GCSAA



Golf Course Environmental Profile

Phase IV Volume I
Pest Management Practices
on U.S. Golf Courses

GCSAA Foundation

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PEST MANAGEMENT

Golf Course Superintendents Association of America

Golf Course Environmental Profile

Phase IV, Volume I

2024 Pest Management Practices on U.S. Golf Courses

The fourth phase of the Golf Course Environmental Profile was conducted by the Golf Course Superintendents Association of America.

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GCEP
Pest Phase IV Public Report

Statement by Board President



On behalf of the Golf Course Superintendents Association of America (GCSAA), our Board of Directors, and the over 21,000 members worldwide, I am pleased to present the fourth edition of the Golf Course Environmental Profile (GCEP) Pest Management Practices Report.

For more than two decades, the GCEP has provided the golf industry with credible, science-based information documenting how golf course management practices continue to evolve. This report builds on that legacy by highlighting both the significant progress golf course superintendents have made in implementing Integrated Pest Management (IPM) and the opportunities that remain to strengthen environmental stewardship.

The results show that routine scouting, weather monitoring, cultural practices, and resistance management remain the foundation of pest management on U.S. golf courses. At the same time, superintendents are increasingly adopting predictive models, digital documentation, and other technologies that support more informed, data-driven decisions. The survey also identifies opportunities to expand the use of comprehensive written IPM plans and continue shifting from reactive pest control toward prevention-based management.

These findings reflect a profession committed to continuous improvement. Every day, golf course superintendents balance golfer expectations, environmental stewardship, regulatory responsibilities, and operational realities while maintaining healthy, resilient playing conditions. Their commitment to science-based management continues to strengthen the environmental performance of golf facilities across the country.

I would like to thank the golf facilities that participated in this survey, as well as the researchers, GCSAA staff, and volunteer members whose efforts make the Golf Course Environmental Profile one of the most respected environmental benchmarking programs in managed turfgrass. I also extend our appreciation to the United States Golf Association for its continued partnership in advancing research and data-driven decision-making in golf course management.

Thank you for the essential work you and your teams perform every day to advance golf's environmental leadership and long-term success.

Paul Carter, CGCS,
2026 GCSAA President

Introduction

Since 2006, the Golf Course Superintendents Association of America has been benchmarking management practices, property features, and environmental stewardship on U.S. golf courses through the Golf Course Environmental Profile (GCEP) survey series, which is now in its fourth edition. The series has produced repeatable, industry-wide data on topics ranging from land use to regulations, as well as water use, nutrient management, and pest control, providing scientifically valid measures of change over time.

GCEP results continue to appear in peer-reviewed outlets such as Crop, Forage and Turfgrass Management (formerly Applied Turfgrass Science) and HortTechnology, and are summarized for practitioners and the public in Golf Course Management and online (https://www.gcsaa.org/what-we-do/environmental-stewardship/golf-course-environmental-profile). Researchers and regulators routinely use the data to inform studies and policy, and GCSAA uses the findings to communicate the industry's commitment to environmental stewardship, guide its environmental programs, identify priority research needs, and support evidence-based responses to regulatory proposals.

Pest management practices at U.S. golf facilities were documented in earlier GCEP rounds (notably 2007 and 2015, with a subsequent survey in 2021), and the fourth edition builds on those efforts. Its objective is to assess trends and identify changes in reliance on pest management practices, the frequency of pesticide storage facility attributes, and practices associated with pesticide mixing and loading.

Methodology

To allow comparisons across survey years, all questions were kept identical to those used in prior surveys. The survey link was distributed by email through mailing lists from the National Golf Foundation and the Golf Course Superintendents Association of America, reaching 13,952 unique golf facilities. For this study, a golf facility was defined as any business where golf is played on one or more courses. The survey was also promoted through GCSAA social media channels. Data collection remained open for seven consecutive weeks, beginning on September 29, 2025. To protect confidentiality, respondents were not identified by name; instead, each response was assigned a unique identification number. The dataset was then combined with data from prior surveys to evaluate changes over time. In total, 1,499 facilities responded, representing 10.7% of all known U.S. golf facilities.

Respondents were grouped by agronomic region (Figure 26). To ensure the results accurately represented the U.S. golf course population, responses were weighted. Facilities were classified into 35 groups based on facility type (public or private), number of holes (9, 18, or 27+),

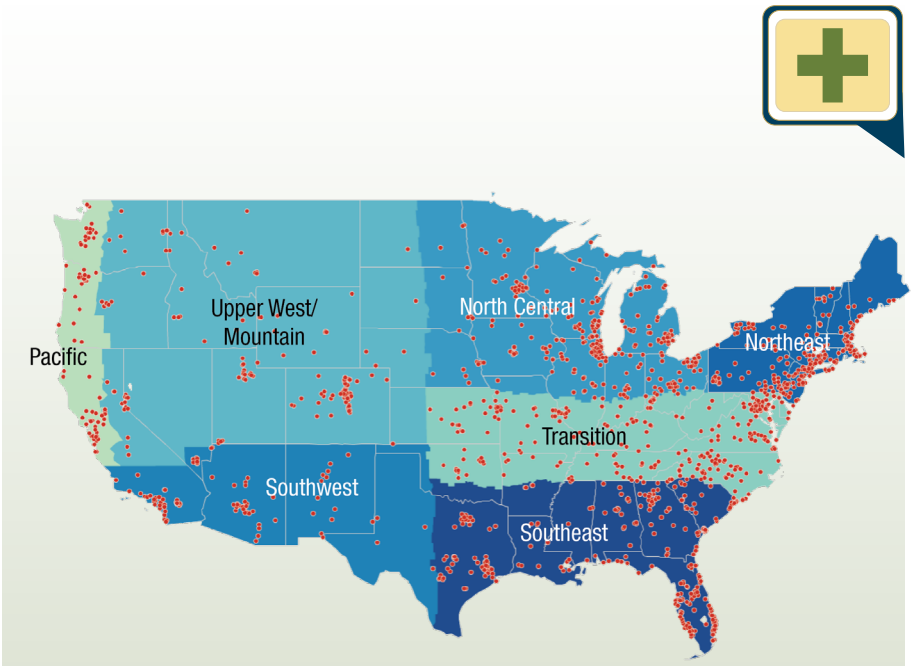


Figure 26. Distribution of the 2024 survey responses within the seven agronomic regions.

and public green fee (<$55 or ≥$55 per round) (Table 5). Weights were calculated by determining the proportion of each group's population relative to the total survey population.

Preliminary analysis showed that the data were not normally distributed. As a result, the data were fit to a log-logistic model, and median comparisons were conducted using the Tukey–Kramer test at an alpha level of 0.10. Statistical comparisons were not performed on projected values. Golf facility frequencies were calculated using statistical software, and differences among survey years were evaluated using the chi-square (χ^2) test at the 0.10 significance level.

Table 5. 2024 nutrient and pest survey responses and weighting factors categorized by region (**Fig.26**), facility type, number of holes, and green fee.

Region	Facility type	Holes	Green fee	Golf facilities		Survey responses		Weight
		No.	$	No.	%	No.	%	
Northeast	All	9	All	652	4.7	18	1.2	3.892
Northeast	Public	18	<$55	402	2.9	10	0.7	4.319
Northeast	Public	18	$55+	639	4.6	71	4.7	0.967
Northeast	Private	18	All	585	4.2	109	7.3	0.577
Northeast	All	27+	All	176	1.3	17	1.1	1.112
North Central	All	9	All	1135	8.1	19	1.3	6.418
North Central	Public	18	<$55	901	6.5	45	3.0	2.151
North Central	Public	18	$55+	753	5.4	109	7.3	0.742
North Central	Private	18	All	448	3.2	110	7.3	0.438
North Central	All	27+	All	301	2.2	31	2.1	1.043
Transition	All	9	All	641	4.6	20	1.3	3.443
Transition	Public	18	<$55	635	4.6	41	2.7	1.664
Transition	Public	18	$55+	514	3.7	85	5.7	0.650
Transition	Private	18	All	520	3.7	117	7.8	0.478
Transition	All	27+	All	180	1.3	28	1.9	0.691
Southeast	All	9	All	444	3.2	9	0.6	5.300
Southeast	Public	18	<$55	541	3.9	41	2.7	1.418
Southeast	Public	18	$55+	669	4.8	87	5.8	0.826
Southeast	Private	18	All	685	4.9	119	7.9	0.618
Southeast	All	27+	All	365	2.6	61	4.1	0.643
Southwest	All	9	All	240	1.7	2	0.1	12.893
Southwest	Public	18	<$55	120	0.9	8	0.5	1.612
Southwest	Public	18	$55+	379	2.7	40	2.7	1.018
Southwest	Private	18	All	228	1.6	45	3.0	0.544
Southwest	All	27+	All	166	1.2	23	1.5	0.775
Upper West/Mountain	All	9	All	389	2.8	11	0.7	3.799
Upper West/Mountain	Public	18	<$55	80	0.6	14	0.9	0.614
Upper West/Mountain	Public	18	$55+	369	2.6	72	4.8	0.551
Upper West/Mountain	Private	18	All	154	1.1	46	3.1	0.360
Upper West/Mountain	All	27+	All	81	0.6	12	0.8	0.725
Pacific	All	9	All	157	1.1	5	0.3	3.374
Pacific	Public	18	<$55	28	0.2	2	0.1	1.504
Pacific	Public	18	$55+	205	1.5	42	2.8	0.524
Pacific	Private	18	All	116	0.8	23	1.5	0.542
Pacific	All	27+	All	54	0.4	7	0.5	0.829

Results

National Summary

Frequency of pest management practices

- The most common pest management practices used were monitoring weather patterns, at 94%, and scouting, at 93% (**Table 1**).
- Use of predictive models, photographic documentation, and remote sensors increased from 2007 to 2024 (**Table 1**).
- The frequency of most of the remaining pest management practices declined between 2007 and 2024 (**Table 1**).

Reliance on pest management practices

- From 2015 to 2024, U.S. golf facilities have increased their reliance on pesticides within each pesticide class (**Figure 1**).
- U.S. golf facilities' reliance on plant growth regulators (PGRs) has remained at about 44% since 2015, but reliance on biological control options has declined from 25% in 2015 to 17% in 2024 (**Figure 1**).

Written pest management plans

- The percentage of U.S. golf facilities with a written integrated pest management (IPM) plan increased from 41% in 2007 to 46% in 2024 (**Table 2**).
- The percentage of U.S. golf facilities with a written pesticide application plan remained at 65%, equivalent to that in 2007 (**Table 2**).
- The percentage of U.S. golf facilities with a pesticide emergency response plan increased from 2007, reaching 58% in 2021(**Table 2**).
- The percentage of U.S. golf facilities with either a written IPM or a pesticide application plan remained at 73%, equivalent to that in 2007 (**Table 2**).

Mixing and loading attributes

- From 2007 to 2024, some attributes of pesticide mixing and loading areas increased, including the inclusion of spill kits, impervious floors, floors that contain spills, and roofs (**Table 3**). The only attribute that declined was the recycling of pesticide containers, which reached 31%.

Storage attributes

- From 2007 to 2024, the attributes

Table 1. Frequency of U.S. golf facilities that responded that they use the listed pest management practice sometimes or frequently in 2007, 2015, 2021, and 2024.

