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USGA GREEN SECTION RECORD

A Publication on Turf Management
by the United States Golf Association

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Dr. Howard B. Sprague accepts award from Harton S. Semple, President of the USGA and Elbert S. Jemison, Jr., Chairman of the USGA Green Section Committee.

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1974

Green Section Education Conference

"Managing Turf In The 70s"

Howard B. Sprague

14th Recipient of USGA Green Section Award

Dr. Howard B. Sprague of the Pennsylvania State University, University Park, Pa., has become the 14th recipient of the USGA Green Section Award for "distinguished service to golf through work with turfgrass." Dr. Sprague accepted the Award during the Annual Green Section Conference on Golf Course Management at the Biltmore Hotel, New York City, on January 25, 1974.

Dr. Sprague has headed the Department of Agronomy at Penn State since 1953 and is Chairman of the Plant Science Division. He is a Fellow and past President of the American Society of Agronomy, and he has had an active career in other professional and scientific organizations. His special fields of interest include plant physiology, plant nutrition, plant breeding, ecology of crop plants, crop production, soil fertility and management, grassland agriculture, management of grazing lands, grounds and land management at military installations, and turfgrass management.

He was a pioneer in the study of *Poa annua.* His bulletin, issued at Rutgers University in the early 1930s on the life habits of the species, was an exceptional contribution to the literature. Dr. Sprague also contributed bulletins on turfgrass nutrition, the role of lime in turfgrass production and experiments on golf turfgrasses applicable on a national scale. Among his many contributions, perhaps none ranks higher than his discovery of the pH factor in the management of fine turfgrasses. He was among the first to recognize the potential of the turfgrass industry, and he was instrumental in establishing a strong turfgrass program at Rutgers University, New Brunswick, N.J. Rutgers has been a national leader in this field.

Dr. Sprague has written over 50 professional and scientific papers as well as three recent books dealing with agronomics. His most recent book, *Turf Management Handbook*, is a basic work written for the homeowner. It is a book whose importance will grow as we increasingly appreciate the role of turfgrass in our environment.

Born in Cortland, Neb., in 1898, Dr. Sprague's name added to those of past Green Section Award Recipients brings it ever greater meaning and significance in the field of turfgrass management for golf.

The Energy Crisis:

Golf Course Implications

by J.R. WATSON, Vice President, The Toro Company, Minneapolis, Minn.

Editor's Note: Although Dr. James R. Watson did not participate in the 1974 Green Section Educational Program in New York in January, his following paper is of such timeliness and importance to the subject, "Managing Turf In The 70s," we are compelled to include it with the proceedings of the day. Dr. Watson originally presented the paper at the Michigan Turfgrass Conference in January, 1974.

The most important bit of advice I can give about the energy crisis and its implications for golf courses, in my opinion, is "stay cool." I know you've been hearing the same from others, but when they say "stay cool" they are asking you to cut back on heating. What I'm suggesting is that you maintain your objectivity and not let the uncertainty and confusion that has built up these past six months stampede you into the abandonment of sound, normal management practices. And, don't be an alarmist and don't spread unfounded rumors! Check your facts and read with care.

There is no present source of information available to tell us how much oil there is in this country, what amount is coming in, and what our real shortage, if any, may be. The lack of qualified data has led to confusion and uncertainty, but there are some hard facts and opinions borne out by the experience of others. We may use this to arrive at sound judgments.

What we must do, I feel, is assess the short-term implications of the energy crisis and deal with them. We can and should prepare long-term contingency plans for future emergencies, but let us first turn our attention to measuring the problems we have here and now. This action will help to provide a base for the preparation and development of solutions for long range problems.

How important are fuel costs to golf course superintendents across the country? The Toro Market Planning Department conducted a survey of a number of superintendents whose courses range from Florida to Washington State.

