New Jersey Department of Environmental Protection (NJDEP)
Water Resource Management
Bureau of Pesticide Control, Licensing & Registration
Pesticide Evaluation & Monitoring

# LAWN CARE PESTICIDE USE IN NEW JERSEY: 2019 SURVEY

## Introduction

The Pesticide Evaluation & Monitoring Section (PEMS) began a series of pesticide use surveys in 1985. These surveys address pesticide use in the state of New Jersey for agriculture, golf courses, termite control, right-of-way, mosquito control, and lawn care. The lawn care survey is conducted every three years and targets pesticides used for lawn care purposes. The lawn care survey includes commercial applications of pesticides to control pests in the maintenance and production of turf, vegetation control on commercial and residential sites, flea and tick control in turf areas, and soil fumigation for turf. This report focuses on the tenth survey completed in the lawn care series (2019).

All statewide pesticide use surveys are performed under the authority of the New Jersey Pesticide Control Code (NJPCP), N.J.A.C. 7:30-6.8(d) et.seq., requiring licensed applicators to maintain pesticide records for three years and to submit use records to the state when requested. This regulative authority provides a level of response that is difficult to duplicate in a voluntary, nationwide survey.

The information collected from the PEMS pesticide use surveys is used by agencies within the NJ Department of Environmental Protection along with other state agencies to aid in research, exposure management and monitoring efforts in areas such as ground water protection, farm worker protection and education, and residual pesticide sampling.

## Survey Methods

The NJDEP Bureau of Pesticide Control, Licensing and Registration's records were used to identify 3,758 licensed commercial applicators holding a 3B (turf) category on their license. Survey forms were mailed along with instructional letters and return envelopes asking for only 2019 lawn care pesticide use. A total of three mailings (the first to lawn care businesses, the second to individuals and the third to non-respondents) were sent during the first four months of 2020.

The survey requested information on each pesticide product used, including trade name, EPA registration number, percent active ingredient, amounts applied, and number of acres treated. The data submitted by the applicators is used to compile the survey results. PEMS relies on the regulated community to provide data that accurately reflects their pesticide applications for the survey year, information contained within this report is based on the information provided at the time of the survey.

Survey information was entered into a database file. This information file was then merged with a second database that linked trade names with chemical names, and a subprogram converted reported amounts of formulated product to amounts of active ingredient (lbs. a.i.).

Results & Discussion

Once all three mailings were completed, 2,865 out of 3,758 (76%) applicators responded. While response rates have been steadily declining since the first survey in 1990, there was a 2% (42 applicators) increase in response rate from the 2106 survey. This small increase does not negate the fact that many surveys are being returned because applicators do not consistently update their mailing addresses to remain current. PEMS forwarded "return to sender" surveys and a list of non-responders to the Bureau of Pesticide Control, Licensing and Registration for follow-up. Pesticides used by the lawn care industry in New Jersey for 2019 totaled 654,708 lbs. a.i. Based on the original reported application data from 2016 this is a 26,193 lbs. a.i. increase from the 2016 report. However, after processing the 2019 lawn care data, PEMS identified and investigated potential reporting errors in the 2016 lawn care data. It was determined that approximately 12,000 lbs. a.i. of imidacloprid was overreported by applicators in 2016, thus reducing the total application amount in 2016 to 616,515 lbs. a.i.. Using the corrected 2016 application amount, the net increase from 2016 to 2019 is approximately only 14,000 lbs. a.i..

Table 1 lists all the compounds reported in the 2019 survey and the amounts (lbs. a.i.) applied. Herbicides comprise 88% of the total pesticide use in the New Jersey lawn care industry. Fungicides (6%), insecticides (6%), growth inhibitors (<1%) and miscellaneous compounds (<1%) account for the rest. Miscellaneous compounds include products such as bird repellents, pH neutralizing agents, antimicrobials and miticides.

