

Report to the Minnesota Legislature: Effectiveness of the Minnesota Phosphorus Lawn Fertilizer Law

March 15, 2007

Minnesota Department of Agriculture
Pesticide and Fertilizer Management Division



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Minnesota Department of Agriculture
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Executive Summary

First introduced as legislation by the Minnesota Department of Agriculture in 1999, the Minnesota Phosphorus Lawn Fertilizer Law was enacted in 2002 and amended in 2004. The law regulates the use of phosphorus fertilizer on lawns and turf with the intent of reducing unnecessary phosphorus fertilizer use and preventing enrichment of rivers, lakes, and wetlands with the nutrient phosphorus.

The law prohibits use of phosphorus lawn fertilizer unless new turf is being established or a soil or tissue test shows need for phosphorus fertilization. Trained golf course staff and sod farms are exempt from these restrictions. The law also requires fertilizer of any type to be cleaned up immediately if spread or spilled on a paved surface, such as a street or driveway.

The Minnesota Phosphorus Lawn Fertilizer Law is contained in Chapter 18C of the Minnesota State Statutes. As of March of 2007, it is the only state law in the nation regulating the use of phosphorus lawn fertilizer, although several states are currently considering similar legislation or rules.

The Minnesota Department of Agriculture collected and examined information to assess the effectiveness of the law. Their findings are contained in the report titled *Report to the Minnesota Legislature: Effectiveness of the Minnesota Phosphorus Lawn Fertilizer Law*, March 15, 2007. The report can be found at www.mda.state.mn.us/phoslaw.

Findings of the report are:

1. Phosphorus-free lawn fertilizer is widely available in stores statewide.
2. Phosphorus-free lawn fertilizer comprised 82% of lawn fertilizer¹ used in 2006 by weight.
3. Amount of phosphorus applied through lawn fertilizers¹ decreased 48% between 2003 and 2006.
4. The law created a “teachable moment” for extensive yard care and water quality education.
5. In a comparison of similar products in two neighboring states, cost of phosphorus-free lawn fertilizer was the same as products that contain maintenance levels of phosphorus.
6. There have been no reports of the law being enforced by local government.
7. Companies are successfully manufacturing and marketing phosphorus-free lawn fertilizer.
8. Changes in water quality resulting from the law have not been documented at this time.
9. Additional research is needed to quantify benefits of the law for water quality planners and to avoid unintended consequences of phosphorus-free lawn fertilizer use on turfgrass health and water quality.
10. Minnesota is currently the only state regulating phosphorus lawn fertilizer use.

¹ Lawn fertilizer as defined in the report on pages 10 and 11.

Recommendations of the report are:

In three years, the Minnesota Phosphorus Lawn Fertilizer Law has substantially reduced phosphorus lawn fertilizer use and has provided a focus point for extensive water quality education for the general public and professionals. Future opportunities include:

Further research into law's impacts:

Quantify law's impact on water quality: Cities involved in Total Maximum Daily Load (TMDL) water quality planning are asking for quantifiable values for phosphorus runoff reduction that can be assigned to the law and other yard care practices. Those values currently are not available.

Expanding on current turfgrass runoff studies is needed to provide TMDL information to water quality planners. Phosphorus contributions to runoff from soil erosion, grass clippings, animal waste, and tree leaves and seeds need to be evaluated in addition to phosphorus contributions from lawn fertilizer use.

Quantify law's impact on turf management: The premise of the law is that soils already high in phosphorus do not need further phosphorus fertilization. There are soils in the state which are not naturally high in phosphorus and could develop phosphorus deficiencies over time due to phosphorus-free fertilizer use. Lawns deficient in phosphorus can lead to poor turfgrass health, which can result in increased soil erosion and nutrient runoff into surface water.

To avoid unintended consequences of phosphorus-free fertilizer use, an assessment of lawn and turf soil fertility should be conducted to detect early trends in low phosphorus levels. Studies on the nature of turfgrass health decline on phosphorus deficient soils should also be conducted.

Further outreach education:

General public education: Continued public education is needed to reinforce messages and to reach new state residents and individuals caring for a lawn for the first time. Point-of-sale information needs to be provided to fertilizer distributors and retail stores to assist in consumer education.

Education for turfgrass professionals and retail store staff: In addition to applying lawn fertilizer themselves, lawn service providers and retail staff are a major source of consumer information. Better informed professionals will result in a better informed public.

Soil testing education: Outreach education on soil testing methods needs to be provided to homeowners to enable them to detect low phosphorus soil conditions before declines in turfgrass health occur.

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The Minnesota Phosphorus Lawn Fertilizer Law

First introduced as legislation by the Minnesota Department of Agriculture in 1999, the Minnesota Phosphorus Lawn Fertilizer Law was enacted in 2002 and amended in 2004. The law regulates the use of phosphorus fertilizer on lawns and turf with the intent of reducing unnecessary phosphorus fertilizer use and preventing phosphorus enrichment of rivers, lakes, and wetlands.

Those advocating for state regulation of phosphorus lawn fertilizer were motivated by several interests:

1. Interest in improving water quality by reducing phosphorus runoff;
2. Interest in reducing the regulatory complexity caused by an increasing number of inconsistent local ordinances regulating phosphorus fertilizer use and sale; and,
3. Interest in reducing needless phosphorus fertilizer use.

Regulating phosphorus lawn fertilizer was considered a valid approach because many soils in Minnesota are high in phosphorus, either from native fertility or years of phosphorus fertilization, and do not need additional phosphorus fertilization to maintain healthy turf. A review of 1991-1994 soil test results from Twin Cities metro area lawns showed 70% to 80% were very high in phosphorus.²

The current law is the result of two separate legislative bills. The first was enacted in 2002 and established the law's major provisions:

- With exceptions, use of phosphorus lawn fertilizer is prohibited in the seven county Twin Cities metro area³ and restricted to 3% P₂O₅ products in remaining Minnesota counties. This provision went into effect January 1, 2004.
- Fertilizer applied to impervious (paved) surfaces needs to be cleaned up.
- Enforcement of the law is by local units of government under their existing authority.
- Local laws regulating phosphorus fertilizer use and sale are preempted.

In 2004, the Minnesota legislature expanded the prohibition on phosphorus lawn fertilizer use from the seven county Twin Cities metro area to statewide. This provision went into effect in January 1, 2005.

As of March 15, 2007, Minnesota is the only state which regulates phosphorus fertilizer use on lawns and turf. This status is likely to change as several states are considering similar legislation or rules.

Summary of the law's provisions: (Full law text provided in Appendix 1.)

Use of Phosphorus Fertilizer on Lawns and Turf is Restricted

(Minnesota Statutes 18C.60. Effective date: 2004 in Twin Cities metro area, 2005 statewide.)

Fertilizers containing phosphorus cannot be used on lawns and turf in Minnesota unless one of the following situations exists:

1. A soil test or plant tissue test shows a need for phosphorus;
2. A new lawn is being established by seeding or laying sod;
3. Phosphorus fertilizer is being applied on a golf course by trained staff;
4. Phosphorus fertilizer is being applied on farms growing sod for sale.

² Swenson, J. 2001. Urban landscapes as a source of phosphorus in surface waters. MS thesis, University of Minnesota, MN.

³ The Twin Cities metro area is defined as the seven counties of Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington.

Minnesota Rule 1510.0420 defines a phosphorus-free fertilizer to contain less than 0.67% phosphate (0.29% phosphorus)⁴, a standard adopted from the American Association of Plant Food Control Officials (AAPFCO).

When used, phosphorus lawn fertilizer needs to be applied at rates recommended by the University of Minnesota and approved by the Minnesota Department of Agriculture. These rates are based on soil test results and can be found in the University of Minnesota Extension publication [Fertilizing Lawns](http://www.extension.umn.edu/distribution/horticulture/DG3338.html) (Publication FO-03338 at www.extension.umn.edu/distribution/horticulture/DG3338.html).

Fertilizer on Paved Surfaces Needs to be Cleaned Up

(Minnesota Statutes 18C.61. Effective date: 2002 statewide.)

Fertilizer spilled or spread on paved surfaces such as sidewalks, driveways, and streets needs to be cleaned up immediately to prevent it from washing away into rivers, lakes, and wetlands. This applies to all fertilizers, whether or not they contain phosphorus.

Enforcement

(Minnesota Statutes 18C.62. Effective date: 2002 statewide.)

Restrictions and prohibitions in this law are enforced by local units of government under their existing authority. Violations are treated as petty misdemeanors.

Preemption of Local Law

(Minnesota Statutes 18C.110. Effective date: 2002 statewide.)

Local units of government may not adopt or enforce ordinances regulating the sale, handling, use or disposal of phosphorus lawn fertilizers. Exceptions to this are local ordinances regulating the sale (not use) of phosphorus lawn fertilizer which were in effect prior to August 1, 2002. Ten Minnesota cities have such ordinances.⁵ Local units of government also may not prohibit or regulate the sale, handling, or use of phosphorus fertilizers for agricultural use.

Consumer Information

(Minnesota Statutes 18C.60. Effective date: 2002 statewide.)

Consumer information is to be provided by the Minnesota Department of Agriculture in consultation with the University of Minnesota, fertilizer industry, lakes groups, and others.

Research Evaluation and Reporting

(Minnesota Statutes 18C.60. Effective date: 2002 statewide.)

Evaluation of research needs to be done by the Minnesota Department of Agriculture in cooperation with the University of Minnesota and in consultation with fertilizer industry, lakes groups, and others. A report on the effectiveness of the phosphorus law is due to the legislature in 2007, which is this report.

Full text of the Minnesota Phosphorus Lawn Fertilizer Law is found in Sections 18C.110, 18C.60, 18C.61 and 18C.62 of the Minnesota Fertilizer, Soil Amendment, and Plant Amendment Law; Chapter 18C of the Minnesota State Statutes. These sections are provided in Appendix 1. More information is available at www.mda.state.mn.us/phoslaw.

⁴ The phosphorus content of fertilizer is measured in terms of percent phosphate (P₂O₅) by weight. However, the phosphorus content in soil and water is commonly measured in parts per million (ppm) phosphorus (P) by weight.

⁵ Bloomington, Eagan, Eden Prairie, Lindstrom, Maplewood, Minneapolis, Plymouth, St. Paul, Savage, and Shorewood.

Findings on the law's effectiveness

The Minnesota Department of Agriculture is required to evaluate the effectiveness of the Minnesota Phosphorus Lawn Fertilizer Law and report to the Minnesota Legislature in 2007. To evaluate the law's effectiveness, Minnesota Department of Agriculture staff framed and then sought answers to the following questions:

- Is phosphorus-free lawn fertilizer readily available to consumers?
- Has the law reduced phosphorus lawn fertilizer use?
- Has the law increased costs to the consumer?
- Has the law been enforced?
- How has the law impacted lawn fertilizer manufacturers and retailers?
- Has the law improved water quality?

Is phosphorus-free lawn fertilizer readily available to consumers?

- ✓ Phosphorus-free lawn fertilizer was found in 97% of stores surveyed.
- ✓ Phosphorus-free lawn fertilizer in pesticide blends was found in 77% of stores surveyed.
- ✓ Organic phosphorus-free lawn fertilizer was found in 3% of stores surveyed.

