An impressive handbook with good pictures of all weed species in the Midwest and written descriptions and explanations of the growth habits.

All of us are aware of the increasing concern over the use of pesticides and their proposed harmful effects to the public. We must, therefore, be keenly aware of the products we are using, the technical data and proper application procedures to avoid any mishaps. To aid in the technical portion, I would recommend:

Farm Chemicals Handbook
1986 Cost $45.00

An extensive book covering all pesticides manufactured in 1986 and the necessary technical information concerning these products. Such information should be taken seriously and thus the reason for this book's inclusion on the second shelf.

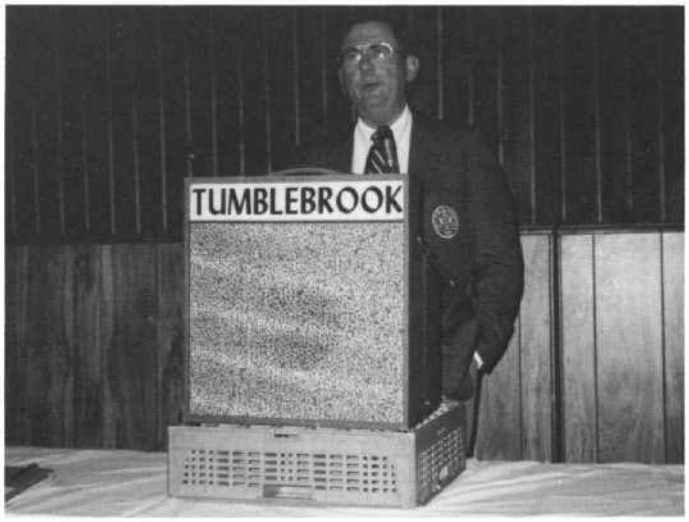
Like I have stated before, the ability to write properly is essential for any successful professional. Many times the written word is the first impression someone may receive of us. Imagine a cover letter on your resume which has poor grammar or poor English usage. Certainly the impression given the reader will be less than positive. For this reason, a book on grammar and writing is priceless for anyone and I would recommend the book:

Fundamentals of Technical Writing
Author: Patricia Robinson
1976 Cost $21.00

It is a college level writing book covering all grammatical aspects and is guaranteed to aid you in the written word. A highly worthwhile book for the Superintendent's library.

It is hoped that these additional selections will help you find that perfect book for your personal library. If none of the books mentioned in the last articles is what you desire, keep looking; there is more to the bookshelf than at first meets the eye.

COOL WEATHER GREETS APRIL WGCSA MEETING



Jim Latham, Great Lakes Region Director of the USGA Green Section, continued the tradition of leading off the first golf meeting of the WGCSA.

Irv Graf, left, and Mike Lees, right, received awards for 25 and 30 years of continuous membership in the WGCSA. Congratulations to two outstanding guys!

Approximately 50 Wisconsin Golf Course Superintendents Association members met the challenge of April golf in Wisconsin and, braving mostly cloudy skies, a fairly brisk Northeast wind and cool temperatures, took advantage of Golf Course Superintendent Bob Belfield's hospitality at Tumblebrook Country Club. The April 28, 1986 meeting signified the "real start" of the playing season in our State.

The Wisconsin GCSA Board of Directors meeting saw approval of several new members including Dan Williams, Riverview Golf Club, Appleton — Class A, Sam Schultz, Vitense Golfland, Madison — Class D, John Sittig, Fort Dodge Country Club, Fort Dodge, IA — Class B, Lohmann Golf Design — Class E and Donald Clemans, River Run Golf Club, Kohler — Class A. Also, in recognition of long and meritorious service to and for the profession of golf course management in the State of Wisconsin, the WGCSA Scholarship has been renamed the Dr. J.R. Love WGCSA Scholarship. Dr. Love's contributions to the "business" are many and significant and the scholarship will personify the contributions for years to come.

Following an excellent dinner prepared by the Tumblebrook staff, the 70 WGCSA members and guests in attendance were able to share in the experiences and insights of Mr. Jim Latham, USGA Green Section Regional Director. Jim's remarks relative to winter injury and spring recovery were timely and appropriate to all in attendance as year in and year out, the winter extremes in our State seem to "play no favorites."