The overall use reported in each category did not change significantly between 2016 and 2019. The 3% net increase in herbicide use can be attributed to the following: a prodiamine increase of 70,627 lbs. ai., a glyphosate decrease of 10,013 lbs. a.i., and a clopyralid decrease of 6,355 lbs. a.i. The 5% decrease in reported insecticide use can be attributed to the 14,273 lbs. a.i. decrease in imidacloprid. This decrease is in contrast with the increased use on a global scale. Upon further examination PEMS determined that inflated amounts reported in the 2016 survey resulted in a perceived reduction in the 2019 imidacloprid use. The 3% net increase in fungicide use can be attributed to an 18,519 lbs. a.i. increase in propiconazole and a 4,735 lbs. a.i. loss in chlorothalonil.

**Table 1**. Pesticide amounts (lbs. a.i.) reported in the New Jersey 2019 Lawn Care Pesticide Use Survey. *Indicates a compound not reported in the 2016 survey.

| HERBICIDES | lbs. a.i. | HERBICIDES | lbs. a.i. |
|---|---|---|---|
| 2,4-D | 196,646 | Amicarbazone | 1 |
| 2,4-DP | 272 | Aminopyralid | 2 |
| Acifluorfen* | 107 | Ammonium nonanoate | 51 |

**Table 1 (cont.)**. Pesticide amounts (lbs. a.i.) reported in the New Jersey 2019 Lawn Care Pesticide Use Survey. *Indicates a compound not reported in the 2016 survey.

| HERBICIDES | lbs. a.i. | HERBICIDES | lbs. a.i. |
|---|---|---|---|
| Benefin* | 17 | Iron HEDTA | 141 |
| Benfluralin | 38 | Isoxaben | 345 |
| Bensulide | 21 | MCPA | 27357 |
| Bromacil | 4 | Mecoprop | 37457 |
| Butafenacil* | 17 | Mesotrione | 155 |
| Capric acid | 1 | Metribuzin* | 35 |
| Caprylic acid | 1 | MSMA | 319 |
| Carfentrazone-ethyl | 120 | Oryzalin | 173 |
| Chlorsulfuron | <1 | Oxadiazon | 20 |
| Clopyralid | 164 | Pelargonic acid | 319 |
| Dicamba | 22,610 | Pendimethalin | 4925 |
| Dichlobenil | 2 | Penoxsulam | 46 |
| Dimethenamid | 46 | Picloram | 29 |
| Diquat | 3,709 | Prodiamine | 101086 |
| Dithiopyr | 71,814 | Prometon | 28 |
| Diuron | 676 | Pyraflufen-ethyl | 7 |
| Ethofumesate* | 9 | Quinclorac | 18414 |
| Fenoxaprop-ethyl | 395 | S-Metolachlor | 176 |
| Florasulam | 64 | Sodium chlorate | 69 |
| Fluazifop-butyl | 7 | Sodium metaborate | 72 |
| Fluroxypyr-meptyl | 8,281 | Siduron | 424 |
| Glufosinate-ammonium | 800 | Simazine* | 17 |
| Glyphosate | 53,555 | Sulfentrazone | 4479 |
| Halosulfuron-methyl | 161 | Sulfometuron | 9 |
| Imazapic* | 3 | Topramezone | 7 |
| Imazapyr | 245 | Triclopyr | 13080 |
| Imazethapyr* | 2 | Trifluralin | 6348 |
| Imazosulfuron* | 495 | | |
| Indaziflam | 200 | | |

**Table 1 (cont.)**. Pesticide amounts (lbs. a.i.) reported in the New Jersey 2019 Lawn Care Pesticide Use Survey. *Indicates a compound not reported in the 2016 survey.

| FUNGICIDES | lbs. a.i. |
|---|---|
| Acibenzolar | 2 |
| Aluminum tris | 130 |
| Azoxystrobin | 7560 |
| Benzovindiflupyr | <1 |
| Boscalid | 17 |
| Chlorothalonil | 3294 |
| Cyazofamid | 15 |
| Difenoconazole* | 1 |
| Fluazinam | 35 |
| Fludioxonil | 2 |
| Flumioxazin | 171 |
| Flutolanil | <1 |
| Fluoxastrobin | 11 |
| Fluxapyroxad | 43 |
| Iprodione | 363 |
| Mancozeb | 249 |
| Mandestrobin | 12 |
| Mefenoxam | 24 |
| Mefentrifluconazole | 1 |
| Myclobutanil | 648 |
| Paclobutrazol | 14 |
| Penthiopyrad | 2 |
| Propamocarb HCL | 197 |
| Propiconazole | 21165 |
| Pydiflumetofen | 3 |
| Pyraclostrobin | 74 |
| Sodium percarbonate | 13 |
| Sulfur | 0 |
| Tebuconazole | 146 |
| Thiophanate-methyl | 2395 |
| Thiram | 110 |
| Triadimefon | 456 |
| Trifloxystrobin | 72 |
| Triticonazole | 59 |

