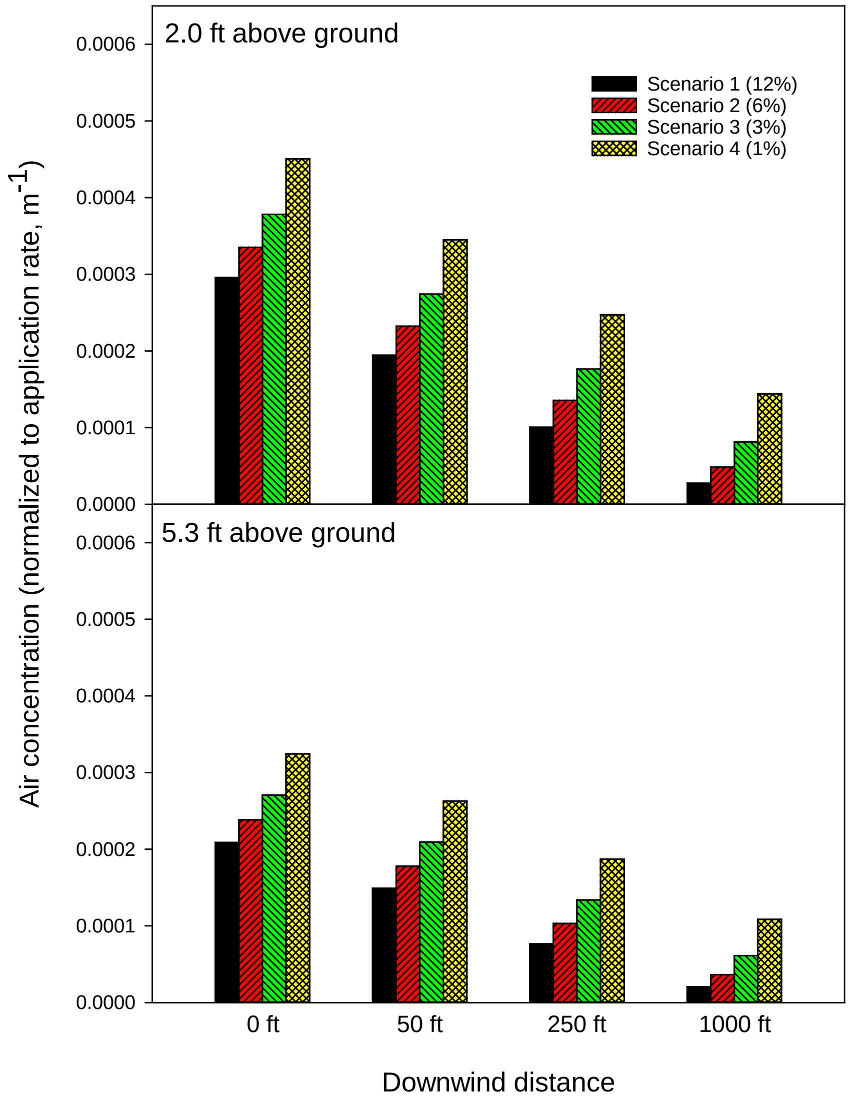

Figure 6. Air concentrations from tank-mixes with different pesticide percentages. The y-axis is the air concentration divided by the application rate. The tank-mixes contain 1-12% pesticide. The spray volume is 2 gal/ac and the droplet size distribution of the nozzles is ASABE Medium. No additive was added to the tank-mix.

Results on both horizontal deposition (Figure 3) and air concentration (Figure 6) show that pesticide drift potential is not directly proportional to its percentage in the tank mix at the same spray volume. At any downwind distance, the horizontal deposition is not the same fraction of application rates for different tank-mixes. Hence, using the same fraction values to calculate depositions for different tank-mixes may cause either underestimation or overestimation, and the difference becomes more significant at far-field downwind distance. In addition, doubling the pesticide percentage in the tank-mix does not proportionally increase the downwind air concentration. Therefore, individual AGDISP runs are required to properly characterize drift across various application rates used for different crops and pests.

A tank-mix often contains other non-volatile component(s), which may be other pesticide(s), or adjuvant(s) such as a wetter/spreader added to improve pesticide performance (Witt, 2017). Scenarios 5 and 6 explore the effects of co-existing non-volatile components (additives) on pesticide drift potential. Pesticide application rates in Scenario 5 and 6 are the same as Scenario 2 and 4 respectively. But, the extra additive maintains the total non-volatile percentage ratio in the tank-mix the same as Scenario 1 at 12%. Table 10 shows the horizontal deposition potential. Comparing Scenarios 2 and 5, and Scenarios 4 and 6, additives slightly increase deposition at near field, but significantly decrease the deposition at far-field. For the tank-mix with 6% pesticide and 6% additive, the deposition at 52.49 ft is 16.98% of the application rate, which is slightly higher than 16.82 % if only 6% pesticide is added to the tank-mix. However, at 498.68 ft, the deposition from additive-included tank-mix is 0.87% of the application rate, compared to 1.39% without additives (Table 10). This difference becomes greater if more additives are added. At 2604.96 ft, the deposition decreased by almost 90% if 11% additive was included. As noted in Table 10, the deposition fraction values are the same for Scenario 1, 5 and 6, all of which have the same non-volatile fraction in the tank-mix (12%). This indicates that pesticide drift deposition is determined by the total non-volatile fraction in the tank-mix. For tank-mixes with the same total non-volatile contents, including both pesticide and additives, their deposition curves will be the same and the same fraction of applied pesticide will deposit at the same downwind distance (Figure 7).

Table 10. Pesticide horizontal deposition at selective downwind distance.

Downwind distance (ft)	Scenario 1 (12% pesticide, no additive)	Scenario 2 (6% pesticide, no additive)	Scenario 5 (6% pesticide, 6% additive)	Scenario 4 (1% pesticide, no additive)	Scenario 6 (1% pesticide, 11% additive)
0	51.23	51.16	51.24	50.03	51.24
52.49	17.02	16.82	16.98	15.97	16.98
98.42	10.90	10.80	10.88	9.95	10.88
196.85	5.87	6.07	5.86	5.49	5.86
498.68	2.37	2.75	2.38	2.86	2.38
997.36	0.87	1.39	0.87	1.89	0.87
1502.61	0.36	0.65	0.36	1.61	0.36
2001.29	0.21	0.38	0.21	1.16	0.21
2604.96	0.09	0.21	0.09	0.82	0.09

[a] The deposition is expressed as percentage of the application rate. The spray volume is 2 gal/ac, and the droplet size distribution of the nozzles is ASABE Medium. Additive was added in the tank-mixes in Scenario 8 and 9 at 6% or 11% respectively.

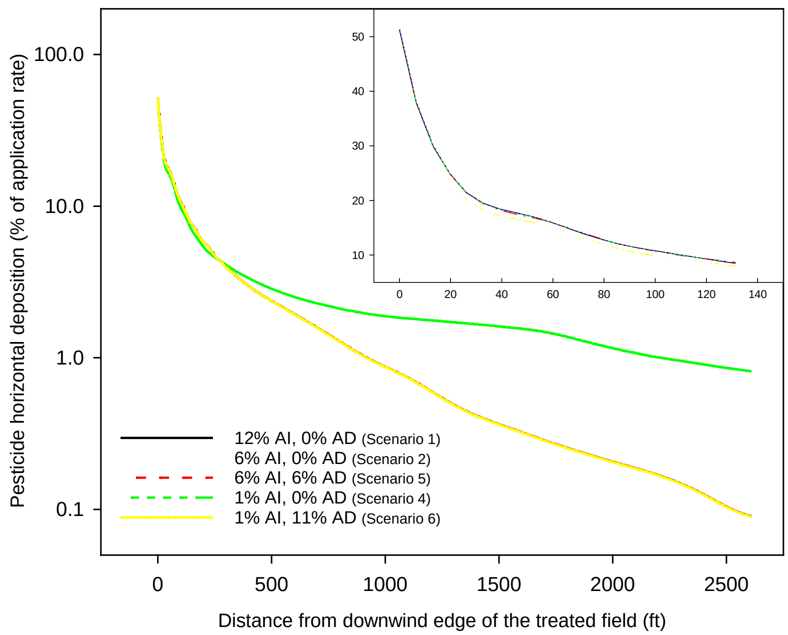

Figure 7. Pesticide horizontal deposition profiles for tank-mixes containing different percentage of pesticide (AI) and additive (AD). The spray volume is 2 gal/ac and the droplet size distribution is ASABE Medium. The deposition curves of Scenario 1 (12% AI, 0% AD), 7 (6% AI, 6% AD), and 8 (1% AI, 11% AD) are overlapped in the figure.

Total non-volatile contents also determine the downwind pesticide air concentrations. For tank-mixes with the same non-volatile fraction, the air concentration of pesticide is proportional to the application rate (Table 11 and 12, Figure 8). For instance, air concentrations from tank-mix with 1% pesticide and no additive are not the same as those from tank-mix with 1% pesticide and 11% additive. However, tank-mix with 12% pesticide and no additive generates air concentrations exactly 12 times of those from tank-mix with 1% pesticide and 11% additive.

Therefore, pesticide drift potential is a function of the total non-volatile content in the tank-mix and for tank-mix with the same percentage of non-volatile materials, pesticide horizontal deposition and air concentration are directly proportional to the pesticide percentage.

Table 11. Air concentration (ng/L) at 2.0 ft above ground for tank-mixes containing different percentage of pesticide and additive.

Downwind distance (ft)	Scenario 1 (12% pesticide, no additive)	Scenario 2 (6% pesticide, no additive)	Scenario 5 (6% pesticide, 6% additive)	Scenario 4 (1% pesticide, no additive)	Scenario 6 (1% pesticide, 11% additive)
0	66.45[a]	37.63	33.23	8.43	5.54
25	48.26	28.32	24.13	6.84	4.02
50	43.69	26.08	21.84	6.45	3.64
75	37.88	23.13	18.94	5.97	3.16
100	34.13	21.27	17.07	5.66	2.84
250	22.61	15.24	11.30	4.62	1.88
500	13.74	10.52	6.87	3.69	1.15
750	8.93	7.60	4.47	3.11	0.74
1000	6.19	5.44	3.09	2.70	0.52

[a]: The spray volume is 2 gal/ac and the droplet size distribution of the nozzles is ASABE Medium. The percentage of additive in the tank-mixes of Scenario 8 and 9 was 6% and 11%, respectively.

Table 12. Air concentration (ng/L) at 5.3 ft above ground for tank-mixes containing different percentage of pesticide and additive.

Downwind distance (ft)	Scenario 1 (12% pesticide, no additive)	Scenario 2 (6% pesticide, no additive)	Scenario 5 (6% pesticide, 6% additive)	Scenario 4 (1% pesticide, no additive)	Scenario 6 (1% pesticide, 11% additive)
0	46.90[a]	26.76	23.45	6.07	3.91
25	37.84	22.12	18.92	5.29	3.15
50	33.45	19.96	16.72	4.92	2.79
75	29.14	17.75	14.57	4.55	2.43
100	26.29	16.35	13.14	4.31	2.19
250	17.19	11.59	8.59	3.50	1.43
500	10.34	7.93	5.17	2.78	0.86
750	6.70	5.71	3.35	2.35	0.56
1000	4.63	4.08	2.32	2.03	0.39

[a] The spray volume is 2 gal/ac, and the droplet size distribution of the nozzles is ASABE Medium. Percentage of additive in the tank-mixes of Scenario 8 and 9 was 6% and 11%, respectively.