The April 28, 1986 WGCSA meeting. Again, thanks to our host Bob Belfield for a great start to our golf season.

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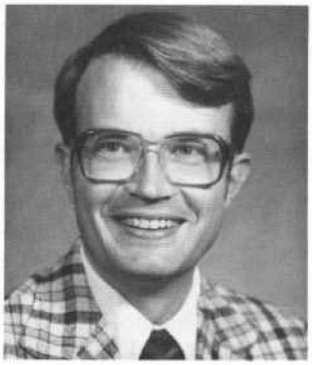
How Computers Aid Growers in Crop Management Systems



By Dr. Walter R. Stevenson

The rapidly increasing use of computer technology has significant implications for management of crops and reducing input costs. A variety of computer applications are in use today in agriculture. These include soil testing/fertilizer recommendations, feed rationing, pest management, irrigation scheduling, weather forecasts, market information, and record keeping programs. This article will briefly discuss a few of these computer applications.

DISEASE PREDICTION MODELS: If a grower could predict when a certain disease was going to become serious, then control measures could be applied at the proper time rather than on a weekly schedule. An important component of such a system is to have the necessary environmental data which would allow one to determine when a certain disease is going to be important. This usually involves such factors as temperature, period of time relative humidity is above a certain value, leaf wetness, etc. Once this information is available, then it can be incorporated into a model. Such a crop management model is being used in potato production in Wisconsin. Growers monitor maximum and minimum daily temperatures, the daily duration of relative humidity 90% or above, the maximum and minimum temperatures during this high relative humidity period, and the daily rainfall or irrigation. This information can be collected on a simple instrument, the recording hygrothermograph. This information is transmitted to a computer at the University of Wisconsin—Madison and the grower is given specific control recommendations. Growers who have used this disease prediction program have reduced their disease control fungicide applications by 10 to 30%. While these savings may not be possible every year, they are indicative of the potential value of disease forecasting systems. The program is also available on a floppy disk for use on microcomputers by growers, crop consultants and county extension agents.

ELECTRONIC MAIL: Electronic mail allows the direct communication between two computers. Extension agents and specialists routinely correspond with an increasing number of growers who use the State computer network. Questions about production practices, pest problems, travel plans, etc. can be quickly answered without having to go through the inconvenience of locating the other party by telephone.

ELECTRONIC NEWSLETTERS: During the course of each growing season, newsletters entitled "Diagnostic Clinic Update" and "Vegetable Disease Update" are prepared weekly by UW—Madison personnel. These newsletters give an update on plant disease problems identified from around the State, information on pest control programs, and other items that seem timely. Information is prepared on a microcomputer and sent statewide over the computer network.

WEATHER INFORMATION: The weather program currently available on the University Extension Computer, WISPLAN, is a program in its early stages of development. Weather information from the National Weather Service is placed on the computer and includes extended weather forecasts, radar summaries, temperature and precipitation tables for various parts of the State, local weather information for four regions of the State, and frost warnings. Another feature of the weather that is being developed is a statewide monitoring system to give a weather summary from each of the University Research Farms on a 24 hour delay.

PEST CONTROL AND PESTICIDE INFORMATION: Growers, consultants, and extension agents have a need for quick access to pest control and pesticide information. Computer databases have been developed over the past several years that contain information on pest and pesticide topics. The National Pesticide Information Retrieval System is a database that allows extension workers to access registration information from the Environmental Protection Agency. For example, a golf course manager has a question concerning the chemicals registered for use on turf to control dollar spot. A trained operator could obtain a list of fungicides including active ingredients, rates, and registration information in a few minutes. Another example of a database at UW—Madison is the Pest Profile Program which has information on weeds, insects, and diseases of turf and vegetable crops. Included is information on life cycles of pests, host ranges, pest identification, the effect of environment on the pest development, and control information. The database is about 1500 pages long and allows the user to access information by specific topic. An up-to-date database assures that growers receive the best information possible.

PEST CALENDAR: The Pest Calendar program was developed to serve as quick reference of current pest problems for extension agents, growers, and Integrated Pest Management personnel. The program allows the user to select the plant type, month, and pest type and to print a paragraph on the selected topic.