Consumers need ready access to phosphorus-free lawn fertilizer for the law to be effective. Between October 10 and October 16, 2006, the availability of phosphorus-free lawn fertilizer was surveyed in 87 stores across the state; 66 stores in Greater Minnesota and 21 stores in the Twin Cities metro area. Products labeled as “lawn”, “lawn and garden”, and “all purpose” fertilizer were inventoried. The survey form used is provided in Appendix 2.

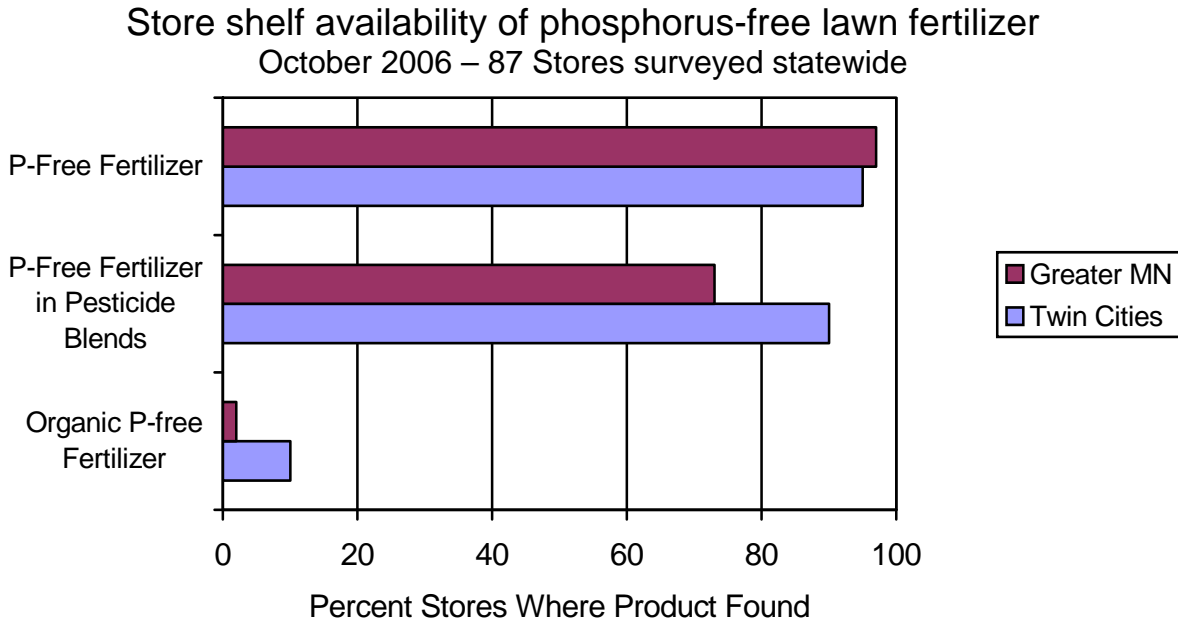
The survey was conducted late in the lawn care season. Nurseries, garden shops, hardware, farm supply and home improvement stores had good stocks of lawn fertilizer on hand; however a number of large discount stores had already removed lawn fertilizer from their sales floor. Only stores that were displaying lawn fertilizer were surveyed.

The overwhelming majority of stores (97%) offered phosphorus-free lawn fertilizer (Figure 1). The percentage of stores offering phosphorus-free lawn fertilizer in Greater Minnesota and in the Twin Cities metro area was nearly the same (97% vs. 95%). A majority of stores (77%) offered phosphorus-free lawn fertilizer in pesticide blends, such as “weed & feed” products designed to both fertilize and control lawn weeds. These products were more prevalent in the Twin Cities metro area (90%) than Greater Minnesota (73%). It is likely the percentage of stores offering phosphorus-free lawn fertilizer in pesticide blends would be higher if the survey was conducted in the spring when “weed and feed” products for both crabgrass weed control and broadleaf weed control are marketed.

Organic phosphorus-free lawn fertilizers were uncommon in the Twin Cities metro area (10% of stores surveyed) and almost non-existent in Greater Minnesota (2% of stores surveyed). Limited market demand was the probable reason for this, since at least three manufacturers market phosphorus-free organic lawn fertilizers in Minnesota.⁶

⁶ Bio Builder, GroWell, and, Renaissance

Figure 1.



While doing the store survey, Minnesota Department of Agriculture staff noted some fertilizer bags did not clearly display the three number “N-P-K” nutrient analysis on the front of the bag, making it difficult to readily identify a product as being phosphorus-free.

Has the law reduced phosphorus lawn fertilizer use?

- ✓ In 2006, 82% of lawn fertilizer used was phosphorus-free, based on weight. All of the top five lawn fertilizer products used in 2006 were phosphorus-free.
- ✓ Tons of phosphorus contained in lawn fertilizers used decreased 48% between 2003 and 2006.

Reducing unnecessary phosphorus lawn fertilizer use is an objective of the Minnesota Phosphorus Lawn Fertilizer Law. The ideal way to measure changes in phosphorus lawn fertilizer use is to gather information directly from end users of lawn fertilizer, homeowners, groundskeepers, etc. Unfortunately, this method was not a practical option for this report. As a substitute for a direct measure, a surrogate measure of lawn fertilizer use was developed using records of tons of specialty fertilizers distributed in the state.

“Specialty fertilizer” is a legal classification for fertilizers “labeled and distributed for, but not limited to, the following uses: greenhouses, nurseries, home gardens, house plants, lawn fertilizer, shrubs, golf courses, municipal parks, and cemeteries.”⁷ Registrants of specialty fertilizers are required to report to the Minnesota Department of Agriculture on the tons of specialty fertilizer they distributed in the state. “Distributed” means a fertilizer was shipped into or within Minnesota; it does not necessarily mean a product was actually sold to an end user or used that year, as some stock may carry over in storage from one year to the next. Despite these shortcomings, “tons distributed” is an available and reasonably accurate indirect measure of specialty fertilizer use. For the purposes of this report, “tons distributed” will be equated with “tons used.”

⁷ Minnesota Statutes, Section 18C.005

As noted, the classification of specialty fertilizer encompasses a number of non-agricultural fertilizer products, lawn fertilizer being just one. To focus on lawn fertilizers, specialty fertilizer records were filtered to include products most likely to be used on lawns. Products obviously intended for garden or other non-lawn use were excluded, as were fertilizers with less than 18% nitrogen content. Focusing on fertilizers with 18% or higher nitrogen content was done for two reasons; 1) It was the lowest nitrogen content of lawn fertilizer commonly found during the October 2006 store survey, and, 2) It prevented fertilizer products typically used for garden or other non-lawn use, such as a 10-10-10, from being included in the analysis. There are a limited number of lawn fertilizers with less than 18% nitrogen, and the record filtering process did have the disadvantage of excluding them.

When used in this measure of lawn fertilizer use, the term *lawn fertilizer* applies to specialty fertilizers distributed in Minnesota that were not obviously intended for garden or other non-lawn use and have an 18% or higher nitrogen content. It is an approximation, and while not perfect, provides a reasonable surrogate measure of lawn fertilizer use.

Using this surrogate measure, Minnesota Department of Agriculture staff measured the amount of lawn fertilizers used in the state between 2003 and 2006; 2003 being the year before the Minnesota Phosphorus Lawn Fertilizer Law prohibited phosphorus lawn fertilizer use in the Twin Cities metro area, and 2006 being the year after the law prohibited phosphorus lawn fertilizer use statewide. Their findings are:

- The law did not appear to reduce overall lawn fertilizer use (Figure 2).
- Between 2003 and 2006, phosphorus-free lawn fertilizer use increased from 44% to 82% of market share by weight (Figure 3).
- In 2003, only one of the top five lawn fertilizer products used were phosphorus-free; in 2005 and 2006, all of the top five lawn fertilizers used were phosphorus-free.
- Total amount of phosphorus contained in lawn fertilizer used decreased 48% between 2003 and 2006 (Figure 4).

A substantial amount of phosphorus-free lawn fertilizer was already used in 2003, the year before the state restriction on phosphorus lawn fertilizer use went into effect. There are two likely reasons for this: 1) Numerous local city ordinances in the Twin Cities metro area were already in effect requiring the use of phosphorus-free product, and, 2) Some stores “got a jump” on providing phosphorus-free product, making it their predominate offering in 2003, the year before the state restriction.

Figure 2.

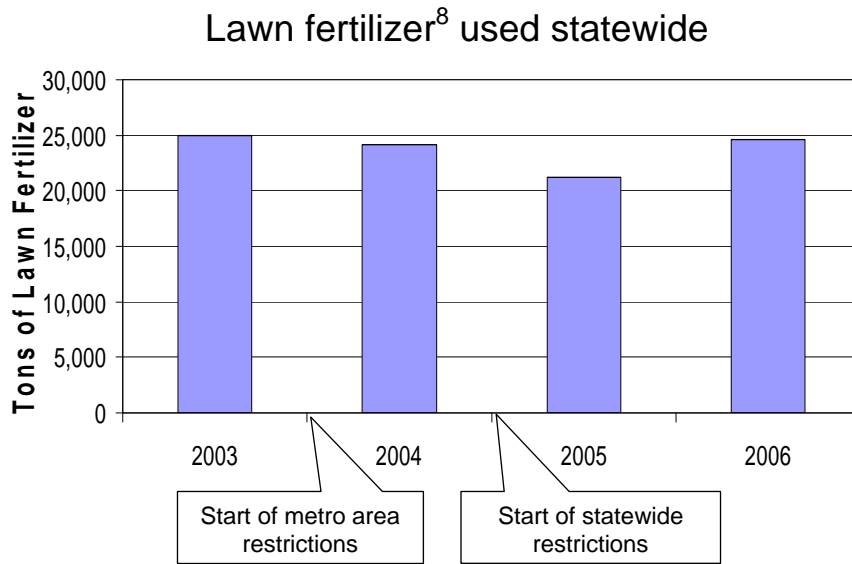
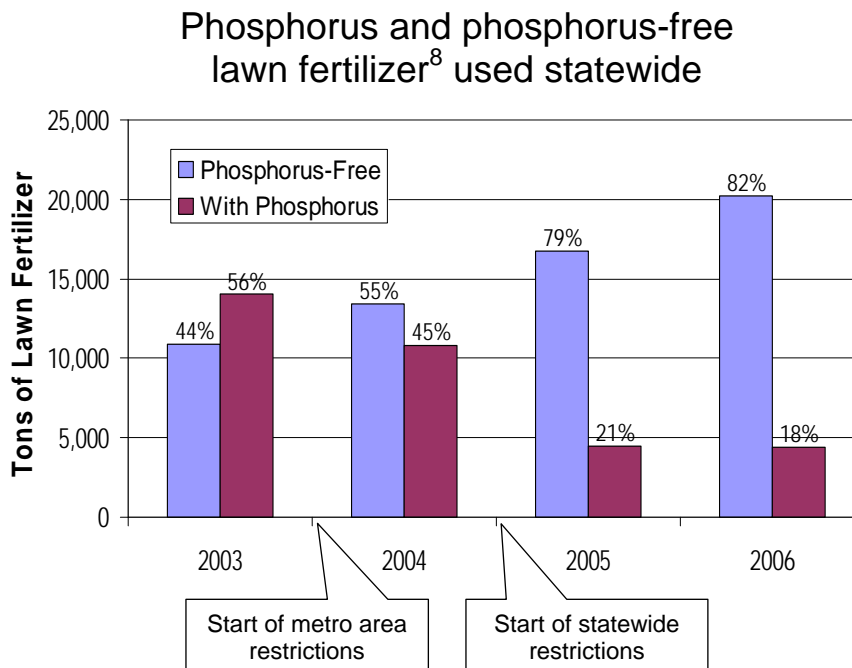
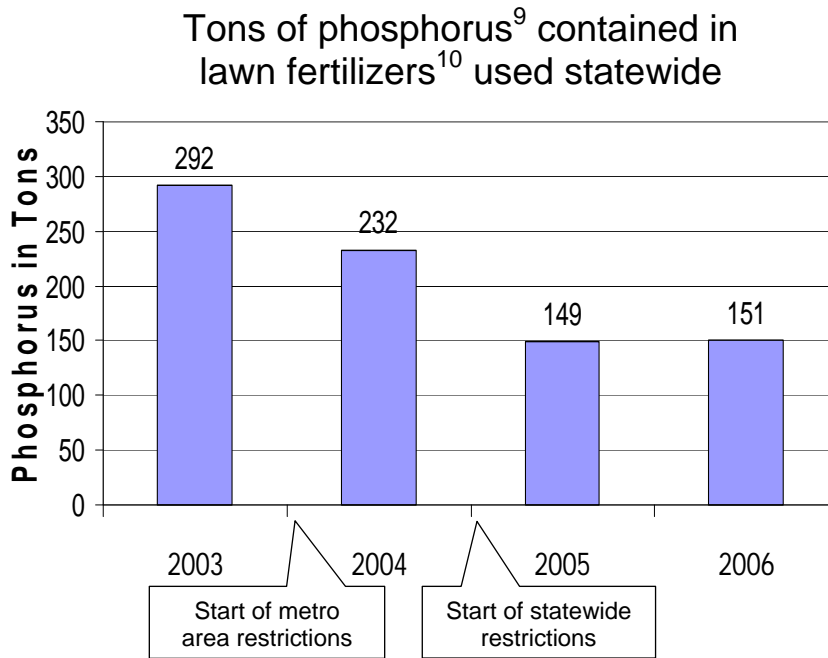