| INSECTICIDES | lbs. a.i. |
|---|---|
| Abamectin* | 1 |
| Acephate | 20 |
| Acetamiprid | 9 |
| Alpha-cypermethrin* | 2 |
| Avermectin* | 1 |
| Benzamide* | 4 |
| Beta-cyfluthrin* | 6 |
| Bifenthrin | 11527 |
| Carbaryl | 750 |
| Chlorantraniliprole | 1343 |
| Clothianidin* | 49 |
| Chlorpyrifos | 207 |
| Cyantraniliprole* | 1 |
| Lambda-cyhalothrin | 360 |
| Cypermethrin | 3 |
| Deltamethrin | 5 |
| Dinotefuran | 3 |
| Fipronil | <1 |
| Fluvalinate | 2 |
| Gamma-cyhalothrin | <1 |
| Hexythiazox | 2 |
| Imidacloprid | 14704 |
| Indoxacarb* | 1 |
| Limonene* | 18 |
| Malathion | 2 |
| Mineral oil | 5925 |
| Permethrin | 159 |
| Pyrethrins | <1 |
| Soap | 714 |
| Spinosad | 22 |
| Thiamethoxam | <1 |
| Trichlorfon | 4750 |
| Zeta-cypermethrin | <1 |

**Table 1 (cont.)**. Pesticide amounts (lbs. a.i.) reported in the New Jersey 2019 Lawn Care Pesticide Use Survey. *Indicates a compound not reported in the 2016 survey.

| GROWTH INHIBITORS | lbs.a.i. |
|---|---|
| Azadirachtin | <1 |
| Ethephon | 61 |
| Flurprimidol | 8 |
| Methoprene | <1 |
| Neem oil | 146 |
| Novaluron | <1 |
| Paclobutrazol | 14 |
| Prohexadione calcium | 2 |
| Pyriproxyfen | <1 |
| Trinexapac-ethyl | 28 |

| MISC | lbs. a.i. |
|---|---|
| Ammonium chloride | 3 |
| Anthraquinone | 381 |
| Bifenazate* | 12 |
| Bacillus strains | 36 |
| Methyl anthranilate | 2 |
| Sulfuric acid | 70 |
| Zinc phosphide | <1 |

Table 2 lists the highest use compounds in the three main lawn care pesticide. The most highly reported pesticide products used in lawn care were 2,4-D formulations. These accounted for approximately 30% of the herbicides used in New Jersey lawn care in 2019. 2,4-D is used to control broadleaf weeds in a variety of applications including agriculture, right of way and aquatic weed control. 2,4-D formulations can be liquid, dust or granular.

**Table 2**. Highest use compounds in the New Jersey 2019 Lawn Care Pesticide Use Survey from the main pesticide categories.

| Compound | Total (lbs. a.i.) | % of Category | % of Total Usage |
|---|---|---|---|
| **HERBICIDES** | | | |
| 2,4-D Formulations | 196,917 | 34 | 30 |
| Prodiamine | 101,086 | 18 | 15 |
| Dithiopyr | 71,813 | 12 | 11 |
| Glyphosate | 53,555 | 9 | 8 |
| **INSECTICIDES** | | | |
| Imidacloprid | 14,704 | 36 | 2 |
| Bifenthrin | 11,527 | 28 | 2 |
| Mineral Oil | 5,925 | 15 | 1 |
| Trichlorfon | 4,750 | 12 | 1 |
| **FUNGICIDES** | | | |
| Propiconazole | 21,165 | 57 | 3 |
| Azoxystrobin | 7,560 | 20 | 1 |
| Chlorothalonil | 3,294 | 9 | 1 |
| Thiophanate-methyl | 2,395 | 6 | <1 |