Computers have become a necessary tool for many crop production specialists and the future will bring even more applications for their use.

Editor's Note: Dr. Walt Stevenson is the Department of Plant Pathology vegetable extension specialist and is particularly interested in the diseases of potatoes and mint. Educated at Cornell (B.S., 1968) and Wisconsin (Ph.D., 1972), Walter spent six years on the faculty at Purdue University before coming to the UW—Madison in 1979.

HANDRICH, VILLA DU PARC HOST MAY WGCSA MEETING

Despite reports of adverse conditions as a result of winter injury to green, tee and fairway turf, the 50 WGCSA members participating in the May 20, 1986 golf event at Villa du Parc Country Club in Mequon, Wisconsin were treated to a well-conditioned facility. "Notorious winners" again surfaced and are listed for the sake of acknowledgement and for scrutiny.

The winners and all other participants, playing under cool, cloudy conditions for the second time this year, were seeing a golf course that, according to one WGCSA member, had been "pretty rough" only six weeks earlier. Congratulations certainly go out to host Golf Course Superintendent Mike Handrich and his dedicated staff for what appeared to be a miraculous turnaround in virtually no time at all.

The WGCSA May meeting was highlighted in the evening when, following an excellent dinner prepared by the Villa du Parc staff, approximately 60 members and guests had the opportunity to listen to and interact with Dr. Roscoe Randall, well known and self-described "bug man" from the University of Illinois. Dr. Randall's timely remarks, particularly relative to the use of Oftanol and "grub control," stimulated many questions and should prove valuable for all Superintendents as summer programs are implemented.

With two successful golf event meetings "under our belts" for 1986, The Wisconsin Golf Course Superintendents Association can look forward to a great remaining schedule and all are encouraged to participate.

Bill Douglas and Gary Tanko teamed up at Villa du Parc.

(Continued from page 1)

graduate. Jones set Walker to work on diseases of vegetables which seemed natural because of his origins. This Wisconsin raised boy was to become the most highly respected plant pathologist in the world and retired at age 70 in 1964. He resides in Sun City, AZ.

Each of these faculty members brought vision and leadership to their program areas and shaped the direction of the Department for the next forty years. Keitt focused on diseases of fruit crops and chemical controls; and his research set the pattern for much of the epidemiological studies, i.e. weather and disease interactions, that were to follow. He also served for 25 years as the second Department Chairman. Vaughan was one of the first extension specialists in the USA and it is his son who established the Vaughan-Bascom Professorship held today by Professor Gayle L. Worf. Vaughan was instrumental in extending knowledge about disease diagnosis and control throughout the State, and he developed a spirit of interdepartmental cooperation that continues today. Vegetable diseases were the responsibility of Walker who developed strong programs on breeding for disease resistance. Riker was instrumental in the formation of the forestry program. His team was the first to identify oak wilt and to devise ways to slow its destructive spread. He and his successors, particularly R. F. Patton, implemented a breeding program for white pine blister rust resistance, the first of its kind in forestry. Riker also had an active research program on the nature of crown gall disease. The bacterial causal agent of this disease has become one of the major tools for plant molecular engineering. Field crop diseases were the responsibility of Dickson. Although not a major part of his program, he did study pink snow mold and fairy ring disease of turf. The Potato Seed Certification Program, which was the first in the USA, was started in 1913 under the direction of Brann. Johnson was responsible for tobacco diseases, but his major impact was in the area of virology.

The early research programs reflected the strengths of the faculty members and the Department became known as the center for research on the influence of environmental factors on disease development, on breeding for disease resistant vegetables, on forage, cereal, and forest pathology, and on disease physiology. This research lead to the control of many of the major diseases affecting Wisconsin crops.

