

# Racetrack Park Turfgrass Management Demonstration

## Personnel

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## Introduction

Turfgrass management of public lands is a complex endeavor that involves balancing functional and aesthetic goals of the turf with community expectations, economics, environmental impact, and human health risk. Environmental impact and health risk are particularly difficult to quantify, but some tools are available for assessing relative risk. Adding to the complexity, individuals often disagree on the functional/aesthetic goals and degree of acceptable impacts and risks. Pesticide hazard indices can be used along with the more commonly used economic and functional/aesthetic parameters to develop a well-balanced turfgrass management plan. The objective of this demonstration is to compare the economics, environmental impact quotient, and turfgrass aesthetics as a result of four turfgrass management strategies at Racetrack Park in Stoughton, WI over a three-year period.

## Initial Field Conditions

Prior to study initiation, assessments of the weeds present were made on May 20<sup>th</sup>, 2015 using the grid intersection method where an 81-point grid was placed on random locations on each field and the plant immediately below each of the 81 intersections was recorded. From this information the percentage of weeds and grass was calculated. For example if dandelions were found under 9 of the 81 intersections, we estimated the dandelions to cover 11% of the area. We made six grid counts (81 intersections each) in each of the four fields for a total of 486 intersections per field.

- Field 1 was composed of 80% desirable turf, and 20% weeds. Clover accounted for half of the weeds present, with broadleaf plantain and dandelion representing approximately 25% each.
- Field 2 was found to be much weedier than field 1, with only 32% desirable turf and 68% weeds. Clover made up over 90% of the weeds on Field 2
- Field 3 was quite similar to Field 2 with 35% desirable turf and 65% weeds. The dominant weed species was clover (88%).
- Field 4 was found to be similar to field 1, with 92% desirable turf and only 8% weeds. Dandelion was the dominant species of weed on field 1 (35%) with clover, plantain, grassy weeds, and other assorted broadleaf weeds ranging from 10-25% each.

Soil samples were taken from each of the 4 fields on May 20<sup>th</sup>, 2015 (Table 1). The fields had uniformly good soil conditions with pH in the ideal range (6.0 – 7.0), and within or just outside of optimal levels of plant available phosphorus (38-50 ppm) and potassium (121-160 ppm). The organic matter content averaged 4.4%, which is considered excellent.

**Table 1.** Initial soil properties of the four fields.

Soil Property	Soil pH	Soil Organic Matter	Phosphorus	Potassium
		%	ppm	ppm
Field 1	7.0	4.3	55	193
Field 2	6.7	3.6	41	171
Field 3	6.7	5.2	64	171
Field 4	6.4	4.3	35	127

### Application of Management Programs and Data Collection

The four application strategies were randomly assigned to the four fields characterized above. Field 1 became the Organic Program, Field 2 became the City of Stoughton Program, Field 3 became the UW Integrated Turfgrass Management Program, and Field 4 became the Mowing Only Program. Applications were scheduled to be consistent with the capabilities and budget of the City of Stoughton's budget for parks. On June 4<sup>th</sup>, 2015 fertilizers and herbicides listed in the table below were applied to Fields 1 and 2. University of Wisconsin staff made the applications to the Organic Program (Field 1), and WeedMan Lawn Care made the applications to Field 2. The City of Stoughton program was applied on June 29, 2015 by TruGreen. Unfortunately, a miscommunication resulted in TruGreen also applying herbicide and fertilizer to the Organic Program field on June 29<sup>th</sup>. No applications to any fields were made in 2016. Applications to Fields 1 and 2 were made on May 16<sup>th</sup>, 2017. The City of Stoughton program was applied on May 15 and October 9, 2017 by Insight FS. Application details are listed in Tables 2 and 3.

We conducted visual ratings of turfgrass quality and made weed assessments in spring, summer, and fall each season. Visual quality was recorded for each field using the National Turfgrass Evaluation Program protocol where 1 represents completely dead or brown turf, 9 represents the highest possible turfgrass quality, and 6 represents minimally acceptable turfgrass quality. Weeds were evaluated at six randomly selected locations in the outfield and assessed using the grid intersection method described above.