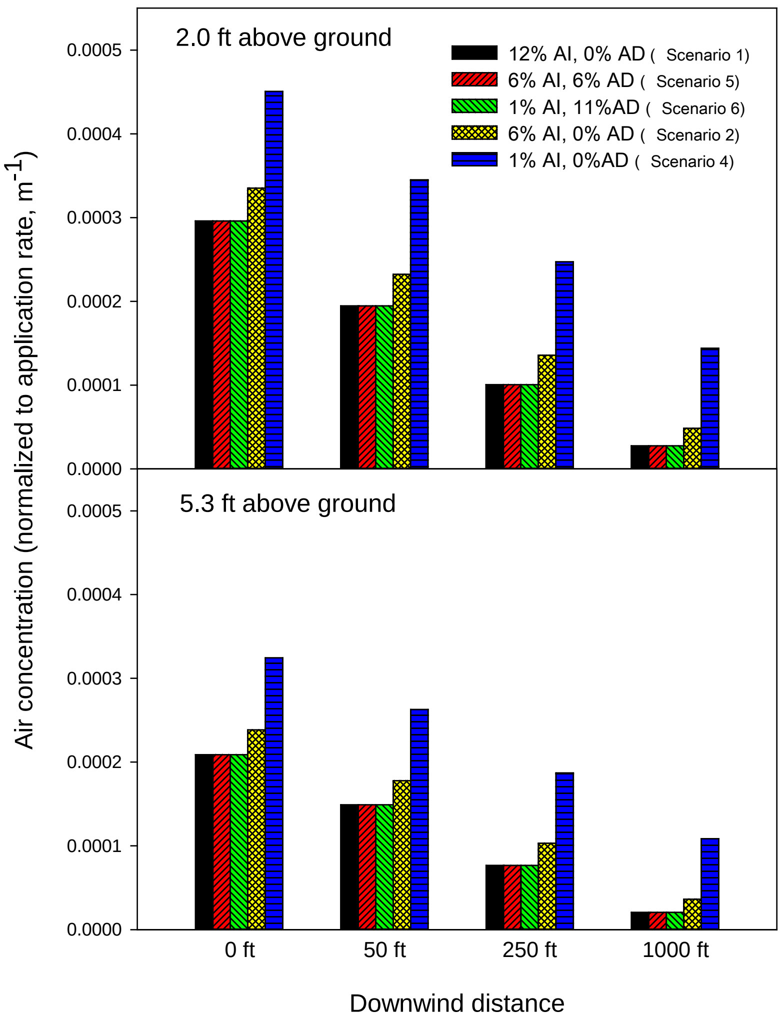

Figure 8. Air concentrations from tank-mixes with different pesticide and additive percentages. Air concentrations were normalized for application rate. The spray volume is 2 gal/ac and the droplet size distribution of the nozzles is ASABE Medium.

<u>Effects of other application parameters</u>

Other application parameters were also evaluated for their effects on pesticide drift, including spray volume rate and spraying DSD. Scenario 7, 8 and 9 investigated applications with the same tank-mixes as Scenario 2, 5 and 3, but at higher spray volume rates (Table 1). As shown in Table 13 and Figure 9, by increasing spray volume but maintaining the same pesticide proportion in the tank mix there is minimal effect on downwind horizontal deposition potential. At 997.36 ft, the horizontal deposition for Scenario 9 is 1.91% of application rate, which is the same as Scenario 3. Spray volume rate also did not affect air concentration resulting from pesticide drift. As shown in Tables 14 and 15, the air concentrations increase proportionally with increasing spray volume rates for the same tank-mix. This increase is caused by an increase in the application rate due to a higher spray volume, but the application rate-normalized air concentrations remain unchanged (Figure 10).

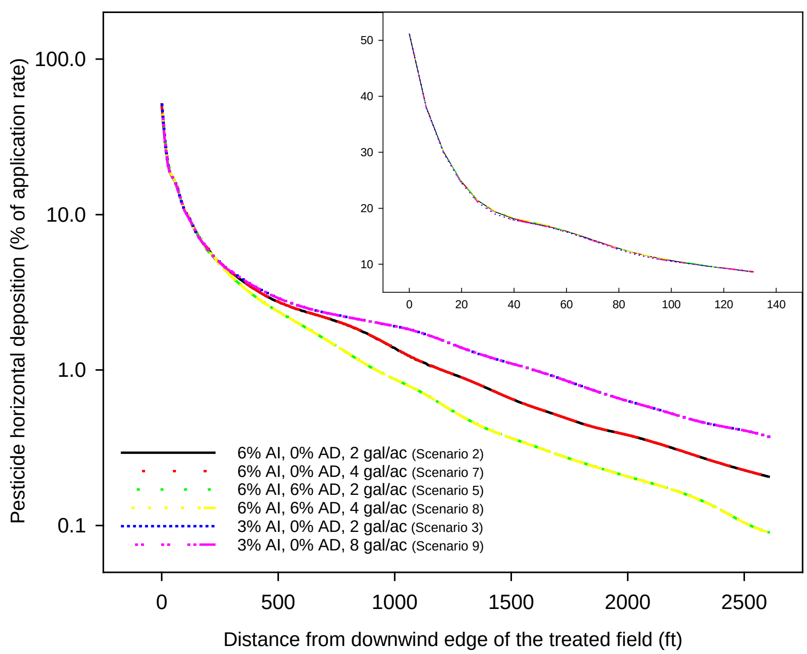

Figure 9. Pesticide horizontal deposition profiles for tank-mixes with different spray volume rates. No additive was added except Scenario 5 and 8 (6%). The droplet size distribution is ASABE Medium.

Table 13. Pesticide horizontal deposition at selective downwind distance for tank-mixes with different spray volume rates.

Downwind distance (ft)	Scenario 2 (6% pesticide, no additive, 2 gal/ac)	Scenario 7 (6% pesticide, no additive, 4 gal/ac)	Scenario 5 (6% pesticide, 6% additive, 2 gal/ac)	Scenario 8 (6% pesticide, 6% additive, 4 gal/ac)	Scenario 3 (3% pesticide, no additive, 2 gal/ac)	Scenario 9 (3% pesticide, 11% additive, 8 gal/ac)
0	51.16[a]	51.19	51.24	51.24	50.95	50.91
52.49	16.82	16.85	16.98	16.98	16.76	16.73
98.42	10.80	10.83	10.88	10.88	10.61	10.60
196.85	6.07	6.09	5.86	5.86	5.97	5.97
498.68	2.75	2.75	2.38	2.38	2.90	2.90
997.36	1.39	1.39	0.87	0.87	1.91	1.91
1502.61	0.65	0.65	0.36	0.36	1.10	1.10
2001.29	0.38	0.38	0.21	0.21	0.63	0.63
2604.96	0.21	0.21	0.09	0.09	0.37	0.37

[a] The deposition is expressed as percentage of the application rate. The droplet size distribution is ASABE Medium.

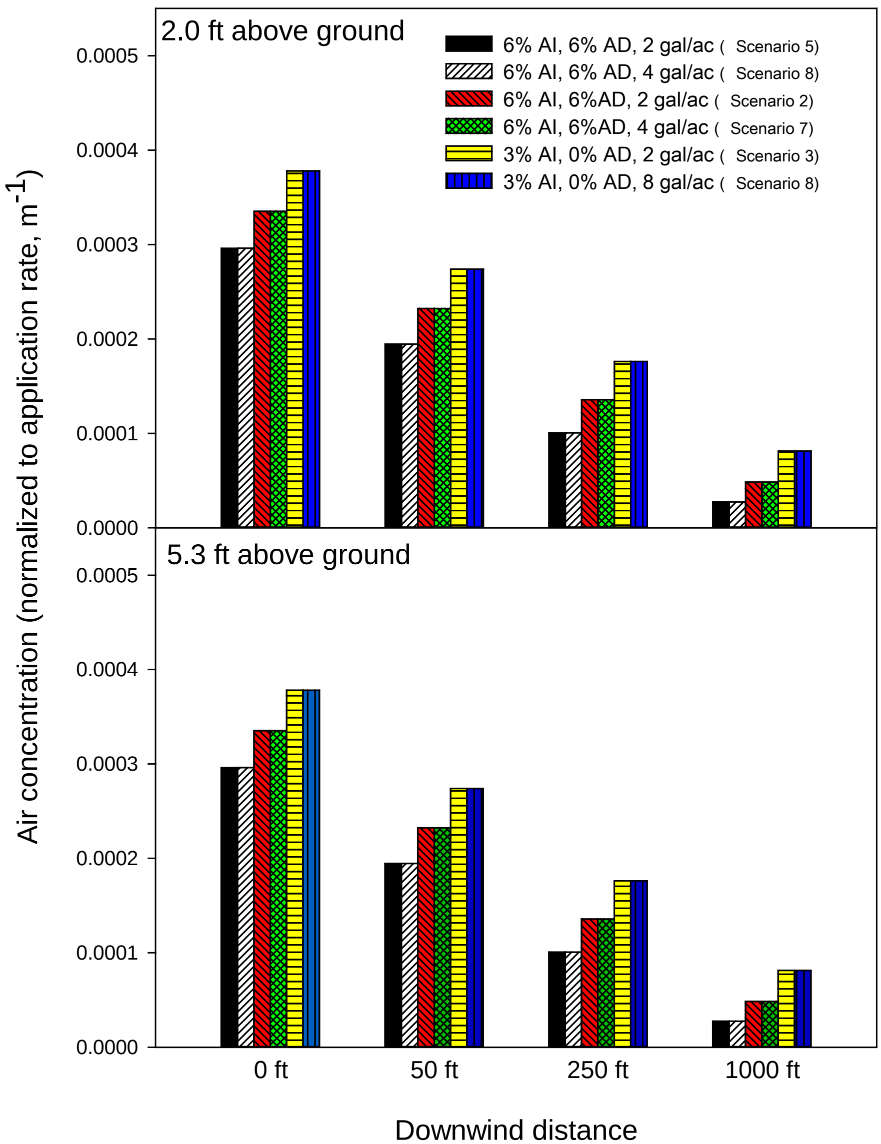

Figure 10. Air concentrations from tank-mixes with different spray volume rates. Air concentrations were normalized by application rate. The droplet size distribution of the nozzles is ASABE Medium.

Table 14. Air concentration (ng/L) at 2.0 ft above ground for different spray volume rates.

Downwind distance (ft)	Scenario 2 (6% pesticide, no additive, 2 gal/ac)	Scenario 7 (6% pesticide, no additive, 4 gal/ac)	Scenario 5 (6% pesticide, 6% additive, 2 gal/ac)	Scenario 8 (6% pesticide, 6% additive, 4 gal/ac)	Scenario 3 (3% pesticide, no additive, 2 gal/ac)	Scenario 9 (3% pesticide, 11% additive, 8 gal/ac)
0	37.63[a]	75.27	33.23	66.46	21.22	84.89
25	28.32	56.64	24.13	48.26	16.57	66.27
50	26.08	52.15	21.84	43.69	15.38	61.54
75	23.13	46.27	18.94	37.88	13.96	55.83
100	21.27	42.54	17.07	34.13	12.99	51.95
250	15.24	30.48	11.30	22.61	9.90	39.58
500	10.52	21.04	6.87	13.74	7.36	29.45
750	7.60	15.21	4.47	8.93	5.83	23.30
1000	5.44	10.88	3.09	6.19	4.57	18.28

[a] The droplet size distribution is ASABE Medium.

