CORNELL UNIVERSITY TURFGRASS TIMES

CUTT

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Crane Flies
Where are They Now?

The European crane flies Tipula paludosa Meigen and Tipula oleracea L. (Diptera: Tipulidae) are natives of the West Palearctic Region and are injurious to turfgrass and other horticultural crops in three geographic areas of establishment in North America. In the eastern Canadian Maritimes, T. paludosa was first detected in Nova Scotia in 1955, but was likely established as early as 1880 in Newfoundland. In Quebec, it was detected in 2002 followed by T. oleracea in 2003. In the Pacific Northwest, both species were first detected in British Columbia, T. paludosa in 1965 and T. oleracea in 1998. Both species are now established in Washington and Oregon, primarily along coastal areas west of the Cascades, and have been detected as far south as northern (T. paludosa) and central coastal (T. oleracea) California. In the geographic area of the eastern Great Lakes, T. paludosa was first detected in southern Ontario (1998), followed by New York (2004). The first detection of T. oleracea was coincident with T. paludosa in New York (2004), followed by eastern Michigan (2005) and southern Ontario (2007).

Known as "leatherjackets" for the tough pupal exuvia left behind by the emerging adult, larvae of T. paludosa and T. oleracea can be problematic in any grass-based ecosystem. They inhabit the top layer of the soil where they feed on root hairs, roots and crowns of their hosts. By pruning and disrupting belowground portions of the plant, they cause damage that leads to severe thinning of the sward and extensive dieback when damaged turf is drought stressed. Larvae will also reside in the thatch, emerging at night to feed on aboveground portions of the stems and foliage.

Beyond turfgrass, there is concern about the pest status of invasive Tipula in other horticultural systems of the United States. In the Pacific Northwest, affected production crops include peppermint, turnips and winter wheat, seedling nurseries, grass seed production and pastures and hayfields. In native habitats of Europe, larvae of T. paludosa damage pastures and cereals while those of T. oleracea are reported primarily as pests of winter cereals planted after oilseed rape crops. Other crops reported as food plants in Europe include brassicas, clover, corn, lettuce, sugar beets, strawberries, turnips, other vegetables, and ornamentals.

One reason for alarm about the spread of these invasives in the eastern United States is that the potentially susceptible landscapes are vast. In New York alone, there are 1.4 million acres of managed turf in the form of home lawns, golf

continued on page 4

This Times

NEW YORK STATE TURFGRASS ASSOCIATION

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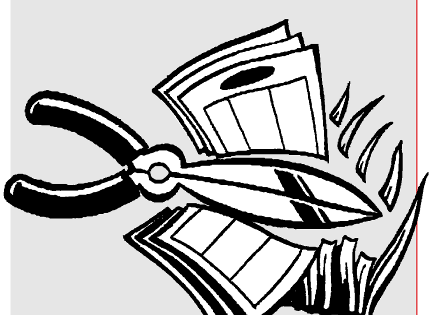
CUTT

Clippings

Lain has been a TPI member since 1970 and served as a State Representative from 1990 to 1995. In addition to his participation in TPI, Lain is also active in the New York Turfgrass Association and has contributed to the New York Turfgrass Foundation for over 10 years.



Charles Lain, Jr. Appointed VP of TPI

Turfgrass Producers International (TPI) announced the appointment of Charles Lain Jr. (Chip) president of Pine Island Turf Nursery, Inc., Pine Island, NY, to the position of Vice President. The appointment took place at TPI's Annual Business meeting held on July 30th in Calgary, Alberta, Canada, during their Summer Convention & Field Days.

Lain has been a TPI member since 1970 and served as a State Representative from 1990 to 1995. In addition to his participation in TPI, Lain is also active in the New York Turfgrass Association and has contributed to the New York Turfgrass Foundation for over 10 years. He is also a member of the New York Turf & Landscape Association, Cultivated Sod Association of New Jersey, New Jersey Turfgrass Association, and the New Jersey Nursery & Landscape Association.

TPI's membership is comprised of turfgrass sod and seed producers, equipment manufacturers and suppliers, and various individuals involved in education and/or turf-related research. TPI's membership exceeds 1,100 with members represented in 44 countries.

Pat Voges Awarded Leadership Honor

The New York State Turfgrass Association congratulates Pat Voges for being honored by the Long Island Farm Bureau at their 91st Annual Awards Gala. His efforts as Government Affairs Chairman of the Nassau Suffolk Landscape Gardeners Association and board member of the Long Island Farm Bureau has greatly served the interests of those who work in the horticultural industry. The Cornell Turfgrass Team and NYSTA commend him for his effective leadership which has helped to unite green industry organizations at the local, state and national levels and strengthen the horticultural industry as a whole.