The next generation of faculty members, like the first, were trained at Wisconsin. These included such men as G. S. Pound who was to become Chairman after Keitt and later Dean of the College. Emphasis during this period continued along the same lines as programs expanded and new faculty were hired. From the midsixties to the present, program expansion occurred primarily in disease physiology with smaller increases in nematology and soilborne plant pathogens. The

creation of a USDA Unit for studies on disease physiology in 1964 brought four new positions to the Department. Kemp, a member of this group, was the first to achieve the expression of a gene in a plant from an unrelated plant, i.e. the transfer and expression of the gene for storage protein from bean in sunflower. In addition, the concept that certain bacteria serve as ice nucleation centers on plants was completed by members of this group (Upper, Arny, and Lindow). These bacteria are free-living on the surface of plants and are responsible for frost injury, thus it is possible to control frost injury through biological control methods.

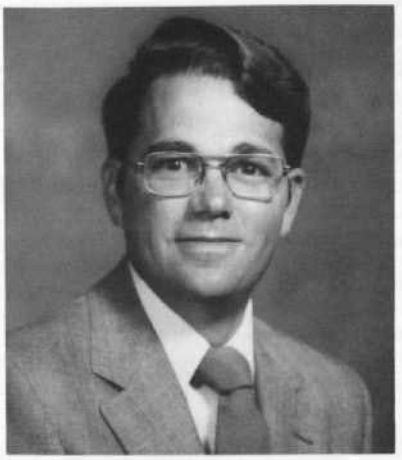
Currently, the Department has twenty-six faculty members; and active research programs continue in most of the areas mentioned above. New programs include the use of computer modeling in the development of disease forecasting systems, the isolation of plant genes which control disease resistance, the development of biological control agents, the development of systems for studying the molecular biology of pathogens and for understanding the factors which determine the specificity of the interactions between plants and their parasites.

A strong emphasis has been placed on the training of graduate students. Over 600 individuals, more than from any other Department of Plant Pathology, have received advanced degrees from the Department. Foreign students have always been part of the graduate program and students have come from forty-three countries. The training of these foreign students has been one of the Department's greatest contributions to world agriculture. Undergraduate training has concentrated on the offering of a strong introductory course in plant pathology for plant science students in the College.

The Department has long been recognized for its leadership in the profession of plant pathology. Professor Jones was the first President of the American Phytopathological Society and seven other faculty members have served as President. Ten graduates from the Department have also been Presidents.

Faculty members have received many honors over the years. One of the most prestigious of these is election into the National Academy of Sciences. Five faculty members have received this honor. Arthur Kelman and Luis Sequeira are current faculty members and J. C. Walker is an Emeritus Professor.

In spite of the Department's international recognition and its dedication to furthering basic knowledge, it retains a commitment to the grower needs of the State. Examples include the applied research programs of many faculty and the Pathogen Detection Clinic. With this sense of responsibility, the history of the first seventy-five years of the Department, edited by P. H. Williams and Melissa Marosy, was written by past and present members of the Department and entitled "WITH ONE FOOT IN THE FURROW."



Editor's Note: Dr. Doug Maxwell started his career as a faculty member in the Department of Plant Pathology at the UW—Madison in 1968. He has served as the Departmental Chairman since 1980. Educated at Nebraska Wesleyan (B.A., 1963) and Cornell (Ph.D., 1968), Dr. Maxwell specializes in fungal physiology and plant breeding for disease resistance in forage legumes. We are grateful to him for his efforts in organizing and coordinating this special issue of THE GRASSROOTS.

Oak Wilt Control — Preventive Medicine

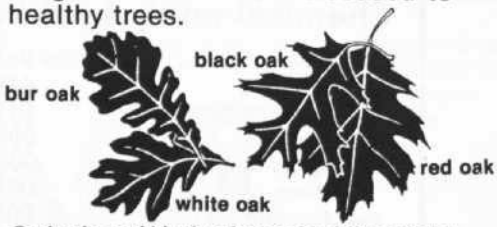
By Dr. James E. Kuntz

Healthy trees contribute greatly to the beauty of urban areas, including golf courses and other recreational areas. In Wisconsin, oaks are major shade and ornamental trees. But they suffer to varying degrees from attack by different insects and diseases. Fortunately, the many oak species vary greatly in their susceptibility or resistance to specific pests or to adverse environmental conditions. Preventive medicine, combining different control strategies, therefore, is possible by choice of the correct **Quercus** species, favorable soils and sites, and judicious management practices.

