NJ Department of Environmental Protection
Bureau of Quality Assurance and Environmental Monitoring
Pesticide Evaluating & Monitoring Section

GOLF COURSE PESTICIDE USE IN NEW JERSEY: 2017 SURVEY

Introduction

The Pesticide Evaluation & Monitoring Section (PEMS) began a series of pesticide use surveys in 1985. These surveys address pesticide use by licensed applicators in the state of New Jersey for agriculture, golf courses, termite control, right-of-way, mosquito control, and lawn care. The golf course survey is conducted every three years and targets pesticides used for golf course maintenance. This report focuses on the tenth survey completed in the golf course series (2017).

All statewide pesticide use surveys are performed under the authority of the New Jersey Pesticide Control Code (NJPCP), N.J.A.C. 7:30-1 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 an accuracy and level of response that is difficult to duplicate in a voluntary, nationwide survey. In fact, these New Jersey surveys could represent a pesticide usage census rather than a probabilistic survey.

The information collected from the PEMS pesticide use surveys is used by programs 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

A list of all the golf courses in New Jersey has been maintained by PEM since the first golf course survey in 1990. The list is updated before each survey mailing. Survey forms were mailed to each golf course, along with instructional letters and return envelopes asking for 2017 golf course pesticide use. A total of three mailings were sent during the first three months of 2018.

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.

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, 255 out of 286 golf courses (89%) had responded. This is slightly higher than the response rate in 2014. A survey will be returned to PEMS if the address has changed or the course has shut down. PEMS also forwarded a list of non-responders to the

Bureau of Compliance for follow-up.

Pesticides used by the golf course industry in New Jersey for 2017 totaled 337,035 lbs. a.i. This is a 12,332 lbs. a.i. increase from 2014.

Table 1 lists all the compounds reported in the 2017 survey and the amounts (lbs. a.i.) applied. Fungicides comprise 80% of the total pesticide use reported in the New Jersey golf course industry. Herbicides (9%), insecticides (7%), growth regulators (3%), bird repellents (<1%) and miscellaneous compounds (1%) account for the rest.

Table 1. Pesticide amounts (lbs. a.i.) reported in the New Jersey 2017 Golf Course Pesticide Use Survey.

FUNGICIDES	lbs. a.i.
Acibenzolar *	265
Azoxystrobin	4,058
Benzovindiflupyr *	<1
Boscalid	1,915
Chlorothalonil	148,129
Copper hydroxide *	3
Cyazofamid	568
Difenoconazole *	123
Etridiazole	369
Fenarimol	6
Fluazinam *	5,324
Fludioxonil	480
Fluopyram *	72
Fluoxastrobin	288
Flutolanil	622
Fluxapyroxad *	1,170
Fosetyl-al	21,447
Iprodione	23,962
Isofetamid *	19
Mancozeb	5,310
Metalaxyl	424
Metconazole	1,037
Myclobutanil	489
Penthiopyrad *	638
Phosphite *	575
Polyoxin D	163
Potassium phosphite	672
Potassium salts *	757
Prochloraz	1,192
Propamacarb HCl	6,472
Propiconazole	7,697
Pyraclostrobin	1,798
Quintozene	2,391
Sodium percabonate *	64
Tebuconazole	6,480
Thiophanate-methyl	13,985
Thiram	3,057
Triadimefon	5,461
Trifloxystrobin	1,015
Triticonazole	642
Vinclozolin	2,090
Total:	**271,229**

GROWTH REGULATORS	lbs. a.i.
Ethephon	4,061
Flurprimidol	917
Gibberelin *	<1
Mefluidide	20
Paclobutrazol	996
Primo *	147
Prohexadione calcium *	134
Trinexapac-ethyl	2,847
Total:	**9,122**

BIRD REPELLENTS	lbs. a.i.
Anthraquinone	4
Total:	**4**

Table 1 (cont.)

HERBICIDES	lbs. a.i.
2,4-D	4,178
2,4-DE	16
2,4-DP	9
2,4-DT	39
Alachlor *	21
Ammonium salts *	3
Bensulide	1,613
Bentazon	35
Bispyribac-sodium	<1
Carfentrazone	49
Clethodim *	5
Clopyralid	547
Dicamba	1,076
Dimethenamid	217
Dithiopyr	6,920
Ethofumesate *	32
MSMA	3
Fenoxaprop-ethyl	64
Fluazifop-butyl	38
Florasulam *	18
Flumiclorac-pentyl	78
Flumioxazin	<1
Fluroxypyr-meptyl	5
Glufosinate-ammonium	5
Glyphosate	990
Halosulfuron	45
Imazosulfuron *	45
Indaziflam *	1
Isoxaben	105
Lactofen	275
MCPA	839
Mecoprop	938
Mefenoxam	541
Mesotrione	78
Metolachlor	59
Oryzalin	3
Oxadiazon	762
Pelargonic acid	2
Pendimethalin	1,909

HERBICIDES	lbs. a.i.
Prodiamine	6,550
Pronamide *	26
Quinclorac	519
Sethoxydim	214
Siduron	227
Sulfentrazone	396
Topramezone *	209
Triclopyr	1,087
Total:	**30,791**

MISCELLANEOUS	lbs. a.i.
Hydrogen peroxide	75
Indolebutryic acid *	<1
OBD *	179
PBO *	110
Peroxyacetic acid *	32
Total:	**396**

Table 1 (cont.).