Pesticide Exposure and Risk

There is always widespread concern about the exposure of humans to pesticides right after an application whether it is to a lawn, sports field or golf course. We have been operating under the assumption that if the spray dries or the dust settles the risk is reduced, based on some studies conducted in the 1990's investigating dislodgeable residues. However, what about exposure to wet material and prolonged exposure following an application?

Researchers at University of Massachusetts, led by John Clark, investigated golfer exposure to two insecticides. The golfers were fitted with absorptive clothing to simulate skin exposure, air sampling pumps for inhalation and urinary testing to determine oral ingestion (like if a golfer put their golf ball in their mouth). This was all conducted on a golf course with study subjects actually playing golf.

Individual golfer exposure was determined in 76 rounds of golf following eight applications of chlorpyrifos and two applications of carbaryl. Estimated exposures to golfers following full course and full rate applications of chlorpyrifos and carbaryl were 19-68 times below current U.S. EPA acute reference dose (Rfd) values, indicating safe exposures under U.S. EPA hazard quotient criteria.

Skin exposures were considered the dominant means of exposing the golfers to these insecticides in worst-case scenarios (golfing within 1 hour of application). While this study should not encourage irresponsible applications and few would argue the benefit of reducing golfer exposure, it does put the risk in proper perspective.

Overseeding and Weed Control

Concern over pesticides for perceived "cosmetic purposes" may lead to reduced use of herbicides. Therefore, municipal turfgrass managers need a cultural method of weed control to provide a safe playing surface for athletes.

A field study was conducted by Guelph Turfgrass Researcher led by Eric Lyons, Ph.D. to determine if overseeding provides enough competition to decrease weed populations in Kentucky bluegrass athletic turf typically used in municipal parks for recreation. Perennial ryegrass was overseeded at 2, 4, and 8 lbs/1000 in May, July, or September, and all permutations of these timings in nonirrigated and irrigated trials at the Guelph Turfgrass Institute (GTI) field station in Guelph, and on in-use soccer fields at the University of Guelph campus and in the town of Oakville, Ontario, Canada over 2 years.

Weed populations were not affected by overseeding in 2005, a dry growing season. However, when weed populations were high and normal growing conditions existed in 2006, overseeding applications in May/July/September at 4 and 8 lb rates decreased perennial weed cover, specifically white clover in the irrigated trial and dandelion in the nonirrigated trial. An increase in perennial ryegrass was observed in all plots that received an overseeding treatment.

Treatments applied on the in-use soccer fields in Oakville and Guelph, which included May/September and May only overseedings, had no effect on weed populations or perennial ryegrass populations compared to the weedy control. Over the short term, high-rate and frequent overseeding with perennial ryegrass appears to provide competition against perennial weeds when weed cover is high and should be considered an important part of a weed management program for municipal turfgrass managers.

CUTT

Scanning the Journals

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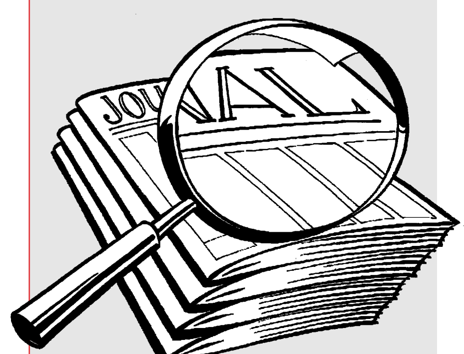


continued from page 1

The first objective was to establish the current known geographic distribution of each species so that future range expansion can be monitored. The second objective was to describe their local incidence across newly infested golf courses to gauge how widespread their establishments have become locally. By doing this, it is possible to ascertain the scope of potential impact from invasive Tipula in turf, not only to establish a baseline for monitoring future changes

courses, athletic fields, parks and other such landscapes. All turf and forage grass species appear to be acceptable hosts for larvae. Therefore production systems such as sod farms, pastures and hayfields are also at risk. In the Pacific Northwest, invasive crane flies are the most serious economic pest of pastures and hayfields in western Oregon and Washington. In grass seed production fields, they have emerged as pests particularly in new stands of grass. In their native Europe, Blackshaw (1985) estimated crane fly larvae to be responsible for yearly losses of over £15 million in pastures of Northern Ireland, where yields increased 74% after control of larvae. The main ramification of establishment is that infestations will likely impact grasses across the full spectrum of species and management intensity.