Management Practice	2007	2015	2021	2024
	Golf Facilities (%)			
Monitor weather patterns	96 a[i]	95 ab	93 b	94 b
Scouting	95 a	95 a	93 a	93 a
Pesticide resistance management strategies	ND[ii]	92 a	90 a	92 a
Monitor weather patterns conducive to outbreaks	ND	93 a	90 b	92 ab
Improve turfgrass health	ND	95 a	90 b	90 b
Cultural practices	95 a	96 a	90 b	91 b
Spot treat damage	ND	92 a	86 b	87 b
Record pest outbreaks	83 a	77 b	75 b	75 b
Higher pest tolerance	71 a	72 a	66 b	65 b
Predictive models	56 b	52 c	60 b	64 a
Pest-tolerant turfgrass	61 a	52 c	55 bc	58 ab
Map pest damage	ND	52 a	53 a	53 a
Pest identification by university or independent laboratory	ND	51 a	49 ab	46 b
Photograph documentation	14 b	37 a	36 a	36 a
Biological controls	47 a	41 b	33 c	34 c
Traps	28 b	34 a	33 a	31 ab
Remote sensors	17 c	31 a	21 b	22 b

[i] Within rows, values followed by a common letter are not significantly different according to the chi-square test at the 10% significance level.
[ii] No data. Question was not asked in 2007.

Table 2. Frequency of written pest management plans on U.S. golf facilities in 2007, 2015, 2021, and 2024.

Pest Management Plan	2007	2015	2021	2024
	Golf Facilities (%)			
Either IPM plan or pesticide application plan	71 a[i]	66 b	71 a	73 a
Pesticide application plan	63 a	58 b	63 a	65 a
Pesticide emergency response plan	52 b	53 b	57 ab	58 a
Integrated pest management (IPM) plan	41 b	32 c	44 ab	46 a

[i] Within rows, values followed by a common letter are not significantly different according to the chi-square test at the 10% significance level.

Table 3. Frequency of mixing and loading area attributes on U.S. golf facilities in 2007, 2015, 2021, and 2024.

Attribute	2007	2015	2021	2024
	Golf Facilities (%)			
Spill kit	53 bi	54 b	60 a	63 a
Anti-siphoning on water line	52 a	52 a	53 a	49 a
Impervious floor	40 b	37 b	38 b	43 a
Emergency water shut-off	37 a	37 a	37 a	38 a
Recycle pesticide containers	35 ab	38 a	34 bc	31 c
Floor contains spills	31 bc	30 c	33 ab	36 a
Roof	28 b	27 b	29 ab	32 a
Water filling capacity > 50 gal (189.3 L) per minute	29 a	28 a	27 a	30 a
Collect rinsate	22 b	24 ab	26 a	23 ab
Stand-alone pesticide mixing tank	14 a	14 a	14 a	13 a

[i] Within rows, values followed by a common letter are not significantly different according to the chi-square test at the 10% significance level.

Table 4. Frequency of storage facility attributes on U.S. golf facilities in 2007, 2015, 2021, and 2024.

Attribute	2007	2015	2021	2024
	Golf Facilities (%)			
Can be locked	90 a[i]	89 ab	87 b	87 b
Signage indicating pesticides inside	78 a	78 a	76 a	75 a
Impervious floors	64 a	58 b	66 a	68 a
Spill kit	60 b	60 b	65 a	67 a
Emergency shower/eyewash	66 a	64 a	64 a	68 a
Floor can contain spills	57 a	54 a	57 a	56 a
Passive venting	58 a	48 c	52 b	50 bc
Dedicated storage building	47 a	49 a	49 a	49 a
Impervious shelving	45 b	41 c	47 ab	50 a
Powered venting	40 a	42 a	41 a	44 a
Explosion-proof electrical fixtures	25 a	24 ab	21 b	24 a

[i] Within rows, values followed by a common letter are not significantly different according to the chi-square test at the 10% significance level.

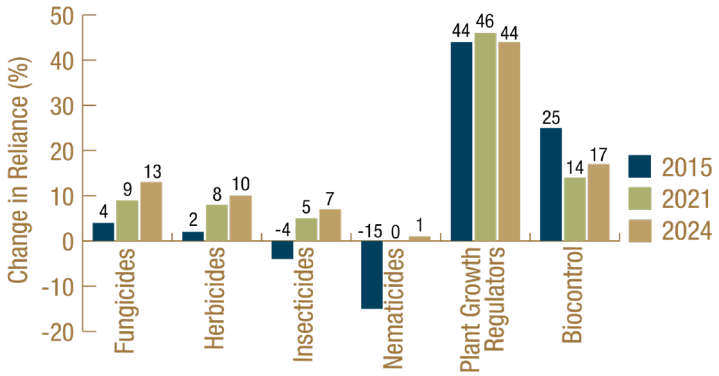


Figure 1. Reliance of U.S. golf facilities on pest management practices during the three years prior to 2015, 2022, and 2024.

Influence of Budget on Pesticide Application Plans

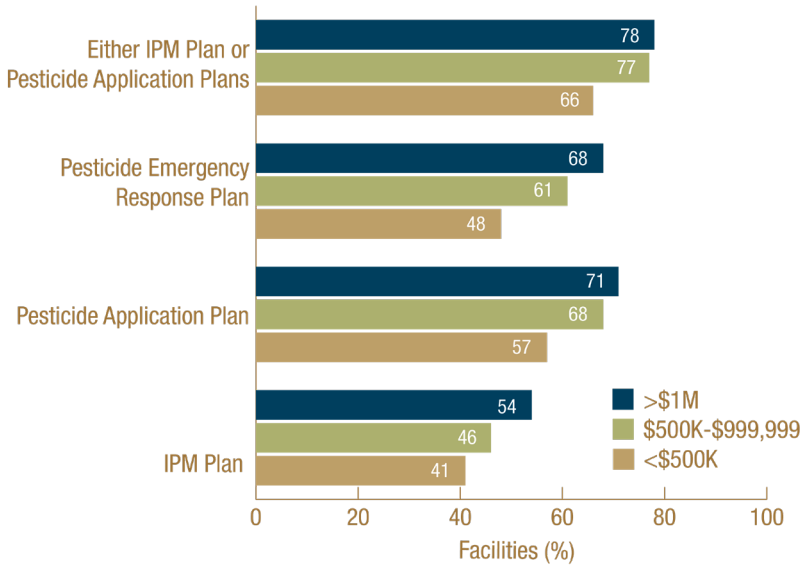


Figure 2. Frequency of written pest management plans on U.S. golf facilities in 2024 as influenced by the facilities annual budget.

of pesticide storage areas remained mostly unchanged except for the percentage of facilities that have spill kits, which increased to 67%, and the percentage of facilities that have impervious shelving, which increased to 50%. A locked building and passive venting declined to 87% and 50%, respectively (**Table 4**).

Budget

- A greater percentage of U.S. golf facilities that operate with an annual budget greater than $1 million have a written IPM plan, pesticide application plan, and pesticide emergency response plan than facilities that operate with an annual budget of less than $500,000 (**Figure 2**).
- Each attribute of pesticide mixing and loading areas on U.S. golf facilities with annual operating budgets greater than $1 million were more frequent than facilities with annual operating budgets less than $500,000, except for anti-siphoning on water lines and recycling pesticide containers (**Figure 3**).
- Each attribute of pesticide storage areas on U.S. golf facilities with annual operating budgets greater than $1 million were more frequent than facilities with annual operating budgets less than $500,000 (**Figure 4**).

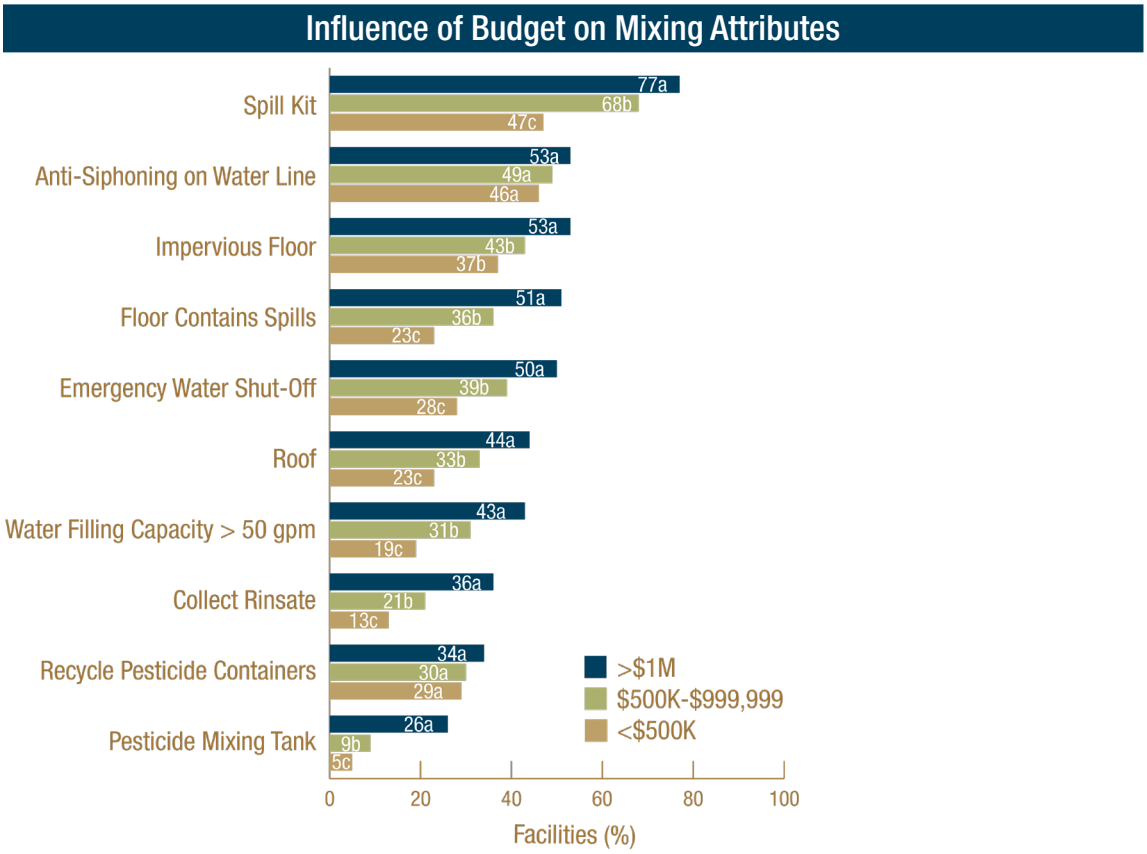


Figure 3. Effect of golf facility annual budget on the properties of pesticide mixing and loading areas for U.S. golf facilities in 2024.