The answers were most enlightening, and they confirmed a long held view of mine—that golf course superintendents, because of the very nature of their business, are excellent planners. They realize that one must utilize all of his managerial skills to anlayze each maintenance operation. Fuel costs, they informed us, make up only 2 to 3 per cent of the total golf course

budget, and even in those instances where the cutback in fuel supplies was as high as one-fourth of pre-crisis deliveries, the superintendents canvassed foresaw few major problems in continuing a high level of maintenance for their courses.

Unless the supply situation becomes so critical that the country must resort to rationing, these men see no reason for major modification or alteration of their normal operating procedures.

The one certainty we can look for from the energy crisis is an increase in play on our golf courses. Recreational travel—whether by car or by plane—has already been affected. That means the green areas close to home—the parks and the golf courses—will get the brunt of the recreational traffic. Heavier play will put greater stress on fairways and greens which can only be countered with good maintenance practices and careful planning of all operational activity. I'm sure you already see where I am leading you: the energy crisis, at least for now, presents **not a threat to the golf courses and other recreational facilities but a real opportunity to provide more service than ever before to the members and users of all turf facilities.**

Far too frequently we accept the first, pessimistic view of a problem. Too few of us try to look at the situation from more than one angle. We are familiar with the man who tells us his cup is half-empty. We must learn to remind ourselves that the cup is also half-full.

IT'S HOW YOU LOOK AT IT

A shift in your point of view can sometimes work wonders. My son Rick told me a story a few days ago that demonstrates that thesis beautifully. Ezra was a farmer, as his father had been, and his grandfather before that. One day Ezra did a most untraditional thing—he went to see his local banker about a loan. The banker asked if Ezra were in trouble? No—just wanted to borrow some money. The banker allowed that this was possible, but he couldn't understand why. They had never loaned money to Ezra's father or grandfather and he was surprised that Ezra needed money. He felt he should explain that when a bank loaned money it charged interest and required "collateral." Ezra said he understood, so the banker asked how much money he needed. "One hundred," said Ezra. Somewhat taken aback, the banker said, "Well, we take our interest out first and you'll get only $92, since the interest rate is 8 per cent. Did Ezra need $100?" No, the $92 was satisfactory, and he produced a certificate for 1,000 shares of General Motors stock as collateral.

The banker protested that this was much greater than was required. Ezra insisted that the certificate be accepted and held until he paid off the loan in a year's time. The loan was consummated.

The banker was highly amused at Ezra's naivetè and told the story around town. Soon it got back to Lucy, Ezra's wife, and she was furious. That night she told Ezra he was the laughing stock of the community. Whereupon Ezra said, "Now Lucy, you just let them laugh. Last year that banker charged me $25 to keep that certificate in the bank's vault!"

Ezra sets us a fine example of creative problem-solving. And there is a continuing need to exercise this type of ingenuity. But fuel costs and prices, at this juncture, do not appear to constitute a serious enough problem to call on the Ezras among us for ingenious solutions to the energy crisis. A straightforward, simple approach seems to be all that is called for.

SOME REPLIES

Let me quote some of the replies we received in our survey to the question: What effect has the energy crisis had on your course? A man in Pennsylvania said his fuel supplies had been cut back 25 per cent since last September. He had already revised his maintenance schedules, and he felt confident that his crew could accomplish everything that had to be done with 75 per cent of last year's fuel supplies that he had been promised.

A Florida superintendent operates close to 150 pieces of gas-powered equipment. He's getting 15 per cent less fuel, but he has had no problems thus far.

If supplies should be cut further, or rationing instituted, what would they do? Most of those responding said they would reduce the maintenance of the rough areas and work to continue the normal operations on tees, greens and fairways. Should the situation tighten even further, they would consider altering the mowing frequencies and fertilizer applications on fairways and roughs. They would also look for alternate power sources.

The common thread that runs through all the reports was that labor costs far outweigh fuel costs. Over the past several years, the most rapidly rising cost factor on the golf course has been labor. Don Ward, Superintendent of the Pine Tree Golf Course at Boynton Beach, Fla., offers a dramatic case history. A few years ago he had a 12-man crew which he has been able to cut back to nine men with the use of sophisticated equipment. Don pointed out that a 10 cent hourly raise for his crew adds $3,000 a year to his budget. Excess fuel costs amounted to one-third this sum. Labor savings,

Dr. James R. Watson (right) and James Moncrief (left), Southern Director, USGA Green Section, discuss the energy crisis during the recent GCSAA International Turfgrass Conference, Anaheim, Calif.