Figure 3.



⁸ Lawn fertilizer as defined through the process described on pages 10 and 11.

Figure 4.



Has the law increased costs to the consumer?

- ✓ Phosphorus-free lawn fertilizer costs were similar to products that contain phosphorus.

A cost comparison was made of lawn fertilizer products at two large chain stores which operate in Minnesota, Wisconsin, and North Dakota. Within store chains, similar lawn fertilizer products were compared, the only difference being Minnesota products were phosphorus-free and North Dakota and Wisconsin products contained a maintenance level of 3% P₂O₅. Prices were the same within store chains, giving indication that consumers were not paying an increased cost for phosphorus-free product.

Has the law been enforced?

- ✓ No enforcements of the law were reported by local units of government.

Enforcement of the Minnesota Phosphorus Lawn Fertilizer Law was assigned by state statute to local units of government. Inquiries into instances of the law being enforced were sent to city clerks, city administrators, and stormwater managers via the League of Minnesota Cities' e-mail system. Seventeen replies were received, none of which reported an enforcement being made. Two cities reported receiving citizen complaints of the law being violated. Both cities responded to complaints by providing information on the law to the parties involved.

Receiving no reports of the law being enforced is consistent with the law's initial intent of reducing phosphorus lawn fertilizer use through education and making phosphorus-free lawn fertilizer readily available to consumers.

⁹ Note that phosphorus (P) is being used in this analysis and not phosphate (P₂O₅).

¹⁰ Lawn fertilizer as defined through the process described on pages 10 and 11.

How have consumers responded to the law?

- ✓ Based on interviews with retail store staff, customers are very supportive of the law.
- ✓ Consumers sought guidance on proper disposal of surplus phosphorus lawn fertilizer.

According to store staff interviewed during the October 2006 store survey (page 9), customer response to the law is very supportive. Ninety-seven percent (97%) of store staff reported customers were supportive of the law. Only 3% of store staff reported instances where customers did not buy product because phosphorus lawn fertilizer was not available.

Consumer questions were received by the Minnesota Department of Agriculture and University of Minnesota Extension about proper disposal of leftover phosphorus lawn fertilizer. A fact sheet addressing available options was developed and distributed (available at: www.mda.state.mn.us/phoslaw).

How has the law impacted lawn fertilizer manufacturers?

- ✓ Formulating new phosphorus-free fertilizer products has not been a problem.
- ✓ Challenges were encountered with registering, inventorying, labeling, and marketing new products.
- ✓ Two year advance notice on law's effective date helped manufacturers plan for changes.

Ten fertilizer manufacturers were interviewed by telephone to gain insights into how the Minnesota Phosphorus Lawn Fertilizer Law affected their operations. They were asked the following questions:

Question: *Have you experienced problems in the manufacture, packaging, or marketing of phosphorus-free lawn fertilizer?*

- None of the manufacturers reported problems in formulating phosphorus-free products. One manufacturer did note extra care was required to prevent phosphorus-free product from being contaminated with trace amounts of phosphorus left in mixing equipment from previous blends.
- Six manufacturers did report challenges associated with introducing new product lines including cataloging, inventorying, marketing, and answering retailer questions.
- Two manufacturers reported increased costs associated with product registration and creating new packaging and labeling.
- One manufacturer reported problems with distribution and restocking when phosphorus-free or phosphorus containing products were shipped to the wrong state.
- Two manufacturers noted the importance of the two year advance notice on the law's effective date. It allowed them to do advance planning and use up existing stocks of packaging.

Question: *Have there been concerns about customer satisfaction with phosphorus-free lawn fertilizer products?*

- Three manufacturers reported receiving inquiries into why phosphorus was missing from products that historically were three-way blends of nitrogen, phosphorus, and potassium.
- Two manufacturers reported that most consumers are unaware of the composition of fertilizers. As long as a product contains nitrogen, the nutrient that "greens up" lawns, consumers are satisfied.
- Three manufacturers expressed concerns that use of phosphorus-free lawn fertilizer will cause deficiencies in soil phosphorus over time, and without increased education and use of soil testing, these deficiencies may lead to decline of lawn health.

Question: *Do you plan to continue producing phosphorus-free fertilizer?*

- All ten manufacturers plan to continue offering phosphorus-free lawn fertilizer.
- Eight manufacturers noted expanding markets for phosphorus-free lawn fertilizer in other areas concerned with water quality, including the Chesapeake Bay region, Florida, Michigan, and Wisconsin.

How has the law impacted lawn fertilizer retailers?

- ✓ Stores report no problem in stocking phosphorus-free product in general, some problem in stocking specific products.

All 87 stores surveyed during October 2006 (page 9) reported that they could obtain phosphorus-free product, although 14% said they could not find phosphorus-free product in a certain brand or for a certain application (e.g., “winterizer”). The experience of stores in Greater Minnesota and the Twin Cities metro area were similar.

Has the law improved water quality?

- ✓ Changes in water quality resulting from the law have not been documented at this time.
- ✓ Existing phosphorus runoff data from Twin Cities streams are too variable in years following phosphorus lawn fertilizer restrictions to indicate short-term trends in water quality.
- ✓ Measuring water quality changes associated with the law is made difficult by the variability of runoff data and the number of phosphorus runoff sources that need to be accounted for.

Measuring changes in phosphorus runoff to lakes, streams, and wetlands as a result of the Minnesota Phosphorus Lawn Fertilizer Law is highly complex due to a number of factors:

- Phosphorus runoff is highly driven by climatic conditions. The amount and timing of precipitation can vary greatly year to year, causing large variations in phosphorus runoff.
- There are many other sources of phosphorus besides lawn fertilizer that might account for changes in phosphorus runoff, including sediment from eroding construction sites, grass clippings, animal waste, and tree leaves and seeds.
- Some phosphorus is chemically bounded to lake sediments. This phosphorus can be released into lake water overtime, masking benefits from reducing phosphorus inputs over the short term.

With these complexities in mind, “adjusted yields” of total phosphorus runoff were compared for three Twin Cities metro area streams using data provided by Metropolitan Council Environmental Services (Table 2 and Figure 5). Adjusted yield expresses total phosphorus runoff on a per acre basis, adjusted by the amount of runoff which occurred (total phosphorus load divided by total runoff volume). Stream data were used instead of lake data to minimize complications caused by “internal loading” of phosphorus released from bottom sediments.

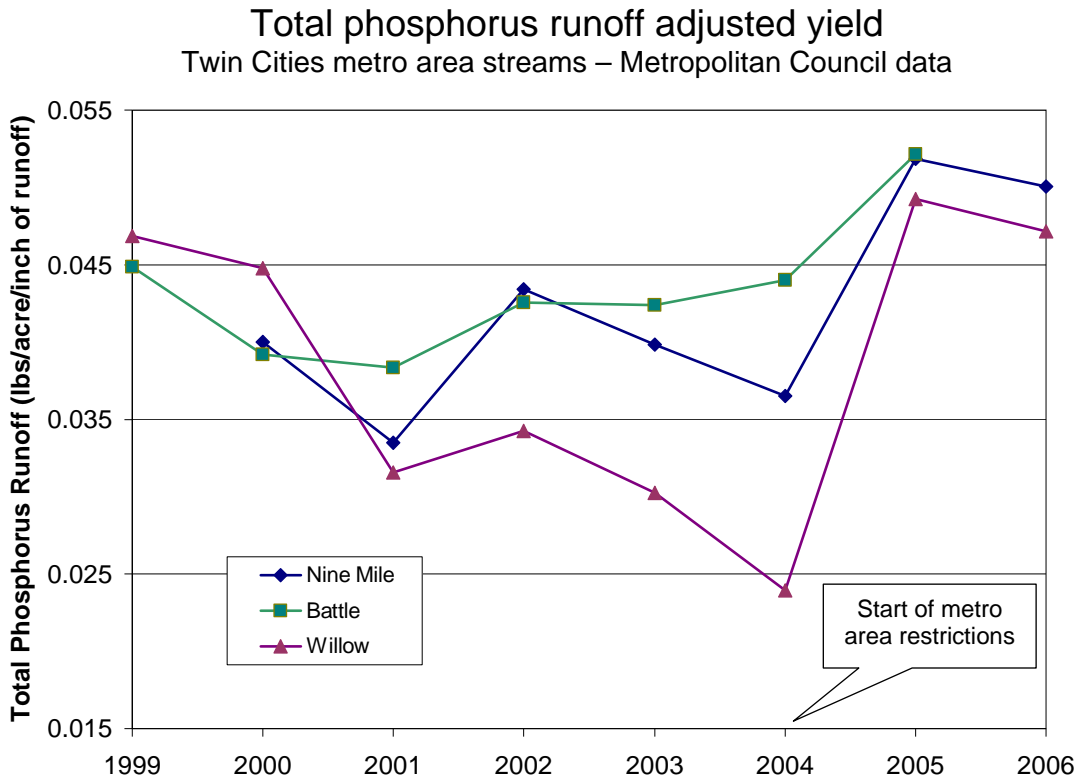
No discernable water quality trends could be determined due to the high variability of the data. High variability in short-term water quality data is not surprising due to the complexities already noted. Many years of watershed monitoring data often are required before statistically valid trends in water quality can be determined.

Table 1.