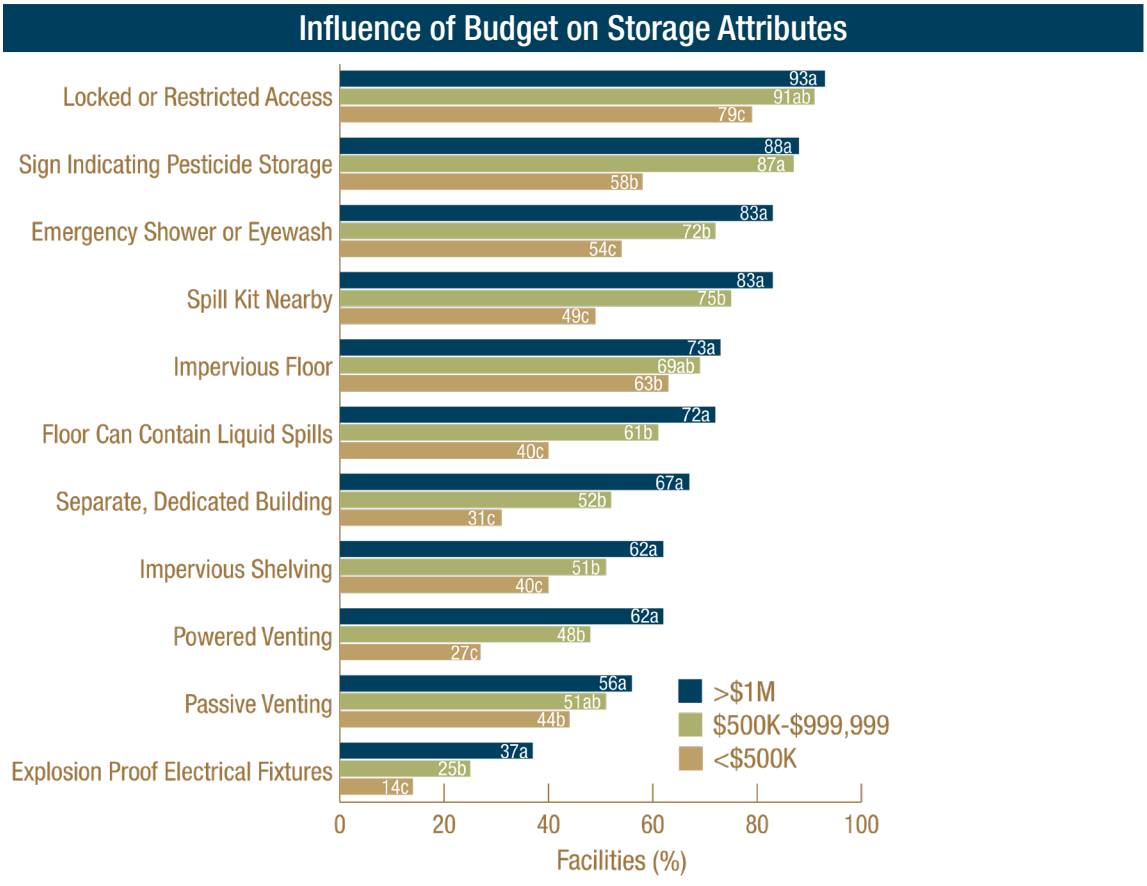


Figure 4. Effect of golf facility annual budget on the properties of pesticide storage areas for U.S. golf facilities in 2024.

Regional Results

NORTH CENTRAL

- Reliance upon PGRs declined slightly from 2015 to 2024 (**Figure 5**). Reliance on biological control products declined from 2015 to 19% in 2024. Reliance upon each class of chemical pest control products increased from 2015 to 2024.
- The percentage of golf facilities that have the listed pesticide storage attributes was equal to or less than the national average (**Figure 6**).
- The percentage of golf facilities that have the listed pesticide mixing and loading attributes were greater than the national average for anti-siphoning water line, floor contains spills, impervious floor, roof, and water filling capacity > 50 gpm; and were less than the national average for spill kit and pesticide mixing tank (**Figure 7**). All other attributes were approximately equal to the national average.

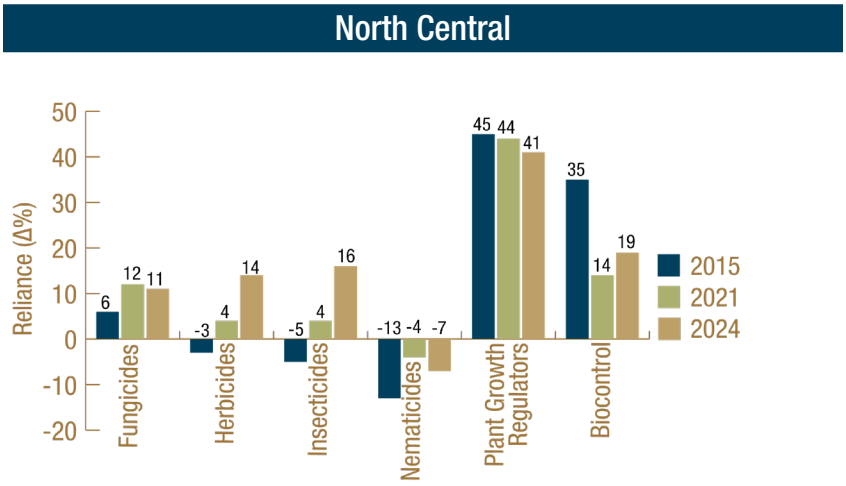


Figure 5. Reliance on all golf facilities on pest management practices during the three years prior to 2015, 2021, and 2024 in the North Central region.

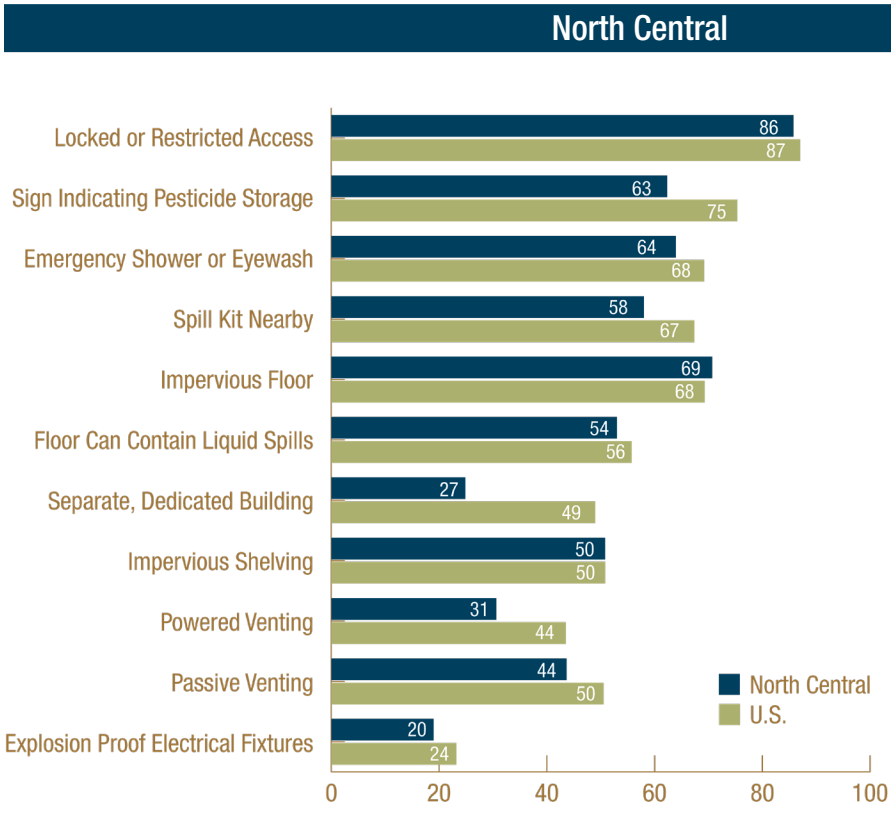


Figure 6. Frequency of pesticide storage area properties for all golf facilities in the North Central region in 2024.

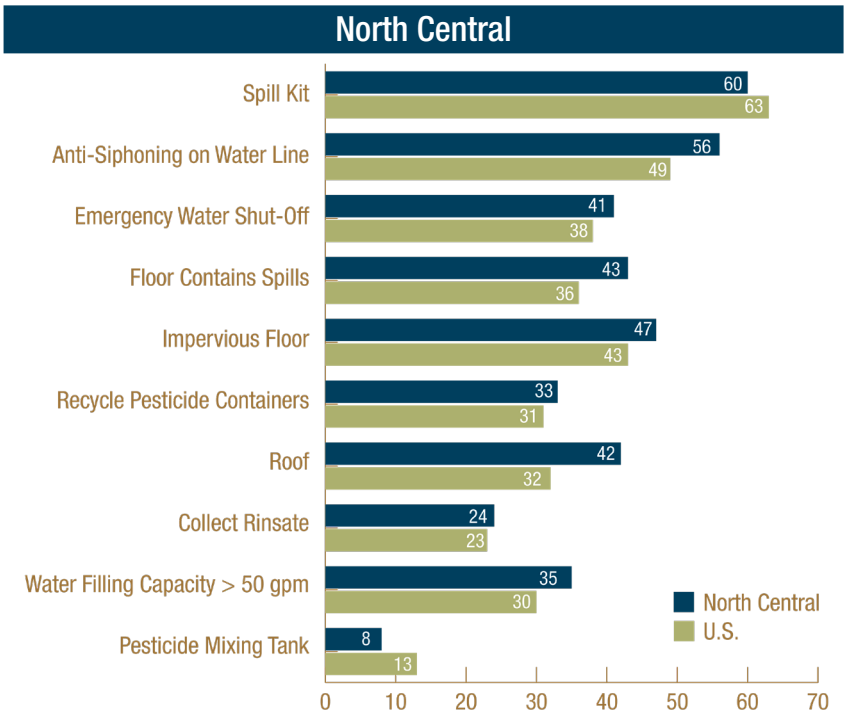


Figure 7. Frequency of pesticide mixing and loading area properties for all golf facilities in the North Central region in 2024.

NORTHEAST

- Reliance on PGRs remained at 44% in 2024, but reliance on biological control products declined to 18% since 2015 (**Figure 8**). Reliance on fungicides and nematicides increased since 2015, whereas reliance on herbicides remained approximately the same between 2015 and 2024, and reliance on insecticides declined compared to 2015.
- The percentage of golf facilities that had the listed pesticide storage attributes was equal to or greater than the national average, except for emergency showers or eyewash stations and impervious shelving, which were slightly less than the national average (**Figure 9**).
- The percentage of golf facilities that have the listed pesticide mixing and loading attributes were less than the national average for emergency water shut-off, floor contains spills, impervious shelving, roof, and collects rinsate, whereas other attributes were approximately equal to the national average (**Figure 10**).

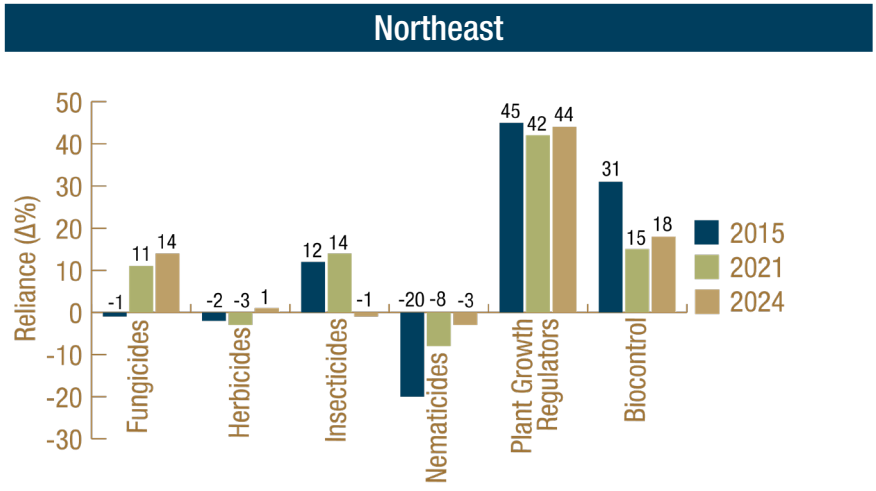


Figure 8. Reliance on all golf facilities on pest management practices during the three years prior to 2015, 2021, and 2024 in the Northeast region.