Movement of infested sod, container stock and other soil media could occasion spread of invasive Tipula locally and regionally. Building awareness and establishing safeguards to curb range expansion would benefit from more precise information on the nature of their threat to turf management. Most importantly, divergence in certain aspects of biology and behavior could strongly influence the outcome of their ultimate repercussions. For instance, female T. paludosa mate and lay most of their full complement of eggs the first night they emerge. Gravid females are also extremely poor fliers because of their low wing to abdomen length ratio, lessening the role of dispersal under natural conditions. Due to this, the species may tend to rapid buildup of local populations. In contrast, female T. oleracea will lay eggs over the course of 3-17 days after emergence, and owing to a relatively high wing to abdomen length ratio, they are more capable fliers when gravid. This species is therefore expected to have a higher rate of range expansion, but potentially a lower pest status due to slower buildup of local populations. Superimposed on this scenario is another major difference: T. paludosa is univoltine, with adult flights in the autumn, while T. oleracea has flights in spring and autumn and is probably bivoltine. In addition to the selection and timing of interventions for pest management, interspecific variation in natural history is relevant to gauging the rate of range expansion, local outbreak potential and overall pest status.

The first objective was to establish the current known geographic distribution of each species so that future range expansion can be monitored. The second objective was to describe their local incidence across newly infested golf courses to gauge how widespread their establishments have become locally. By doing this, it is possible to ascertain the scope of potential impact from invasive Tipula in turf, not only to establish a baseline for monitoring future changes, but to coalesce information relevant for transmission to stakeholders in areas of future range expansion. Our experience is that outside affected areas, very few turfgrass managers and entomologists are familiar with crane flies as pests since so few taxa are of economic concern.

Geographic Distribution. Based on at least one positive identification from 27 locality entries, T. paludosa was detected in four counties and 11 municipalities over the 3 years (Table 1). In 2004 it was originally reported from two counties (Erie, Niagara). Two more counties were added in 2005 (Monroe, Ontario) and none was added in 2006 (Fig. 1). Combining data collected over all 3 years, T. paludosa was collected from two parks, 11 golf courses and 14 residential home lawns (11 were individual residences in a single municipality [Pittsford, NY]).

Based on positive identification from 26 locality entries, T. oleracea was detected in 12 counties and 23 municipalities (Table 1). In 2004 it was originally reported from one of the same counties as T. paludosa (Niagara) (Fig. 1). Two more counties were added in 2005 (Monroe, Oswego) and nine were added in 2006 (Erie, Livingston, Nassau, Onondaga, Ontario, Seneca, Suffolk, Wayne, Wyoming). Pooling data collected over all 3 years, T. oleracea was collected from 23 golf courses and two residential home lawns. The most notable addition in 2006 was the detection of T. oleracea at two residences and one additional site on Long Island. One report was made by a home owner in New Hyde Park, NY (Nassau Co.) due to nuisance swarms of adults after spring emergence. The second residential report was based on a single individual caught at a residence in Riverhead, NY (Suffolk Co.) during the fall emergence. In addition, a single female was recovered from an exotic bark beetle trap in Babylon (Suffolk Co.) that was included in a survey conducted by the Cooperative Agricultural Pest Survey of New York (det. E. R. Hoebeke, Cornell). Both species were sympatric at five localities (all golf courses) situated in five municipalities and two counties (Niagara, Monroe) (Fig. 2).

In western New York, all localities fell within the Great Lakes Ecoregion, one of seven ecoregions that occur in New York based on boundaries defined by The Nature Conservancy with respect to similarities in soil, physiography, climate, hydrology, geology and vegetation (Sotomayor 2004) (Fig. 2). The most outlying locality (T. oleracea, Collins, Erie Co.) was at the boundary with the Western Allegheny Plateau and the High Allegheny Plateau Ecoregions. All localities outside of western New York were from Long Island within the North Atlantic Coast Ecoregion.

Based on the detection criteria, 22 localities situated in 21 municipalities and 14 counties were recorded as sites where invasive Tipula were absent (Table 2). For the spring and autumn flight periods, mean date of those surveys was 18 May (range 5 May-8 June, n=10) and 23 September (range 12-30 September, n=14), respectively. Those periods of time were comparable to when live adults were collected from other localities. For T. paludosa, mean date of collection was 23 September (range 1 September-11 October, n=33). For T. oleracea, mean dates of collection were 17 May (range 24 April-1 July, n=19) and 20 September (range 1-29 September, n=7).