Table 15. Air concentration (ng/L) at 5.3 ft above ground for different spray volume rates.

Downwind distance (ft)	Scenario 2 (6% pesticide, no additive, 2 gal/ac)	Scenario 7 (6% pesticide, no additive, 4 gal/ac)	Scenario 5 (6% pesticide, 6% additive, 2 gal/ac)	Scenario 8 (6% pesticide, 6% additive, 4 gal/ac)	Scenario 3 (3% pesticide, no additive, 2 gal/ac)	Scenario 9 (3% pesticide, 11% additive, 8 gal/ac)
0	26.76[a]	60.77	23.45	46.90	15.19	60.77
25	22.12	51.52	18.92	37.84	12.88	51.52
50	19.96	47.03	16.72	33.45	11.76	47.03
75	17.75	42.70	14.57	29.14	10.67	42.70
100	16.35	39.81	13.14	26.29	9.95	39.81
250	11.59	30.04	8.59	17.19	7.51	30.04
500	7.93	22.24	5.17	10.34	5.56	22.24
750	5.71	17.53	3.35	6.70	4.38	17.53
1000	4.08	13.73	2.32	4.63	3.43	13.73

[a] The droplet size distribution is ASABE Medium.

Scenario 10-13 investigated the drift potential from nozzles with different DSDs. The same pesticide tank-mixes were applied at the same spray volume rate but using different nozzle sizes, i.e., ASABE Fine to Medium, Medium, and Coarse. The horizontal deposition estimates are summarized in Figure 11 and Table 16. These results show that finer spraying droplets generate greater downwind horizontal deposition throughout the entire modeling domain. For a tank-mix containing 6% pesticide, the deposition at 98.42 ft is 13.88% of application rate for ASABE Fine to Medium DSD, which is higher than 10.80% for medium DSD and 6.28% for coarse DSD. Fitting the deposition curves to Equation 1 confirms that, for the entire modeled downwind domain, coarser spraying droplets generate a faster decrease of deposition potential along the downwind distance (Table 17-19).

Smaller spray droplet sizes also increase downwind air concentrations (Table 20 and 21). For 6% tank-mix and at 100 ft downwind, pesticide air concentrations at 2.0 and 5.3 ft are 29.31 and 22.49 ng/L for ASABE Fine to Medium DSD, higher than 21.27 and 16.35 ng/L for medium DSD and 10.37 and 7.99 ng/L for coarse DSD. This difference is greater in the far-field. For example, at 1000 ft downwind, the air concentration from Fine to Medium DSD and at 5.3 ft height is almost 4 times of the concentration from Coarse DSD.

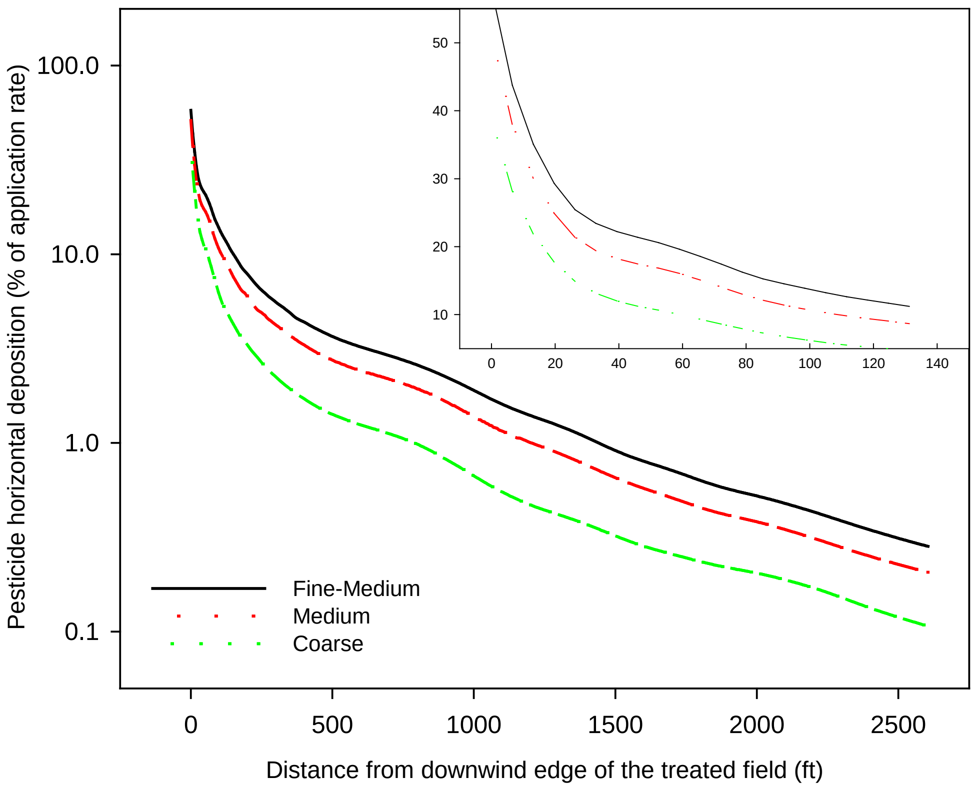

Figure 11. Pesticide horizontal deposition profiles for different droplet size distributions (DSDs) including ASABE Fine to Medium, Medium and Coarse. The tank-mix contain 6% pesticides and are applied at 2 gal/ac. No additive was added.

Table 16. Pesticide horizontal deposition at selective downwind distance from tank-mixes applied at different droplet size distribution (DSD). A complete list of deposition at different downwind distances is provided in the Appendix A.

Downwind distance (ft)	Scenario 10 (6% pesticide, fine to medium DSD)	Scenario 2 (6% pesticide, medium DSD)	Scenario 12 (6% pesticide, coarse DSD)	Scenario 11 (1% pesticide, fine to medium DSD)	Scenario 4 (1% pesticide, medium DSD)	Scenario 13 (1% pesticide, coarse DSD)
0	57.96[a]	51.16	38.86	56.40	50.03	38.38
52.49	20.59	16.82	10.64	19.46	15.97	10.32
98.42	13.88	10.80	6.28	12.71	9.95	5.88
196.85	7.96	6.07	3.36	7.10	5.49	3.14
498.68	3.68	2.75	1.42	3.74	2.86	1.50
997.36	1.91	1.39	0.67	2.47	1.89	0.99
1502.61	0.91	0.65	0.32	2.10	1.61	0.83
2001.29	0.52	0.38	0.20	1.56	1.16	0.54
2604.96	0.28	0.21	0.11	1.14	0.82	0.37

[a] The deposition is expressed as percentage of the application rate. Spectrums of include ASABE Fine to Medium, Medium and Coarse. The spray volume rate is 2 gal/ac. No additive was added.

Table 17. Parameter values from fitting the <100 ft portion of the deposition curve to a first-order decay equation ($Y = a\mathrm{e}^{-bX}$). The tank-mixes contain 6% pesticides and are applied at 2 gal/ac. No additive was added. Droplet size distributions (DSDs) including ASABE Fine to Medium, Medium and Coarse. Y is the deposition as a percent of application rate and X is the square root of downwind distance (ft).

Scenario	DSD[a]	a[b]	b	R^2
11	Fine to Medium	58.7576 ± 1.1694	0.1474 ± 0.0040	0.9879
2	Medium	52.1375 ± 1.0727	0.1588 ± 0.0043	0.9881
13	Coarse	40.1802 ± 0.9262	0.1827 ± 0.0053	0.9873

[a] Droplet size distributions

[b] Values of a and b were expressed as mean ± standard deviation. Equation fitting was performed using SigmaPlot 13.0.

Table 18. Parameter values from fitting the 100-500 ft portion of the deposition curve to a first-order decay equation ($Y = a\mathrm{e}^{-bX}$). The tank-mixes contain 6% pesticides and are applied at 2 gal/ac. No additive was added. Droplet size distributions (DSDs) including ASABE Fine to Medium, Medium and Coarse. Y is the deposition as a percent of application rate, and X is the square root of downwind distance (ft).

Scenario	DSD[a]	a[b]	b	R^2
11	Fine to Medium	39.4317 ± 0.8795	0.1116 ± 0.0015	0.9897
2	Medium	31.3083 ± 0.7921	0.1145 ± 0.0017	0.9873
13	Coarse	19.5451 ± 0.4307	0.1235 ± 0.0015	0.9917

[a] Droplet size distributions

[b] Values of a and b were expressed as mean ± standard deviation. Equation fitting was performed using SigmaPlot 13.0.

Table 19. Parameter values from fitting the >500 ft portion of the deposition curve to a first-order decay equation ($Y = a\mathrm{e}^{-bX}$). The tank-mixes contain 6% pesticides and are applied at 2 gal/ac. No additive was added. Droplet size distributions (DSDs) including ASABE Fine to Medium, Medium and Coarse. Y is the deposition as a percent of application rate, and X is the square root of downwind distance (ft).

Scenario	DSD[a]	a[b]	b	R^2
11	Fine to Medium	28.2044 ± 0.4748	0.0871 ± 0.0006	0.9904
2	Medium	22.2798 ± 0.3894	0.0894 ± 0.0006	0.9902
13	Coarse	12.0415 ± 0.2036	0.0918 ± 0.0006	0.9911

[a] Droplet size distributions

[b] Values of a and b were expressed as mean ± standard deviation. Equation fitting was performed using SigmaPlot 13.0.

Table 20. Air concentration (ng/L) at 2.0 ft above ground from tank-mixes applied at different droplet size distribution (DSD).

Downwind distance (ft)	Scenario 10 (6% pesticide, fine to medium DSD)	Scenario 2 (6% pesticide, medium DSD)	Scenario 12 (6% pesticide, coarse DSD)	Scenario 11 (1% pesticide, fine to medium DSD)	Scenario 4 (1% pesticide, medium DSD)	Scenario 13 (1% pesticide, coarse DSD)
0	48.77[a]	37.63	21.72	11.02	8.43	4.70
25	38.06	28.32	15.03	9.18	6.84	3.57
50	35.17	26.08	13.46	8.69	6.45	3.29
75	31.71	23.13	11.55	8.12	5.97	2.98
100	29.31	21.27	10.37	7.73	5.66	2.79
250	21.40	15.24	7.16	6.37	4.62	2.23
500	14.95	10.52	4.77	5.11	3.69	1.75
750	10.99	7.60	3.29	4.33	3.11	1.46
1000	8.05	5.44	2.24	3.76	2.70	1.25

[a] The deposition is expressed as percentage of the application rate. Spectrums of include ASABE Fine to Medium, medium and coarse. The spray volume rate is 2 gal/ac. No additive was added.

Table 21. Air concentration (ng/L) at 5.3 ft above ground from tank-mixes applied at different droplet size distribution (DSD).

