System...offer basic support for nay and all citizens of the state...in the areas of social concern, economic development, the educational infrastructure, the government at all levels, environmental and natural resource protection, and the linchpin of any midwestern state...its agriculture?

Isn't that really why the UW and the UW System came into being so many years ago? The state and its people...our ancestors from the past century...needed help to lead productive, enlightened, and prosperous lives...and University of Wisconsin was there to help.

The Wisconsin Idea was and is a great Idea, a great concept, and a great feeling...and is something that I truly wish was alive and well down here as well. There is much that the University of Illinois could contribute to the welfare and prosperity of the people of this state.

Don't misunderstand me...I am certainly no expert on the University of Illinois System and I do know that the agricultural sector, in particular, depends heavily on the U of I for research and guidance. Other sectors of the states economy seem to have little contact with Champaign-Urbana.

In an overall sense, there certainly is not the same feeling here people in whatever walk of life turn to their university system for whatever reason in time of need.

All of the universities of this state are almost all separate...the University of Illinois System has only three member campuses...while NIU at DeKalb, SIU at Carbondale, Eastern Illinois University, Western Illinois University are all state funded...but are operated as totally separate facilities from each other.

As parents of elementary school children bound someday for college, Sue and I can't help but notice the differences between Wisconsin...with a population of about five million people...and a university system with dozens of campuses to choose from...and Illinois...with the sixth highest population of all of the states...eleven and a half million people...and a system of high education that really is...each campus for itself.

These differences filter down into the everyday life of the citizens of the state. Wisconsin is a much more united, cohesive state...definitely more liberal politically...and more socially concerned for the welfare of those who reside within it borders.

Illinois suffers from lots of polarity in all areas between Chicagoland and what's known here as 'downstate' (i.e. anyplace other than Chicagoland). I had heard about it before moving here, but did not realize how strong, pervasive, and negative this whole concept could be.

People in Wisconsin would do well to reflect on the condition of their lives and the lives of their loved ones by virtue of living in a state such as Wisconsin. Clean and honest government...bountiful natural resources and a real statewide concern for protecting those resources...a great university system...good roads...great public schools...a rich and diverse heritage in agriculture...and a much greater public concern for protecting and enhancing it all along the way.

Believe me...these words are coming from one couple who had this life for many years...probably took it all a bit for granted...and assumed that this quality of life was the standard throughout the Midwest.

We fully realize now that it's not automatically the case.

We do enjoy our life here in Illinois and appreciate what life here is offering us. We do, however, reflect back on life in Wisconsin, and know with certainty that life there would not again be taken for granted should the future opportunity to relocate back home ever arise.

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The Turfgrass Disease Diagnostic Lab: Report for 1996-1997

Jeffrey Gregos, Gary Gaard, and Douglas Maxwell Department of Plant Pathology

What a year this has been for the TDDL!!! We feel that it is only fitting to recap this past years projects as many of you have helped support them through contract donations, donations of materials, and most importantly your continue encouragement. The main change was the hiring of Jeffrey Gregos, a graduate of the four-year Penn State turfgrass program. Jeffrey Gregos arrived in October 1996, just in time to get started on the snow mold trials for the winter of 1996-1997. As we look into the future we can only see the TDDL growing even larger. Hopefully, the University may even let us fill the vice-Meyer position. Until then we will try to fill the gap as best as we can. But, it depends on your continued support for the TDDL to function. So, in the next couple of months, when we start our fund raising campaign again, I hope that you think of us generously. Last year we had over 80 contract holders, this year we would like to break 100. So now for the detail of 1997.

Background: The Turfgrass Disease Diagnostic Lab (TDDL) at UW-Madison was organized in the spring of 1995 as a separate part of the Plant Pathology. The TDDL was created to provide more extensive turfgrass disease diagnosis to the commercial turf industry of the State and to initiate a research program on turfgrass disease diagnosis. Some immediate goals were to provide a rapid turnaround-time, voice contact with professional turfgrass managers, information on the diagnosis procedures, and recommendations for disease management.

In October 1995, the TDDL, the Department of Plant Pathology, and WTA joined resources to provide for the continuation and growth of the TDDL. This involved a fund raising effort by WTA to provide "contracts" of \$1,000 each from 23 donors. The WTA raised \$19,000 in contracts. The Department of Plant Pathology was committed to provide half of the salary for the TDDL diagnostician and additional funds for Mr. Steve Millett. With the reorganization in the fall of 1995, fees were increased from \$10/sample to \$20/homeowner sample and from \$25/sample to \$60/commercial turfgrass sample. A separate account was established for the TDDL in the Department of Plant Pathology so that its budget could be managed separately form any other departmental activities.