The distribution boundaries were defined in Figure 2 with respect to the position of sites where each species was present and absent. The resulting range maps revealed that T. paludosa was limited to western New York, centered around the greater Buffalo/Niagara and Rochester metropolitan areas. Because of the lack of intervening positive sites, these were depicted as disjunct areas of establishment. Overall, this area was estimated to cover 3,881 km^2, or 2,786 in Buffalo/Niagara and 1,095 in Rochester. In contrast, T. oleracea occurred in two geographic regions: western New York and Long Island. In western New York, the area was estimated to encompass 23,122 km^2, nearly 6 times greater than that of T. paludosa. Along the Erie Canal and Interstate 90 corridor it occurred as far east as Manlius, NY (Onondaga Co.), including the Syracuse, NY metropolitan area. It was detected as far north as Sandy Creek, NY (Oswego Co.) along the eastern shore of Lake Ontario, as far south as Ovid, NY (Seneca Co.) in the Finger Lakes area, and as far south as Collins, NY (Erie Co.) along the eastern shore of Lake Erie. The Long Island distribution encompassed another 8,834 km^2 for a total estimated distribution of 31,956 km^2. Long Island was depicted as a disjunct area of establishment because of the absence of T. oleracea in several intervening areas. This included five localities in the eastern Erie Canal and Mohawk River corridor within the eastern arm of the Great Lakes Ecoregion, three in the northern end of the Lower New England-Northern Piedmont Ecoregion, two in the High Allegheny Plateau and two in the Western Allegheny Plateau.

These baseline distribution data allow for certain predictions about range expansion, even without information on the physiogeographic corridors that might be relevant to natural crane fly dispersal. Monitoring priorities should include the remaining areas of the Great Lakes Ecoregion. Beyond that, the prevalence of invasive Tipula in coastal areas, along waterways and at lower elevations suggests specific routes favorable for natural range expansion or successful establishment if introduction were to occur. This would include the eastern shore of Lake Ontario northeast toward the St. Lawrence-Lake Champlain Ecoregion. Along the north shore, T. paludosa occurs as far east as Port Hope and Cobourg, Ontario (P. Charbonneau, personal communication),

continued on page 6

The most notable addition in 2006 was the detection of T. oleracea at two residences and one additional site on Long Island. One report was made by a home owner in New Hyde Park, NY (Nassau Co.) due to nuisance swarms of adults after spring emergence. The second residential report was based on a single individual caught at a residence in Riverhead, NY (Suffolk Co.) during the fall emergence. In addition, a single female was recovered from an exotic bark beetle trap in Babylon (Suffolk Co.) that was included in a survey conducted by the Cooperative Agricultural Pest Survey of New York