Twin Cities urban watersheds included in Figure 5

Watershed	City Location	Size	Percent residential area
Battle Creek	Oakdale, Maplewood, Woodbury	7,296 acres	38%
Nine Mile Creek	Bloomington, Eden Prairie, Edina	24,492 acres	43%
Willow Creek	Burnsville, Savage	6,558 acres	37%

Figure 5.



Adjusted yields of total phosphorus runoff for three Twin Cities metro area streams are presented above using data from Metropolitan Council Environmental Services. No discernable water quality trends are apparent.

Consumer information programs

- ✓ The law created a “teachable moment” about yard care and water quality protection.
- ✓ Public understanding of issues surrounding the law rests at the 52% to 59% level in 2003.
- ✓ Coalitions of agencies and organizations came forward to provide extensive education on the law.

Level of public understanding surrounding the law:

The Second Minnesota Report Card on Environmental Literacy: In 2003, a statewide telephone survey on environmental issues was conducted for the *The Second Minnesota Report Card on Environmental Literacy*, published by the Minnesota Office of Environmental Assistance and the Center for Global Environmental Education, Hamline University (www.seek.state.mn.us/eemn_b.cfm). The survey was conducted the year after the Phosphorus Lawn Fertilizer Law was enacted and a year before the law’s requirement for phosphorus-free lawn fertilizer use went into effect in the Twin Cities metro area. Results on questions specific to runoff water pollution and the impact of phosphorus are given in Table 2:

Table 2.

Public understanding of runoff pollution concepts - 2003

Question / Correct Response	Correct responses
<i>What is the most common cause of pollution of streams, rivers and oceans?</i> (Correct response: “Surface water running off yards/streets/lots/farm fields.”)	54%
<i>Where do you think water entering storm sewers goes?</i> (Correct response: “To lakes, rivers, and wetlands.”)	59%
<i>Which of the following is the major environmental impact of phosphorus?</i> (Correct response: “It promotes excessive plant and algae growth in lakes and rivers.”)	52%

According to the survey, more than half of Minnesotans understood the issues surrounding the law as it went into effect.

Survey of retail store staff knowledge: During the October of 2006 store survey (page 9), store staff members were asked questions as to their understanding of the law. Store staff are a major source of consumer information and these questions were designed to assess their ability to accurately relay details on the law to the public. Results were:

Question: *What information do you give customers when they ask about the reason behind the phosphorus-free lawn fertilizer law?*

- 72% of staff were able to provide a full or partial explanation of the law’s purpose. Twin Cities metro area store staff provided full or partial explanations more often than Greater Minnesota store staff (90% vs. 66%).

Question: *What information do you give customers asking if they are allowed to apply a lawn fertilizer which contains phosphorus?*

- 55% of staff were able to give a full or partial explanation of the situations where use of phosphorus fertilizer is allowed. Twin Cities metro area store staff provided full or partial explanations more often than Greater Minnesota store staff (75% vs. 47%).

These results points to an opportunity to better inform the public about the law by providing better education to retail store staff.

During the same survey, retail store staff were asked as to the need for continued consumer education on the law. Sixty-seven percent (67%) of store staff thought further consumer education on the law was needed, either because of a lack of current knowledge or the fact that new people are always coming into the state or caring for their first lawn.

Media coverage:

Extensive media coverage lead up to the enacting of the Minnesota Phosphorus Lawn Fertilizer Law in 2002. Subsequently, media coverage reoccurred in 2004 and 2005 when requirements for phosphorus-free lawn fertilizer use went into effect first in the Twin Cities metro area and then statewide.

Media coverage communicated the connections between phosphorus, runoff, and algae problems in surface water. Information was provided to the media by the Minnesota Department of Agriculture, the University of Minnesota Extension Service, and collaborative outreaches of local units of government in the Lake Superior, Red River Valley and Twin Cities metro areas. In addition, articles on the law were included in newsletters and websites of cities, lake and watershed organizations, fertilizer distributors, and nursery and garden retail stores.

Media outreach done by regional collaborations of local government include:

Regional Stormwater Protection Team (RSPT)

Lake Superior Basin, NE Minnesota – NW Wisconsin
www.duluthstreams.org/stormwater/rspt.html

Featured four seasonal “Another Watershed Moment” public service announcements on Duluth, MN and Superior, WI television during 2004. Also distributes stormwater education brochures and posters through its website and hosts community water festivals.

Regional Storm Water Association (RSWA)

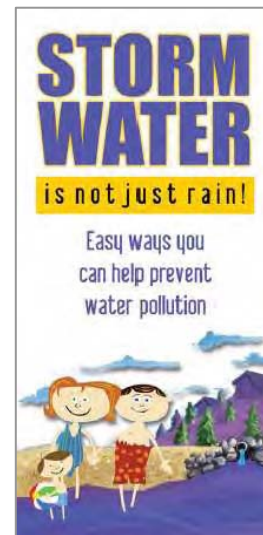
Red River Basin, Minnesota – North Dakota
www.undeerc.org/watman/stormwater

The RSWA hosts training sessions and distributes stormwater education posters, brochures and fact sheets through its website for member use.

Minnesota Water – Let’s Keep it Clean

Metro WaterShed Partners, Twin Cities metro
www.cleanwatermn.org

Minnesota Water-Let’s Keep it Clean has placed clean water messages in Twin Cities daily and community newspapers, on radio and on television, including a year-long “Water is Life” feature with KARE 11 television news. It features educational advertisements in *The Scoop*, the magazine of the Minnesota Nursery and Landscape Association. Its website distributes publications, photographs, and media packets for city, county, and watershed organization use.



Publications:

Use Phosphorus-free Lawn Fertilizer to Protect Minnesota Lakes and Rivers (Appendix 3)

Joint publication of the Minnesota Office of Environmental Protection, Minnesota Department of Agriculture, University of Minnesota Extension, and Metro WaterShed Partners. Two pages. Published 2003, revised 2004.

Target audience: General public

Distribution: 20,000

www.mda.state.mn.us/phoslaw/resources.htm

(Provided as Appendix 3)



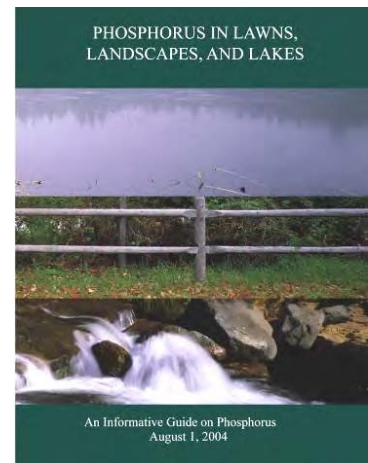
Phosphorus in Lawns, Landscapes, and Lakes

Joint publication of the Minnesota Department of Agriculture, Minnesota Office of Environmental Assistance, Minnesota Pollution Control Agency, and University of Minnesota Extension. Twenty-one pages. Published 2004.

Target audience: Natural resource professionals, lake and watershed association members, government decision makers, and concerned citizens.

Distribution: 2,000

www.mda.state.mn.us/phoslaw/resources.htm



Phosphorus Lawn Fertilizer Law In-store Posters

Minnesota Department of Agriculture. Published 2003, revised 2004.

Target audience: Retail stores wishing to provide in-store education on the law to their customers. Three sizes.

www.mda.state.mn.us/phoslaw/resources.htm

Phosphorus Lawn Fertilizer Media Packet

Metro WaterShed Partners. Published 2004.

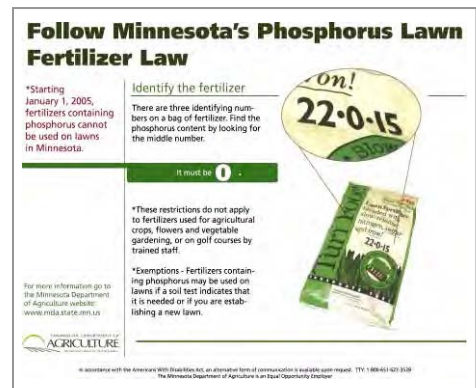
Target audience: Local government staff responsible for providing public education. Website resource provides a press release, talking points fact sheet, mailer flyer and links to publications, illustrations, and further information.

www.cleanwatermn.org/tools/mediaPackets/PhosphorusFert

Regulation of Phosphorus Fertilizer Application to Turf in Minnesota: Historical Perspective and Opportunities for Research and Education.

Carl Rosen and Brian Horgan, University of Minnesota. 2005. International Turfgrass Society Research Journal, Volume 10.

(Provided as Appendix 4.)



Developing a Phosphorus Fertilizer Training Program for Golf Course Personnel

Horgan, B. P.; Bierman, P.; Rosen, C. 2003. Journal of Extension, Volume 41, 5.

<http://www.joe.org/joe/2003october/tt6.shtml>

Distributed presentations:

Minnesota Phosphorus Law - PowerPoint Presentation

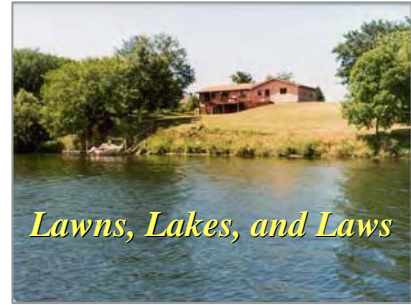
Jerry Spetzman, Minnesota Department of Agriculture. March 2005.

www.cleanwatermn.org/tools/toolsPresentations.asp

Lakes, Lawns, and Laws – PowerPoint Presentation

Ron Struss, University of Minnesota Extension. April 2005.

www.cleanwatermn.org/tools/toolsPresentations.asp



Training sessions:

Phosphorus Fertilizer Training School for Golf Turf Managers

Brian Horgan and Carl Rosen, University of Minnesota, in conjunction with the Minnesota Golf Course Superintendent Association and the Minnesota Turf and Grounds Foundation. Held 1/2003, 3/2003, 7/2003, 1/2004, 7/2004, 1/2005, 5/2005, 1/2006, and 1/2007. 405 trained through January 2007.

Master Gardener Turfgrass Core Course Training

Robert Mugaas and Carl Rosen, UM Extension, 2003 – 2006. Annual trainings in five locations.

University of Minnesota Turf and Grounds Day

Brian Horgan, Carl Rosen, Troy Carson, and Pamela Rice, University of Minnesota. Turfgrass nutrient runoff plots toured and results explained. 7/2003 – 7/2006.

Research studies

- ✓ Two Minnesota studies on nutrient runoff from lawns are in process.
- ✓ Expanded research is needed to evaluate the law's impact on water quality and turf management.
- ✓ Cities are asking for quantifiable values for phosphorus runoff reduction that can be assigned to the Minnesota Phosphorus Lawn Fertilizer Law. These values are not currently available.

Minnesota Statutes directs the Minnesota Department of Agriculture to “*encourage targeted research opportunities to investigate the effects of phosphorus fertilization of turf on urban stormwater quality.*” The Minnesota Department of Agriculture is aware of nine research studies proposed between 2003 and 2007 to study the effects of the Minnesota Phosphorus Lawn Fertilizer Law on water quality. Of these nine, two were funded, six were not funded, and one is pending. The two funded studies are:

1. A turfgrass runoff research study being conducted by the University of Minnesota, which has been funded by the MN Turf and Grounds Foundation, MN Golf Course Superintendents Association, MN Nursery and Landscape Association, and Responsible Industry for a Sound Environment. Paper with 2005 and 2006 results will be submitted to a peer-reviewed journal in fall 2007.
2. A paired urban watershed runoff study being conducted by Three Rivers Park District, which has been funded by an EPA IMPACT grant, an EPA 104B grant, and Three Rivers Park District funds. Study report to be submitted to the Minnesota Pollution Control Agency in spring 2007.