In October 1996, Mr. Jeffrey S. Gregos arrived to assume major responsibility of an expanded disease management program for the TDDL. Mr. Steve Millett shifted to a full-time graduate student position, but has continued to contribute articles for the Grass Roots. Mr. Gary Gaard handles the homeowner samples and wildlife enhancement program. Again, funding was to be a split of contracts (\$23,000), Department of Plant Pathology (salary for Gary Gaard, and half the salary for Gregos), and gift funds from a turfgrass multiple donor account. Additional funding was received for the construction of the 20,000 sq. ft. green (WTA, private contributions, and grant/gift account). A \$29,000 contribution from Greens Mix for the greens mix was much appreciated.

Activities for the TDDL for 1997:

Samples processed: From April to Nov. 15, 1997, 205 turf samples were processed.

Commercial turfgrass manager samples (paid) = 30 Commercial turfgrass manager samples (contracts) = 9 Amateur manager samples (paid) = 84

Samples by manager type:

Golf course samples = 102 Sod grower samples = 1 Homeowner samples = 84 Lawn care samples = 16

Of the commercial samples, 1 was from out-of-state. (Continued on page 24)



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(Continued from page 23)

Frequency of Turf Problems Diagnosed by the TDDL in 1997 205 Samples Through November 15

Diagnosis	Samples	Grower Type				
		GC	HL	LC	SF	AF
Environmental/cultural	46	17	24	4	1	0
Necrotic Ring Spot	24	0	17	7	0	0
Rhizoctonia Diseases	14	14	0	0	0	0
Typhula Blight	12	3	7	2	0	0
Take-all Patch	11	11	0	0	0	0
Leaf Spots	10	4	6	0	0	0
Anthracnose	10	10	0	0	0	0
Microdochium Patch	9	9	0	0	0	0
Weed/Grass ID	9	0	9	0	0	0
Summer Patch	9	8	0	1	0	0
Chinch Bug	8	0	7	1	0	0
Unidentified/inadequate	6	З	3	0	0	0
Leptosphaerulina	5	5	0	0	0	0
Dollar Spot	5	4	1	0	0	0
Pythium	5	5	0	0	0	0
Phytotoxicity	5	3	1	1	0	0
Nematode Assays*	4*	4*	0	0	0	0
Fairy Ring	3	З	0	0	0	0
Slime Mold	3	0	3	0	0	0
Curvularia	2	1	1	0	0	0
Animal urine	2	0	2	0	0	0
Rust	2	0	1	0	0	1
Red Thread	1	0	1	0	0	0
Thatch	1	0	1	0	0	0
Algae	1	0	0	0	0	1
C-15 Decline	1	1	0	0	0	0
Tricks	1	1	0	0	0	0
TOTAL	203	101	84	15	1	2

*Not included in total, may be beyond thresholds, none established for turf in Wisconsin

GC = Golf Course; HL = Home Lawn; LC = Lawn Care; SF = Sod Farm; AF = Athletic Field

<u>On-site visits:</u> About 25 on-site visits were made: 20 to golf courses and 5 to home owners. All of the \$1,000 contract holders received site-visits this year.

Effort to increase contract holders: Two mailings (around 1,100 recipients), presentation at winter Turfgrass Expo, Northern Great Lakes Superintendents Association Meeting (Gregos and Maxwell), and coffee meetings (Gregos).

<u>Coffee Meetings:</u> These were organized to give Mr. Gregos the opportunity to visit with golf course superintendent members of the Turfgrass Industry in various parts of the State. They were held at Hudson, Green Bay, Woodruf, Appleton, Racine, La Crosse, Eau Claire, Stevens Point, Lake Geneva. About 50 contracts were obtained as a result of this "coffe meetings".

<u>Educational programs:</u> One computer workshop on email and internet were organized for Turfgrass Industry at the Winter Turfgrass Expo. One plant disease laboratory was offered at the Wisconsin Turfgrass School in February 1997.

Two summer disease training workshop were offered for support staff of golf courses and the Turfgrass Industry on contracts. Topics included hands on microscopic observation of turfgrass pathogens, biotechnology, and fungicide theory.

TDDL staff participated in the WTA Field Day in August. With the addition of three fungicide evaluation trials for the control of turfgrass diseases, and the sod evaluation.

Sessions on plant diseases were held at the second Homer Owner Field Day at the Noer Facility in August. About 100 people attended.

The world wide web site created by D. Maxwell and M. Maxwell, has been updated and encompasses over 50 pages of information on turfgrass diseases and the research being conducted by the members of the Turf Pathology Team (WEB address: http://www.wisc.edu/plheathser).