Feature Story

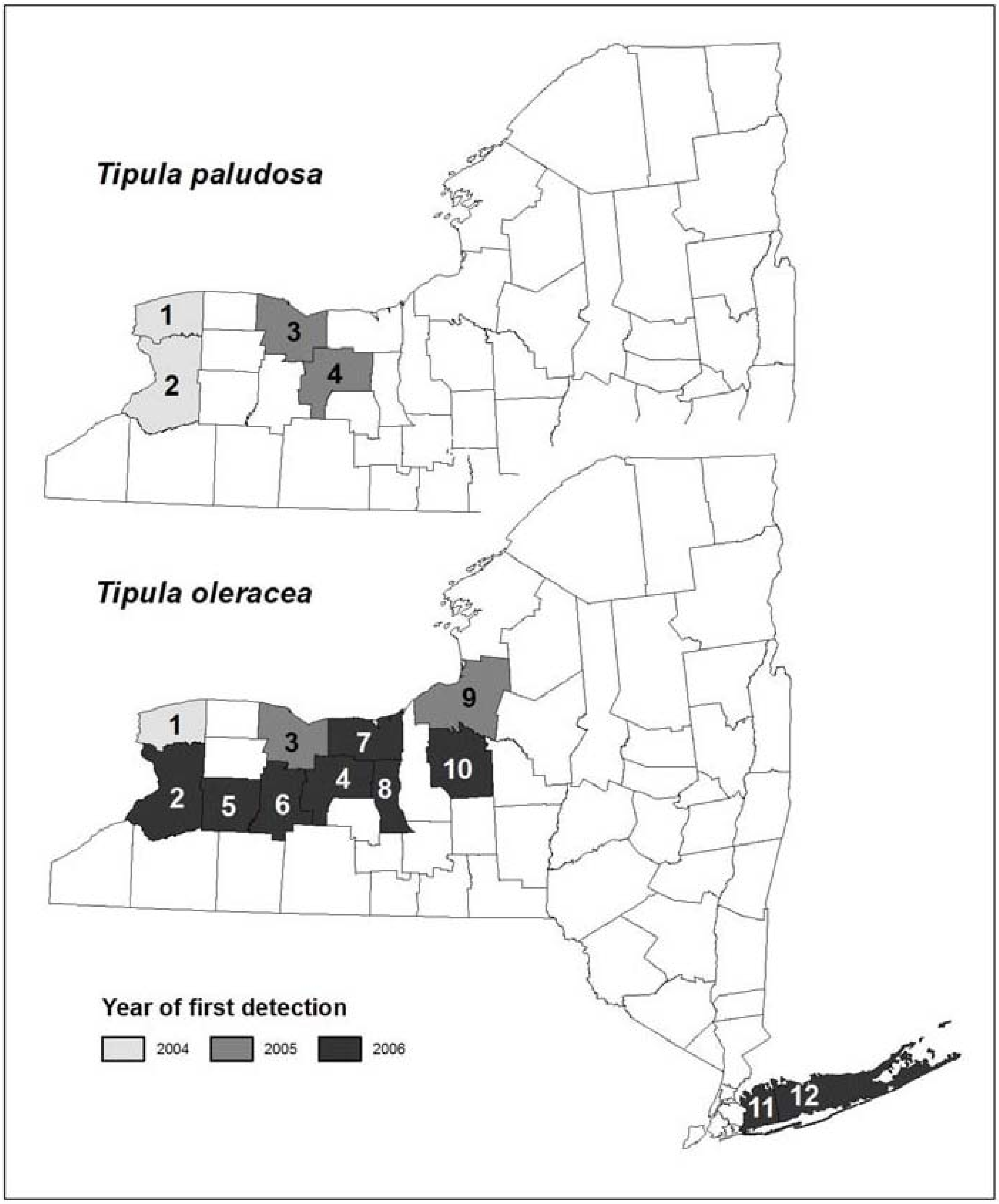
continued from page 5

The last invasive insect to threaten turfgrass of the Northeast was the European chafer (R. majalis), which arrived in 1940 and coincidentally first established in western New York. Today it remains one of the most troublesome turf-infesting insects across the state.

The establishment of T. paludosa and T. oleracea will also have serious repercussions for turfgrass management in the Northeast. Besides the scarce regional awareness of crane flies as pests, management will undoubtedly be challenged by (1) diverging natural history

which are situated north of a point approximately equidistant between Buffalo and Rochester. Southward expansion along the eastern and southern shores of Lake Erie might be the most likely source of natural infestation into Pennsylvania and Ohio. Corridors would also include the Mohawk River Valley/eastern Erie Canal toward the Hudson River Valley of the Lower New England/Northern Piedmont Ecoregion. The Lower Hudson River Valley might also be considered a corridor for the northward expansion of T. oleracea from Long Island. Furthermore, Long Island may also be T. oleracea's gateway to New England, New Jersey and the coastal areas of the Mid-Atlantic, parallel to its purported spread from British Columbia south to California.

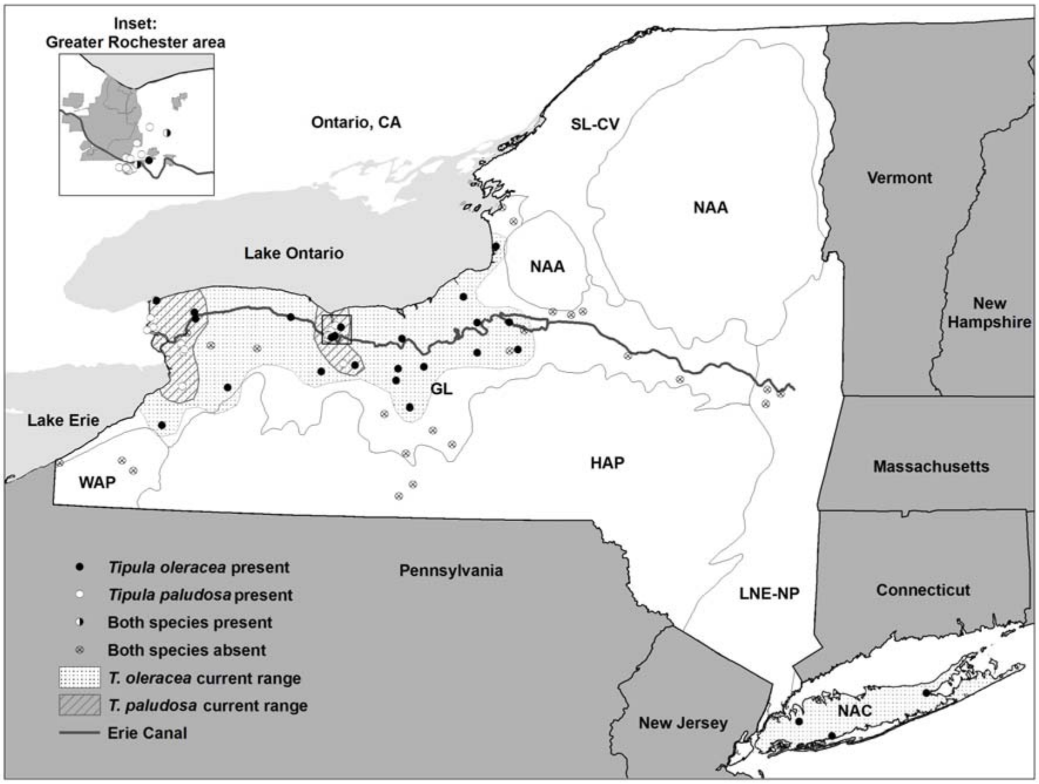
The last invasive insect to threaten turfgrass of the Northeast was the European chafer (R. majalis), which arrived in 1940 and coincidentally first established in western New York. Today it remains one of the most troublesome turf-infesting insects across the state. The establishment of T. paludosa and T. oleracea will also have serious repercussions for turfgrass management in the Northeast. Besides the scarce regional awareness of crane flies as pests, management will undoubtedly be challenged by (1) diverging natural history that means tailoring control programs