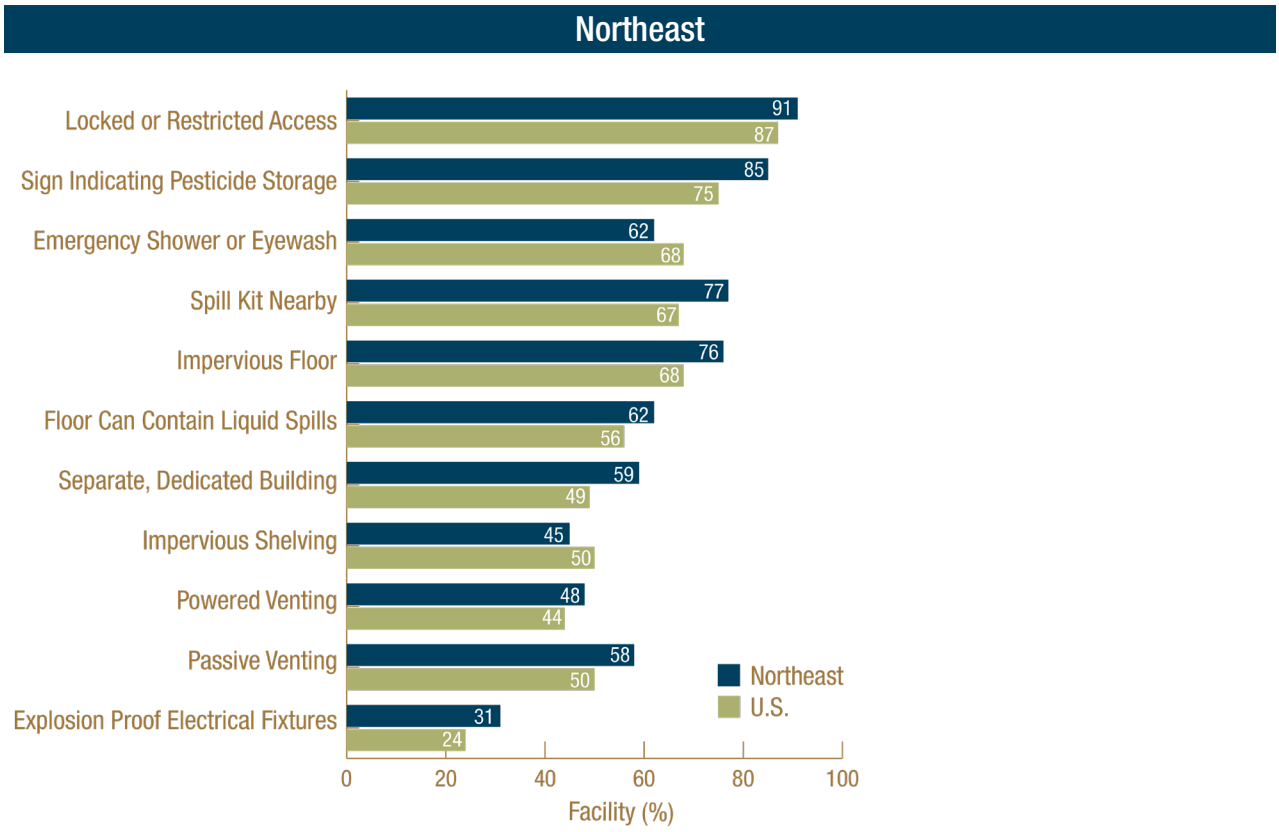


Figure 9. Frequency of pesticide storage area properties for all golf facilities in the Northeast region in 2024.

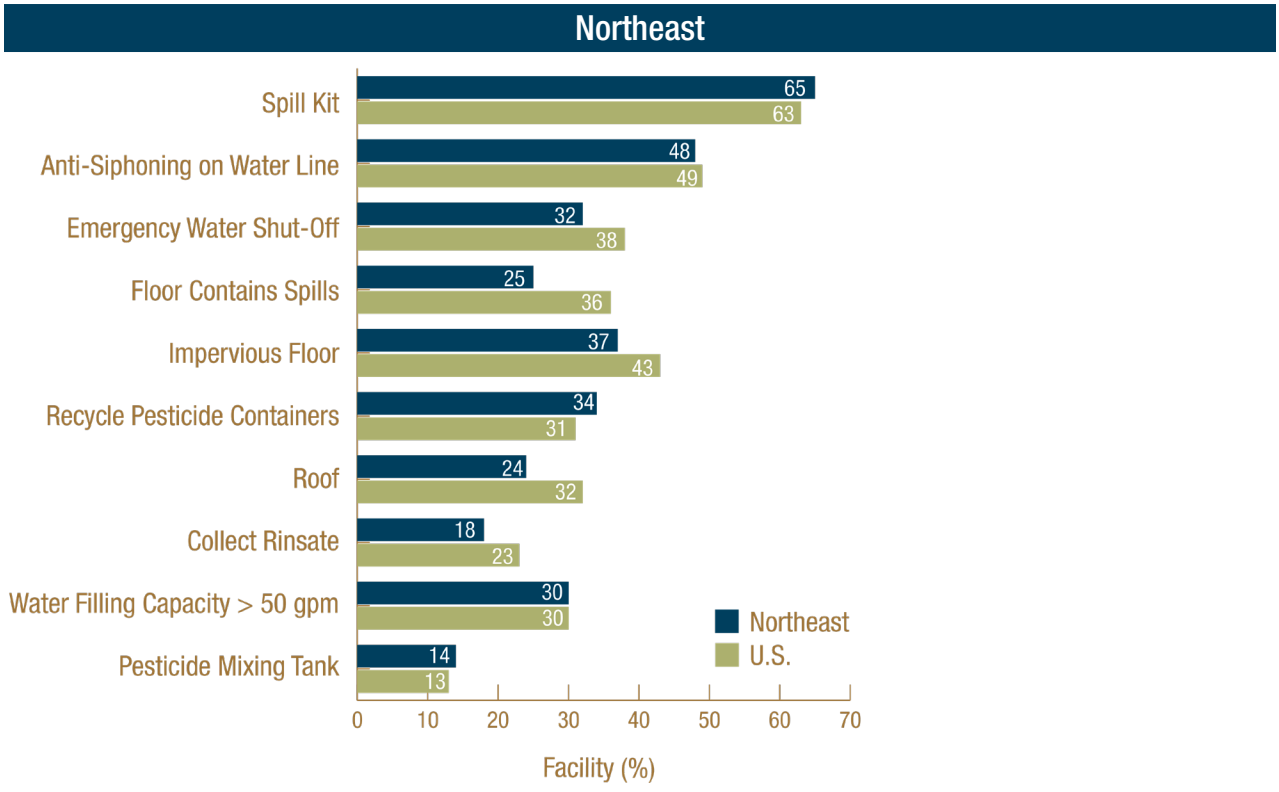


Figure 10. Frequency of pesticide mixing and loading area properties for all golf facilities in the Northeast region in 2024.

PACIFIC

- Reliance upon PGRs and biocontrol both declined to 18% and 12%, respectively, in 2024 (**Figure 11**). Reliance on insecticides and nematicides increased from 2015 to 2024, whereas reliance on fungicides and herbicides has remained unchanged since 2015.
- The percentage of golf facilities that have the listed pesticide storage attributes were generally greater than the national average, with the exceptions of equal to or less than the national average, for impervious floor, floor that can contain spills, impervious shelving, powered venting, and explosion proof electrical fixtures (**Figure 12**).
- The percentage of golf facilities that have the listed pesticide mixing and loading attributes was greater than or equal to the national average for each attribute except emergency water shut-off, floor contains spills, roof, and water filling capacity > 50 gpm, which were slightly less than the national average (**Figure 13**).

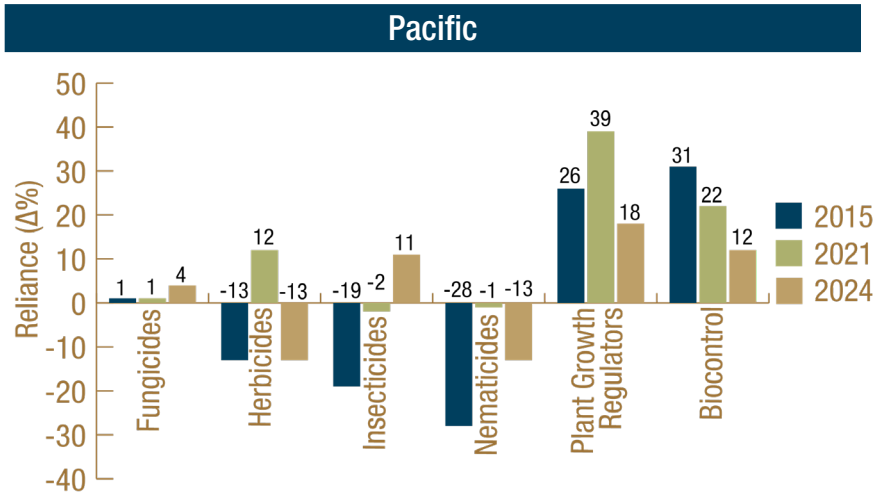


Figure 11. Reliance on all golf facilities on pest management practices during the three years prior to 2015, 2021, and 2024 in the Pacific region.

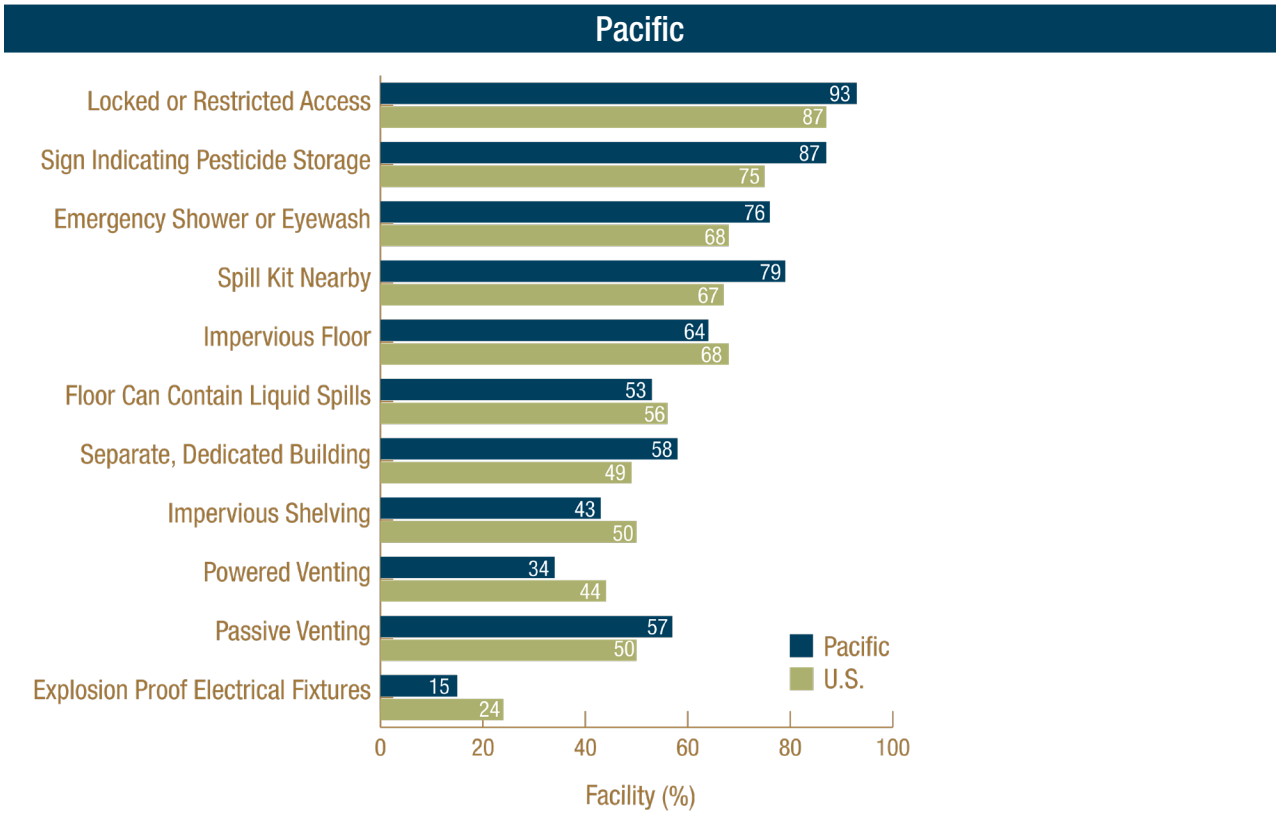


Figure 12. Frequency of pesticide storage area properties for all golf facilities in the Pacific region in 2024.

