Pesticide Drift in the Midwest: 2010-2016

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Background

Modern agricultural production relies heavily on pesticide application. 40.7 million pounds of pesticides were applied over 55.3 million acres of farmland in Indiana, Iowa and Michigan (2012).

Workers and the public who are near fields during treatment are at risk of pesticide exposures from drifting chemicals.

No comprehensive assessment of the magnitude of pesticide drift from row crops exists for Midwest farming operations.

Pesticide complaints to state agencies may provide useful information to assess the burden of pesticide drift in rural and urban communities.

Objectives

Identify determinants of pesticide drift in the Midwest and compare between states.

Determine if differing state policies were associated with drift characteristics and/or reporting of incidences.

Determine the proportion of events that occurred due to applicators ignoring pesticide label guidance.

Methods

Three states with different intensities of row crop production were selected. Each has a state-based reporting system for pesticide drift complaints.

- Iowa: 92% of land is crop
  Pesticide Bureau of the Iowa Department of Agricultural and Land Stewardship (IDALS)
- Indiana : 64% of land is crop
  Indiana State Chemist (ISC)
- Michigan: 27% of land is crop
  Michigan Department of Agriculture and Rural Development (MDARD)

Converted narratives into 42 parameters.

Identified application conditions associated with pesticide drift risks:
Wind, temperature, humidity, distance to damage location, type of applicator, method of application, and target crop

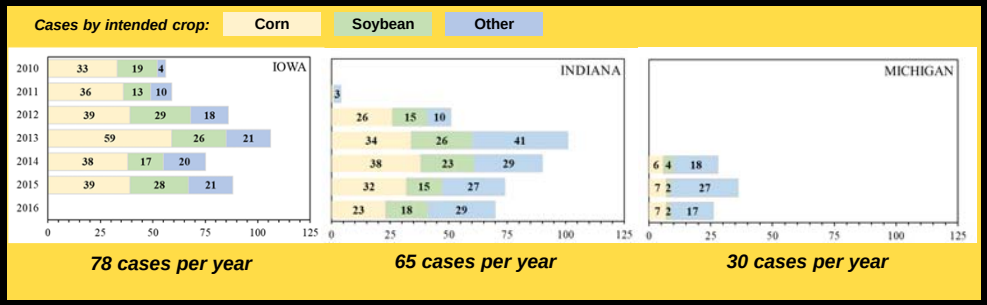
Compared state pesticide regulations.

Compared wind, application method, applicator type, and target crop by drift distance using t-tests. Identified factors associated with reported damage outcomes with chi-square tests and frequency with odds ratios.

Results

Case Summaries:

Figure 1. Number of drift incidents per year per state and the corresponding targeted crop for application.



78 cases per year *65 cases per year* *30 cases per year*

Table 1. Number of confirmed incidents in which label or government recommendations were violated when applying the most common pesticides.

Pesticide	N	Wind >4.5 m/s	Wind >6.7 m/s	Gusts >6.7 m/s	°C >25°	Humidity <40%	Distance <7.62 m
2,4-D	150	56	18	73	40	26	47
Acetochlor	63	26	12	20	23	12	22
Atrazine	139	62	19	64	51	31	46
Glyphosate	266	111	37	130	97	58	99
Pyraclostrobin	58	26	6	23	22	12	4
Metolachlor	70	26	12	34	19	18	25
Saflufenacil	58	24	6	23	11	15	16
Prothioconazole	24	6	1	2	10	1	2
Tebuconazole	11	2	0	1	3	0	1
Total	839	339 (40%)	111 (13%)	370 (44%)	276 (33%)	173 (21%)	262 (31%)

Regulation Differences by State:

Table 2. State pesticide application regulation comparison.

Regulation Component	Iowa	Indiana	Michigan
Registration of pesticides	+	+	+
Licensing of applicators	+	+	+
Renewal of application licenses	+	+	+
Civil penalties	+	+	+
Exemptions from licensing	+	+	+
Language concerning drift of pesticides	+	+	+
Language concerning exposure to livestock	+	-	-
Language concerning exposure to bees	+	-	-
Notification of drift required	-	-	+

Results, cont.

Critical Factors of Drift Cases

***Comparison of drift distances (t-test)*:**

Aerial applications were associated with:
- Iowa: *smaller* drift distances (p = 0.02)
- Michigan: *larger* drift distances (p = 0.001)

Larger drift distances were significantly associated with:
- Indiana: *commercial applicators* (p = 0.04)
- Iowa: private applicators (p = 0.006)

***Comparisons of Effects (Chi-squared)*:**

Crop damage was significantly associated with aerial applications
- Iowa (p = 0.01) and Indiana (p = 0.004)

Reports *of human exposure* was associated with:
- Iowa: applications to corn (p = 0.02) and all aerial applications (p = <0.001)
- Indiana: land applications in high wind (p = 0.005)

Frequency of Outcomes (Odds Ratios):

Indiana: human exposure was 2.6x more likely during land applications

Iowa: human exposure was 1.61x more likely when corn was the target crop

All States: Aerial applications ($\chi = 0.10$) and commercial applicators ($\chi = 0.56$) protected vegetation from damage

Conclusions

Application method, type of applicator, the target crop, and wind speed were significantly associated with drift cases.

Efforts to reduce occurrence of applications in high wind (40% at wind >4.5 m/s) and increasing buffers between applied field and neighbors (31% within 7.62 m) could reduce drift effects.

States have similar regulations concerning pesticides, but notification differences may help reduce reporting.

Future databases and investigations should consistently collect data relating to relative humidity, temperature, buffer zones, and private applicator information to better understand conformance to application guidelines.

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