Downwind distance (ft)	Scenario 10 (6% pesticide, fine to medium DSD)	Scenario 2 (6% pesticide, medium DSD)	Scenario 12 (6% pesticide, coarse DSD)	Scenario 11 (1% pesticide, fine to medium DSD)	Scenario 4 (1% pesticide, medium DSD)	Scenario 13 (1% pesticide, coarse DSD)
0	35.05[a]	26.76	15.11	7.99	6.07	3.32
25	29.68	22.12	11.70	7.09	5.29	2.76
50	26.95	19.96	10.27	6.62	4.92	2.50
75	24.32	17.75	8.86	6.18	4.55	2.27
100	22.49	16.35	7.99	5.88	4.31	2.13
250	16.26	11.59	5.45	4.81	3.50	1.69
500	11.28	7.93	3.60	3.85	2.78	1.32
750	8.25	5.71	2.47	3.26	2.35	1.10
1000	6.04	4.08	1.68	2.83	2.03	0.94

[a] The deposition is expressed as percentage of the application rate. Spectrums of include ASABE Fine to Medium, medium and coarse. The spray volume rate is 2 gal/ac. No additive was added.

<u>Impacts on bystander exposure assessment</u>

AGDISP estimates have been used by both US EPA and DPR to assess residential bystander pesticide exposure due to aerial spray drift (CDPR, 2018; USEPA, 2012a). Specifically, the horizontal deposition estimates are used to calculate pesticide deposition on a downwind turf and the associated bystander dermal and oral exposure (USEPA, 2012b). The air concentration estimates were also used by US EPA and DPR to calculate bystander inhalation exposure (CDPR, 2018; USEPA, 2014; USEPA, 2012c).

US EPA's standard practice is to use a 50 ft-wide area turf that is located at various downwind distances. The dermal and incidental oral exposures are assumed to occur while bystanders are walking, playing, or mowing on this turf. To account for different application rates, the current US EPA practice assumes the same drift fraction for a certain downwind distance, and calculates pesticide deposition by multiplying the deposition fraction with target application rate. However, as discussed above, the horizontal deposition fraction varies among different tank-mix properties and the deposition values may not be proportional to application rate. Therefore, using the same deposition fraction together with a simple proportional adjustment for changing application rates may overestimate or underestimate the drift potential, and further affect the accuracy of exposure assessment.

Table 22 and 23 summarize pesticide deposition on a 50 ft turf, as a fraction of the application rate, for six representative application scenarios. These results indicate that using a base set of "deposition fraction" values that are then adjusted proportionally for application rate may not be appropriate, as the fraction values are different among different application conditions. This difference changes with downwind distance. For instance, at <75ft, highest deposition fraction values were seen for the 2 lb/ac scenario, while at >75ft, the highest values were seen for the lowest rate, 1 lb/ac scenario (Table 22). Also finer spraying nozzles generated greater downwind drift (Table 23). These findings suggest that: 1) using fraction values generated from one application scenario could underestimate or overestimate pesticide depositions for other application scenarios, especially for those with rather different tank-mix pesticide content, and 2) even for screening purposes, selecting a single application rate to run AGDISP may not represent the reasonable worst case spray drift for all application scenarios at all downwind distances.

Table 22. Pesticide deposition within a 50 ft-wide turf[a] locating at various downwind distances.

Downwind (ft)	1 lbs/ac, no additive	2 lbs/ac, no additive	6 lbs/ac, no additive	2 lbs/ac, 2lbs/ac additive
25[b]	17.19	17.26[c]	17.09	17.20
50	13.71	13.71	13.47	13.60
75	10.89	10.89	10.48	10.69
100	9.08	9.01	8.55	8.78
150	6.71	6.65	6.02	6.35
200	5.37	5.29	4.44	4.91
250	4.56	4.34	3.36	3.84
300	3.97	3.68	2.56	3.09
500	2.65	2.25	1.08	1.48
750	2.00	1.35	0.51	0.74
1000	1.32	0.84	0.29	0.43

[a] 50 ft wide turf is a standard turf suggested by US EPA for residential exposure assessment;

[b] This represents a turf expanding from 25 to 75 ft downwind;

[c] The deposition is expressed as percentage of application rate. The droplet size distribution (DSD) is ASABE Medium, and the spray volume rate is 2 gal/ac.

Table 23. Pesticide deposition within a 50 ft-wide turf at various downwind distances.

	25ft[a]	50ft	100ft	250ft	500ft	1000ft
			ASABE Fine to Medium			
1lbs/ac	20.96	17.07	11.71	6.00	3.54	1.82
2lbs/ac	21.09[b]	17.11	11.67	5.74	3.04	1.17
6lbs/ac	20.87	16.78	11.05	4.49	1.50	0.43
			ASABE Medium			
1lbs/ac	17.19	13.71	9.08	4.56	2.65	1.32
2lbs/ac	17.26	13.71	9.01	4.34	2.25	0.84
6lbs/ac	17.09	13.47	8.55	3.36	1.08	0.29
			ASABE Coarse			
1lbs/ac	11.11	8.38	5.07	2.44	1.37	0.63
2lbs/ac	11.14	8.36	5.04	2.29	1.15	0.38
6lbs/ac	11.04	8.21	4.76	1.72	0.50	0.13

[a] This represents a turf expanding from 25 to 75 ft downwind;

[b] The deposition is expressed as percentage of application rate. There is no additive added in the tank-mix, and the spray volume rate is 2 gal/ac.

An example of this under/over-estimation of bystander exposure is shown in Figure 12, where fraction values from 2 lbs/ac, no additive application were used to calculate bystander dermal and oral exposure for the other three scenarios. The under-/over-estimations are seen for all downwind distances, but drastically increase while moving far-field. For instance, for a 50 ft wide turf section at 1000-1050 ft, using the selected fraction values caused around a 40% underestimation for 1lb/ac application, and an almost 200% overestimation for 6 lb/ac application. The extent of under/over-estimation varies depending on the scenario selected to retrieve fraction values, as well as other application, weather, and field input values for the scenario of interest. Similar conclusions were also seen for inhalation exposure (Figure 13).

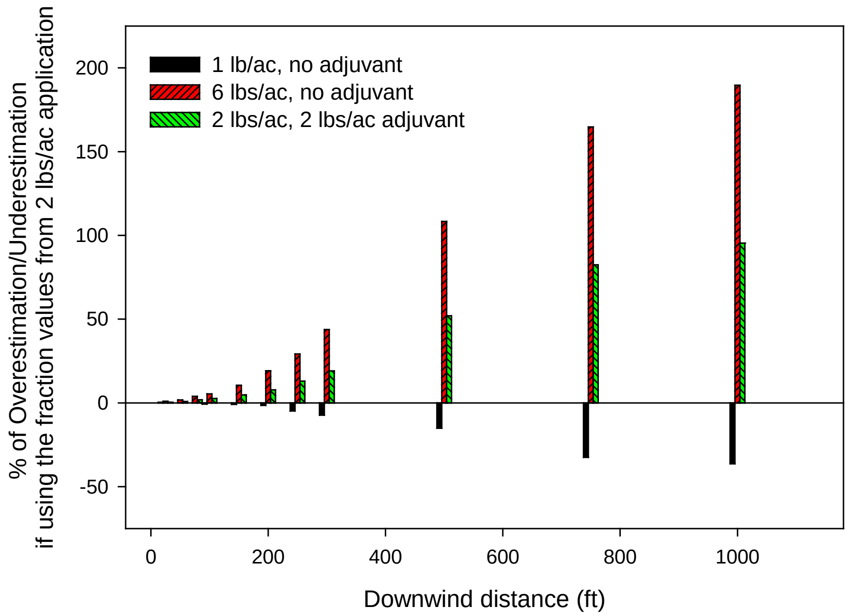

Figure 12. Percentage of overestimation or underestimation on residential bystander dermal and oral exposure. Exposure routes include dermal contact for adults, and dermal contact and incidental oral ingestion for children.

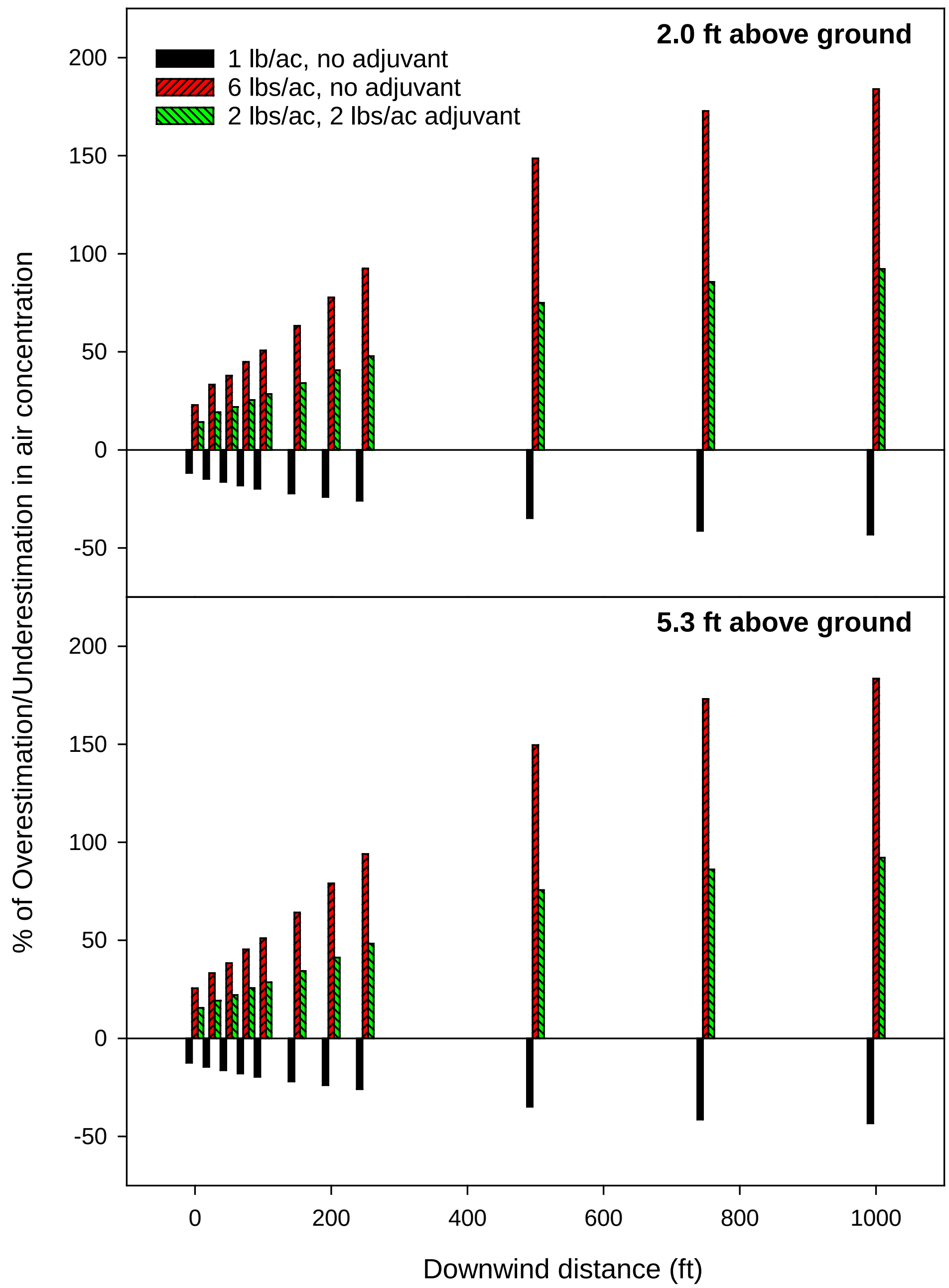

Figure 13. Percentage of overestimation or underestimation on residential bystander inhalation exposure.