Monitoring of Biological Control Agents: Over the summer lab personnel assisted personnel from Westmoor in monitoring the populations of the bacterial biocontrol agent being tested for reducing dollar spot.

Molecular methods for detection of turfgrass pathogens: Continued efforts to develop molecular (DNA)-based methods for characterizing the major turfgrass pathogens. Some results were published in *The Grass Roots* and these methods are now being used in the Introductory Plant Pathology class this fall. This winter the sequence data for 6 turfgrass fungi will be submitted to the National Data Base for Genetic Information at the National Institute of Health, Washington, DC. Initially funded by WTA and continued funding from gift support and D. Maxwell's salary savings (The Dean's office now covers half of his salary).

<u>Snow Mold Trials:</u> Mr. Gregos established the snow mold fungicides test at four golf courses (four fairways and one putting green)—two northern sites, one central site, and one site in southeastern WI. Twenty-nine treatments were included. Steve Millett also established snow mold trials at four other golf courses. Snow mold field days were held at Gateway Golf Club, Sentryworld, North Hills C. C., O. J. Noer Turfgrass Facility. Results were presented at 4 locations in the spring with a half day field day at each location. Over 100 members of the Turfgrass Industry attended these field days. Research data was published in *The Grass Roots.*



The trials have been expanded this year (1997-1998) with 75 treatments and are in 6 locations; Superior, Hudson, Sayner, Land O' Lakes, Stevens Point, and O. J. Noer. Field days are planned to be held at 5 of these locations this spring. Dates are yet to be determined and a mailing will be sent out in the spring.

Construction of green: With joint funding between the WTA and the TDDL a 20,000 sq. ft. green was constructed at the O. J. Noer Turfgrass Facility for Turfgrass Pathology Research. One thousand tons of greens-mix was donated by the GreensMix, Waupaca WI, and the construction was done by Admire Greenscapes, Randy Smith, Owner. Several other donations were received from Northshore C. C., irrigation; Reinders Inc., irrigation; Scotts Co, fertilizer; L. L. Olds Co., turfgrass seed; Long Island, Lurvey's, Jasperson, Jasperson Evergreen, Halter, and Deaks Sod Farms, Kentucky bluegrass sod; Blackhawk C. C., equipment; Maple Bluff C. C., equipment; Wisconsin Agricultural Research Stations, labor and equipment. With these donations we were able to keep the costs well under the budgeted \$25,000 from the WTA and \$10,000 from the gift/grant fund from the TDDL program.

The green was used for the evaluations of dollar spot control for summer 1997, and as it matures plans are to use it for spray volume research, and anthracnose/summer patch trials in addition to the dollar support trials.

Construction of fairway for brown patch evaluations: An old Kentucky bluegrass plot was renovated and re-established with Colonial Bentgrass. The seed was donated by L. L. Olds Co., and it was established by TDDL staff. This summer 19 treatments were evaluated in the trial. Next year 25-30 treatments should be evaluated.

<u>Sod plots:</u> Thirteen sod growers from across the state have participated in this trial. This long-term evaluation was established this spring and will continue for 4-6 years. Initial funding by the WTA of \$1,200 has been obtained for establishment of these plots. Additional funding of \$900 a year has been committed to continue the research on this plot for the duration of this project.

<u>Pythium Greenhouses:</u> Two green houses (\$5,000, gift/grant funds to TDDL) were ordered this fall and construction of them started. The greenhouses are required to promote an ideal environment for the evaluation of Pythium Blight controls. Irrigation system expansion is



required for this area and will be installed this fall or next spring. This cost will be made up over the next year or two with grant-in-aide from trial entries.

<u>The Grass Roots Articles:</u> In total the members of the Turfgrass Pathology Team have written over 12 articles for the Grass Roots this past year. Major authors included Gaard, Gregos, Maxwell and Millet.

<u>WTA Newsletter reports:</u> Several articles were written for the WTA news letter this year by Gregos and Gaard.

<u>Grant proposals submitted</u>: The Turfgrass Pathology team has recently been involved in two grant proposals, one for the USGA and the other an Interdisciplinary Hatch Grant.

The USGA proposal is for additional funding for Mr. Millett's Ph. D. requirements and additional funding for Mr. Gregos' snow mold control evaluations. The final proposal was submitted at the end of October. Final approval should be known in the next couple of months.

The Interdisciplinary Hatch Grant has been prepared by member of the Horticulture, Agronomy, and Plant Pathology Departments. This grant is for the selection and production of turfgrass germplasm for resistance to snow mold. This will be the direction of Mr. Gregos' master degree program. This funding if approved will not be available until fall 1998.