Table 3 shows lawn care pesticide use by county. Warren County had the highest use overall, with an increase from 8,809 lbs. a.i. in 2016 to 65,734 lbs. a.i. in 2019. Warren, Middlesex and Burlington counties received a total of 30% of lawn care applications in New Jersey in 2019. It should be noted that county totals for lawn care pesticide use are difficult to quantify since many companies work in two or more counties and they do not report a total for each county, just total use over all their application sites. PEMS requests the respondents identify which county received most of their applications and that is the information entered into the database. For example, the license number that reported 62,363 of the 65,734 lbs. a.i. in Warren County is associated with a large, franchised landscape company. While Warren was listed as the county receiving the majority of use, a large company may have applications made across several counties. In addition, several respondents did not list a county and therefore approximately 100 lbs. a.i. do not appear in Table 3.

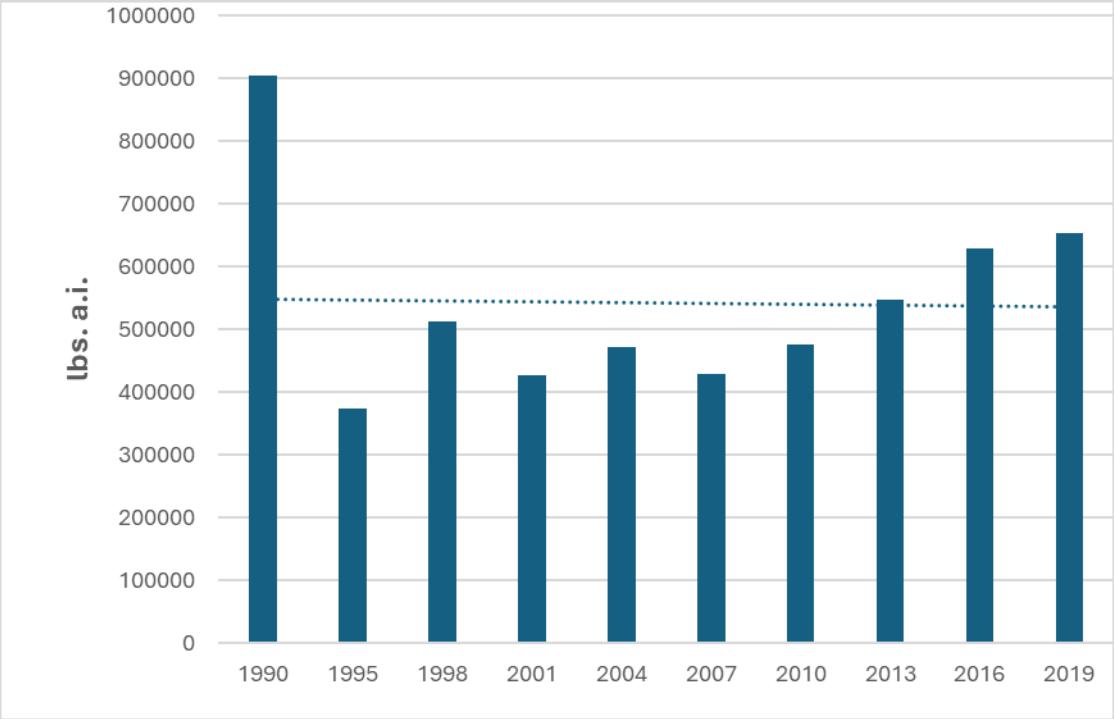
**Table 3**. Total pesticide amounts (lbs. a.i.) by county.

| County | Total (lbs. a.i.) | % of Total Usage |
|---|---|---|
| Atlantic | 7,087 | 1 |
| Bergen | 59,178 | 9 |
| Burlington | 64,015 | 10 |
| Camden | 28,955 | 4 |
| Cape May | 21,695 | 3 |
| Cumberland | 15,372 | 2 |
| Essex | 10,437 | 2 |
| Gloucester | 38,227 | 6 |
| Hudson | 366 | <1 |
| Hunterdon | 10,348 | 2 |
| Mercer | 17,196 | 3 |
| Middlesex | 65,117 | 10 |
| Monmouth | 51,180 | 8 |
| Morris | 42,546 | 6 |
| Ocean | 53,758 | 8 |
| Passaic | 14,919 | 2 |
| Salem | 31,432 | 5 |
| Somerset | 35,989 | 5 |
| Sussex | 5,373 | 1 |
| Union | 15,380 | 2 |
| Warren | 65,734 | 10 |