Conclusion

AGDISP is a useful tool to estimate pesticide downwind drift, but proper development of model inputs is critical to generate meaningful output values. The analysis conducted in this document illustrates the difficulty of finding a particular tank-mix composition that represents a reasonable worst-case drift scenario for all downwind distances. AGDISP outputs from low-application rate scenario underestimate horizontal deposition at near-field for high rate applications. AGDISP outputs from low-application rate scenario overestimate downwind horizontal deposition and air concentration for high-application rate scenarios in the far-field. As AGDISP is a recommended model by US EPA to assess residential bystander exposure to pesticide spray drift from aerial applications, so this analysis emphasized the importance of proper model use and selecting scenario-specific model inputs for accurate drift exposure assessment.

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Appendix A

Table A1. Pesticide horizontal deposition at different downwind distance for Scenario 1-7, 13 and 15. The tank-mixes has no additive and is applied at 2 gal/ac. The droplet size distribution (DSD) for Scenario 1-7 is ASABE Medium. The DSD for Scenario 12 and 14 is ASABE Fine to Medium and ASABE Coarse respectively.

Downwind (ft)	Scenario							
	1 (12%[a])	2 (6%)	3 (3%)	4 (1%)	5 (0.5%)	6 (0.1%)	12 (6%)	14 (6%)
0	51.2300	51.1600	50.9500	50.0300	48.0900	46.5800	57.9607	38.8560
6.5616	37.9500	38.0200	37.8300	36.9600	35.0600	33.8400	43.7507	28.1998
13.1232	29.9600	30.0700	29.8300	28.9400	27.2000	26.1500	35.0744	21.8813
19.6848	24.9000	24.9400	24.6100	23.7100	22.1600	21.1700	29.3206	17.7590
26.2464	21.4400	21.3800	21.0000	20.2000	18.7900	17.7800	25.4446	14.8733
32.808	19.5000	19.3900	18.9900	18.2400	16.9100	15.8900	23.4203	13.1373
39.3696	18.4300	18.2200	17.9700	17.1800	15.9100	14.8600	22.2311	12.0012
45.9312	17.7300	17.4400	17.3800	16.5600	15.2800	14.2300	21.3782	11.2024
52.4928	17.0200	16.8200	16.7600	15.9700	14.6100	13.6600	20.5884	10.6424
59.0544	16.0600	16.0300	15.9000	15.1600	13.6800	12.8900	19.6164	10.0056
65.616	14.9700	15.0700	14.9100	14.1900	12.6700	11.9700	18.5640	9.2843
72.1776	13.8900	14.0200	13.8500	13.0900	11.6600	10.9500	17.4303	8.5916
78.7392	12.9000	12.9900	12.7700	12.0100	10.7100	9.9400	16.2504	7.9026
85.3008	12.0600	12.1000	11.8400	11.1500	9.9300	9.1000	15.2630	7.2685
91.8624	11.4200	11.3900	11.1400	10.4900	9.3100	8.4400	14.5262	6.7417
98.424	10.9000	10.8000	10.6100	9.9500	8.8300	7.9200	13.8767	6.2818
104.9856	10.4000	10.2600	10.1800	9.5200	8.4200	7.4900	13.2257	5.8573
111.5472	9.8900	9.8000	9.7900	9.1600	7.9900	7.1200	12.6412	5.4994
118.1088	9.4100	9.4000	9.3900	8.7900	7.5100	6.7500	12.1471	5.2159
124.6704	8.9300	9.0400	8.9800	8.3700	7.0500	6.3800	11.6869	4.9905
131.232	8.4900	8.6600	8.5700	7.9400	6.6800	6.0100	11.2156	4.8153
137.7936	8.1100	8.2700	8.1600	7.5400	6.3700	5.6500	10.7449	4.6269
144.3552	7.8000	7.9000	7.7700	7.1900	6.0900	5.3300	10.3266	4.4368
150.9168	7.5600	7.5800	7.4500	6.9000	5.8200	5.0600	9.9713	4.2586
157.4784	7.3300	7.2900	7.1800	6.6500	5.5700	4.8300	9.6374	4.0917
164.04	7.0800	7.0100	6.9500	6.4300	5.3400	4.6500	9.2919	3.9292
170.6016	6.7900	6.7500	6.7600	6.2400	5.1300	4.4900	8.9477	3.7749

177.1632	6.5100	6.5300	6.5700	6.0600	4.9300	4.3400	8.6355	3.6403
183.7248	6.2600	6.3600	6.3700	5.8700	4.7600	4.1800	8.3728	3.5336
190.2864	6.0400	6.2200	6.1700	5.6700	4.6100	4.0200	8.1561	3.4461
196.848	5.8700	6.0700	5.9700	5.4900	4.4900	3.8800	7.9572	3.3578
203.4096	5.7300	5.9000	5.7900	5.3300	4.3800	3.7600	7.7474	3.2597
209.9712	5.6200	5.7000	5.6200	5.1900	4.2700	3.6400	7.5290	3.1600
216.5328	5.5100	5.5000	5.4800	5.0700	4.1600	3.5400	7.3209	3.0680
223.0944	5.3800	5.3300	5.3700	4.9600	4.0500	3.4400	7.1283	2.9849
229.656	5.2100	5.1900	5.2600	4.8800	3.9600	3.3600	6.9431	2.9087
236.2176	5.0300	5.0700	5.1500	4.7900	3.8700	3.2800	6.7667	2.8270
242.7792	4.8600	4.9700	5.0400	4.7000	3.7900	3.2000	6.6085	2.7492
249.3408	4.7300	4.9000	4.9300	4.6100	3.7100	3.1300	6.4715	2.6759
255.9024	4.6200	4.8200	4.8300	4.5300	3.6400	3.0600	6.3472	2.6070
262.464	4.5200	4.7300	4.7200	4.4700	3.5800	2.9900	6.2212	2.5424
269.0256	4.4200	4.6200	4.6200	4.4100	3.5200	2.9200	6.0902	2.4817
275.5872	4.3300	4.5100	4.5300	4.3500	3.4600	2.8500	5.9669	2.4247
282.1488	4.2400	4.4300	4.4500	4.2900	3.4000	2.7900	5.8602	2.3712
288.7104	4.1300	4.3500	4.3800	4.2200	3.3300	2.7300	5.7605	2.3207
295.272	4.0200	4.2700	4.3200	4.1500	3.2700	2.6800	5.6557	2.2720
301.8336	3.9300	4.2000	4.2600	4.0900	3.2100	2.6300	5.5493	2.2244
308.3952	3.8400	4.1300	4.2000	4.0200	3.1600	2.5800	5.4536	2.1779
314.9568	3.7700	4.0600	4.1300	3.9600	3.1000	2.5300	5.3701	2.1332
321.5184	3.7000	3.9900	4.0700	3.9000	3.0600	2.4900	5.2880	2.0910
328.08	3.6300	3.9200	4.0000	3.8500	3.0100	2.4500	5.1997	2.0514
334.6416	3.5500	3.8500	3.9400	3.8000	2.9700	2.4200	5.1093	2.0143
341.2032	3.4800	3.7900	3.8900	3.7400	2.9300	2.3800	5.0218	1.9793
347.7648	3.4200	3.7300	3.8300	3.6900	2.8900	2.3500	4.9336	1.9460
354.3264	3.3500	3.6700	3.7800	3.6500	2.8500	2.3100	4.8405	1.9135
360.888	3.2900	3.6100	3.7200	3.6000	2.8100	2.2800	4.7432	1.8816
367.4496	3.2300	3.5500	3.6700	3.5600	2.7700	2.2600	4.6526	1.8500
374.0112	3.1700	3.5000	3.6200	3.5100	2.7400	2.2300	4.5775	1.8193
380.5728	3.1100	3.4400	3.5700	3.4700	2.7100	2.2000	4.5183	1.7899
387.1344	3.0600	3.3900	3.5200	3.4300	2.6700	2.1800	4.4689	1.7621
393.696	3.0100	3.3400	3.4800	3.3900	2.6400	2.1500	4.4219	1.7359
400.2576	2.9600	3.3000	3.4300	3.3500	2.6100	2.1300	4.3725	1.7108
406.8192	2.9100	3.2500	3.3900	3.3100	2.5800	2.1000	4.3194	1.6865

413.3808	2.8600	3.2100	3.3500	3.2700	2.5500	2.0800	4.2640	1.6628
419.9424	2.8200	3.1600	3.3100	3.2300	2.5300	2.0600	4.2087	1.6395
426.504	2.7700	3.1200	3.2700	3.2000	2.5000	2.0400	4.1556	1.6166
433.0656	2.7300	3.0800	3.2300	3.1600	2.4700	2.0100	4.1052	1.5943
439.6272	2.6900	3.0400	3.1900	3.1300	2.4500	1.9900	4.0571	1.5730
446.1888	2.6500	3.0000	3.1500	3.1000	2.4200	1.9700	4.0105	1.5529
452.7504	2.6100	2.9600	3.1200	3.0700	2.4000	1.9500	3.9653	1.5340
459.312	2.5700	2.9300	3.0900	3.0300	2.3700	1.9300	3.9186	1.5160
465.8736	2.5400	2.9000	3.0500	3.0000	2.3500	1.9100	3.8740	1.4987
472.4352	2.5000	2.8600	3.0200	2.9700	2.3200	1.9000	3.8314	1.4819
478.9968	2.4700	2.8300	2.9900	2.9400	2.3000	1.8800	3.7908	1.4656
485.5584	2.4400	2.8000	2.9600	2.9200	2.2800	1.8600	3.7517	1.4497
492.12	2.4000	2.7800	2.9300	2.8900	2.2600	1.8500	3.7138	1.4343
498.6816	2.3700	2.7500	2.9000	2.8600	2.2400	1.8300	3.6768	1.4195
505.2432	2.3400	2.7200	2.8700	2.8400	2.2200	1.8100	3.6406	1.4053
511.8048	2.3100	2.6900	2.8400	2.8100	2.2000	1.8000	3.6054	1.3918
518.3664	2.2800	2.6700	2.8200	2.7900	2.1800	1.7800	3.5712	1.3788
524.928	2.2500	2.6500	2.7900	2.7600	2.1600	1.7600	3.5383	1.3664
531.4896	2.2200	2.6200	2.7700	2.7400	2.1400	1.7500	3.5066	1.3543
538.0512	2.1900	2.6000	2.7500	2.7200	2.1300	1.7300	3.4760	1.3425
544.6128	2.1700	2.5800	2.7200	2.6900	2.1100	1.7200	3.4465	1.3309
551.1744	2.1400	2.5500	2.7000	2.6700	2.0900	1.7000	3.4178	1.3195
557.736	2.1100	2.5300	2.6800	2.6500	2.0800	1.6900	3.3900	1.3083
564.2976	2.0800	2.5100	2.6600	2.6300	2.0600	1.6800	3.3631	1.2973
570.8592	2.0600	2.4900	2.6400	2.6100	2.0500	1.6600	3.3371	1.2868
577.4208	2.0300	2.4700	2.6200	2.5900	2.0300	1.6500	3.3120	1.2767
583.9824	2.0000	2.4600	2.6000	2.5700	2.0200	1.6300	3.2875	1.2671
590.544	1.9800	2.4400	2.5800	2.5500	2.0000	1.6200	3.2634	1.2578
597.1056	1.9500	2.4200	2.5600	2.5300	1.9900	1.6100	3.2397	1.2488
603.6672	1.9300	2.4000	2.5500	2.5100	1.9700	1.5900	3.2161	1.2399
610.2288	1.9000	2.3900	2.5300	2.4900	1.9600	1.5800	3.1928	1.2312
616.7904	1.8800	2.3700	2.5100	2.4800	1.9500	1.5700	3.1698	1.2225
623.352	1.8500	2.3500	2.5000	2.4600	1.9300	1.5500	3.1474	1.2139
629.9136	1.8300	2.3400	2.4800	2.4400	1.9200	1.5400	3.1256	1.2055
636.4752	1.8000	2.3200	2.4600	2.4300	1.9100	1.5300	3.1045	1.1972
643.0368	1.7800	2.3100	2.4500	2.4100	1.8900	1.5200	3.0839	1.1891