**Table 2.** Application Data for 2015.

Field #	Management Program	Fertilization	Herbicide
1	Organic	Chick Magic Organic Fertilizer (5-3-0) 1.5 lbs N/1000 sq. ft 40% soluble nitrogen 60% slow release nitrogen Liquid 17-0-5, and Granular 25-0-5* 1.5 lbs N/1000 sq. ft. 100% quick release nitrogen	TruePower 3*
2	City of Stoughton	Liquid 17-0-5, and Granular 25-0-5 1.5 lbs N/1000 sq. ft 100% quick release nitrogen	TruePower 3
3	Integrated Turfgrass Management	Spread-It and Forget-It Fertilizer (35-0-10) 1.5 lbs N/1000 sq. ft. 20% soluble nitrogen 80% slow release nitrogen	Confront
4	Mowing Only	None	None

\* These application were made by mistake and were not factored into the estimated cost of the application, but obviously factored into the agronomic outcomes.

**Table 3.** Application Data for 2017.

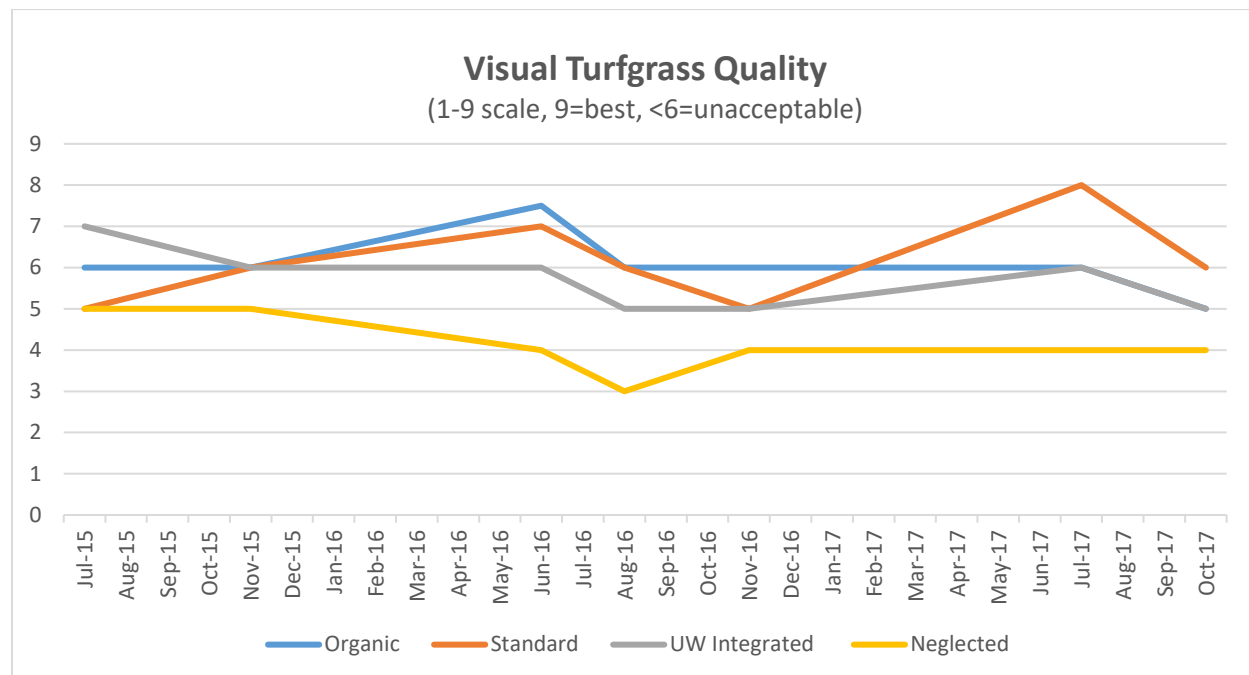
Field #	Management Program	Fertilization	Herbicide
1	Organic	Milorganite (5-2-0) 2.0 lbs N/1000 sq. ft. 15% soluble nitrogen 85% slow release nitrogen	None
2	City of Stoughton	Granular (25-0-5) 2.0 lbs N/1000 sq. ft.* 66% soluble nitrogen 33% slow release nitrogen	Millennium Ultra 2 Dimension Ultra 40wp
3	Integrated Turfgrass Management	Spread-It and Forget-It Fertilizer (35-0-10) 1.5 lbs N/1000 sq. ft. 20% soluble nitrogen 80% slow release nitrogen	Confront
4	Mowing Only	None	None