The University of Minnesota study is being conducted by Dr. Brian Horgan and Dr. Carl Rosen on the University of Minnesota Turfgrass Research, Outreach, and Education Center in Saint Paul, Minnesota. The plots measure phosphorus runoff from four fertilizer treatments and two grass clippings treatments. The fertilizer treatments included: 1) no fertilizer, 2) nitrogen and potassium, 3) nitrogen, potassium and low rate phosphorus, and, 4) nitrogen, potassium and high rate phosphorus. Clippings management included clippings removed and clippings recycled.

Two seasons of data have been collected, 2005 and 2006. Preliminary findings, not yet published, include:

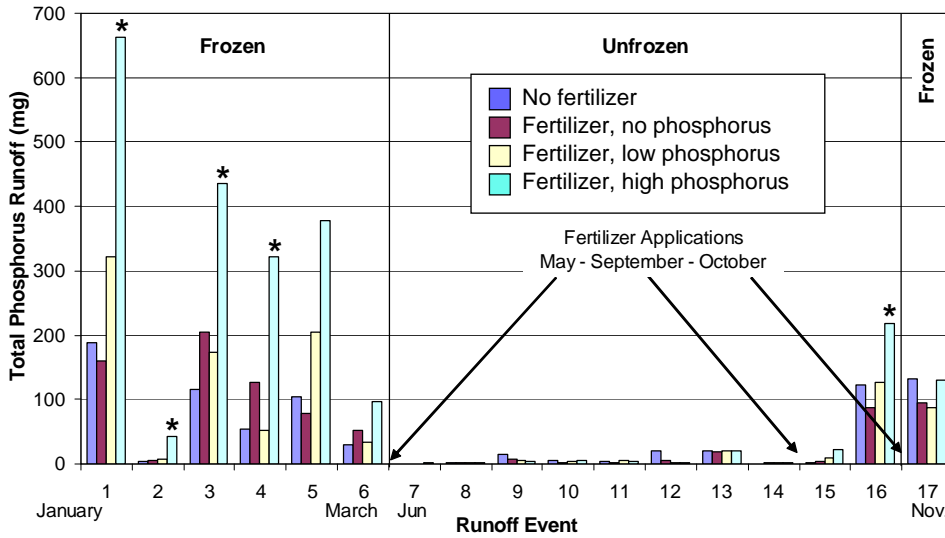
- In 2005 and 2006, the majority of phosphorus runoff occurred in the soluble form.
- In 2005 and 2006, the majority of phosphorus runoff occurred when ground was frozen (Fig. 6).
- In 2005, plots receiving the high rate of phosphorus fertilization had significantly higher phosphorus runoff. Phosphorus runoff from plots receiving no fertilizer, fertilizer with no phosphorus, and fertilizer with low phosphorus was not significantly different (Figure 6).
- In 2006, phosphorus runoff from plots receiving no fertilizer (no nitrogen, phosphorus, or potassium) appeared to be as high as plots receiving phosphorus fertilizer (results not yet statistically verified).

These findings suggest an effective lawn fertilization program needs to strike a balance between assuring adequate nutrients for healthy turf growth and avoiding excessive fertilization that can contribute to nutrient runoff. These are preliminary findings based on two seasons of data. The University of Minnesota is currently seeking funding to continue research on the plots two more seasons.

Continuing and expanding on such turfgrass runoff studies is important, especially to cities required to develop Total Maximum Daily Load (TMDL) water quality plans for reducing phosphorus runoff. Cities draining to waters listed as impaired by the Minnesota Pollution Control Agency due to excessive nutrients are being required to reduce phosphorus runoff by given amounts up to 80%. These cities are asking for quantifiable values for phosphorus runoff reduction that can be assigned to the Minnesota Phosphorus Lawn Fertilizer Law and other yard care practices. These values are not currently available.

Figure 6.

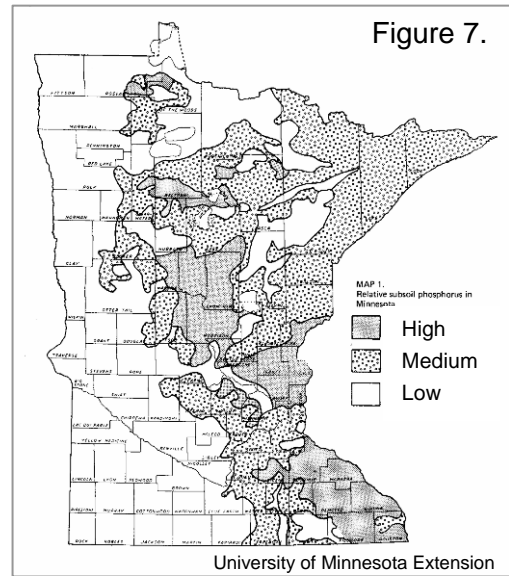
Total phosphorus runoff from turfgrass plots - 2005
 University of Minnesota Turfgrass Research, Outreach, and Education Center



Preliminary unpublished data from a turfgrass runoff study being conducted by Drs. Horgan and Rosen, University of Minnesota. Only treatments labeled “★” had statically significantly differences in phosphorus runoff within a given runoff event.

Research is also needed on the long-term impacts of the law on turf management. The premise of the law is that soils already high in phosphorus do not need further phosphorus fertilization. There are soils in the state, such as high pH soils in western Minnesota, which are not naturally high in phosphorus and could develop phosphorus deficiencies over time through use of phosphorus-free fertilizer (Figure 7)¹¹.

As suggested by the University of Minnesota study, deficiencies in soil nutrients can lead to poor turfgrass health, which in turn can impair water quality. Unhealthy lawns are no longer able to maintain dense ground cover, resulting in increased soil erosion and nutrient runoff.



Map of subsoil phosphorus levels. Areas with no shading are low in phosphorus¹¹.

¹¹ Guide to Computer Programmed Soil Test Recommendations for Field Crops in Minnesota. 1989. Minnesota Extension Service, Publication AG-BU-0519.

The following activities could be undertaken to avoid the unintended consequences of poor turf health, soil erosion, and impaired water quality:

- An assessment of lawn and turf soil fertility designed to detect early trends in low phosphorus levels.
- Studies on the rate and nature of turfgrass health decline on phosphorus deficient soils.
- Educational outreach on the benefits of and procedures for soil testing.

These activities are reflected in Table 3 which is a listing of recommended research compiled by the University of Minnesota and the Minnesota Department of Agriculture.

Table 3.

Research needs to evaluate impact of law
Compiled by University of Minnesota and Minnesota Department of Agriculture

- 1) **Measure effect of phosphorus-free lawn fertilizer use on phosphorus runoff from lawns:** It is anticipated that phosphorus-free lawn fertilizer use will reduce phosphorus in runoff, both from having less phosphorus lawn fertilizer product running off and from lowering soil phosphorus levels over time. Research to quantify these reductions is important, especially to cities required to reduce phosphorus runoff as part of Total Maximum Daily Load (TMDL) water plans.
- 2) **Identifying sources of urban phosphorus runoff:** There are many sources of urban phosphorus runoff in addition to phosphorus lawn fertilizer. Grass clippings, eroding soil, animal waste, and tree leaves and seeds are all potential phosphorus sources, and their relative contributions have not been determined. Identifying the sources of urban phosphorus runoff would assist cities required to reduce phosphorus runoff as part of Total Maximum Daily Load (TMDL) water plans.
- 3) **Measure effect of phosphorus-free lawn fertilizer use on long-term lawn health:** Use of phosphorus-free lawn fertilizer will lower soil phosphorus levels over time. Lawns may become phosphorus deficient, resulting in a decline of lawn health and an inability to control soil erosion and protect water quality. Monitoring soil phosphorus levels can detect trends in low phosphorus soil levels before they result in poor turfgrass health and water quality impacts. Research plot studies could determine the nature and rate of turfgrass health decline on phosphorus deficient soils allowing for diagnostic tools to be developed.
- 4) **Measure effect of grass clipping management on plant nutrient needs and nutrient runoff:** Current lawn fertilizer recommendations provide nitrogen, phosphorus, and potassium credits when grass clippings are returned (“recycled”) to the lawn. Research is needed to fine tune these credits and to determine the impact of grass clipping management has on nutrient runoff.
- 5) **Develop recommendations for organic lawn fertilizer management:** Increasing interest in organic lawn management will lead to increased use of compost as a topdressing. Research is needed to determine the rate which topdressed compost provides nutrients to the soil and what effect topdressing with compost has on infiltration rates and nutrient runoff.
- 6) **Develop recommendations for corrective addition of phosphorus:** Under the law, phosphorus lawn fertilizer is allowed be used for establishing new lawns and for correcting low soil phosphorus levels. Research is needed to determine the best methods for applying phosphorus lawn fertilizer, including rates, timing, and application methods.

Similar legislation by other states

Currently Minnesota is the only state regulating the use of phosphorus fertilizer on lawns and turf. Phosphorus regulating rules or legislation are advancing in four states, all of which have used the Minnesota law as a reference:

Florida

Rules are being drafted to regulate use of nitrogen and phosphorus fertilizer on “urban turf”, a designation which excludes athletic fields and golf courses. The rule is expected to be enacted in 2007.

Maine

Legislation has been introduced in the spring 2007 session to prohibit sale or use of fertilizer containing phosphorus for nonagricultural lawn or turf unless a soil test show needs or a new lawn is being established.

Michigan

Legislation was introduced in 2005 that included a statewide reduction of phosphorus lawn fertilizer use. Subsequent discussions on whether the law should be a restriction instead of a reduction and the role of local government lead to the phosphorus lawn fertilizer portion of the bill being removed. There remains interest in statewide restrictions, but no new legislation has been proposed.

Wisconsin

State legislation modeled after the Dane County, Wisconsin, phosphorus lawn fertilizer ordinance is anticipated in spring 2007. The Dane County ordinance prohibits the use of phosphorus lawn fertilizer unless a soil test show needs or a new lawn is being established. It also prohibits the display of phosphorus lawn fertilizers in stores.