649.5984	1.7500	2.2900	2.4400	2.4000	1.8800	1.5100	3.0636	1.1811
656.16	1.7300	2.2800	2.4200	2.3800	1.8700	1.4900	3.0433	1.1730
662.7216	1.7100	2.2600	2.4100	2.3700	1.8600	1.4800	3.0229	1.1649
669.2832	1.6800	2.2500	2.3900	2.3500	1.8500	1.4700	3.0024	1.1567
675.8448	1.6600	2.2300	2.3800	2.3400	1.8300	1.4600	2.9817	1.1484
682.4064	1.6400	2.2200	2.3700	2.3200	1.8200	1.4500	2.9610	1.1400
688.968	1.6200	2.2000	2.3600	2.3100	1.8100	1.4400	2.9403	1.1317
695.5296	1.5900	2.1900	2.3500	2.3000	1.8000	1.4300	2.9198	1.1234
702.0912	1.5700	2.1700	2.3300	2.2800	1.7900	1.4200	2.8994	1.1151
708.6528	1.5500	2.1600	2.3200	2.2700	1.7800	1.4100	2.8791	1.1069
715.2144	1.5300	2.1400	2.3100	2.2600	1.7600	1.4000	2.8587	1.0987
721.776	1.5100	2.1300	2.3000	2.2500	1.7500	1.3900	2.8383	1.0904
728.3376	1.4900	2.1100	2.2900	2.2400	1.7400	1.3800	2.8177	1.0820
734.8992	1.4700	2.0900	2.2800	2.2200	1.7300	1.3700	2.7970	1.0735
741.4608	1.4500	2.0800	2.2700	2.2100	1.7200	1.3600	2.7761	1.0650
748.0224	1.4300	2.0600	2.2600	2.2000	1.7100	1.3500	2.7553	1.0563
754.584	1.4100	2.0500	2.2500	2.1900	1.7000	1.3400	2.7345	1.0476
761.1456	1.3900	2.0300	2.2400	2.1800	1.6900	1.3300	2.7138	1.0388
767.7072	1.3700	2.0200	2.2300	2.1700	1.6800	1.3200	2.6930	1.0299
774.2688	1.3500	2.0000	2.2200	2.1600	1.6700	1.3100	2.6721	1.0209
780.8304	1.3300	1.9800	2.2100	2.1400	1.6600	1.3000	2.6510	1.0116
787.392	1.3100	1.9700	2.2000	2.1300	1.6500	1.2900	2.6297	1.0021
793.9536	1.2900	1.9500	2.1900	2.1200	1.6400	1.2800	2.6081	0.9924
800.5152	1.2700	1.9300	2.1800	2.1100	1.6300	1.2800	2.5864	0.9825
807.0768	1.2600	1.9200	2.1700	2.1000	1.6200	1.2700	2.5645	0.9724
813.6384	1.2400	1.9000	2.1600	2.0900	1.6100	1.2600	2.5426	0.9623
820.2	1.2200	1.8800	2.1500	2.0800	1.6000	1.2500	2.5207	0.9519
826.7616	1.2000	1.8600	2.1400	2.0700	1.5900	1.2400	2.4987	0.9415
833.3232	1.1900	1.8500	2.1300	2.0600	1.5800	1.2300	2.4765	0.9309
839.8848	1.1700	1.8300	2.1200	2.0500	1.5700	1.2200	2.4541	0.9202
846.4464	1.1500	1.8100	2.1100	2.0500	1.5700	1.2200	2.4314	0.9093
853.008	1.1400	1.7900	2.1000	2.0400	1.5600	1.2100	2.4085	0.8983
859.5696	1.1200	1.7700	2.1000	2.0300	1.5500	1.2000	2.3854	0.8873
866.1312	1.1100	1.7500	2.0900	2.0200	1.5400	1.1900	2.3622	0.8762
872.6928	1.0900	1.7400	2.0800	2.0100	1.5300	1.1900	2.3391	0.8652
879.2544	1.0800	1.7200	2.0700	2.0000	1.5300	1.1800	2.3160	0.8543

885.816	1.0700	1.7000	2.0600	2.0000	1.5200	1.1700	2.2930	0.8434
892.3776	1.0500	1.6800	2.0500	1.9900	1.5100	1.1700	2.2701	0.8327
898.9392	1.0400	1.6600	2.0400	1.9800	1.5000	1.1600	2.2472	0.8220
905.5008	1.0200	1.6400	2.0300	1.9700	1.5000	1.1500	2.2243	0.8114
912.0624	1.0100	1.6200	2.0200	1.9600	1.4900	1.1400	2.2014	0.8009
918.624	1.0000	1.6000	2.0200	1.9600	1.4800	1.1400	2.1786	0.7904
925.1856	0.9874	1.5800	2.0100	1.9500	1.4800	1.1300	2.1557	0.7801
931.7472	0.9756	1.5700	2.0000	1.9400	1.4700	1.1200	2.1329	0.7698
938.3088	0.9642	1.5500	1.9900	1.9400	1.4600	1.1100	2.1101	0.7597
944.8704	0.9531	1.5300	1.9800	1.9300	1.4600	1.1100	2.0875	0.7496
951.432	0.9424	1.5100	1.9700	1.9300	1.4500	1.1000	2.0649	0.7397
957.9936	0.9320	1.4900	1.9600	1.9200	1.4500	1.0900	2.0423	0.7298
964.5552	0.9218	1.4700	1.9600	1.9100	1.4400	1.0900	2.0198	0.7200
971.1168	0.9118	1.4600	1.9500	1.9100	1.4400	1.0800	1.9972	0.7103
977.6784	0.9020	1.4400	1.9400	1.9000	1.4300	1.0800	1.9747	0.7005
984.24	0.8924	1.4200	1.9300	1.9000	1.4300	1.0700	1.9524	0.6909
990.8016	0.8830	1.4000	1.9200	1.8900	1.4200	1.0600	1.9301	0.6814
997.3632	0.8737	1.3900	1.9100	1.8900	1.4200	1.0600	1.9081	0.6720
1003.925	0.8646	1.3700	1.9100	1.8800	1.4100	1.0500	1.8862	0.6627
1010.486	0.8556	1.3500	1.9000	1.8800	1.4100	1.0500	1.8647	0.6535
1017.048	0.8467	1.3300	1.8900	1.8700	1.4000	1.0400	1.8434	0.6445
1023.61	0.8379	1.3200	1.8800	1.8700	1.4000	1.0400	1.8224	0.6357
1030.171	0.8291	1.3000	1.8700	1.8600	1.3900	1.0300	1.8016	0.6271
1036.733	0.8204	1.2900	1.8600	1.8600	1.3900	1.0300	1.7811	0.6187
1043.294	0.8117	1.2700	1.8500	1.8500	1.3900	1.0200	1.7610	0.6105
1049.856	0.8030	1.2600	1.8400	1.8500	1.3800	1.0200	1.7413	0.6025
1056.418	0.7944	1.2400	1.8300	1.8500	1.3800	1.0100	1.7220	0.5948
1062.979	0.7858	1.2300	1.8200	1.8400	1.3700	1.0100	1.7031	0.5873
1069.541	0.7772	1.2100	1.8100	1.8400	1.3700	1.0000	1.6847	0.5800
1076.102	0.7686	1.2000	1.8000	1.8300	1.3700	1.0000	1.6667	0.5729
1082.664	0.7599	1.1900	1.7900	1.8300	1.3600	0.9935	1.6492	0.5661
1089.226	0.7513	1.1700	1.7700	1.8300	1.3600	0.9886	1.6321	0.5594
1095.787	0.7426	1.1600	1.7600	1.8200	1.3500	0.9838	1.6154	0.5528
1102.349	0.7339	1.1500	1.7500	1.8200	1.3500	0.9791	1.5991	0.5465
1108.91	0.7252	1.1400	1.7400	1.8200	1.3500	0.9744	1.5831	0.5403
1115.472	0.7165	1.1300	1.7300	1.8100	1.3400	0.9696	1.5676	0.5343

1122.034	0.7077	1.1200	1.7200	1.8100	1.3400	0.9650	1.5525	0.5284
1128.595	0.6989	1.1100	1.7000	1.8100	1.3400	0.9604	1.5377	0.5226
1135.157	0.6901	1.1000	1.6900	1.8000	1.3300	0.9559	1.5233	0.5170
1141.718	0.6813	1.0800	1.6800	1.8000	1.3300	0.9515	1.5092	0.5115
1148.28	0.6724	1.0700	1.6600	1.8000	1.3300	0.9472	1.4954	0.5061
1154.842	0.6635	1.0600	1.6500	1.7900	1.3200	0.9430	1.4819	0.5008
1161.403	0.6547	1.0600	1.6400	1.7900	1.3200	0.9387	1.4688	0.4957
1167.965	0.6458	1.0500	1.6200	1.7900	1.3200	0.9345	1.4559	0.4906
1174.526	0.6370	1.0400	1.6100	1.7800	1.3100	0.9301	1.4433	0.4857
1181.088	0.6283	1.0300	1.6000	1.7800	1.3100	0.9257	1.4310	0.4810
1187.65	0.6196	1.0200	1.5800	1.7800	1.3100	0.9212	1.4190	0.4764
1194.211	0.6110	1.0100	1.5700	1.7700	1.3000	0.9167	1.4072	0.4720
1200.773	0.6025	1.0000	1.5600	1.7700	1.3000	0.9123	1.3957	0.4678
1207.334	0.5940	0.9928	1.5400	1.7700	1.3000	0.9078	1.3844	0.4637
1213.896	0.5858	0.9844	1.5300	1.7600	1.2900	0.9034	1.3733	0.4597
1220.458	0.5776	0.9762	1.5200	1.7600	1.2900	0.8990	1.3623	0.4559
1227.019	0.5696	0.9681	1.5000	1.7600	1.2900	0.8946	1.3515	0.4522
1233.581	0.5617	0.9601	1.4900	1.7500	1.2800	0.8902	1.3408	0.4486
1240.142	0.5540	0.9521	1.4800	1.7500	1.2800	0.8858	1.3303	0.4452
1246.704	0.5464	0.9442	1.4600	1.7500	1.2700	0.8815	1.3198	0.4418
1253.266	0.5391	0.9363	1.4500	1.7400	1.2700	0.8772	1.3094	0.4385
1259.827	0.5318	0.9285	1.4400	1.7400	1.2700	0.8730	1.2990	0.4352
1266.389	0.5248	0.9206	1.4300	1.7400	1.2600	0.8688	1.2886	0.4320
1272.95	0.5179	0.9127	1.4100	1.7300	1.2600	0.8647	1.2782	0.4288
1279.512	0.5111	0.9049	1.4000	1.7300	1.2600	0.8606	1.2677	0.4256
1286.074	0.5046	0.8970	1.3900	1.7300	1.2500	0.8565	1.2572	0.4225
1292.635	0.4981	0.8891	1.3800	1.7200	1.2500	0.8523	1.2466	0.4193
1299.197	0.4919	0.8811	1.3700	1.7200	1.2500	0.8482	1.2360	0.4162
1305.758	0.4858	0.8732	1.3600	1.7200	1.2400	0.8441	1.2253	0.4131
1312.32	0.4799	0.8652	1.3400	1.7100	1.2400	0.8399	1.2146	0.4100
1318.882	0.4741	0.8572	1.3300	1.7100	1.2400	0.8358	1.2037	0.4069
1325.443	0.4685	0.8492	1.3200	1.7100	1.2300	0.8317	1.1929	0.4038
1332.005	0.4630	0.8412	1.3100	1.7000	1.2300	0.8276	1.1819	0.4007
1338.566	0.4578	0.8333	1.3000	1.7000	1.2300	0.8236	1.1710	0.3976
1345.128	0.4526	0.8253	1.2900	1.7000	1.2200	0.8195	1.1600	0.3945
1351.69	0.4476	0.8174	1.2800	1.6900	1.2200	0.8154	1.1490	0.3914