to each species, (2) obvious corridors for range expansion via natural dispersal, (3) likely routes of human-mediated dispersal via infested soil material, (4) isolated but serious manifestations of injury to low and high maintenance turf, and (5) specific gaps in our understanding of habitat associations. Most critically, studies designed to assess habitat invasibility may hold relevance for predicting which environments are most favorable for crane fly establishment and development. Whether T. paludosa and T. oleracea have diverging habitat preferences is unknown, much less what those preferences might be in the face of turf management regimes (e.g. home lawn versus golf course, or putting green, fairway and rough-mown turf).

by Daniel Peck, Ph.D.
NYSAES

Whether T. paludosa and T. oleracea have diverging habitat preferences is unknown, much less what those preferences might be in the face of turf management regimes (e.g. home lawn versus golf course, or putting green, fairway and rough-mown turf).



New York State Turfgrass Association
Calendar of Events

2009

January 7-9	**Empire State Green Industry Show** Rochester Riverside Convention Center, Rochester, NY
January 19-23	**Cornell Turfgrass Short Course** Cornell University Campus, Ithaca, NY
February 23-25	**Cornell Turgrass Advanced Short Course** Cornell University Campus, Ithaca, NY
February 24-25	**Southeast Regional Conference** Holiday Inn Suffern, Suffern, NY
March 2	**Western Regional Conference** The Millennium Hotel, Buffalo, NY
March 19	**Adirondack Regional Conference** Crowne Plaza Lake Placid Resort, Lake Placid, NY

2010

January 6-8	**Empire State Green Industry Show** Rochester Riverside Convention Center, Rochester, NY

> *We did notice with this project that you could have really great looking turf on a plot but the sod failed to be harvestable when placed on the sod stretcher. This was very true on the high nitrogen plots that were dark green and dense but tore easy. Conversely, plots with little or no N applied looked off color but still some what dense and had good sod strength.*

continued from page 12

An ion exchange resign bag was placed at the bottom of each lysimeter to capture nitrate and ammonium leaching past the root zone. Plots are 3 m X 3 m, with 4 replications of each fertilizer treatment and plots arranged in a completely random design. Plots were seeded on Sept 15, 2005 with 75%-25% Midnight Moon Kentucky bluegrass-Fescue mix at a rate of 100-120 lbs/acre.

Fifteen treatments included: the conventional establishment fertilization practice at full rate and half nitrogen rate that the sod farm uses (growers program), three nitrogen sources (quick, moderate and slow release sources) applied at 2, 4, 6 and 8 lbs N/1000 sq.ft. /yr (6 lbs. N/1000 sq. ft./yr is the standard rate for sod production on Long Island), a BMP program using slower release sources, and an unfertilized control plot to determine the amount of residue N in the soil and the amount of N that was mineralized during the study. Plots were fertilized on September 15, 2005, Oct. 20, 2005, May 2, 2006 and July 25, 2006.

For the grower treatment and the BMP a starter fertilizer (12-26-12) was applied at the time of seeding. All other plots received 2 lbs. of P2O5 and 1 lb. K2O/1,000 sq.ft. at seeding. The sod grower accidentally applied a nitrogen fertilizer (16-8-8 Lebanon at about 1.5 lbs. N/1,000 sq.ft.) once in March of 2006 on more than half of the plots, thus, potentially affecting the results as discussed later. Sod strength measurements were done on July 25, 2006, Aug 24, 2006, Sept. 18, 2006, and Oct. 25, 2006. Sod was cut with an 18″ wide sod cutter at a length of 4′ by ¾-1″ thick. Each plot had two tensile measurements taken per date per plot. Once the sod strength reached the value for commercially harvestable sod (99 lbs. as determined from samples of sod from Briarcliff Sod Farm), the resin bags were then removed, in this case on Oct. 25, 2006 from all plots.