<u>Wildlife Enhancement:</u> Plant Pathology Department provided 20% support of technical staff member (Gaard) to work on environmental issues.

(Continued on page 27)

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(Continued from page 25)

On July 23 The O. J. Noer Turfgrass Research and Education Facility received a letter from The Audubon Cooperative Sanctuary System of New York. Their letter states "Congratulations! You have been designated as a **Certified Audubon Cooperative Sanctuary**".

A low maintenance wildlife garden designed by a Landscape Architecture student Becky Hanson was seeded with CARE-FREE fine fescue. Nurseries have committed to contributing most of the shrubs and trees for this garden. They will be planted in the spring of 1998. The garden includes several areas for demonstration of ground covers.

The National Park Service will provide seed for one acre of prairie (seed mix is three grasses and 18 forbs). Landscape Architecture student Brad Guhr will supervise establishment as part of his graduate training. An area 12,600 square feet was seeded October 9. A 13,000 square foot area will be seeded next year. Both areas are on University Ridge G.C. property—Jeff Parks has helped with planning and area preparation.

Volunteer undergraduate students from Wildlife Ecology will help establish and monitor a fifty house bluebird trail on University Ridge and the Noer Facility. A bat colony house was built and put up.

Common interest has been identified with both the Madison Audubon Society and the Bluebird Restoration Association of Wisconsin. There are indicators that they would support education and outreach, and also provide financial support for research. Development of the portion of the Ice Age Trail that crosses the Noer Facility have been reactivated. The wildlife garden is an example. The only other planned addition on the Noer Facility is a demonstration area of turfgrasses for the walking path.

<u>Turfgrass Disease Scouts</u>: The TDDL attempted developing a disease scout network this year to disseminate information to the growers in a timely and efficient fashion. As result of the time constraint on the growers picked and the TDDL personnel, this was found to be impractical. Also the number of hits taken on the TDDL site is lower during the summer months. As a result of this experience, this effort will be abandoned for 1998.

Future Plans:

It is proposed that the Wisconsin Turfgrass Association and the UW-Madison continue the partnerships to fund a full-time turfgrass Specialist (Jeffrey Gregos). This person would have the following responsibilities: diagnosis of the turfgrass diseases (nearly full-time from May to Oct.), provide expanded educational and outreach programs, and assist in applied research. The Plant Pathology Department has made a commitment for the near future to fund half the salary for this position. Additional student helpers (partially paid by gift/grant funds) will be hired in 1998 to assist Mr. Gregos in plot maintenance and the applied research program.

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THE SNOWFLAKE MAN





I'm not sure it merits the term "pilgrimage", but this fall I got serious and devoted the better part of a day to learning more about and getting to know the man who might be the most famous person ever in the study of snow — Wilson Alwyn Bentley. W. A. Bentley was a farm kid from Jericho Center, Vermont who lived in the later years of the 1800s and passed away in December of 1931. He was known as the Snowflake Man of Jericho for his pioneering photomicrographs of individual snowflakes.

Bentley's work has interested me for a long time, years before I made my first foray into Vermont. My interest in him resulted from an interest in snow. It is pretty difficult to live in a northern state like Wisconsin for your whole life and not be curious about snow. Double that curiosity if you grew up on a farm and experienced a career as a golf course superintendent. After all, it is an old farm adage that says "a year of snow, a year of plenty." It has been an observation I've confirmed many times as a course manager as well.

Snow's value to those of us growing plants results primarily from its efficiency as an insulator. The experiments confirming that are basic and long standing. One simple test recorded an open air temperature of -27 degrees F. and a temperature seven inches beneath the snow surface of +24 degrees F. In another simple experiment the air temperature above a snow bank was -32 degrees F.; one inch below the surface the temperature was -1 degree F., and at one foot below the surface the thermometer read a toasty +31 degrees F. Clearly, whether you are managing golf greens or alfalfa fields or simply growing roses at home, snow is something you need for a successful winter.

Snow (more specifically snowflakes) has interested men for centuries. The classic, undamaged snowflake is a little, six-sided star. Chinese



A historical marker on the village green in Jericho Center, Vermont honors its most famous son, W.A. Bentley.



The house on the Bentley farmstead. Note the snowflake design on the peak of the house.



This photo was taken in the Bentley Museum — the old billows camera and the microscope he used are in the foreground.

scholars noticed this symmetry first in 135 B.C. Naturalist Albertus Magnus wrote about snowflakes in 1260, and the Archbishop of Upsola published a crude drawing (a woodcut, actually) of a snow crystal in 1550.