\* This application was split between two dates in 2017

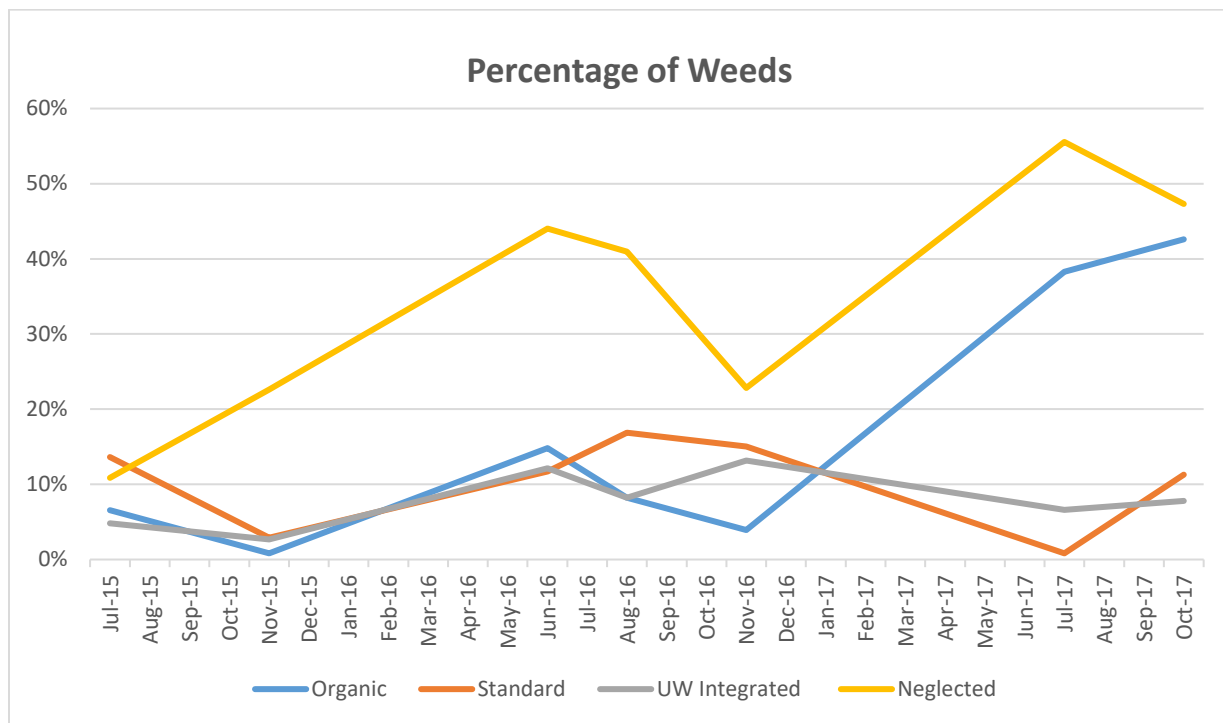
## Results

### *Agronomic Responses*

Visual turfgrass quality is a subjective rating that integrates turfgrass color, density, uniformity, and overall appearance. In general, the three fertilized treatments have maintained turfgrass quality around the minimally acceptable level, sometimes rising above, other times dipping just below (Fig. 1). However, the field that has been neglected (mowed only) has slowly declined from a visual quality of 5 to 4 over the past three seasons. These results suggest that the three fertilization strategies are capable of producing approximately equal and acceptable turfgrass quality. The mowing only treatment has demonstrated that fertilization is a necessary step for maintaining acceptable quality.



**Figure 1.** Visual turfgrass quality over the study period. A rating of 1 represents dead or brown turf, a 9 represents the highest possible turf quality, and a 6 represents the minimally acceptable turf quality.



**Figure 2.** Weed percentage over time for the four fields at Racetrack Park.

Weed percentages were relatively low at all fields near the beginning of the study (Fig. 2). A decline in weed population was observed in 2015 for all but the neglected field (a conventional herbicide was accidentally applied to the organic field in 2015). Weed populations rose in 2016, a season which saw no fertilizer or herbicide applications on any of the fields. In 2017, weed populations declined in the standard and UW Integrated fields, while rising sharply in the organic field. In July 2017, weed populations were <10% in the herbicide treated fields and 40-55% in the Organic and Mowing Only Programs.

In conclusion, we find that all three fields treated with fertilizer produced acceptable turfgrass quality for the majority of the study period. Weed populations were kept below 20% for the two treatments utilizing herbicides. Weeds were highest in the mowing only program, followed by the organic management program which began to see substantial weed encroachment in 2017. This suggests that weed encroachment cannot be managed by maintaining adequate fertility alone at this site.

## Environmental Hazard Analysis

The Environmental Impact Quotient (EIQ) and Hazard Quotient are two formulas utilizing toxicological data to provide quasi-quantitative estimates of the environmental and health impacts of applied pesticides. These indices don't provide a full risk assessment because they don't estimate potential exposure, but they can be useful in comparing the relative environmental and health risks of various turfgrass management programs. Note that the risk of all products used in this study was deemed acceptable by the USEPA but a lower relative hazard may provide a way of differentiating among product choices. Just as a turfgrass manager may select a product because of low cost and high efficacy against weeds, these pesticide hazard models could also be factored in when making a product selection. In this case, the UW Integrated Turfgrass Management program picked an herbicide known to be effective, comparably priced with other effective products, but had one of the lowest impact quotients.