Sod harvestability: strength and quality

Sod is determined to be harvestable when it is dense, dark green foliage and will not fall apart when handled. In the first year of this study we record sod strength measurements over time. Generally, the source or rate of fertilizers applied had little effect on sod strength. Commercially available sod (Briarcliff Sod Farm) was determined to have an average sod strength measurement of 99 lbs. Based on the sod strength measurements from the first year of the study, almost all fertilizer sources and rates had acceptable sod strength by Oct 25, 2006, 13 months after seeding. Only on the August 24, 2006 sampling date the slow release sources of Nitroform (1X rate), half the amount of the grower's program was statistically higher than the regular grower's program.

There were no formal visual quality ratings taken because we believed that sod would most likely have acceptable visual quality to have the sod strength necessary to be harvestable. We did notice with this project that you could have really great looking turf on a plot but the sod failed to be harvestable when placed on the sod stretcher. This was very true on the high nitrogen plots that were dark green and dense but tore easy. Conversely, plots with little or no N applied looked off color but still some what dense and had good sod strength.

Nitrate Leaching

The extent of nitrate leaching was determined as at the time of harvest, covering the time period from seeding to harvest. In this way we can compare the extent of leaching between different nitrogen fertilizers applied at different rates.

We are not able to determine when in

the production cycle the nitrate leaching occurred. The unfertilized check is used to determine what might leach unrelated to fertilizing, and reflects the amount of nitrate leaching that comes from mineralization of soil organic matter, from rainfall, and from irrigation. About 50 lbs/acre or 1 lb of nitrate/1,000 sq.ft. leached from the unfertilized plots. Because of the unexpected application of fertilizer made by the grower in March 2006 to part of the plots, only data from 2 of the 4 replicates were evaluated.

The purpose of this study was to evaluate if the release rate and the amount of nitrogen applied during a sod cropping period affected the amount of nitrate leaching. Looking at the source and rate part of the study two trends were noted. First, except for one treatment (Nitroform at 1.5 lbs N/1000 sq.ft. rate), the degree of leaching was linked to how fast the N was released, i.e., fats release leaches more. Thus, urea had more leaching than IBDU that was greater than Nitroform. Second, increasing N rate increased nitrate leaching. This was most evident for urea and less apparent with the other sources, especially with Nitroform. Many of the moderate-release (IBDU) to slow release (Nitroform) treatments had about the same amount or less nitrate leaching than the unfertilized

The bases of the BMP were to modify the growers program with seasonally adjusted N sources to hopefully reduce the extent of N leaching. Both of growers' programs had 3 times the amount of leaching and the BMP had over 4 times the amount of leaching than the unfertilized control.

Table 1. The fertilization treatments including sources and rates applied.

	Fertilizer	analysis	Rate	Total amount of N
			bs/1000 sq.ft.	
1	Control	unfertilized check		
2	Grower program*			6.8
	starter	10-26-12	0.8 N	
	urea	45-0-0	2.0 N	
3	½ Grower program*			3.4
	starter	0-26-12	0.4 N	
	urea	45-0-0	1.0 N	
4	IBDU (moderate)	31-0-0	0.5 N	2.0
5	“	“	1.0 N	4.0
6	“	“	1.5 N	6.0
7	“	“	2.0 N	8.0
8	Nitroform (slow)	38-0-0	0.5 N	2.0
9	“	“	1.0 N	4.0
10	“	“	1.5 N	6.0
11	“	“	2.0 N	8.0
12	Urea (quick)	46-0-0	0.5 N	2.0
13	“	“	1.0 N	4.0
14	“	“	1.5 N	6.0
15	“	“	2.0 N	8.0
16	BMP*			6.0
		10-26-12 (starter)	0.8 N	
		IBDU	1.2 N	
		Nutralene	2.0 N	
		Nitroform	2.0 N	

** Starter fertilizer applied at seeding (Sept. 15, 2005) and the three other applications were made on Oct. 20, 2005, May 2, 2006 and July 25, 2006*

continued on page 10

Healthy Ecosystem

continued from page 9

This data suggests that the application of quickly available N sources at seeding may result in large amount of nitrate leaching. Other studies have also observed that N leaching is the greatest during the establishment period.

check.

The other fertilizer treatments included the standard grower fertilizer practice (including half the amount of N applied) and one based on BMP, designed to reduce leaching. Both grower's programs leached 3 times more N than the BMP and had over 4 times the amount of leaching than the unfertilized control. This data suggests that the application of quickly available N sources at seeding may result in large amount of nitrate leaching. Other studies have also observed that N leaching is the greatest during the establishment period.