Findings

Upon review of data collected, the Minnesota Department of Agriculture reports these findings on the effectiveness of the Minnesota Phosphorus Lawn Fertilizer Law:

1. **Phosphorus-free lawn fertilizer is widely available:** 97% of the stores surveyed in October of 2006 offered phosphorus-free products. Phosphorus-free lawn fertilizers in pesticide blends (“weed and feed”) were also found to be widely available.
2. **Phosphorus-free lawn fertilizer now dominates the market:** Between 2003 and 2006, phosphorus-free lawn fertilizer use increased in market share from 44% to 82% by weight. In 2003, only one of the top five lawn fertilizer products used was phosphorus-free; in 2005 and 2006, all of the top five lawn fertilizer products used were phosphorus-free.
3. **The amount of phosphorus applied through lawn fertilizers decreased:** The amount of phosphorus applied through lawn fertilizers decreased 48% between 2003 and 2006; from 292 tons in 2003 to 151 tons in 2006.
4. **The law created a “teachable moment” for yard care and water quality education:** Extensive outreach education on the law, yard care practices, and water quality protection occurred for both general public and professional audiences, offered by state and local government, professional organizations, interest groups, and the University of Minnesota.
5. **Consumer costs did not increase:** In a comparison of similar products in two neighboring states, cost of phosphorus-free lawn fertilizer was the same as products that contain maintenance levels of phosphorus.
6. **There have been no reports of the law being enforced:** A limited number of local units of government reported issuing warnings to violators of the law, but no enforcement actions. This is consistent with the law’s initial intent of reducing phosphorus lawn fertilizer use through education and making phosphorus-free lawn fertilizer readily available to consumers.
7. **Companies are successfully manufacturing and marketing phosphorus-free lawn fertilizer:** Challenges encountered with registering, inventorying, labeling, and marketing new product lines were successfully managed. The lead time provided in the law helped manufacturers plan for changes.
8. **Changes in water quality resulting from law have not been documented at this time:** Variability in available short-term water quality data prevents changes in water quality resulting from the law to be documented. Documenting water quality changes resulting from the law will be difficult without a number of well designed studies that can control for seasonal climatic variability and account for sources of phosphorus other than lawn fertilizer.
9. **Additional research is needed to measure impact of the law:** Further studies are recommended to quantify benefits of the law for water quality planners and to avoid unintended consequences of phosphorus-free lawn fertilizer use on turfgrass health and water quality.
10. **Minnesota is currently the only state regulating phosphorus lawn fertilizer use:** Rules or legislation regulating phosphorus lawn fertilizer are advancing in four states, Florida, Maine, Michigan, and Wisconsin, all of which have used the Minnesota law as a reference.

Recommendations

In three years, the Minnesota Phosphorus Lawn Fertilizer Law has substantially reduced phosphorus lawn fertilizer use and has provided a focus point for extensive yard care and water quality education for the general public and professionals. Future opportunities include:

Further research into law's impacts:

Quantify law's impact on water quality: Cities involved in Total Maximum Daily Load (TMDL) water quality planning are asking for quantifiable values for phosphorus runoff reduction that can be assigned to the law and other yard care practices. Those values currently are not available.

Expanding on current turfgrass runoff studies is needed to provide TMDL information to water quality planners. Phosphorus contributions to runoff from soil erosion, grass clippings, animal waste, and tree leaves and seeds need to be evaluated in addition to phosphorus contributions from lawn fertilizer use.

Quantify law's impact on turf management: The premise of the law is that soils already high in phosphorus do not need further phosphorus fertilization. There are soils in the state which are not naturally high in phosphorus and could develop phosphorus deficiencies over time due to phosphorus-free fertilizer use. Lawns deficient in phosphorus can lead to poor turfgrass health, which can result in increased soil erosion and nutrient runoff into surface water.

To avoid unintended consequences of phosphorus-free fertilizer use, an assessment of lawn and turf soil fertility should be conducted to detect early trends in low phosphorus levels. Studies on the nature of turfgrass health decline on phosphorus deficient soils should also be conducted.

Further outreach education:

General public education: Continued public education is needed to reinforce messages and to reach new state residents and individuals caring for a lawn for the first time. Point-of-sale information needs to be provided to fertilizer distributors and retail stores to assist in consumer education.

Education for turfgrass professionals and retail store staff: In addition to applying lawn fertilizer themselves, lawn service providers and retail staff are a major source of consumer information. Better informed professionals will result in a better informed public.

Soil testing education: Outreach education on soil testing methods needs to be provided to homeowners to enable them to detect low phosphorus soil conditions before declines in turfgrass health occur.

END OF REPORT

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The Minnesota Phosphorus Lawn Fertilizer Law is contained in Sections 18C.110, 18C.60, 18C.61 and 18C.62 of the Minnesota's Fertilizer, Soil Amendment, and Plant Amendment Law, Chapter 18C of the Minnesota State Statutes. Text of these sections are given below and were obtained from the State of Minnesota Office of the Revisor of Statutes via the www.leg.state.mn.us/leg/statutes.asp website.

18C.60, Minnesota Statutes 2006

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18C.60 - PHOSPHORUS TURF FERTILIZER USE RESTRICTIONS.

Subdivision 1. Definition.

For the purpose of this section, "turf" means noncrop land planted in closely mowed, managed grasses including, but not limited to, residential and commercial residential property, private golf courses, and property owned by federal, state, or local units of government, including parks, recreation areas, and public golf courses. Turf does not mean pasture, hayland, hay, turf grown on turf farms, or any other form of agricultural production.

Subdivision 2. Phosphorus use restrictions.

(a) A person may not apply a fertilizer containing the plant nutrient phosphorus to turf statewide, except under conditions listed in paragraph (b).

(b) Paragraph (a) does not apply when:

- (1) a tissue, soil, or other test by a laboratory or method approved by the commissioner¹² and performed within the last three years indicates that the level of available phosphorus in the soil is insufficient to support healthy turf growth;
- (2) the property owner or an agent of the property owner is first establishing turf via seed or sod procedures, and only during the first growing season; or
- (3) the fertilizer containing the plant food phosphorus is used on a golf course under the direction of a person licensed, certified, or approved by an organization with an ongoing training program approved by the commissioner.

(c) Applications of phosphorus fertilizer authorized under paragraph (b) must not exceed rates recommended by the University of Minnesota and approved by the commissioner.

Subdivision 3. Consumer information.

The commissioner, in consultation with the University of Minnesota Extension Service, fertilizer industry representatives, lakes groups, and other interested or affected parties, must produce consumer information on use restrictions and recommended best practices for lawn fertilizer containing phosphorus, and on best management practices for other residential sources of phosphorus in the urban landscape. The information must be in a format and of a content suitable for posting and distribution at retail points of sale of fertilizer that contains phosphorus and is for use on turf.

Subdivision 4. Research evaluation; report.

The commissioner, in cooperation with the University of Minnesota and the University of Minnesota Extension Service, and, after consultation with representatives of the fertilizer industry, lakes groups, and other interested or affected parties, shall evaluate research needs and encourage targeted research opportunities to investigate the effects of phosphorus fertilization of turf on urban stormwater quality. The commissioner must evaluate the effectiveness of the restrictions on phosphorus fertilizers under this section and report to the legislature by January 15, 2007.

History: 2002 c 345 s 4; 2004 c 179 s 1; 2005 c 10 art 1 s 12

¹² "commissioner" refers to the Commissioner of the Minnesota Department of Agriculture.

18C.61, Minnesota Statutes 2006

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18C.61 FERTILIZER APPLICATION TO IMPERVIOUS SURFACE; PROHIBITION.

(a) A person may not apply a fertilizer to an impervious surface. Fertilizer released on an impervious surface must be immediately contained and either legally applied to turf or any other legal site or returned to the original or other appropriate container.

(b) For the purposes of this section, "impervious surface" means a highway, street, sidewalk, parking lot, driveway, or other material that prevents infiltration of water into the soil.

History: 2002 c 345 s 5

18C.62, Minnesota Statutes 2006

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18C.62 ENFORCEMENT.

Sections 18C.60 and 18C.61 are enforced by local units of government under their existing authority. Violation of a provision in either of these sections is a petty misdemeanor.

History: 2002 c 345 s 6

18C.110, Minnesota Statutes 2006

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18C.110 PREEMPTION OF LOCAL LAW.

(a) Except as specifically provided in this chapter, a local unit of government may not adopt or enforce any ordinance that prohibits or regulates, and may not in any other way prohibit or regulate, the distribution, sale, handling, use, or application of phosphorus fertilizers and phosphorus fertilizer products that are applied or will be applied to land used for growing crops or any other agricultural use.

(b) Except as specifically provided in this chapter, a local unit of government may not adopt or enforce any ordinance that prohibits or regulates the registration, labeling, distribution, sale, handling, use, application, or disposal of turf fertilizer containing phosphorus.

(c) This section does not prohibit a local ordinance that restricts the sale of turf phosphorus fertilizer that was in effect on August 1, 2002.

(d) This section does not preempt local authority or responsibility for zoning, fire codes, or hazardous waste disposal.

(e) Paragraphs (a) and (d) are effective April 20, 2002. Paragraphs (b) and (c) are effective January 1, 2004.

History: 2002 c 345 s 2; 2002 c 400 s 2

Interview questions to ask a store staff member familiar with lawn fertilizers:

Point of purchase consumer information:

1. What information do you give customers when they ask about the reason behind the phosphorus-free lawn fertilizer law?
(Correct answer: To protect water quality. Phosphorus running off land increases the amount of algae in lakes and rivers.)
Correct answer? Yes No Partial Details: _____

2. What information do you give customers asking if they are allowed to apply a lawn fertilizer which contains phosphorus?
(Correct answer: P lawn fertilizer can only be used when seeding or sodding a new lawn, or when soil testing shows a need for P.)
Correct answer? Yes No Partial Details: _____

3. Is there need for further customer education on the phosphorus-free lawn fertilizer law?
Response? _____

Store's experience in making the switch to P-free product:

1. Are phosphorus-free lawn fertilizer products readily available from suppliers?
Response: _____

2. What has been customer response to phosphorus-free lawn fertilizer law?
Response: _____

3. Other comments: _____



YOUR LAWN AND THE ENVIRONMENT

Use phosphorus-free lawn fertilizer to protect Minnesota lakes and rivers

Minnesota has recently passed a statewide law that restricts the use of lawn fertilizers containing phosphorus, the primary nutrient that turns lakes green with algae.

New Phosphorus Law

Starting January 1, 2005, fertilizers containing phosphorus cannot be used on lawns in Minnesota. This is an expansion of the current state law that restricts the use of phosphorus in the Twin Cities metro area. Look for the middle number on a bag of fertilizer. It should be zero (0).

Keep fertilizer off paved surfaces: It's illegal to spread any fertilizer on hard surfaces such as streets, sidewalks, and driveways. Rain can wash the fertilizer into nearby storm drains or road ditches, eventually getting into a lake or river near you. If you accidentally spill or spread fertilizer on a hard surface, clean it up immediately.

Exemptions

Fertilizers containing phosphorus may be used on lawns if a soil test indicates that it is needed or if you are establishing a new lawn.

These restrictions do not apply to fertilizers used for agricultural crops, flower and vegetable gardening, or on golf courses by trained staff.



THE PROBLEM: TOO GREEN



GREEN AND MUCKY Excess algae and weed growth is a major problem in many Minnesota lakes and waterways.



MORE PHOSPHORUS, LESS FISH Too much algae lowers oxygen levels and darkens the water. This can have a devastating effect on fish populations.

What to look for

On any bag or box of fertilizer, there is a string of three numbers. The middle number indicates the phosphorus content and should read "0".



Will phosphorus-free fertilizer keep my lawn healthy?

Soils in most parts of Minnesota already have an adequate amount of phosphorus to grow a healthy lawn. In these instances, adding more phosphorus in fertilizer is not needed and will not benefit your lawn.

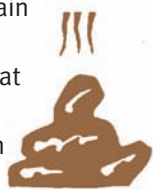
DO THE GREEN THING: FERTILIZE RESPONSIBLY Most garden centers and hardware stores carry phosphorus-free lawn fertilizers.

What can you do to protect water quality?