1358.251	0.4428	0.8094	1.2700	1.6900	1.2200	0.8114	1.1380	0.3883
1364.813	0.4381	0.8016	1.2600	1.6900	1.2200	0.8074	1.1270	0.3853
1371.374	0.4336	0.7937	1.2600	1.6800	1.2100	0.8034	1.1159	0.3822
1377.936	0.4292	0.7859	1.2500	1.6800	1.2100	0.7994	1.1049	0.3791
1384.498	0.4250	0.7782	1.2400	1.6800	1.2100	0.7955	1.0938	0.3760
1391.059	0.4208	0.7705	1.2300	1.6700	1.2100	0.7916	1.0828	0.3729
1397.621	0.4168	0.7628	1.2200	1.6700	1.2000	0.7878	1.0717	0.3698
1404.182	0.4129	0.7551	1.2100	1.6700	1.2000	0.7841	1.0606	0.3666
1410.744	0.4091	0.7476	1.2000	1.6600	1.2000	0.7803	1.0496	0.3635
1417.306	0.4054	0.7400	1.1900	1.6600	1.2000	0.7765	1.0386	0.3603
1423.867	0.4018	0.7325	1.1900	1.6600	1.1900	0.7728	1.0277	0.3571
1430.429	0.3983	0.7252	1.1800	1.6500	1.1900	0.7691	1.0169	0.3539
1436.99	0.3948	0.7178	1.1700	1.6500	1.1900	0.7654	1.0062	0.3507
1443.552	0.3914	0.7106	1.1600	1.6500	1.1900	0.7617	0.9956	0.3475
1450.114	0.3880	0.7035	1.1600	1.6400	1.1900	0.7581	0.9851	0.3443
1456.675	0.3847	0.6965	1.1500	1.6400	1.1800	0.7545	0.9748	0.3411
1463.237	0.3814	0.6896	1.1400	1.6300	1.1800	0.7509	0.9646	0.3380
1469.798	0.3782	0.6828	1.1300	1.6300	1.1800	0.7472	0.9547	0.3349
1476.36	0.3750	0.6761	1.1300	1.6300	1.1800	0.7435	0.9449	0.3318
1482.922	0.3719	0.6696	1.1200	1.6200	1.1800	0.7399	0.9353	0.3288
1489.483	0.3688	0.6632	1.1100	1.6200	1.1800	0.7362	0.9259	0.3258
1496.045	0.3658	0.6569	1.1000	1.6200	1.1700	0.7324	0.9168	0.3228
1502.606	0.3628	0.6507	1.1000	1.6100	1.1700	0.7288	0.9079	0.3199
1509.168	0.3598	0.6447	1.0900	1.6100	1.1700	0.7251	0.8991	0.3171
1515.73	0.3570	0.6388	1.0800	1.6100	1.1700	0.7215	0.8907	0.3143
1522.291	0.3541	0.6330	1.0800	1.6000	1.1700	0.7179	0.8824	0.3115
1528.853	0.3514	0.6274	1.0700	1.6000	1.1700	0.7144	0.8744	0.3088
1535.414	0.3486	0.6219	1.0600	1.5900	1.1700	0.7109	0.8666	0.3062
1541.976	0.3459	0.6165	1.0600	1.5900	1.1600	0.7074	0.8590	0.3036
1548.538	0.3433	0.6112	1.0500	1.5900	1.1600	0.7041	0.8516	0.3011
1555.099	0.3406	0.6060	1.0400	1.5800	1.1600	0.7008	0.8444	0.2986
1561.661	0.3380	0.6010	1.0400	1.5800	1.1600	0.6976	0.8374	0.2962
1568.222	0.3354	0.5961	1.0300	1.5800	1.1600	0.6945	0.8306	0.2938
1574.784	0.3328	0.5912	1.0200	1.5700	1.1600	0.6915	0.8240	0.2915
1581.346	0.3302	0.5865	1.0100	1.5700	1.1600	0.6886	0.8175	0.2893
1587.907	0.3276	0.5818	1.0100	1.5700	1.1500	0.6858	0.8112	0.2871

1594.469	0.3250	0.5773	1.0000	1.5600	1.1500	0.6830	0.8050	0.2849
1601.03	0.3224	0.5728	0.9943	1.5600	1.1500	0.6803	0.7990	0.2829
1607.592	0.3198	0.5684	0.9874	1.5500	1.1500	0.6777	0.7931	0.2809
1614.154	0.3172	0.5641	0.9805	1.5500	1.1500	0.6751	0.7873	0.2789
1620.715	0.3146	0.5598	0.9736	1.5400	1.1500	0.6726	0.7816	0.2770
1627.277	0.3121	0.5556	0.9667	1.5400	1.1500	0.6701	0.7759	0.2752
1633.838	0.3095	0.5515	0.9598	1.5400	1.1400	0.6676	0.7703	0.2734
1640.4	0.3069	0.5473	0.9529	1.5300	1.1400	0.6652	0.7648	0.2716
1646.962	0.3044	0.5432	0.9459	1.5300	1.1400	0.6629	0.7593	0.2699
1653.523	0.3019	0.5391	0.9390	1.5200	1.1400	0.6606	0.7538	0.2682
1660.085	0.2994	0.5351	0.9321	1.5200	1.1400	0.6583	0.7483	0.2665
1666.646	0.2970	0.5310	0.9251	1.5100	1.1400	0.6561	0.7428	0.2649
1673.208	0.2945	0.5270	0.9182	1.5100	1.1300	0.6539	0.7373	0.2633
1679.77	0.2922	0.5229	0.9112	1.5000	1.1300	0.6517	0.7318	0.2617
1686.331	0.2898	0.5189	0.9042	1.5000	1.1300	0.6496	0.7263	0.2601
1692.893	0.2875	0.5149	0.8973	1.4900	1.1300	0.6476	0.7209	0.2585
1699.454	0.2853	0.5110	0.8903	1.4800	1.1300	0.6456	0.7154	0.2570
1706.016	0.2831	0.5070	0.8833	1.4800	1.1300	0.6438	0.7099	0.2555
1712.578	0.2809	0.5031	0.8764	1.4700	1.1200	0.6419	0.7044	0.2539
1719.139	0.2787	0.4992	0.8694	1.4700	1.1200	0.6402	0.6989	0.2524
1725.701	0.2766	0.4953	0.8625	1.4600	1.1200	0.6385	0.6934	0.2509
1732.262	0.2745	0.4914	0.8556	1.4500	1.1200	0.6368	0.6879	0.2495
1738.824	0.2725	0.4876	0.8488	1.4500	1.1200	0.6352	0.6824	0.2480
1745.386	0.2704	0.4838	0.8420	1.4400	1.1200	0.6337	0.6769	0.2465
1751.947	0.2684	0.4801	0.8353	1.4300	1.1100	0.6321	0.6715	0.2451
1758.509	0.2664	0.4764	0.8286	1.4300	1.1100	0.6306	0.6660	0.2436
1765.07	0.2644	0.4727	0.8220	1.4200	1.1100	0.6292	0.6607	0.2422
1771.632	0.2624	0.4691	0.8155	1.4100	1.1100	0.6277	0.6553	0.2408
1778.194	0.2605	0.4655	0.8090	1.4000	1.1100	0.6262	0.6500	0.2394
1784.755	0.2586	0.4620	0.8026	1.4000	1.1100	0.6247	0.6448	0.2380
1791.317	0.2567	0.4586	0.7963	1.3900	1.1100	0.6232	0.6397	0.2366
1797.878	0.2548	0.4552	0.7900	1.3800	1.1000	0.6217	0.6346	0.2352
1804.44	0.2529	0.4519	0.7837	1.3700	1.1000	0.6201	0.6296	0.2339
1811.002	0.2511	0.4486	0.7776	1.3600	1.1000	0.6185	0.6247	0.2326
1817.563	0.2493	0.4455	0.7714	1.3600	1.1000	0.6169	0.6199	0.2313
1824.125	0.2475	0.4424	0.7654	1.3500	1.1000	0.6152	0.6152	0.2300