INSECTICIDES	lbs. a.i.
Abamectin *	6
Acephate *	222
Avermectin	4
Bacillus (biological)	77
Bifenthrin	764
Carbamate *	200
Carbaryl	2,818
Chlorantraniliprole	1,990
Chlorpyrifos	5,371
Clothianidin	363
Confidor *	2
Cyantraniliprole *	347
Cyfluthrin	2
Cyhalothrin (lambda)	123
Cypermethrin *	38
Diquat *	18
Imidacloprid	1,962
Indoxacarb	471
Oil	6,299
Pyrethrins *	55
Soap *	2,942
Spinosad	153
Thiamethoxam	46
Trichlorfon	1,220
Total:	**25,493**

*Indicates a compound not reported in the 2014 survey.
^Miscellaneous compounds include synthetic alternatives (naturally occurring elements/compounds), synergists, and disinfectants.

Table 2 lists the highest use compounds in the three main golf course pesticide categories (lbs. a.i.) as listed in Table 1. The most highly reported pesticide used on golf courses was chlorothalonil (fungicide). Chlorothalonil accounted for approximately 55% of the fungicides used on New Jersey golf courses in 2017, and 44% of the total pesticides used on golf courses overall. Chlorothalonil is a broad spectrum, non-systemic fungicide used to control a variety of turf diseases on golf courses. Chlorothalonil formulations can be applied as a dust, dry or water-soluble grains, a wettable powder, a liquid spray, a fog, and a dip.

Table 2. Highest use compounds in the New Jersey 2017 Golf Course Pesticide Use Survey from the main pesticide categories.

Compound	Total (lbs. a.i.)	% of Category	% of Total Usage
FUNGICIDES			
Chlorothalonil	148,129	55	44
Iprodione	23,962	9	7
Fosetyl-al	21,447	8	6
Thiophanate-methyl	13,985	5	4
Propiconazole	7,697	3	2
HERBICIDES			
Dithiopyr	6,920	22	2
Prodiamine	6,550	21	2
2,4-D	4,178	14	1
Pendimethalin	1,909	6	1
Bensulide	1,613	5	<1
INSECTICIDES			
Oil	6,299	25	2
Chlorpyrifos	5,371	21	2
Soap	2,942	12	1
Carbaryl	2,818	11	1
Chlorantraniliprole	1,990	8	1
Imidacloprid	1,962	8	1

Table 3 shows golf course pesticide use by county. Monmouth county had the highest use overall, with an increase from 39,137 lbs. a.i. in 2014 to 54,478 lbs. a.i. in 2017. Monmouth county accounted for 16% of the total golf course pesticide use in New Jersey. Somerset county had the second highest use rate in the State with 32,790 lbs. a.i. applied. This is a 2% decrease from the total applied in Somerset county in 2014. Between 2014 and 2017, some counties opened new courses while other counties closed courses. Overall, the net change was a loss of seven courses over the three years between the survey periods.