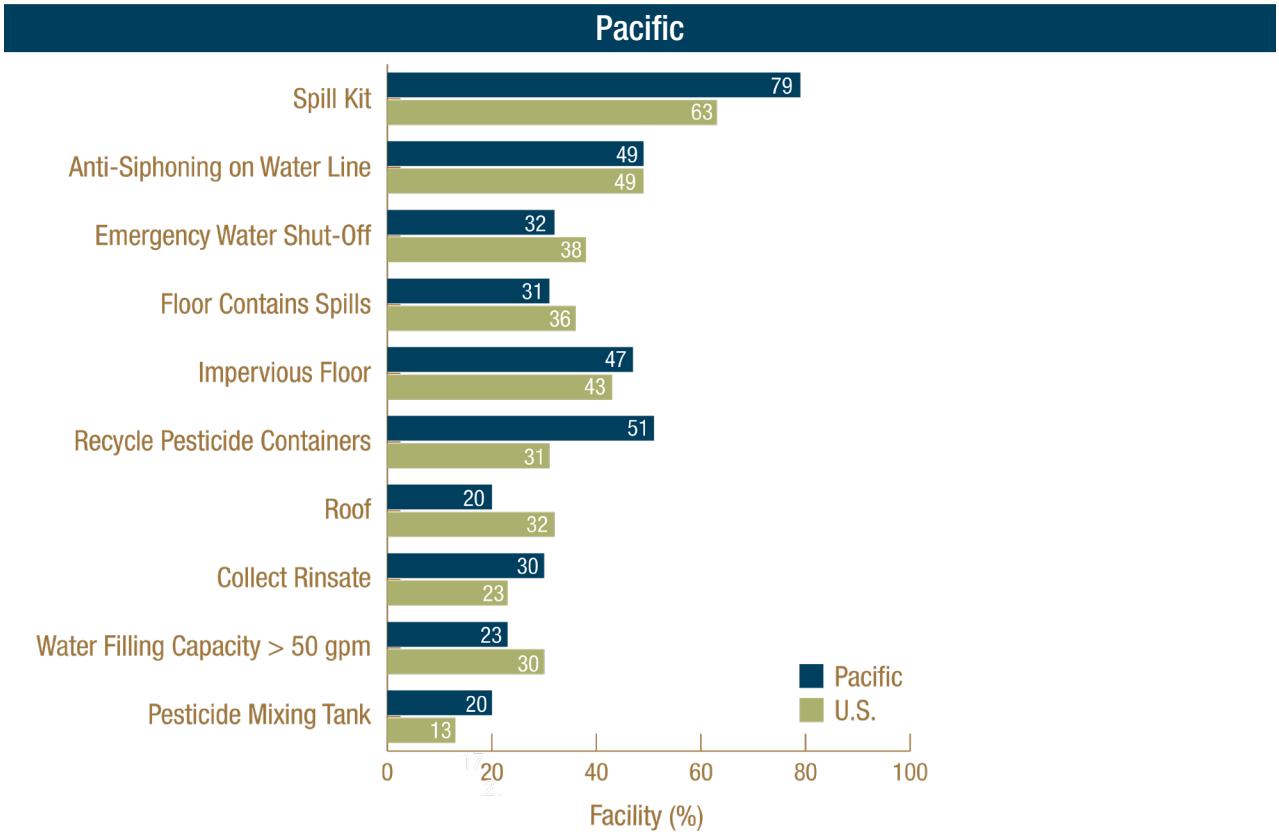


Figure 13. Frequency of pesticide mixing and loading area properties for all golf facilities in the Pacific region in 2024.

SOUTHEAST

- Reliance upon PGRs and biological control products remained unchanged between 2015 and 2024 at 51% and 20%, respectively (**Figure 14**). Reliance upon each class of chemical pest control products increased from 2015 to 2024.
- The percentage of golf facilities that have the listed pesticide storage attributes were equal to or greater than the national average for all attributes (**Figure 15**).
- The percentage of golf facilities that have the listed pesticide mixing and loading attributes was greater than or equal to the national average for each attribute except spill kit and anti-siphoning on water line, which were less than the national average (**Figure 16**).

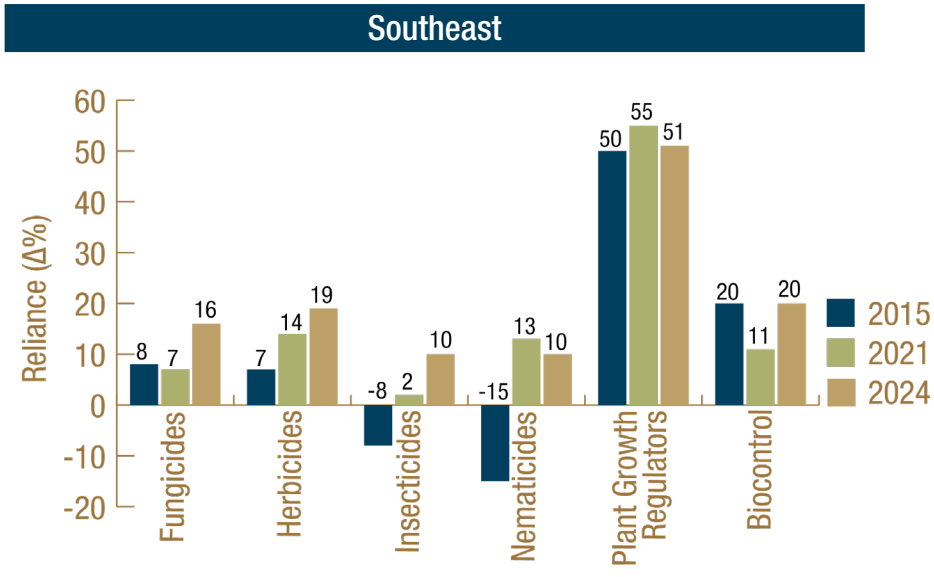


Figure 14. Reliance on all golf facilities on pest management practices during the three years prior to 2015, 2021, and 2024 in the Southeast region.

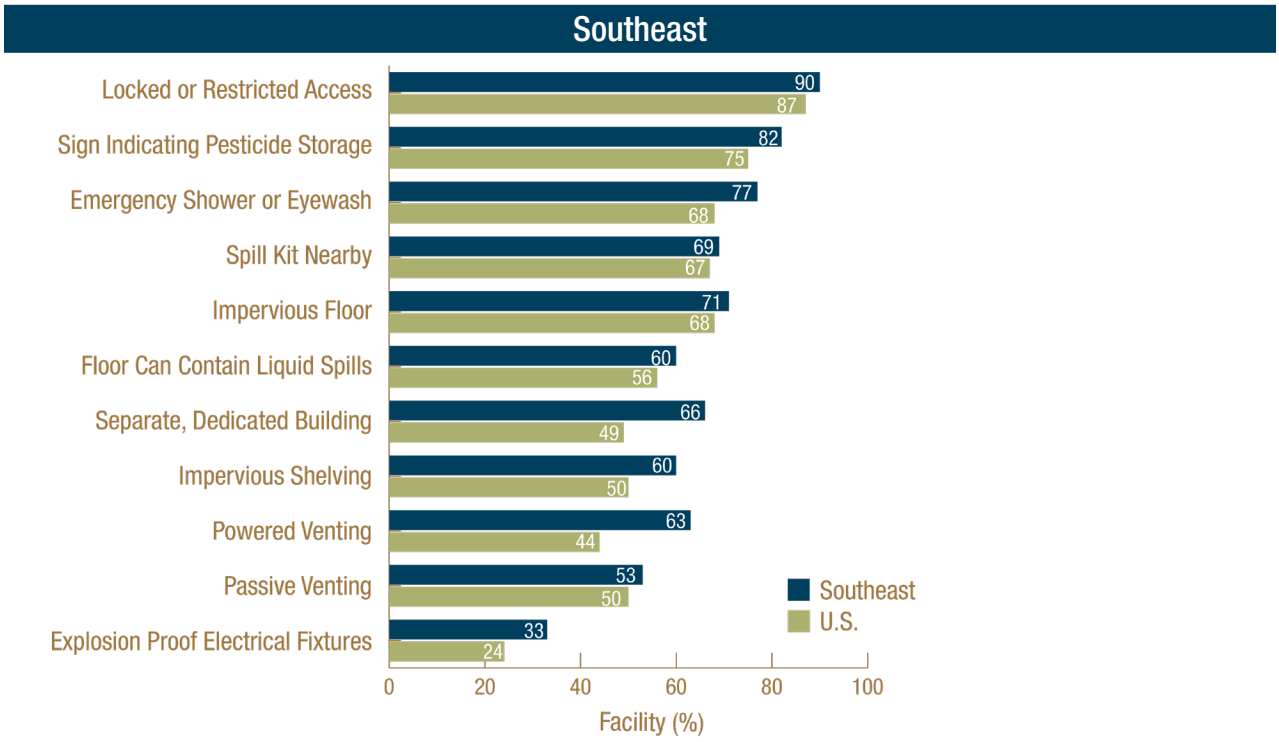


Figure 15. Frequency of pesticide storage area properties for all golf facilities in the Southeast region in 2024.

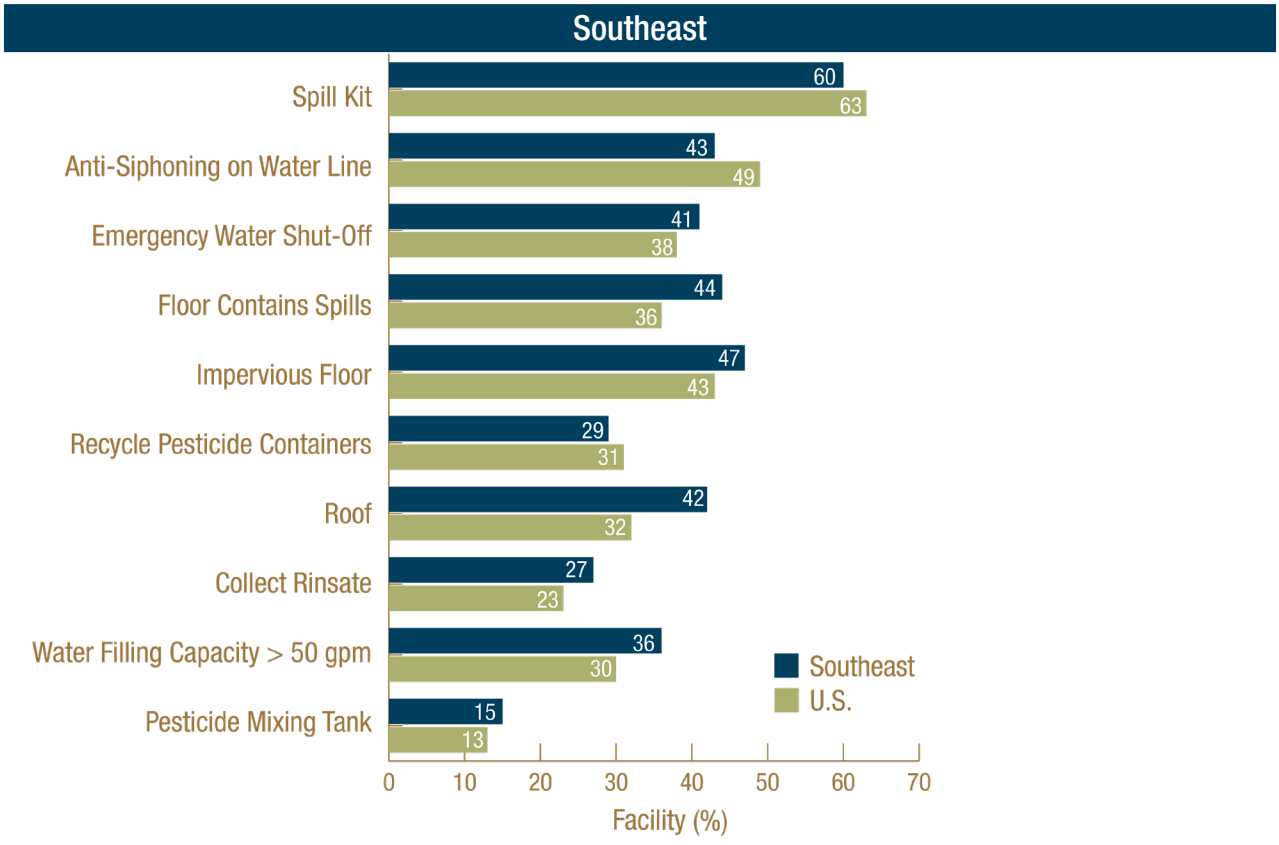


Figure 16. Frequency of pesticide mixing and loading area properties for all golf facilities in the Southeast region in 2024.

