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

GOLF COURSE PESTICIDE USE IN NEW JERSEY: 2023 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 twelfth survey completed in the golf course series (2023).

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) 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.

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 PEMS 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 asking for 2023 golf course pesticide use. A total of three mailings were sent during the first three months of 2024.

The survey requested information on each pesticide product used, including trade name, EPA registration number, percent active ingredient and amounts applied.

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, 259 out of 315 golf courses (82%) had responded. This is a 1% increase in response rate from the 2020 survey. 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 our Bureau of Pesticide Control, Licensing and Registration Enforcement unit for follow-up.

Pesticides used by the golf course industry in New Jersey for 2023 totaled 334,360 lbs. a.i. This is a 3,805 lbs. a.i. increase from 2020.

Table 1 lists all the compounds reported in the 2023 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 (10%), insecticides (7%), growth regulators (3%), and miscellaneous compounds (<1%) account for the rest.

Table 1. Pesticide amounts (lbs. a.i.) reported in the New Jersey 2023 Golf Course Pesticide Use Survey. *Indicates a compound not reported in the 2020 survey. ^Miscellaneous compounds include synthetic alternatives (naturally occurring elements/compounds), synergists, and disinfectants.

HERBICIDES	lbs. a.i.
2,4-D	4,887
2,4-DP	12
Acetic acid	11
Aminopyralid	47
Bensulide	1,088
Bispyribac-sodium*	2
Carfentrazone-ethyl	60
Clopyralid	270
Dicamba	880
Dimethenamid	99
Dipotassium endothall	45
Dithiopyr	13,217
Ethofumesate	1
Fenoxaprop-ethyl	59
Florasulam	77
Fluazifop-p-butyl	142
Fluroxypyr-meptyl	164
Glufosinate-ammonium	27
Glyphosate	234
Halosulfuron	26
Imazamox	3
Imazosulfuron	482
Isoxaben	191
MCPA	696
Mecoprop	430
Mefenoxam	675
Mesotrione	52
Metolachlor	1

HERBICIDES (cont.)	lbs. a.i.
Methiozolin	2
MSMA	24
Oxadiazon	1085
Pelargonic acid	99
Pendimethalin	2,480
Penoxsulam	1
Prodiamine	3,954
Quinclorac	716
Sethoxydim	180
Siduron	29
Sulfentrazone	115
Topramezone	32
Triclopyr	1,254
Total:	**33,849**

GROWTH REGULATORS	lbs. a.i.
Ethephon	5,380
Flurprimidol	605
Mefluidide	2
Paclobutrazol	655
Prohexadione calcium	905
Trinexapac-ethyl	2,981
Total:	**10,528**

MISCELLANEOUS	lbs. a.i.
Bacillus amyloliquefaciens*	20
Citric acid*	25
Hydrogen peroxide	72
Peroxyacetic acid	7
Reynoutria sachalinensis*	2
Total:	**126**

Table 1. (cont.)

FUNGICIDES	lbs. a.i.
Acibenzolar	249
Aluminum tris*	83
Azoxystrobin	2,721
Benzovindiflupyr	56
Boscalid	1,324
Chloroneb*	2
Chlorothalonil	138,943
Copper hydroxide	61
Copper sulfate	133
Cyazofamid	1,350
Difenoconazole	303
Etridiazole	94
Fluazinam	9,208
Fludioxonil	315
Fluindapyr*	36
Flumioxazin*	3
Fluopicolide	3
Fluopyram	227
Fluoxastrobin	355
Flutolanil	563
Flutriafol	590
Fluxapyroxad	1,091
Fosetyl-al	23,766
Iprodione	17,176
Isofetamid	92
Mancozeb	7,214
Mandestrobin	172
Mefentrifluconazole	1,982
Metalaxyl	185
Metconazole	801
Myclobutanil	45
Octhilinone*	2
Penthiopyrad	568
PCNB	1,473
Phosphorous acids salts	3,936
Picarbutrazox*	148
Polyoxin D	87
Potassium phosphite	2,614
Propamacarb HCl	9,147