Perhaps the most detailed thinking about snowflakes I have read was written in the winter of 1609 by the Polish astronomer and mathematician Johannes Kepler. The question he posed, in general terms, was "why snowflakes in their first falling, before they are entangled in larger plumes, always fall with six corners and six rods (radii), tufted like feathers..."

Kepler then wrote a long winded



Bentleys' final resting place is on a rural Vermont hillside, looking at Mt. Mansfield.

dissertation that compared snowflake shapes to the honeycombs of bees and the most efficient way to stack cannonballs. In the end, he said snowflakes were hexagonal because "it is their nature to be so."

More recent explanations of this phenomenon by mathematicians and physicists use atomic theory, something now taught kids in grade school science. The hex shape relates to the atomic structure of water—the angle formed by the two hydrogen atoms and the single oxygen atom is 60 degrees—one-sixth of a circle. Snowflakes are shaped by their molecular constituent! The best art of depicting snowflakes carefully and accurately was the work of the Arctic explorer, Scoresby, in 1820. Although he was deliberate and detailed, it took W.A. Bentley to move snowflake depiction from art to photography.

The Bentley farm was almost literally in the shadow of the western slope of Vermont's highest mountain, Mt. Mansfield. Most Americans are more familiar with the eastern slope of Mt. Mansfield. There is found the von Trapp Lodge near Stowe, Vermont. This is the real Austrianborn family that the 1965 movie *The Sound of Music* loosely depicts. The Bentley farm was a good place to study snowflakes; it is very cold in the winter in that part of Vermont and it snows a lot. Wilson had lots of subjects to study.

It was probably twenty years ago when I first read about Snowflake Bentley, as he was affectionately called. After that I discovered a great collection of his glass plates of snowflakes in the Fairbanks Museum in St. Johnsbury, Vermont. A decade ago I found a copy of his magnum opus, Snow Crystals, a book he wrote with Dr. W. J. Humphreys of the U.S. Weather Bureau, in the Dartmouth College bookstore. It is a Dover reproduction of the 1931 McGraw-Hill book, and it is a beauty. Jen Sammerdyke used photos in it for this issue's cover.

I buzzed through Jericho two times previous to last fall—once on my way to Burlington and Lake Champlain, and again the time I was on my way to President Chester A. Arthur's childhood home near Fairfield, Vermont. But I never really connected with the Bentley story on either pass through the village. I vowed that this past fall I would spend whatever time was required to learn all I could about W.A. and his very interesting life. It took nearly a day, but I feel very satisfied with what I was able to learn.

Bentley is always referred to as the Snowflake Man of Jericho, Vermont. The fact is that he was actually from Jericho Center, a small village southeast of Jericho. The Bentley farm was located a mile or a mile and a half east of Jericho Center. And always, you are aware of Mt. Mansfield with it forehead, nose and Adam's apple, Mr. Bentley's career with snowflakes really started on February 9, 1880



W.A. Bentley photographing snow crystals.

when his mother gave him an inexpensive microscope for his birthday. February in Vermont (like Wisconsin) means snow and the first thing he observed through his microscope was a snowflake. His study didn't end until he died in 1931. He lived until three weeks after his book was published.

During a snowstorm Mr. Bentley used a smooth board about a foot square that he had painted black to capture snowflakes. A mitten would cover his hand so no heat was transferred to the board. Damaged flakes were brushed off with a feather from a bird's wing.

He hurried into a small wooden shed where he had his equipment set up. The snowflake he selected to photograph was carefully picked up from the board with a fine splinter of wood and placed on a glass microscope slide. Great care was given to place the snowflake perfectly flat so all parts would be reflected equally on the photograph. The camera was pointed toward the window and the snowflake was photographed through the microscope. The exposure times were long, ranging from ten seconds to 100 seconds. During a snow storm, W.A. would take photomicrograph after photomicrograph this way.

The process required a steady hand, which he had because he had never used either tobacco or liquor. He moved quickly, holding his breath so as not to melt the snowflake.

The camera he used was a big bellows implement; it is shown here with Bentley next to it. A combination of pulleys and wheels and ropes which he designed permitted him to focus this sort of clumsy apparatus while watching the ground glass at the rear. The camera is now on display in the Red Mill Museum in Jericho. I took a picture of it while I was there; reflections reduced the quality somewhat, but I have included it here, as well.

Once the glass plates were removed from the fixing bath, Bentley would wash them in the ice cold stream that flowed from a spring in back of their farm house. Talk about low technology!

W.A. Bentley took photomicrographs of almost 6,000 snow crystals (Continued on page 31)



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