SOUTHWEST

- Reliance on PGRs increased from 42% in 2015 to 56% in 2024, whereas reliance on biological control products declined from 14% in 2015 to 9% in 2024 (**Figure 17**). Reliance on fungicides and herbicides declined, but reliance on insecticides increased, and reliance on nematicides remained unchanged from 2015 to 2024.
- The percentage of golf facilities that have the listed pesticide storage attributes were equal to or less than the national average (**Figure 18**).
- The percentage of golf facilities that have the listed pesticide mixing and loading attributes were greater than the national average for pesticide mixing tanks, whereas all other attributes were either equal to or less than the national average (**Figure 19**).

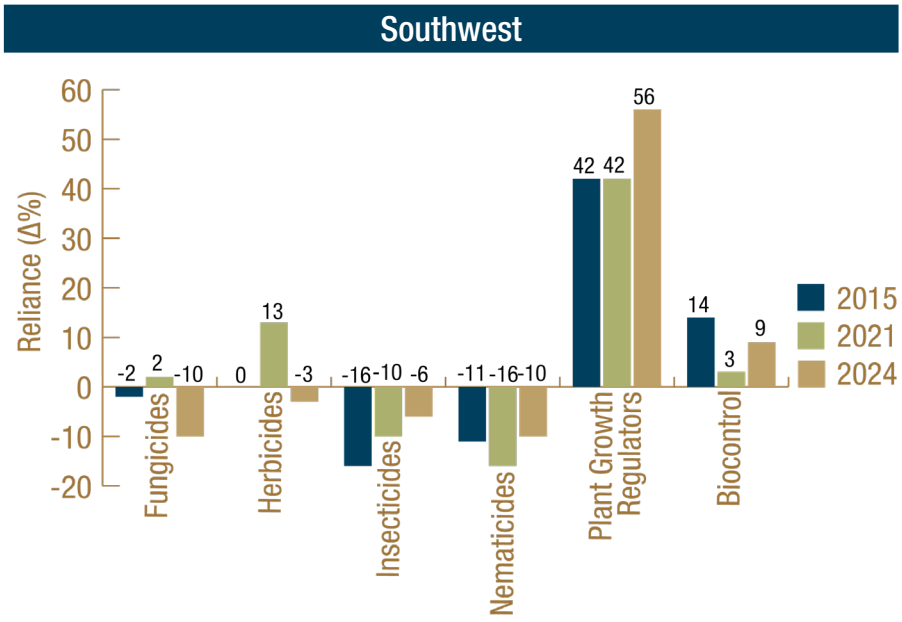


Figure 17. Reliance on all golf facilities on pest management practices during the three years prior to 2015, 2021, and 2024 in the Southwest region.

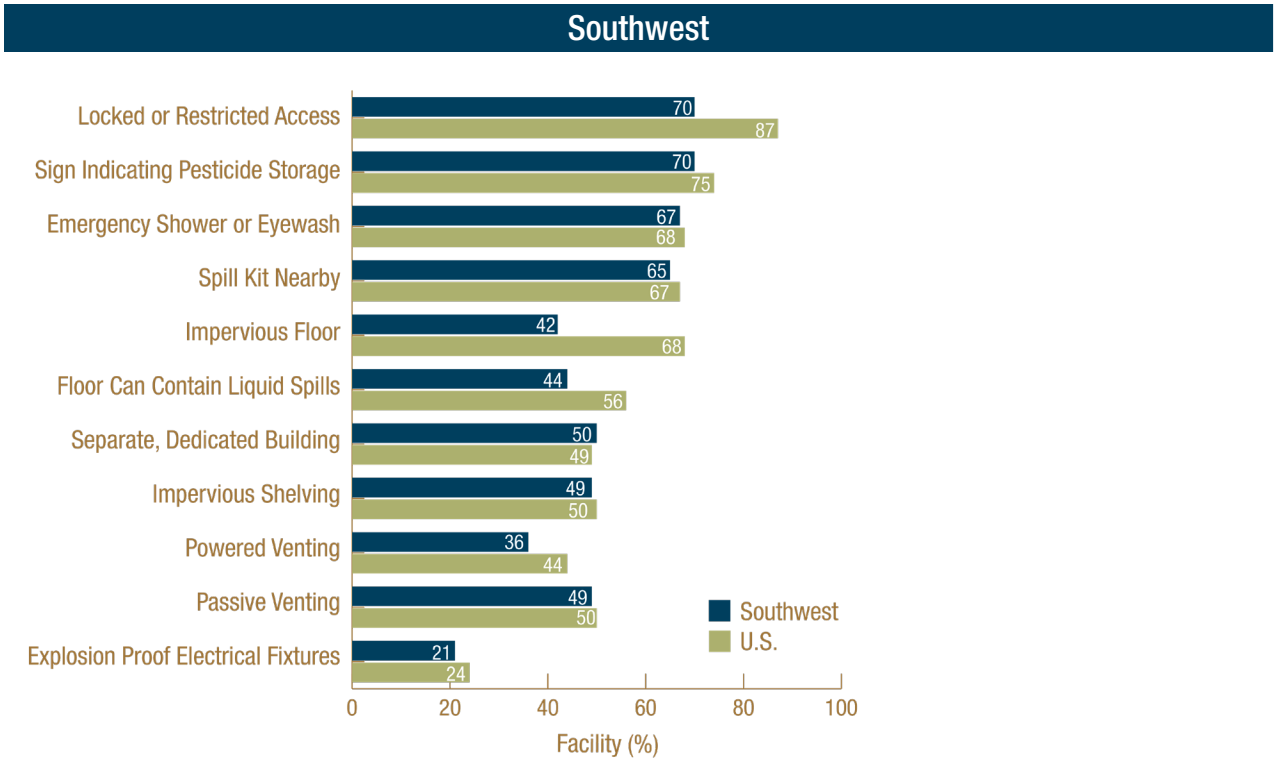


Figure 18. Frequency of pesticide storage area properties for all golf facilities in the Southwest region in 2024.

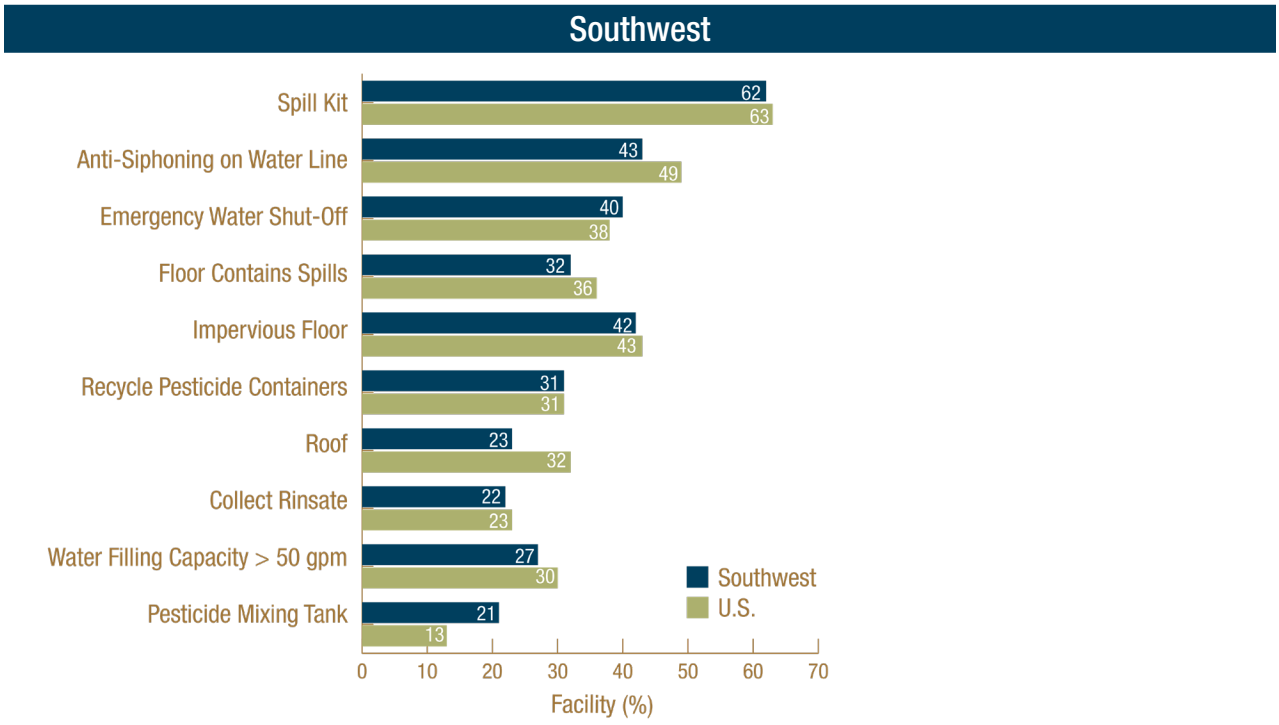


Figure 19. Frequency of pesticide mixing and loading area properties for all golf facilities in the Southwest region in 2024.

TRANSITION

- Reliance upon PGRs increased only slightly from 41% in 2015 to 43% in 2024, whereas reliance upon biological control products remained unchanged at 19% in 2024 (**Figure 20**). Reliance upon each class of chemical pest control products increased from 2015 to 2024.
- The percentage of golf facilities that have the listed pesticide storage attributes were generally equal to or greater than the national average except for impervious shelving and explosion proof electrical fixtures, which were less than the national average (**Figure 21**).
- The percentage of golf facilities that have the listed pesticide mixing and loading attributes were less than or equal to the national average except for anti-siphoning on water line, which was greater than the national average (**Figure 22**).

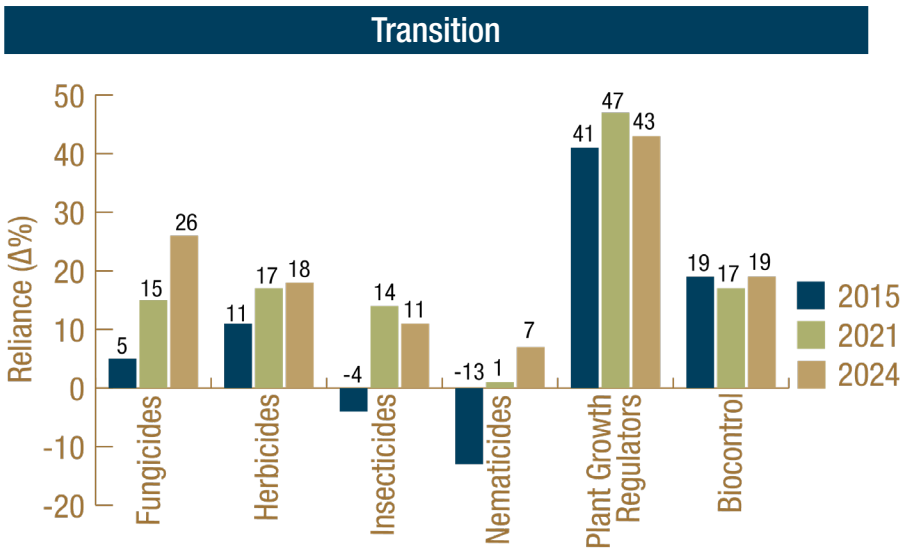


Figure 20. Reliance on all golf facilities on pest management practices during the three years prior to 2015, 2021, and 2024 in the Transition region.