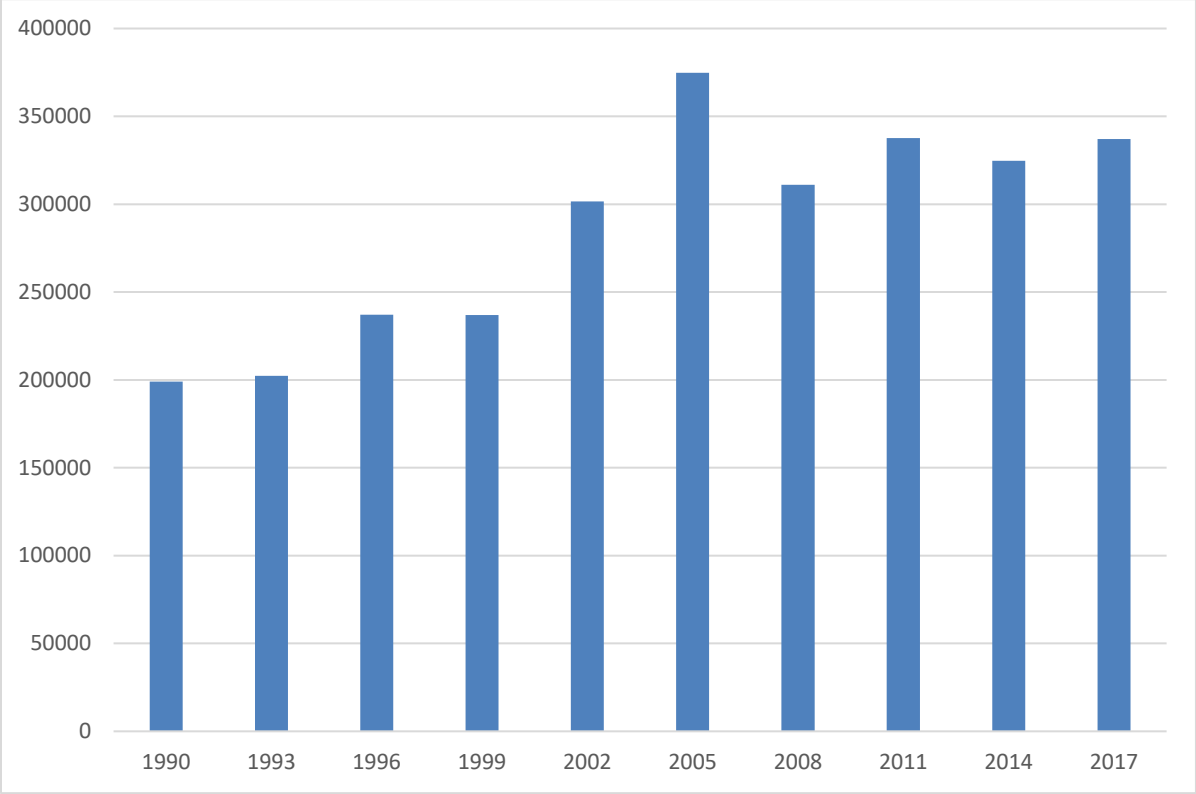
Table 3. Total pesticide amounts (lbs. a.i.) reported by county in the New Jersey 2017 Golf Course Pesticide Use Survey.

County	# of Courses	Amount lbs. a.i.	% of Total
Atlantic	24	26665	8
Bergen	19	25855	8
Burlington	18	18251	5
Camden	8	13346	4
Cape May	9	11270	3
Cumberland	1	546	<1
Essex	16	18279	5
Gloucester	9	6385	2
Hudson	2	4796	1
Hunterdon	7	10746	3
Mercer	14	9097	3
Middlesex	14	17838	5
Monmouth	31	54478	16
Morris	20	21301	6
Ocean	22	18811	6
Passaic	9	13174	4
Salem	4	4853	1
Somerset	22	32790	10
Sussex	17	11399	3
Union	10	13366	4
Warren	8	3627	1
Unknown*	--	166	<1

*When the data was entered into the database, no county was listed for multiple data records.

Figure 1 shows the total lbs. a.i. used in New Jersey for each golf course survey conducted. The reported pesticide usage for golf courses has been consistent over the last four surveys conducted. An overall increase of approximately 150,000 lbs. a.i. has been reported since the first survey in 1990.

Figure 1. Total lbs. a.i. used in New Jersey for each golf course survey conducted (1990-2017).



Summary & Conclusions

There was a net loss of seven golf courses operating in New Jersey during the years between the 2014 and 2017 surveys. While the number of golf courses operating in New Jersey decreased, the survey response rate increase from 87% to 89% between 2014 and 2017. This increase in response rate could account for the 12,332 lbs. ai. increase in reported use between 2014 and 2017.

Since PEMS began collecting golf course pesticide use survey data in 1990, fungicides have been the most heavily used chemicals on New Jersey golf courses. In 1990 and 1993, reported fungicide use on golf courses was 63% and 71% of the total pesticide use reported respectively. In 1996, the reported fungicide use increased to 84% of the total reported use and has remained above 80% in the subsequent two decades. Chlorothalonil has been reported as the most heavily used golf course fungicide since 1990, consistently accounting for 40% or more of the reported golf course fungicides.

Glyphosate is the most heavily used broad spectrum, system herbicide in the world. It is applied to control almost any annual or perennial unwanted plant everywhere--from farms to golf courses to back yards. However, between 2014 and 2017, reported glyphosate use decreased from 3,081 lbs. a.i. to 990 lbs. a.i. on New Jersey golf courses. The decrease in reported glyphosate use might

be explained by the increase in reported use of prodiamine. Prodiamine is a herbicide used to control pre-emergent grasses and broadleaf weeds. Prodiamine could have been used proactively for pre-emergent weed control, to avoid reactive applications of glyphosate to control weeds after they have already emerged.

Monmouth and Somerset Counties consistently report the highest use of golf course pesticides. In 2017, surface water downstream from golf courses in these two counties were monitored for possible non-target pesticide runoff. In the future, PEMS will continue to evaluate the survey data for geographic changes in the heaviest reported golf course pesticide use and implement surface water monitoring to identify non-target runoff and its impact on the environment.