Fertilizers, leaves, grass clippings, eroded soil, and animal waste are all sources of phosphorus. When they are swept or washed into the nearest street or storm drain, they end up in your local lake or river. You can do your part to protect water quality by doing the following:



- ▶ Follow Minnesota's phosphorus lawn fertilizer law.
- ▶ Keep leaves and lawn clippings out of your gutters, streets, and ditches.
- ▶ Never wash or blow soil or grass clippings into the street.
- ▶ Pick up pet waste promptly. Pet waste can contain harmful bacteria as well as nutrients that cause excess algae and weed growth in lakes and rivers.
- ▶ Control soil erosion around your house. When left bare, soil is easily washed away with rain, carrying phosphorus with it. Soil erosion can be prevented by keeping soil covered with vegetation or mulch.



SWEEP IT UP Grass clippings and leaves left on streets and sidewalks are a major source of phosphorus pollution in lakes and rivers.

Find out what you need: Test your soil

A soil test is a good idea, especially if you are concerned that your lawn may need phosphorus.



Instructions on soil testing are available through the University of Minnesota Extension Service's INFO-U by calling 612-624-2200 (metro) or 1-800-525-8636 and requesting message 468.

Soil testing information can also be obtained through the Internet by visiting www.extension.umn.edu and searching for "Lawn Soil Testing."

A list of laboratories certified for soil testing by the Minnesota Department of Agriculture can be found at www.mda.state.mn.us/appd/soilabs.htm.

Visit www.reduce.org for lots of ideas about reducing waste and toxic chemicals in your day-to-day life.

[reduce.org](http://www.reduce.org)

To obtain additional copies of this fact sheet

contact Office of Environmental Assistance's **Education Clearinghouse** at 1-800-877-6300, 651-215-0232 or e-mail: clearinghouse@moea.state.mn.us.

For more information on lawn care

- ▶ The **Yard & Garden Line** is the University of Minnesota Extension Service's one-stop telephone link to information about plants and insects in the home landscape. Call 612-624-4771 or visit www.extension.umn.edu/projects/yardandgarden.
- ▶ University of Minnesota **Extension Service's web site**: www.extension.umn.edu. From the home page click on "Garden" then on "Lawns."
- ▶ University of Minnesota Extension Service - **Sustainable Urban Landscape Information Series (SULIS)**: www.sustland.umn.edu. From the home page, click on "Maintenance" then on "Sustainable Lawn Maintenance."
- ▶ **Minnesota Department of Agriculture**: www.mda.state.mn.us. From the home page, click on "Water & Land," then on "Lawn Care & Water Quality."
- ▶ **Minnesota Pollution Control Agency**: www.pca.state.mn.us. From the home page, click on "Water."

**REGULATION OF PHOSPHORUS FERTILIZER APPLICATION TO TURF IN MINNESOTA:
HISTORICAL PERSPECTIVE AND OPPORTUNITIES FOR RESEARCH AND EDUCATION****Carl J. Rosen* and Brian P. Horgan****ABSTRACT**

In an effort to reduce the amount of phosphorus (P) runoff into lakes and rivers, Minnesota became the first state in the U. S. to restrict the application of P fertilizer to turfgrass. Attempts to restrict or ban P fertilizer application to turfgrass were initiated over 20 years ago and were primarily based on soil test surveys showing that 70 to 80% of home lawns in the Twin Cities Metropolitan Area had soil P levels in the very high range (greater than 25 mg kg⁻¹ Bray P). The implication of these surveys was that P runoff potential is higher as soil test P increases. Prior to the recent state legislation, numerous city ordinances were passed that varied in their restrictions on P fertilizer use and led to confusion among lawn care professionals, garden center personnel, state agencies, lake associations, and homeowners. The state legislation preempts local ordinances and has provision for application of P without a soil test during the first year following seeding or sodding, and in subsequent years when soil testing shows a soil P deficiency. In addition, P fertilizer can be used on a golf course under the direction of a person that participated in a certified training program. The legislation has led to an increase in the availability of zero P containing lawn fertilizers at retail stores and an increased awareness by many homeowners of P impacts on water quality.

Keywords

erosion, eutrophication, P cycle, runoff, soil testing

INTRODUCTION

Phosphorus (P) is an essential element required for the growth and development of all plants. In natural fresh surface waters, additions of P result in accelerated eutrophication, a process associated with increased aquatic plant growth and subsequent reduction of water clarity, habitat loss, and decreased dissolved oxygen levels leading to fish kills (Mercias and Malone, 1984). In turfgrass grown on native soils, added P from fertilizers has been shown to increase growth during an establishment year, but had no effect on growth during subsequent years when soil test P levels were adequate (Turner and Waddington, 1983). In soils, P is considered relatively immobile, but runoff and erosion processes can result in significant transport of P to surface water (Pote et al., 1996). The problem tends to be accentuated in urban environments where hard surfaces reduce the area for water infiltration into soils and storm drains are often directly connected to rivers and lakes (Waschbusch et al. 1999). Also accentuating the problem is the relative sensitivity of aquatic systems to P compared to turfgrass and other terrestrial systems. Whereas a P water concentration of 20 to 30 µg L⁻¹ can initiate the eutrophic process in lakes,

a concentration an order of magnitude higher (200-300 µg L⁻¹) is required in soil solution to sustain plant growth (Daniel et al., 1998).

A generalized P cycle for an urban setting is shown in Figure 1. The main form of P taken up by plants is inorganic orthophosphate, which comes from various sources such as weathering of soil rocks and minerals, P adsorbed on soil particles, P mineralized from organic matter, and applied fertilizer P. Residue from plant and animal material can cycle P back to the soil in the organic form and is also susceptible to runoff as the residue decays. Runoff of particulate P can be a problem in soils not covered with vegetation (bare soil) and runoff of dissolved P can be a problem in areas where there is a high amount of organic residue, high soil test P, or recently applied P fertilizer (Pote et al., 1999). While the basic processes in the P cycle are similar to natural or agricultural systems, the reduced area for water infiltration in urban areas due to roads, sidewalks, and buildings, disturbance of landscapes during construction, the direct linkage of storm drainage systems to surface waters, as well as fertilizer unintentionally spilled onto hard surfaces increases the potential for P runoff and erosion.

Minnesota is a state with an abundance of fresh water. According to the Minnesota Department of Natural Resources (MNDNR, 2004 - <http://www.dnr.state.mn.us/faq/mnfacts/water.html>), there over 11,000 fresh water lakes greater than 4 ha and more than 111,000 km of river and stream shoreline within the state. Accelerated eutrophication of surface water bodies in Minnesota due

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*Corresponding author: crosen@umn.edu

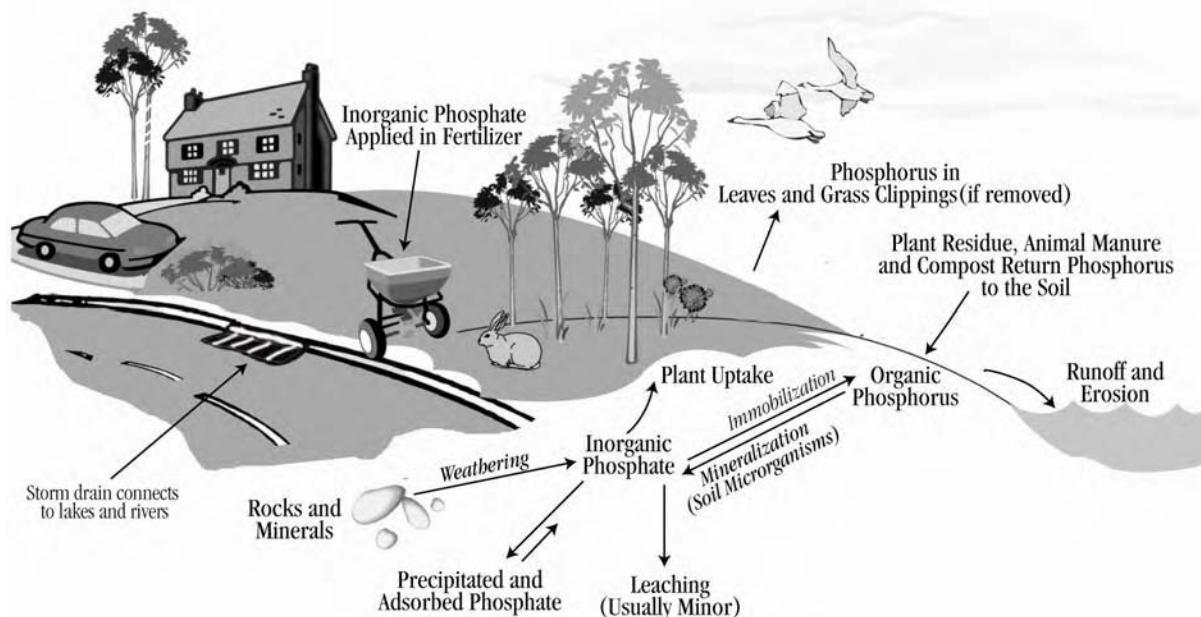


Figure 1. Phosphorus cycle in an urban landscape.

to increased P loading in runoff has been an increasing problem for many years (Heiskary and Swain, 2002). In an effort to reduce the amount of P in runoff, many municipalities adopted ordinances to restrict P fertilizer application to turf. After much debate, the Minnesota legislature passed statewide laws in 2002 and 2004 restricting P fertilizer application to turf and became the first state in the U.S. to enact such legislation. The objective of this paper is to provide an account of the factors leading up to legislation on P fertilizer use restrictions, outline the specific legislation, and to report on current impacts and consequences of the law. The fate of P in the urban landscape and the need for further research to determine P fertilizer management impacts on water quality and turf health will also be discussed.

FACTORS LEADING UP TO P FERTILIZER LEGISLATION FOR TURF

In 1971, the City of Minneapolis and Minneapolis Parks and Recreation Board funded one of the first studies to evaluate the causes of eutrophication in an urban setting (Shapiro and Pfannkuch, 1973). The research was conducted by the University of Minnesota Limnological Research Center with specific objectives of determining: 1) the conditions in the five lakes making up the "Chain of Lakes" in Minneapolis; 2) the factors responsible for these conditions; and 3) methods for improving the lake quality. A paired watershed study comparing treatments of street collection of leaves with not collecting leaves and use of P containing fertilizers on lawns with use of P free fertilizers showed that P from decaying organic debris had

greater impact on P loading than use of P fertilizer. Shapiro and Pfannkuch (1973) recommended street sweeping regularly to reduce organic debris, which in turn would reduce P runoff.

Grava and Fenster (1979) reported a survey of soil P levels in Minnesota lawns and gardens based on soil test reports submitted to the University of Minnesota Soil testing Laboratory. The survey was a summary of nearly 20,000 samples submitted between 1972 and 1976. The results showed that 70 to 80% of lawn and garden soils tested in the very high range, which was defined as a Bray P1 test of greater than 25 mg kg⁻¹ (Table 1). Based on these results the authors concluded that:

"Phosphorus is an essential plant nutrient and must be present in adequate amounts. Its overuse must be avoided, however, because of concern for resource conservation, possible detrimental effects on environment, and cost of fertilizer. Current soil test recommendations, in cases of high P buildup, suggest the application of 0.5 pound of P₂O₅ per 1,000 square feet, (10.6 kg of P per ha) or none at all. There is a need for popularly available nitrogen-potassium fertilizer containing no phosphorus to meet the requirements of many lawns and gardens."