**Table 4.** The four management programs resulted in different pesticide impact scores.

Field #	Management Program	Environmental Impact Quotient (EIQ)	Hazard Quotient (HQ)
1	Organic	0 (55)	0 (5794)
2	City of Stoughton		
	2015 TruPower 3	55	5794
	2017 Millenium Ultra 2	28	2097
	2017 Dimension	8	280
	2017 Millenium Ultra 2	28	2097
	<b>Total</b>	<b>119</b>	<b>10268</b>
3	Integrated Turfgrass Management		
	2015 Confront	11	1344
	2017 Confront	11	1344
	<b>Total</b>	<b>22</b>	<b>2688</b>
4	Mowing Only	0	0

\* applied in 2015 only

\*\* applied in 2017 only

## Economic Analysis

Economic analysis is difficult to conduct precisely because of fluctuating product pricing and in the case of the City of Stoughton, the outside contractors that are hired to make the applications. For this study, we used a partial budget analysis approach where only the costs of the materials applied were considered. We did not factor in the cost of making the applications (which is substantial), under the assumption that the application costs would be constant. This assumption is compromised by the fact that the City of Stoughton Program made two applications in 2017, where all other applications were once per year. Another factor is that the large volume of the organic fertilizer required to reach the nitrogen target would likely substantially increase the application costs.

The costs per acre of the four strategies are reported in Table 5. The cost per acre was the highest for the Organic Program, as a result of the relatively high cost of the organic fertilizers utilized. The City of Stoughton's Program was less than half of the cost of the Organic Program, and utilized fertilizers with

100% quick release nitrogen in 2015 and 66% quick release nitrogen in 2017. The UW's Integrated Turf Program utilized fewer pesticides than the City's Program, a higher percentage of slow release nitrogen, but the products cost approximately 50% more than what the City Program used. The UW Program was \$60 per acre cheaper than the Organic Program.

**Table 5.** Estimated costs of the products used in each of the four programs. These costs were estimated from discussions with local turfgrass suppliers and applicators.

Field #	Management Program	Approx. Fertilization Cost per acre, per year	Approx. Herbicide Cost per acre, per year	Total Cost per acre, per year
1	Organic	\$250	\$0	\$250
2	City of Stoughton	\$70	\$46	\$116
3	Integrated Turfgrass Management	\$170	\$22	\$192
4	Mowing Only	\$0	\$0	\$0

### Summary and Conclusions

This study tracked the agronomic, environmental, and economic performance of four turfgrass management programs at Racetrack Park over a three-year period. We found the three programs that received inputs of fertilizer were able to maintain acceptable turfgrass quality over the study period. The Organic Program (which mistakenly received an extra fertilizer and herbicide treatment at the initiation of the study) was above reasonable threshold levels for weeds by the middle of 2017. The Organic Program had the greatest cost per acre, followed by the UW Integrated Turfgrass Management Program. The City of Stoughton Program was the lowest cost program of the three with fertilizer inputs, and was less than half of the cost of the Organic Program system. For the two programs where weed control products were used, the UW Integrated Turfgrass Management Program had an EIQ six times lower than the City's Program.

Overall, this demonstration was useful for highlighting that maintaining functional turfgrass can be achieved in different ways. The Organic Program was able to maintain acceptable quality for three years, given an initially weed free starting point. After year three years, weeds are above or approaching reasonable thresholds. The City of Stoughton Program met turfgrass quality goals and minimized costs, however this program had the highest pesticide hazard scores. The UW Integrated Program used a combination of lower toxicity herbicides and a fertilizer with a high percentage of slow release nitrogen. This system had an intermediate cost relative to the Organic and City programs. We hope that this demonstration is useful for future conversations about turfgrass management in Stoughton and elsewhere.

### Collaborators/Supporters

- WeedMan donated their equipment and labor to make the fertilizer and herbicide applications to field 2 in 2015.
- Chick Magic donated the fertilizer used on field 1 in 2015.
- Dow AgroSciences donated the Confront herbicide for field 2 in 2015 and 2017
- Bruce Company donated their equipment and labor to make the fertilizer and herbicide applications to field 2 in 2017.
- Milorganite donated the fertilizer used on field 1 in 2017.