1830.686	0.2458	0.4394	0.7594	1.3400	1.1000	0.6136	0.6106	0.2288
1837.248	0.2440	0.4365	0.7534	1.3300	1.1000	0.6119	0.6061	0.2276
1843.81	0.2423	0.4336	0.7475	1.3200	1.1000	0.6102	0.6018	0.2264
1850.371	0.2406	0.4309	0.7417	1.3200	1.1000	0.6086	0.5976	0.2253
1856.933	0.2390	0.4283	0.7360	1.3100	1.0900	0.6069	0.5935	0.2242
1863.494	0.2373	0.4257	0.7303	1.3000	1.0900	0.6052	0.5895	0.2231
1870.056	0.2357	0.4232	0.7247	1.2900	1.0900	0.6035	0.5856	0.2221
1876.618	0.2341	0.4208	0.7192	1.2900	1.0900	0.6018	0.5819	0.2211
1883.179	0.2325	0.4184	0.7138	1.2800	1.0900	0.6001	0.5782	0.2201
1889.741	0.2310	0.4161	0.7084	1.2700	1.0900	0.5985	0.5747	0.2191
1896.302	0.2294	0.4139	0.7032	1.2700	1.0900	0.5968	0.5712	0.2181
1902.864	0.2278	0.4117	0.6980	1.2600	1.0900	0.5951	0.5679	0.2172
1909.426	0.2263	0.4095	0.6929	1.2500	1.0900	0.5935	0.5646	0.2163
1915.987	0.2248	0.4074	0.6879	1.2400	1.0900	0.5918	0.5613	0.2153
1922.549	0.2232	0.4053	0.6830	1.2400	1.0900	0.5901	0.5582	0.2144
1929.11	0.2217	0.4033	0.6782	1.2300	1.0900	0.5884	0.5550	0.2135
1935.672	0.2202	0.4012	0.6734	1.2200	1.0900	0.5868	0.5520	0.2126
1942.234	0.2187	0.3992	0.6687	1.2200	1.0900	0.5850	0.5490	0.2117
1948.795	0.2172	0.3972	0.6641	1.2100	1.0900	0.5833	0.5460	0.2108
1955.357	0.2157	0.3952	0.6596	1.2000	1.0900	0.5816	0.5431	0.2100
1961.918	0.2143	0.3932	0.6551	1.2000	1.0900	0.5798	0.5402	0.2091
1968.48	0.2128	0.3912	0.6507	1.1900	1.0900	0.5780	0.5373	0.2082
1975.042	0.2114	0.3891	0.6464	1.1800	1.0900	0.5762	0.5344	0.2073
1981.603	0.2100	0.3871	0.6421	1.1800	1.0900	0.5744	0.5315	0.2064
1988.165	0.2086	0.3851	0.6379	1.1700	1.0800	0.5725	0.5287	0.2054
1994.726	0.2072	0.3830	0.6337	1.1700	1.0800	0.5707	0.5258	0.2045
2001.288	0.2058	0.3809	0.6296	1.1600	1.0800	0.5688	0.5229	0.2036
2007.85	0.2045	0.3788	0.6255	1.1500	1.0800	0.5670	0.5201	0.2026
2014.411	0.2032	0.3767	0.6214	1.1500	1.0800	0.5652	0.5172	0.2016
2020.973	0.2019	0.3745	0.6175	1.1400	1.0800	0.5634	0.5143	0.2006
2027.534	0.2006	0.3723	0.6135	1.1400	1.0800	0.5616	0.5113	0.1996
2034.096	0.1993	0.3701	0.6096	1.1300	1.0800	0.5599	0.5084	0.1986
2040.658	0.1980	0.3679	0.6058	1.1200	1.0800	0.5581	0.5054	0.1976
2047.219	0.1967	0.3656	0.6020	1.1200	1.0800	0.5565	0.5024	0.1965
2053.781	0.1955	0.3634	0.5982	1.1100	1.0800	0.5548	0.4994	0.1955
2060.342	0.1943	0.3611	0.5944	1.1100	1.0800	0.5531	0.4964	0.1944

2066.904	0.1930	0.3587	0.5907	1.1000	1.0800	0.5515	0.4933	0.1933
2073.466	0.1918	0.3564	0.5870	1.1000	1.0700	0.5498	0.4903	0.1922
2080.027	0.1906	0.3541	0.5833	1.0900	1.0700	0.5482	0.4872	0.1911
2086.589	0.1894	0.3517	0.5796	1.0900	1.0700	0.5466	0.4841	0.1900
2093.15	0.1882	0.3494	0.5760	1.0800	1.0700	0.5450	0.4810	0.1889
2099.712	0.1870	0.3470	0.5723	1.0800	1.0700	0.5434	0.4779	0.1878
2106.274	0.1858	0.3447	0.5687	1.0700	1.0700	0.5418	0.4748	0.1866
2112.835	0.1846	0.3424	0.5651	1.0700	1.0700	0.5402	0.4717	0.1855
2119.397	0.1834	0.3400	0.5614	1.0600	1.0700	0.5386	0.4687	0.1844
2125.958	0.1822	0.3377	0.5578	1.0600	1.0700	0.5370	0.4656	0.1833
2132.52	0.1810	0.3354	0.5542	1.0500	1.0700	0.5355	0.4625	0.1821
2139.082	0.1797	0.3331	0.5505	1.0500	1.0600	0.5339	0.4594	0.1810
2145.643	0.1785	0.3308	0.5469	1.0400	1.0600	0.5323	0.4564	0.1799
2152.205	0.1773	0.3285	0.5432	1.0400	1.0600	0.5308	0.4533	0.1787
2158.766	0.1761	0.3262	0.5396	1.0300	1.0600	0.5293	0.4503	0.1776
2165.328	0.1748	0.3239	0.5359	1.0300	1.0600	0.5278	0.4472	0.1764
2171.89	0.1736	0.3217	0.5323	1.0200	1.0600	0.5263	0.4442	0.1753
2178.451	0.1723	0.3194	0.5287	1.0200	1.0600	0.5249	0.4411	0.1741
2185.013	0.1711	0.3171	0.5251	1.0200	1.0600	0.5235	0.4381	0.1729
2191.574	0.1698	0.3149	0.5215	1.0100	1.0600	0.5221	0.4350	0.1717
2198.136	0.1685	0.3126	0.5179	1.0100	1.0500	0.5207	0.4320	0.1705
2204.698	0.1673	0.3104	0.5143	1.0100	1.0500	0.5194	0.4289	0.1693
2211.259	0.1660	0.3081	0.5108	1.0000	1.0500	0.5182	0.4259	0.1681
2217.821	0.1647	0.3059	0.5073	1.0000	1.0500	0.5170	0.4229	0.1668
2224.382	0.1634	0.3036	0.5039	0.9945	1.0500	0.5158	0.4198	0.1656
2230.944	0.1621	0.3014	0.5005	0.9910	1.0500	0.5147	0.4168	0.1644
2237.506	0.1608	0.2992	0.4972	0.9875	1.0500	0.5135	0.4138	0.1631
2244.067	0.1595	0.2970	0.4939	0.9841	1.0500	0.5125	0.4108	0.1618
2250.629	0.1582	0.2948	0.4907	0.9808	1.0500	0.5115	0.4078	0.1606
2257.19	0.1568	0.2926	0.4875	0.9774	1.0500	0.5105	0.4048	0.1593
2263.752	0.1555	0.2904	0.4844	0.9740	1.0500	0.5096	0.4018	0.1581
2270.314	0.1541	0.2883	0.4814	0.9707	1.0500	0.5087	0.3989	0.1568
2276.875	0.1528	0.2862	0.4784	0.9674	1.0400	0.5078	0.3959	0.1555
2283.437	0.1514	0.2841	0.4755	0.9641	1.0400	0.5070	0.3930	0.1543
2289.998	0.1500	0.2819	0.4727	0.9608	1.0400	0.5063	0.3901	0.1530
2296.56	0.1486	0.2799	0.4699	0.9575	1.0400	0.5055	0.3873	0.1518

2303.122	0.1472	0.2778	0.4672	0.9542	1.0400	0.5048	0.3845	0.1505
2309.683	0.1458	0.2758	0.4645	0.9509	1.0400	0.5041	0.3817	0.1493
2316.245	0.1443	0.2738	0.4620	0.9476	1.0400	0.5034	0.3789	0.1480
2322.806	0.1429	0.2718	0.4594	0.9443	1.0400	0.5028	0.3761	0.1468
2329.368	0.1415	0.2698	0.4570	0.9409	1.0400	0.5022	0.3734	0.1456
2335.93	0.1400	0.2679	0.4546	0.9376	1.0400	0.5016	0.3707	0.1444
2342.491	0.1385	0.2660	0.4523	0.9343	1.0400	0.5010	0.3681	0.1432
2349.053	0.1371	0.2641	0.4500	0.9310	1.0400	0.5005	0.3654	0.1420
2355.615	0.1356	0.2622	0.4479	0.9278	1.0400	0.5000	0.3628	0.1408
2362.176	0.1341	0.2604	0.4457	0.9245	1.0400	0.4995	0.3602	0.1396
2368.738	0.1326	0.2586	0.4437	0.9212	1.0300	0.4991	0.3577	0.1385
2375.299	0.1311	0.2568	0.4416	0.9179	1.0300	0.4987	0.3552	0.1374
2381.861	0.1296	0.2550	0.4397	0.9146	1.0300	0.4983	0.3527	0.1362
2388.422	0.1281	0.2532	0.4378	0.9114	1.0300	0.4979	0.3502	0.1351
2394.984	0.1266	0.2515	0.4359	0.9081	1.0300	0.4976	0.3478	0.1341
2401.546	0.1251	0.2498	0.4341	0.9049	1.0300	0.4973	0.3454	0.1330
2408.107	0.1236	0.2481	0.4323	0.9017	1.0300	0.4970	0.3430	0.1319
2414.669	0.1221	0.2465	0.4305	0.8985	1.0300	0.4967	0.3407	0.1309
2421.23	0.1206	0.2448	0.4287	0.8953	1.0300	0.4964	0.3384	0.1299
2427.792	0.1191	0.2432	0.4270	0.8921	1.0300	0.4962	0.3361	0.1289
2434.354	0.1176	0.2416	0.4253	0.8889	1.0300	0.4960	0.3338	0.1279
2440.915	0.1162	0.2400	0.4235	0.8858	1.0300	0.4958	0.3316	0.1270
2447.477	0.1147	0.2385	0.4218	0.8827	1.0300	0.4956	0.3294	0.1260
2454.038	0.1133	0.2369	0.4201	0.8796	1.0300	0.4954	0.3272	0.1251
2460.6	0.1119	0.2354	0.4183	0.8766	1.0300	0.4952	0.3250	0.1242
2467.162	0.1105	0.2339	0.4166	0.8736	1.0300	0.4950	0.3229	0.1232
2473.723	0.1092	0.2324	0.4148	0.8706	1.0300	0.4948	0.3207	0.1224
2480.285	0.1079	0.2310	0.4130	0.8677	1.0200	0.4947	0.3186	0.1215
2486.846	0.1066	0.2295	0.4112	0.8648	1.0200	0.4945	0.3165	0.1206
2493.408	0.1054	0.2281	0.4093	0.8619	1.0200	0.4944	0.3145	0.1197
2499.969	0.1042	0.2267	0.4074	0.8591	1.0200	0.4943	0.3125	0.1189
2506.531	0.1030	0.2252	0.4055	0.8563	1.0200	0.4942	0.3104	0.1181
2513.093	0.1019	0.2239	0.4035	0.8536	1.0200	0.4941	0.3084	0.1172
2519.654	0.1008	0.2225	0.4015	0.8509	1.0200	0.4940	0.3065	0.1164
2526.216	0.0997	0.2211	0.3994	0.8482	1.0200	0.4940	0.3045	0.1156
2532.778	0.0987	0.2198	0.3973	0.8455	1.0200	0.4940	0.3026	0.1148

2539.339	0.0978	0.2184	0.3952	0.8429	1.0200	0.4940	0.3007	0.1140
2545.901	0.0968	0.2171	0.3930	0.8403	1.0200	0.4941	0.2988	0.1133
2552.462	0.0960	0.2158	0.3908	0.8377	1.0200	0.4941	0.2970	0.1125
2559.024	0.0951	0.2145	0.3886	0.8352	1.0200	0.4942	0.2952	0.1118
2565.586	0.0943	0.2132	0.3863	0.8327	1.0200	0.4943	0.2934	0.1110
2572.147	0.0935	0.2120	0.3840	0.8302	1.0200	0.4944	0.2916	0.1103
2578.709	0.0928	0.2107	0.3816	0.8278	1.0200	0.4944	0.2899	0.1095
2585.271	0.0921	0.2095	0.3792	0.8253	1.0100	0.4945	0.2882	0.1088
2591.832	0.0915	0.2083	0.3768	0.8229	1.0100	0.4946	0.2865	0.1081
2598.394	0.0909	0.2071	0.3743	0.8204	1.0100	0.4947	0.2848	0.1074
2604.955	0.0903	0.2059	0.3718	0.8180	1.0100	0.4948	0.2832	0.1067

[a] The deposition is expressed as a fraction of the application rate. Number in the brackets indicates pesticide percentage in the tank-mix.