Figure 1 shows the total lbs. a.i. used in New Jersey for each lawn care survey conducted. The reported pesticide usage for lawn care has decreased by approximately 50% since the survey began in 1990. Since 1998, lawn care use averages around 500,000 lbs. a.i. per year.

As discussed, PEMS identified errors resulting in an inflated amount of reported imidacloprid use in 2016. We can estimate that the total for 2016 lawn care use should be approximately 12,000 lbs. a.i. less than what is indicated on the chart. However, because we cannot determine the exact adjusted amount, the total amount for 2016 reflects the original total reported.

**Figure 1.** Total lbs. a.i. used in New Jersey for each lawn care survey conducted (1990-2019).




Summary & Conclusions

Neonicotinoids, including imidacloprid, have become the most heavily used insecticides world-wide. Neonicotinoids have also been shown to have negative impacts on honeybees and other non-target pollinators. While processing the survey data, PEMS noted that imidacloprid use in NJ decreased by nearly 50% between 2016 and 2019 (28,977 to 14,704 lbs. a.i.). This decrease is in contrast with the increased use on a global scale. Upon further examination, PEMS identified three respondents with significant decreases in reported imidacloprid use between 2016 and 2019, accounting for nearly the entire 50% decrease. The three respondents were contacted to gather more information. In two instances, the respondents identified mathematical errors in their 2016 submissions. The third respondent indicated that a loss in clients resulted in a decrease in overall use. Therefore, the perceived reduction of imidacloprid use in 2019 was the result of an inflated amount reported in 2016.

The reported use in Passaic County decreased by approximately 93,000 lbs. a.i. between 2016 and 2019. Additionally, the reported use in Sussex County decreased by approximately 25,000 lbs. a.i. between 2016 and 2019. These two counties border our neighbor state to the north—New York. Reciprocal license programs allow New York licensed applicators to also apply pesticide products in New Jersey. It is possible that the respondents did not follow the survey instructions and reported New York usage along with their New Jersey usage, resulting in the decreases in 2019.

Prodiamine is a pre-emergent herbicide for crabgrass and broadleaf weed control. It has the flexibility to be applied in both the spring and fall, allowing for season long crabgrass control. Prodiamine is a general use product in New Jersey. General use products do not require a pesticide license to purchase or apply, and can provide a cost savings. While general use products are typically less costly and less toxic than their restricted use counterparts (only for purchase and application by licensed applicators), they are also typically less effective and may require multiple applications. Prodiamine use increased by approximately 70,000 lbs. a.i. from 2016 to 2019 and was applied state-wide. Spring and fall applications, combined with the reduced effectiveness of a general use pesticide resulting in multiple applications, could explain the increase.

The purpose of this survey is to monitor overall use trends in New Jersey's lawn care industry. While it is important to note outliers in the survey data (as listed above), it is most important to evaluate the data as a whole, while keeping in mind that the data is being provided by licensed pesticide applicators, not pesticide research scientists. However, pesticide applicators are still the best source of use information that is specific to New Jersey. To that end, the data indicates that pesticide use for lawn care in New Jersey has increased by a rate of approximately 7% per survey year, for an overall increase of approximately 200,000 lbs. a.i. over the last 20 years.

Herbicides continue to account for more than 80% of the pesticides used for lawn care and should remain the focus of PEMS surface water monitoring in residential areas to identify non-target impacts. While total insecticide use is less than 10% of lawn care, imidacloprid use for residential insect control remains the highest of all the categories surveyed (golf course, structural, agriculture, mosquito, and right-of-way). With growing concerns regarding neonicotinoid hazards to pollinators, PEMS will work with industry leaders to identify best management practices to protect pollinators during routine lawn care.