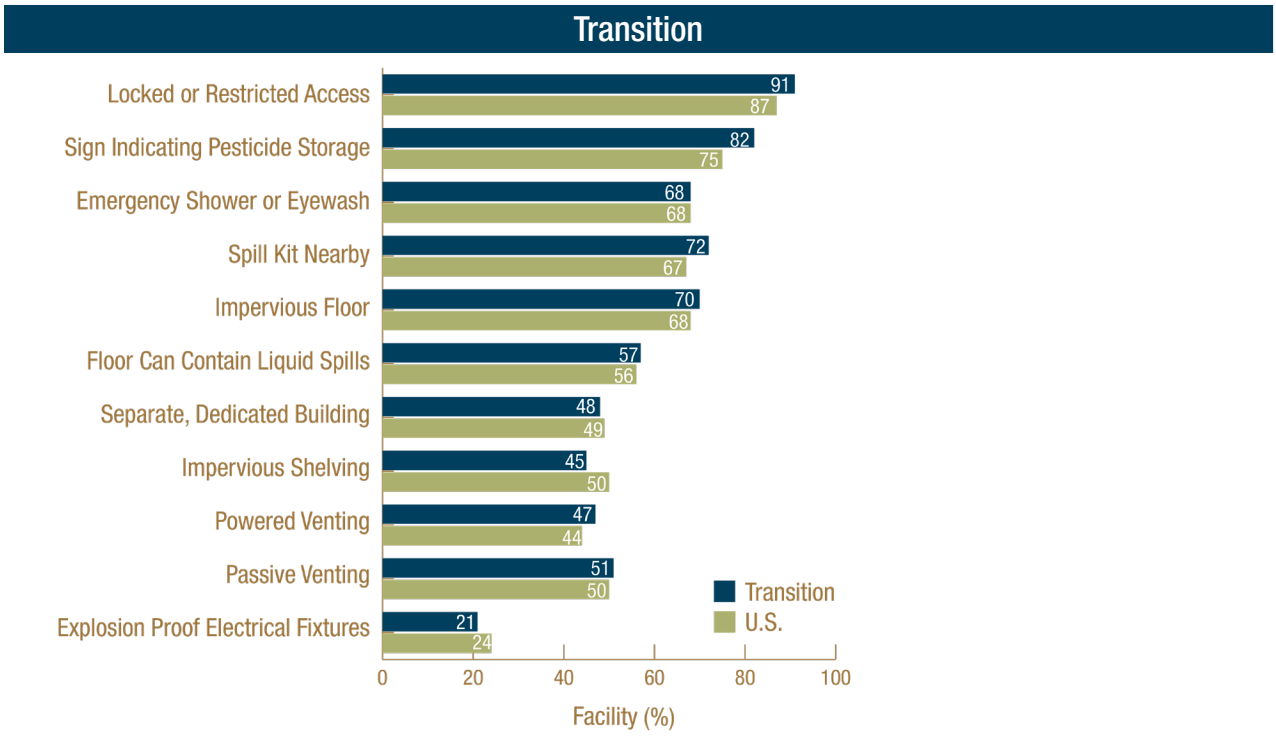


Figure 21. Frequency of pesticide storage area properties for all golf facilities in the Transition region in 2024.

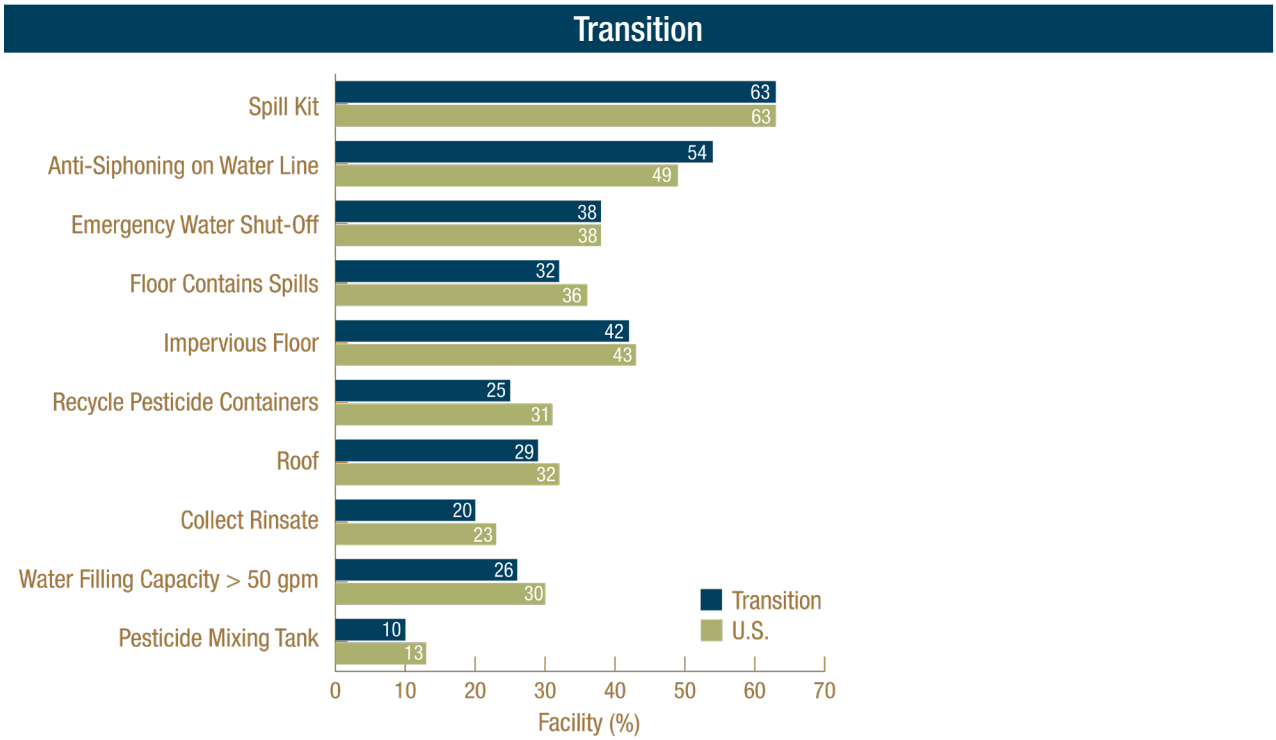


Figure 22. Frequency of pesticide mixing and loading area properties for all golf facilities in the Transition region in 2024.

UPPER WEST/ MOUNTAIN

- Reliance on PGRs did not change from 2015 to 2024, remaining at 46%, but biocontrol products decreased from 18% in 2015 to 7% in 2024 (**Figure 23**). Reliance upon fungicides, herbicides, and insecticides were generally unchanged, whereas reliance on nematicides increased from 2015 to 2024.
- The percentage of golf facilities that have the listed pesticide storage attributes were less than or equal to the national average (**Figure 24**).
- The percentage of golf facilities that have the listed pesticide mixing and loading attributes were less than or equal to the national average, except for pesticide mixing tanks, which was 6% greater than the national average (**Figure 25**).

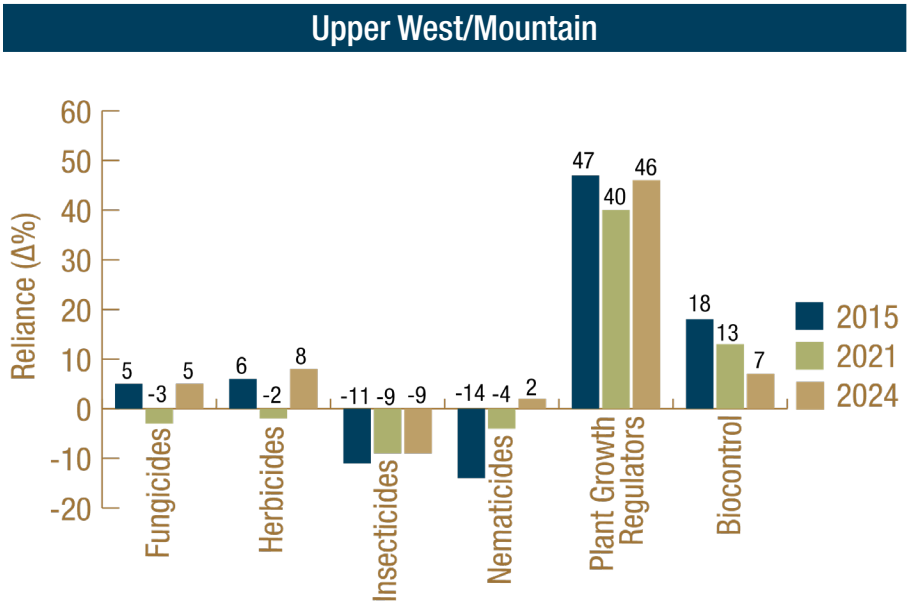


Figure 23. Reliance on all golf facilities on pest management practices during the three years prior to 2015, 2021, and 2024 in the Upper West/Mountain region.

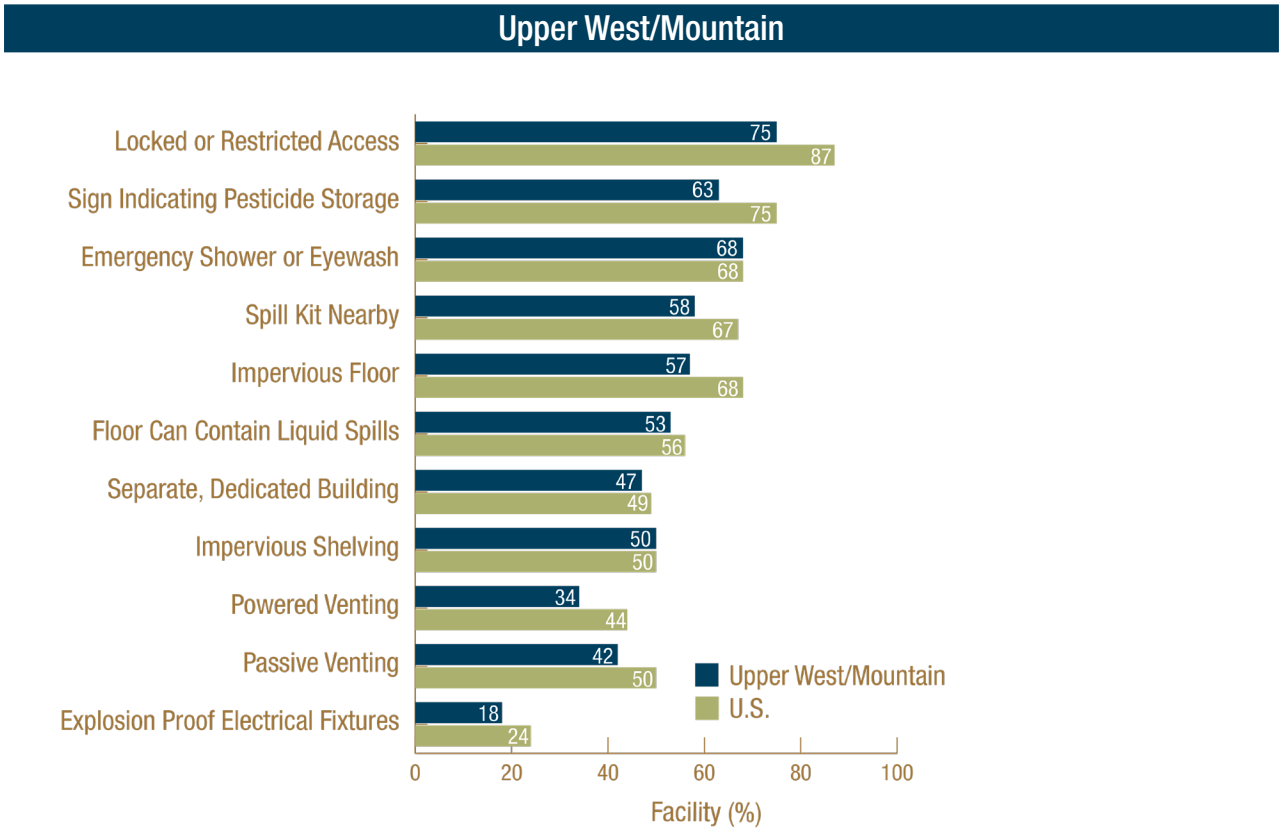


Figure 24. Frequency of pesticide storage area properties for all golf facilities in the Upper West/Mountain region in 2024.