Oak wilt, a native, systemic, vascular wilt disease, incited by the fungus **Ceratocystis fagacearum**, is a serious lethal threat to oaks mainly east of the Great Plains. Every year in Wisconsin, oak wilt kills thousands of oaks in both urban and rural stands. Although there is no cure for diseased trees, much can be done to prevent initial infection and to limit further spread of the fungus pathogen. Oaks are not doomed; preventive medicine can be effective.

Disease Physiology. Before control measures can be formulated and applied, critical aspects of the disease must be understood. Continuing research has supplied much information. Microscopic spores of the causal fungus enter the water-conducting vessels, usually the large, open, long springwood vessels of the outer current annual wood ring. Especially in the spring (May and June), fresh, unprotected wounds are common entry points. Spores quickly multiply and are carried rapidly both upward and downward in the transpiration stream. Their metabolic products incite several internal host reactions including the proliferation of certain sapwood cells, the protrusion of balloon-like growths (tyloses) into infected vessels, the induction of gums and other dark staining materials, activation of dormant buds, and premature abscission of leaves. Vessels become plugged; water movement ceases; leaves wilt; and above ground parts of most trees die the first season. Roots, even infected ones, persist and remain active for some time, especially those roots grafted to roots of adjacent oaks.

In a dying oak, the fungus forms vegetative mycelium which grows outward to the cambium between the bark and wood. Under warm, moist conditions, the fungus destroys the cambium, loosens the bark, and forms many scattered mycelial mats or "pressure pads" which raise and crack the bark. The mats sporulate profusely and emit a "juicy fruit" odor which apparently attracts many insects including the common and familiar "picnic beetles." Such mat-invading insects become contaminated with spores and may serve as "vectors" to carry the fungus overland from diseased to healthy trees.



Red oaks and black oaks can be differentiated from the more resistant white and bur oaks by leaf characteristics. Leaf edges of reds and blacks have pointed tips; leaf edges of white and bur oaks are more curved and without points.

Host Symptoms. Red and black oaks are extremely susceptible to infection by the oak wilt fungus. Most die rapidly. Few, if any, recover. As commonly seen in June or July, leaves in the periphery of the upper crown wilt first, cure slightly, and pale to bronze or brown from their margins inward. Leaf symptoms progress rapidly downward through the crown. Leaves at all stages may defoliate prematurely. Occasionally, brown to black discoloration can be detected in the outer sapwood ring of a cut branch. Vessels, tightly plugged with tyloses, also can be seen with a handlens or microscope. Disease diagnosis can be confirmed in the laboratory by isolation of the fungus pathogen in pure culture from infected host tissues. Trees infected in late summer or fall may not develop symptoms until leaves begin to expand in the following spring.

White and bur oaks appear less susceptible to initial infection and resistant to subsequent disease development. Although some infected trees die the first season, many live for several years with more branches dying each year. Crown "stagheading" results. Some trees even recover. Their cambium remains active and lays down healthy wood over the infected annual ring, "burying" the infection.

In the current annual ring, initial infection is limited to arcs originating at the entry point of the fungus pathogen. Wilted and bronze leaves soon develop on branches with vascular connections to these infected areas in the trunk. The crown "symptom pattern" discloses the progressive development of the disease within the tree. Vessel plugging and dark brown streaking of outer sapwood are limited to infected arcs and associated branches. Premature defoliation is seldom heavy.

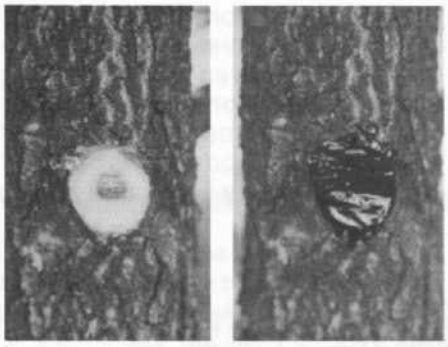
Disease Spread. The fungus pathogen is carried from infected oaks to healthy oaks in two ways. First, insect vectors contaminated with spores from sporulating mats infest fresh wounds where infections begin. Later, the fungus is drawn through root grafts from infected to adjacent healthy oaks. Present control depends on preventing such initial infection and subsequent spread.