Despite the need for a zero P containing fertilizer, almost all fertilizer sold to homeowners for the past 30 years contained some P in various N:P ratios ranging from 1.3 to 21. Soil test P levels in lawns and gardens likely increased over the years due to use of low N:P containing fertilizers such as 10.0-4.3-8.3 (N-P-K) and the so-called

Table 1. Percent distribution of soil test phosphorus in the very high range for lawns and gardens in various areas of the state (Grava and Fenster, 1979).

Area	% > 25 mg kg ⁻¹ P	Number of samples
Twin Cities Area ¹	79	11,156
Rest of State ¹	74	8,059
Lawns in the Twin Cities Area	75	4,005

¹Includes both lawns and gardens.

“winterizing” formulations with almost the same amount of P as N.

In 1985, the first ordinance restricting P fertilizer application to lawns was passed by the City of Shoreview, a suburb of St. Paul, Minnesota in Ramsey County. In this ordinance, P fertilizer application was limited to 1.3% P granular or 0.2% P liquid not to exceed 10 kg P ha⁻¹ per year. Other municipalities in the Twin Cities area adopted this ordinance over the next 10 years. During this time, educational efforts were made to encourage soil testing of lawns to determine the need for P fertilizer (Rosen et al., 1986). Unfortunately, even though this effort resulted in an increase in homeowner soil testing (Univ. of Minn. Soil Testing Laboratory, personal communication), availability of zero P containing fertilizers at garden centers continued to be limited. Many lawn care professionals, however, voluntarily began reducing or eliminating P application to established lawns in the 1980s based on soil test recommendations.

The City of Plymouth, a suburb of Minneapolis in Hennepin County, adopted an ordinance in 1996 that required all commercial lawn applicators to use zero P containing fertilizers unless a soil test indicated a need. This was the first ordinance that used soil test information to determine if P fertilizer could be applied. A study conducted by Barten (1997) at the Hennepin Park District (now Three Rivers Park District) in Hennepin County reported that P concentrations in runoff (May-October) from P fertilized lawns were higher than those from lawns not receiving P fertilizer. However, actual P loading from runoff was not measured. Researchers assumed a 10% runoff volume from turf to estimate loading rates. Additional soil test surveys compiled during 1991-94 revealed similar trends to the Grava and Fenster report – 70 to 80% of urban soils tested were very high in soil P (Swenson, 2001).

By 2000, the City of Plymouth and a neighboring city of Shorewood passed an additional ordinance that required all homeowners to use zero P containing fertilizer for lawns unless a soil test indicated a need for P. The sale of P fertilizer was also restricted in the Shorewood ordinance. Bills to restrict P fertilizer application to lawns were sponsored by the Minnesota Department of Agriculture and introduced in the Minnesota State

Legislature, but failed to pass during the 2000 and 2001 sessions. The reasons why the bills failed to pass were either they were not restrictive enough for lake association or environmental groups or they were too restrictive for industry groups.

Between the 2001 and 2002 legislative session, a core group of cities worked to pull together a broad coalition of cities, lake associations, and environmental groups to push the zero P legislation in 2002 based on the Plymouth model. Part of that strategy included getting cities in the seven county Twin Cities Metropolitan Area (TCMA) to adopt ordinances restricting the use of lawn fertilizers containing P. As cities adopted ordinances, pressure built for broader P restrictions within the metropolitan area. This pressure intensified when Minneapolis and St. Paul, the state's two largest cities, adopted P restrictions in 2001. During that time, the Minnesota Department of Agriculture sponsored a series of workshops where all stakeholders were invited to represent their points of view in crafting a new draft bill. The League of Minnesota Cities became another major player when they approved, as part of their legislative platform, a resolution supporting the zero P legislation and helped in lobbying efforts during the 2002 session.

STATEWIDE FERTILIZER USE RESTRICTIONS

Numerous ordinances passed by local governments led to confusion among lawn care and garden center professionals, state agency and lake association personnel, and homeowners. The need for statewide regulation became more important. In 2002 after intensive lobbying by environmental groups and support by the Minnesota Department of Agriculture, a compromise bill was reached in the Minnesota State Legislature and statewide P fertilizer application restrictions were written into law. The Minnesota Department of Agriculture played a key role in bringing together industry and environmental groups to develop the compromise bill. During the session, the University of Minnesota Extension Turfgrass Working Group provided written testimony pointing out merits and limitations of the bill. In this testimony, a neutral stance was taken because the bill enforced existing University recommendations for P fertilizer application to turf based on a soil test, yet at the same time these recommendations were not originally developed for regulatory purposes. The “Phosphorus Turf Fertilizer Use Restrictions” bill was signed into Minnesota state law 19 April 2002. As described below, portions of the bill went into effect in 2002, while actual P application restrictions went into effect 1 January 2004.

The following is a summary of the 2002 law as found in Chapter 18C.60 of Minnesota Statutes (<http://www.revisor.leg.state.mn.us/stats/18C/>). In the seven county TCMA, lawn fertilizer use is restricted to 0% P content. Exceptions include if a new lawn is being seeded or sodded and only during the first year of establishment

Table 2. Phosphorus recommendations for an established lawn or turfgrass area.

Phosphorus (P) Soil Test Level		Relative Level	Amount of Phosphorus (P) to apply kg P ha ⁻¹
mg kg ⁻¹			
Bray P1	Olsen P		
0-10	0-7	low	21
11-25	8-18	medium to high	10
over 25	over 18	very high	0

From Rosen et al. 1998. Soil test interpretations and fertilizer management for lawns, turf, gardens, and landscape plants. Univ. Minn. Ext. Serv. BU-1731-F.

or if a soil or tissue test shows a need for P. In those cases, lawn fertilizers with P can be used. Outside the seven county TCMA, lawn fertilizer use is restricted to dry products with no greater than 1.3% P content by weight and liquid products applied at rates no greater than 6.5 kg P per ha.

In an effort to avoid further confusion, in the 2004 legislative session, additional regulations were passed requiring that only P free fertilizer be used on lawns across the state. In other words, the restrictions would be uniform throughout the state and will go into effect 1 January 2005.

Additional statewide exceptions include golf courses when a person has been trained in a program approved by the Minnesota Department of Agriculture directs their fertilizer use and sod fields, which are considered a form of agricultural production.

When P is applied during establishment or based on a tissue or soil test, the rates need to follow those recommended by the University of Minnesota and approved by the Minnesota Department of Agriculture. Table 2 shows current P fertilizer recommendations for established lawns based on University of Minnesota soil test procedures (Rosen et al., 1998).

In addition to the P use restriction, consumer information on use restrictions, recommended best management practices for lawn fertilizer containing P, and best management practices for other residential sources of P in the urban landscape needs to be provided by the Minnesota Department of Agriculture in consultation with the University of Minnesota, fertilizer industry, lake groups, and others.

There is also a research evaluation provision in the legislation. The Minnesota Department of Agriculture in consultation with the University of Minnesota, fertilizer industry, lake groups, and others is required to evaluate research needs and encourage targeted research opportunities to investigate the effects of P fertilization of turf on urban stormwater quality. The Minnesota

Department of Agriculture is to submit a report of effectiveness of the P fertilizer legislation to the legislature by 15 January 2007.

In the same 2002 legislative session a bill was also passed that makes it illegal to spill or spread fertilizer on impervious surfaces (paved areas such as sidewalks, driveways, and streets). If such a spill or spreading occurs it must be cleaned up immediately (M.S. Chapter 18C.61). This applies to all fertilizer, whether it contains P or not and went into effect statewide 1 August 2002.

Restrictions and probations in the law are enforced by local units of government under their existing authority and violations are a petty misdemeanor (M.S. Chapter 18C.62).

One aspect of the bill that caused considerable debate was whether local units of government could regulate the sale of fertilizers and how the legislation may affect sale or use of fertilizer for agricultural crop production. These concerns were addressed by passing a preemption of local law bill (M.S. Chapter 18C.110). This statute states that local units of government may not adopt or enforce ordinances regulating the sale, handling, or use of P fertilizers for agricultural use (growing of crops) and went into effect 20 April 2002. In addition, a local unit of government may not regulate the sale of P fertilizer. One compromise was that local ordinances that regulate the sale of P lawn fertilizer that were in effect on 1 August 2002 would be allowed to stay in effect.

CONSEQUENCES AND IMPACTS OF THE LEGISLATION

In response to the need for a training program to certify golf course personnel about proper use of P fertilizer, Horgan et al. (2003) developed a comprehensive curriculum. Response to this program has been positive based on surveys conducted. In addition to this education program for golf course personnel, bulletins and fact sheets have been jointly prepared by the University of Minnesota Extension Service, state agencies, and organizations to increase awareness of the new regulation, and Metro WaterShed Partners, a collaboration of water resource educators, launched its "Minnesota Water – Let's Keep it Clean" program that focused on the law during its spring 2004 media campaign. Educational efforts have also focused on two common misconceptions that persist concerning the law. The first misconception is the law is a ban on P lawn fertilizers. The law is not a ban, but a restriction on use. The second misconception is that the law restricts the sale of P lawn fertilizer. The law restricts P lawn fertilizer use, not sale with the exception of a few municipalities that passed a local ordinance restricting sale before 1 August 2002.

One outcome of the legislation is that most organic fertilizers can no longer be used on lawns because they contain P. The Minnesota Department of Agriculture is in charge of fertilizer labeling and allows an

investigational allowance for all fertilizers (Chapter 1510.0420; <http://www.revisor.leg.state.mn.us/forms/getrulechap.shtml>). The current investigational allowance for a zero P containing fertilizer is 0.28% P. This allowance makes it possible for some organic fertilizers to be labeled as containing zero P even though a small amount might be present. Although investigational allowances are necessary, application of organic fertilizers based on N recommendations can lead to a significant amount of P applied per application because of the low N percentages in these products.

What to do with leftover P containing lawn fertilizers is also a concern for some homeowners. For those fertilizers that contain pesticides, the current recommendation is to use the fertilizer on lawns outside of the seven county Twin Cities metro area where it is legal to do so until 1 January 2005. The only other option is to take the fertilizer to a county household hazardous waste collection site. Disposal in this manner could end up being very costly to counties. Fertilizers containing P, but without pesticides, can be used on vegetable and flower gardens, trees and shrubs, agricultural fields, or on lawns outside of the seven counties until 1 January 2005, or simply placed in the conventional waste stream.

By far the greatest impact of this legislation has been an increase in the availability of P free lawn fertilizers. Until this past year, only 5-10% of fertilizers sold in garden centers were available without P (Rosen et al, 1998). In 2004, the majority of the lawn fertilizers available within the metro area were labeled P free; although some of the larger chain stores did not comply as well as locally owned garden centers. In addition, fertilizers sold as winterizing fertilizers are also P free, but now contain higher concentrations of K compared to the normal lawn fertilizer.

Long term impacts on the health of lawns is a major concern as most homeowners will likely not use soil testing to determine the need for P and will only use zero P containing fertilizers. While loading of P on landscapes will undoubtedly be less, impacts of the legislation on surface water quality remain to be seen. As depicted in Figure 1, there are many other sources that can contribute to P runoff. To help determine the potential impact of the legislation, studies are currently being conducted at the University of Minnesota Turfgrass, Research, Outreach, and Education Center to determine the effect of clipping management with and without P fertilizer application on P runoff and soil test P concentrations.

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