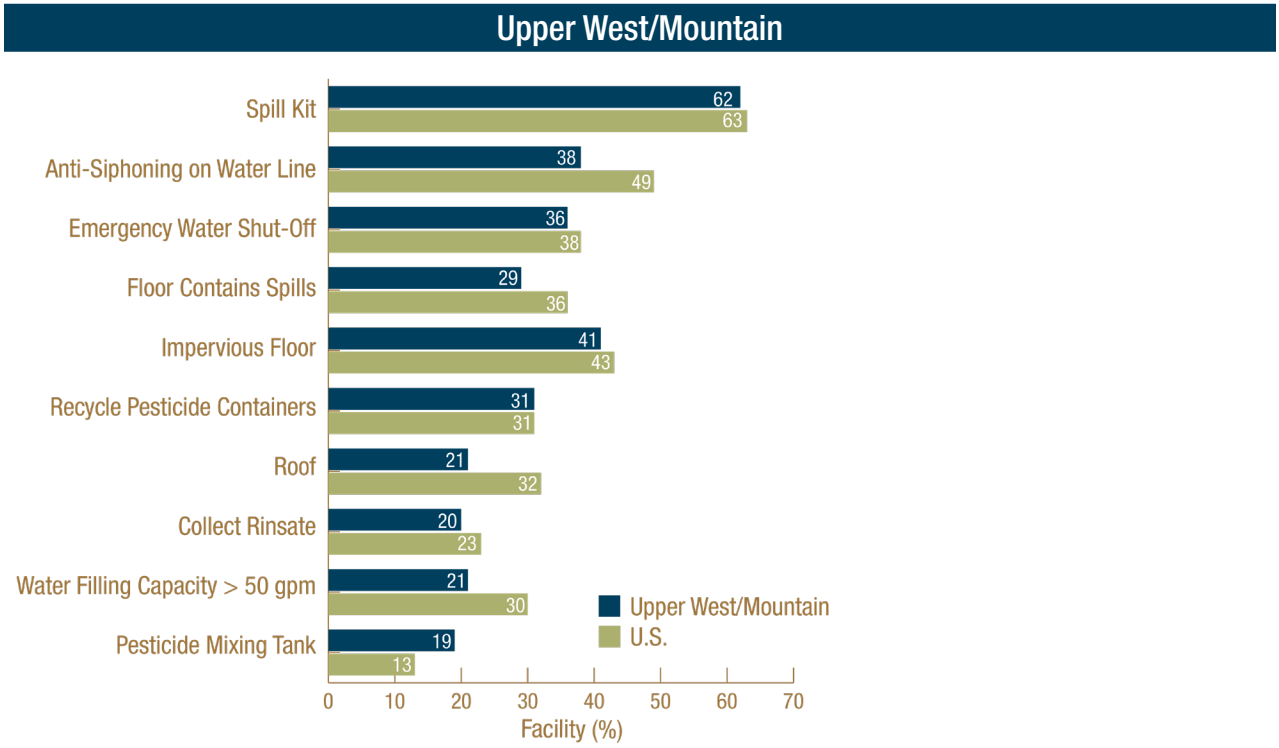


Figure 25. Frequency of pesticide mixing and loading area properties for all golf facilities in the Upper West/Mountain region in 2024.

Conclusion and Recommendations

The percentage of golf facilities employing common pest management practices remains high, such as monitoring weather patterns and scouting used by more than 90% of facilities. However, the frequency of many other less common practices has overall declined from 2007 to 2024, with individual exceptions of increases in the use of predictive models, photographic documentation, and remote sensing technologies. The reasons for these changes are not fully understood. Continued education and outreach efforts should emphasize the value of integrated approaches and the appropriate adoption of emerging technologies to support decision-making.

Reliance upon chemical pesticides has increased nationally from 2015 to 2024 across most pesticide classes, while reliance upon biological control products has declined. Use of plant growth regulators has remained stable. This shift toward chemical control may reflect increased performance expectations, reduced pest tolerance, perceived limitations in the efficacy of biological products, or (in the case of nematicides) a larger portfolio of products to choose from. Because biocontrol products are often used to supplement, rather than replace, conventional pesticides, their reduced use may indicate a broader shift in pest management strategy. Efforts to improve confidence in and performance of non-chemical options, where appropriate, should be encouraged.

ritten pest management plans has improved modestly since 2007, particularly for IPM and emergency response plans, while pesticide application plans have remained unchanged. Despite these gains, a substantial proportion of facilities still lack comprehensive written plans. These plans are critical for improving decision-making, ensuring regulatory compliance, and protecting environmental and worker safety. Increased adoption of written plans should be encouraged through education and the promotion of available industry resources.

Attributes associated with pesticide mixing, loading, and storage areas have generally remained stable or improved slightly over time. Notable improvements include increased adoption of spill kits and impervious surfaces, though some attributes, such as recycling of pesticide containers and passive venting, have declined. While capital investments in infrastructure can be cost-prohibitive, incremental improvements, such as installing spill containment features or upgrading flooring, can meaningfully reduce risk. Facilities should evaluate these investments in the context of environmental stewardship and operational safety.

Facility budget continues to be a major determinant of pest management capacity. Facilities with annual budgets greater than $1 million are more likely to have written plans and more comprehensive mixing, loading, and storage infrastructure than facilities with budgets less than $500,000. These differences likely reflect disparities in labor availability, financial resources, and access to expertise. Expanding access to practical, low-cost IPM tools and guidance will be critical to supporting facilities limited budgets.

Regional differences in pest management practices and infrastructure were evident but generally reflected the broader national trends. In most regions, reliance on chemical pesticides increased while reliance on biological control declined. Similarly, variability in infrastructure attributes suggests that regional conditions, resources, and priorities influence implementation. Regionally targeted education and guidance may help address these disparities and improve adoption of best management practices across diverse operating environments.

Appendix

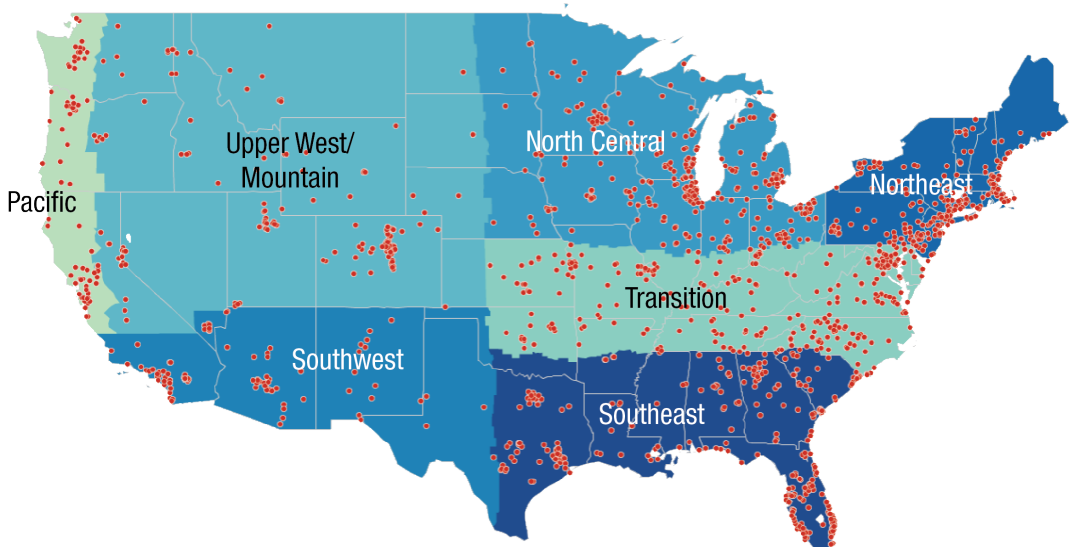


Figure 26. Distribution of the 2024 survey responses within the seven agronomic regions.

Table 5. 2024 nutrient and pest survey responses and weighting factors categorized by region (**Fig.26**), facility type, number of holes, and green fee.

Region	Facility type	Holes	Green fee	Golf facilities		Survey responses		Weight
		No.	$	No.	%	No.	%	
Northeast	All	9	All	652	4.7	18	1.2	3.892
Northeast	Public	18	<$55	402	2.9	10	0.7	4.319
Northeast	Public	18	$55+	639	4.6	71	4.7	0.967
Northeast	Private	18	All	585	4.2	109	7.3	0.577
Northeast	All	27+	All	176	1.3	17	1.1	1.112
North Central	All	9	All	1135	8.1	19	1.3	6.418
North Central	Public	18	<$55	901	6.5	45	3.0	2.151
North Central	Public	18	$55+	753	5.4	109	7.3	0.742
North Central	Private	18	All	448	3.2	110	7.3	0.438
North Central	All	27+	All	301	2.2	31	2.1	1.043
Transition	All	9	All	641	4.6	20	1.3	3.443
Transition	Public	18	<$55	635	4.6	41	2.7	1.664
Transition	Public	18	$55+	514	3.7	85	5.7	0.650
Transition	Private	18	All	520	3.7	117	7.8	0.478
Transition	All	27+	All	180	1.3	28	1.9	0.691
Southeast	All	9	All	444	3.2	9	0.6	5.300
Southeast	Public	18	<$55	541	3.9	41	2.7	1.418
Southeast	Public	18	$55+	669	4.8	87	5.8	0.826
Southeast	Private	18	All	685	4.9	119	7.9	0.618
Southeast	All	27+	All	365	2.6	61	4.1	0.643
Southwest	All	9	All	240	1.7	2	0.1	12.893
Southwest	Public	18	<$55	120	0.9	8	0.5	1.612
Southwest	Public	18	$55+	379	2.7	40	2.7	1.018
Southwest	Private	18	All	228	1.6	45	3.0	0.544
Southwest	All	27+	All	166	1.2	23	1.5	0.775
Upper West/Mountain	All	9	All	389	2.8	11	0.7	3.799
Upper West/Mountain	Public	18	<$55	80	0.6	14	0.9	0.614
Upper West/Mountain	Public	18	$55+	369	2.6	72	4.8	0.551
Upper West/Mountain	Private	18	All	154	1.1	46	3.1	0.360
Upper West/Mountain	All	27+	All	81	0.6	12	0.8	0.725
Pacific	All	9	All	157	1.1	5	0.3	3.374
Pacific	Public	18	<$55	28	0.2	2	0.1	1.504
Pacific	Public	18	$55+	205	1.5	42	2.8	0.524
Pacific	Private	18	All	116	0.8	23	1.5	0.542
Pacific	All	27+	All	54	0.4	7	0.5	0.829



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