Root grafts often unite red and black oaks growing within 50 feet of one another. Root grafts are less common among white and bur oaks, and rare, or not at all, between roots of members of the red and white oak groups. Root grafts are natural "pipelines" among adjacent oaks for water

and nutrients—but also, unfortunately, for the fungus pathogen. When vascular plugging reduces upward transpiration in an infected tree, the fungus is drawn through grafted roots into adjacent healthy oaks. New infections begin. An expanding oak wilt "pocket" of dead and dying trees results. In mixed oak stands, white and bur oaks may escape this "tree-to-tree" spread of the fungus among red and black oaks.

Insects, especially "picnic" beetles (sap-feeding nitidulid beetles) carry spores from fungal mats on infected oaks to fresh wounds on stems and branches of healthy oaks. Such wound infections on single scattered trees may initiate new infection centers in healthy oak stands.

Control.* Avoid initial infections through fresh wounds. Oaks are particularly susceptible in the spring and early summer, especially from budbreak to full-leaf expansion. Occasional infection through fresh wounds may follow summer rains. Consequently, prune and remove oaks during the winter. If spring or summer wounding does occur, protect wounds against spore-bearing insect vectors by prompt and thorough wound treatment with thick paint or wound dressing.



A fresh, flush-cut—vulnerable to infection (left). The cut on the right was painted immediately and thoroughly to prevent infection.

Sever root grafts. Sever either mechanically or chemically, root grafts connecting healthy trees to infected trees. A series of "barriers" among adjacent healthy oaks may be necessary since some trees beyond the first barrier may be infected already. Various mechanical equipment can be used to cut roots underground. Grafted roots can be severed chemically by soil fumigants (Vapam). Killed root sections block spread of the fungus.

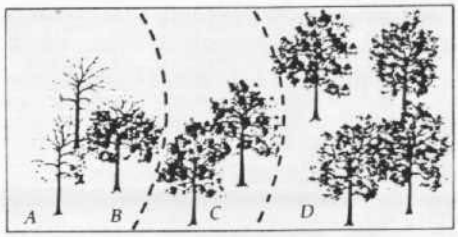


Illustration of a typical oak wilt "pocket," showing where barriers should be put. (A) Oaks killed by wilt. (B) Oaks with current symptoms. (C) Oaks without symptoms but near diseased trees (may already be infected). (D) Healthy oaks permitted by two rows of barriers.

Reduce mat formation by drying infected wood. Completely girdle the trunk base through the outer sapwood of diseased red and black oaks. Girdling hastens bark and wood drying which reduces or prevents fungus mat formation. Avoid moving infected materials,

When girdling diseased trees, cut deeply into the heartwood as shown.

including firewood, into areas free of oak wilt. Even where oak wilt is present, infected firewood should be dried rapidly. Cut, split, and stack off the ground as a single tier in a dry, open, sunny area. If possible, remove the bark. Protect from moisture.

In remote "roughs" where individual trees are of less value, local spread of oak wilt can be stopped by **creating a barrier of poisoned trees** around the oak wilt pocket. Root kill is essential. Removal and drying of infected material will improve control.

Meanwhile, continued research suggests that disease resistance may be found even among red and black oaks. Moreover, systemic chemotherapy may prove helpful in aiding the recovery of infected oaks, especially bur and white oaks.

*For details, see University of Wisconsin-Extension Circular A1693, Oak (**Quercus**) Disorder: Oak Wilt.

*Editor's Note: Jim Kuntz retired from the Plant Pathology Department in December of 1984, but in his position as Emeritus Professor he has hardly slowed down. Known for his exuberance for the study of plant diseases (this editor enjoyed having Dr. Kuntz as a lab instructor in PP 300, **many** years ago!), he continues his research on walnut canker, wilt and seed rot.*

Dr. Kuntz received a B.A. degree from Ohio Wesleyan in 1941 and both M.S. and Ph.D. degrees from Wisconsin in 1942 and 1945, respectively. He achieved international recognition for his contributions in the study of the oak wilt disease. He also has made major contributions in the general area of urban forest problems, those kinds of diseases of major concern to Golf Course Superintendents.