The amount of nitrate leaching as expressed on a percent applied basis showed that five of the 15 treatments resulted in less than 15 % of the applied N that leached. There were 9 of the 15 treatments that had < 50 % of the applied N that leached. In other studies we have conducted in Long Island on established Kentucky bluegrass, the greatest percent of leaching was about 50. There should be caution in over emphasizing the results of this first year study since we only considered two of the four replicates.

by Marty Petrovic, Ph.D.
Cornell University

Table 2. Impact of fertilizer sources and rates on sod strength for 2006.

Treatment	7/25/2006	8/24/2006	9/18/2006	10/25/2006
	---------------------------- lbs ----------------------------			
Urea at 0.5X	45a*	70ab	93a	110a
Urea at 1X	48a	73ab	87a	96a
Urea at 1.5X	49a	68ab	78a	96a
Urea at 2X	42a	57ab	73a	95a
IBDU at 0.5X	58a	67ab	85a	109a
IBDU at 1X	59a	65ab	90a	108a
IBDU at 1.5X	52a	72ab	87a	101a
IBDU at 2X	49a	65ab	82a	100a
Nitroform at 0.5X	52a	72ab	87a	110a
Nitroform at 1X	52a	80a	90a	112a
Nitroform at 1.5X	51a	76ab	86a	114a
Nitroform at 2X	46a	70ab	85a	101a
Control (unfertilized)	49a	70ab	87a	105a
BMP	48a	65ab	77a	95a
Grower Program at 0.5X	48a	82a	83a	99a
Grower Program at 1X	46a	53b	74a	93a

*lbs of sod tensile strength, average of 2 samples per plot and 4 replicates. Values in the same column not connected by same letter are significantly different. Commercially acceptable sod strength based on this equipment is about 98 lbs.

CORNELL TURFGRASS SHORT COURSE

JANUARY 19 - 23, 2009

ON THE CAMPUS OF CORNELL UNIVERSITY

ITHACA, NEW YORK

TUITION: $700.00 PER PERSON INCLUDES ALL LEARNING MATERIALS & REFRESHMENT BREAKS

DEC CREDITS AVAILABLE

CORNELL Turfgrass

- Come and learn the latest research-based information from leading Cornell Turfgrass Scientists that will provide an excellent foundation for new members of the industry or a refresher for more experienced professionals.
- This course blends interactive classroom learning with hands-on labs focused on improving your plant and pest diagnostic skills.
- DEC and GCSAA credits will be available.
- Registration available at http://www.hort.cals.edu/turfshortcourse.
- For More Information regarding the Cornell Turfgrass Short Course contact Maxine Welcome at MW45@cornell.edu or by calling 607-255-5439

CUTT

Healthy Ecosystem

The goal of the research and outreach project is to develop a sod production fertilization program that will minimize the contribution of nitrogen fertilization to groundwater quality degradation.

Reducing Nitrogen Groundwater Contamination from Sod Production on Long Island, NY

Many of the surface waters in the US, including New York State and the New York City watershed, as well as most of the northeastern US are at risk from the negative impacts of nitrogen and phosphorus runoff and leaching into groundwater. For example, fertilization during sod production on Long Island results in groundwater consistently above drinking water standards (nitrate concentration averaged 18.6 mg/L in 2001 and 24.8 mg/L in 2002). The Peconic Estuary Program recommends a 25% reduction in nitrogen loading from sod production with the implementation of Best Management Practices (BMP's). Sod production, accounting for about 3,000 acres on Long Island, is constantly in the establishment phase where the potential for nitrogen leaching is the greatest. During spring and fall, leaching losses of nitrogen and phosphorus can be significant. Furthermore, the application of soluble nutrients needed to establish a dense stand of turf has the potential to contaminate ground and surface water. The need to develop sound best management practices for nitrogen management for sod production is imperative.

The goal of the research and outreach project is to develop a sod production fertilization program that will minimize the contribution of nitrogen fertilization to groundwater quality degradation. A great deal of work has been done on nutrient losses from agricultural crops, however, due to the nature of turfgrass systems (i.e. perennial ground cover, no tillage) application of crop research to turfgrass can lead to erroneous conclusions. Our hypothesis is that BMP's (nitrogen rate and sources) can be developed to minimize the contamination of groundwater from managed turfgrass areas such as sod production while maintaining an acceptable sod production rate.

The study was initiated in early Fall 2005 and continued through 2006 when sod was harvestable. The site was a sod production field in eastern Long Island (Delea Sod Farms). The soil at the site is Haven loam (HaA). Following the normal establishment practices and seeding, two 30 cm dia. by 30 cm long polyvinalchloride (PVC) lysimeter were installed in each plot.

continued on page 8

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