FUNGICIDES (cont.)	lbs. a.i.
Propiconazole	6,853
Prothioconazole	951
Pydiflumetofen	285
Pyraclostrobin	2,245
Tebuconazole	10,079
Thiophanate-methyl	15,120
Thiram	639
Triadimefon	3,072
Trifloxystrobin	1,047
Triticonazole	137
Vinclozolin	9
Total:	**267,555**

INSECTICIDES	lbs. a.i.
Abamectin	13
Alpha-cypermethrin*	15
Bifenthrin	694
Burkholderia spp.	32
Carbaryl	323
Chlorantraniliprole	2,407
Chlorpyrifos	3,727
Clothianidin	194
Cyantraniliprole	183
Cyhalothrin*	15
Dinotefuran*	59
Diquat	22
Imidacloprid	1,983
Indoxacarb	222
Lambda-cyhalothrin	177
Novaluron*	861
Oil	9,929
Quillaja extract*	1
Spinosad	445
Tetraniliprole*	356
Thiamethoxam	62
Trichlorfon	518
Zeta-cypermethrin*	64
Total:	**22,302**

Table 2 lists the highest use compounds in the three main golf course pesticide. The most highly reported pesticide used on golf courses was chlorothalonil (fungicide). Chlorothalonil accounted for approximately 52% of the fungicides used on New Jersey golf courses in 2023, and 42% 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 2023 Golf Course Pesticide Use Survey from the main pesticide categories.

Compound	Total (lbs. a.i.)	% of Category	% of Total Usage
FUNGICIDES			
Chlorothalonil	138,943	52	42
Fosetyl-al	23,766	9	7
Iprodione	17,176	6	5
Thiophanate-methyl	15,120	6	5
Tebuconazole	10,079	4	3
HERBICIDES			
Dithiopyr	13,217	39	4
2,4-D	4,887	14	1
Prodiamine	3,954	12	1
Pendimethalin	2,480	7	1
Triclopyr	1,254	4	<1
INSECTICIDES			
Oil	9,929	45	3
Chlorpyrifos	3,727	17	1
Chlorantraniliprole	2,407	11	1
Imidacloprid	1,983	9	1
Novaluraon	861	4	<1

Table 3 shows golf course pesticide use by county. Monmouth county had the highest use overall, with a increase from 53,548 lbs. a.i. in 2020 to 58,286 lbs. a.i. in 2023. Monmouth county accounted for 17% of the total golf course pesticide use in New Jersey. Five counties (Atlantic, Bergen, Essex, Morris and Somerset) all reported at least 20,000 lbs. a.i. each. The remaining 15 counties only accounted for 31% of the total reported use. Between 2020 and 2023,

some counties opened new courses while other counties closed courses. Overall, the net change was a gain of 6 courses over the three years between the survey periods.

Table 3. Total pesticide amounts (lbs. a.i.) reported by county in the New Jersey 2023 Golf Course Pesticide Use Survey.

County	# of Courses	Amount lbs. a.i.	% of Total
Atlantic	24	27,639	8
Bergen	24	26,625	8
Burlington	19	12,782	4
Camden	9	14,631	4
Cape May	13	16,468	5
Cumberland	3	134	<1
Essex	18	26,874	8
Gloucester	11	5,754	2
Hudson	3	2,783	1
Hunterdon	7	10,195	3
Mercer	15	7,455	2
Middlesex	18	17,037	5
Monmouth	37	58,286	17
Morris	23	24,326	7
Ocean	20	18,187	5
Passaic	7	15,443	5
Salem	6	3,232	1
Somerset	21	26,439	8
Sussex	18	8,087	2
Union	12	9,098	3
Warren	7	2,882	1

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 six 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 (1990-2023).