Don concludes, are more important than rising fuel costs.

TO CONSERVE FUEL

Nevertheless, there are a number of things golf course superintendents can do to conserve fuel. The first of these is to select the most efficient piece of equipment for each job. Generally, reel mowers and sickle bar mowers are more efficient than rotary or flail mowers. The scissors action of the reel not only cuts better but requires less power. Data developed by our engineering division show several significant points with regard to equipment selection and fuel consumption. For example, a 70-inch reel mower is capable of cutting a 70-inch swath of grass with a 6.25 horsepower engine, while a rotary mower uses a 14 horsepower engine for a 60-inch width of cut. With the same mowing speed, reel mowers will use up to 50 per cent less fuel per acre of cut grass than rotary mowers. The number of blades in a reel not only affects the quality of cut, but also the fuel consumption. A 5-bladed reel will use 8 to 12 per cent less power and fuel than a 6-bladed reel. However, determining the quality of cut for a given area is something only the superintendent can do, so it is up to him to decide if he can take advantage of this fuel-saving opportunity by using fewer blades on the reels.

Let me say again that it is more efficient to use one large piece of equipment than to use two or more smaller mowers. The riding greensmower can cover a given area in the same time that it takes three to four walk greensmowers. While a 9-gang fairway mower—although it uses 5 to 10 per cent more fuel than a 7-unit machine—will increase mowing capacity by 20 per cent. I hardly need to remind you that clean, properly adjusted equipment, and sharp blades, require less power and therefore less fuel. But perhaps you have not thought of some of these mowing practices that could also save fuel:

Plan mowing patterns that require the least amount of transport between locations.

Use the least amount of overlap consistent with the skills of your operators.

By selecting the height of cut best suited for each area, you may be able to increase heights, particularly in the roughs, and thereby add one or two days to your mowing cycle.

We are truly fortunate to have in this country more than 11,000 golf courses. That network is, in my opinion, a national treasure, one that will increase in importance to the people of this country as we move further into a new age. The energy crisis provides turfgrass managers with their greatest challenge and their greatest opportunity in years. The production and maintenance of good turfgrass facilities can only grow in importance, for those facilities are a vital and necessary part of our way of life.

SUMMARY

In summary, the energy situation does not appear to have reached crisis levels in so far as golf course operations are concerned at this time. Superintendents must "keep cool,"

remain objective, and not become alarmists. The following statements summarize the energy crisis implications for golf courses:

Increasing costs—materials, supplies, labor.
Delays in delivery of products, parts, whole goods and supplies.
Few actual shortages.
Exceptions: Some petro-chemical products.
Operating costs increasing.
Labor highest cost item in budget and offers major opportunity for relief of budgetary pressures resulting from increased costs.
Labor-saving equipment a critical consideration and need.
Fuel costs: 2 to 3 per cent of total maintenance budget.
Fuel Cutback: 10-25 per cent.
Some course layouts being changed to accommodate high capacity equipment.
Changes in working hours to fit car pools and other transportation schedules.
Increased play and more intensive use of *all* turfgrass facilities.
Management. Critical need for improvement of all managerial talents.
Necessary to recognize that turf facilities are economic entities and their investments and operating decisions must be predicated on sound business judgment.
Opportunity: Increased challenges and increased opportunity for all involved with turfgrass.

The Superintendent In The 70s

by **CLIFFORD A. WAGONER,** President GCSAA

Since my subject refers to all the 1970s, this discussion will review where we are now, our future, and what kind of programs the Golf Course Superintendents Association of America has and will have to help the superintendent in the years ahead.

It is my opinion, after serving six years on the GCSAA Executive Committee and visiting golf course superintendents in all sections of the country, almost all superintendents are seeking ways to improve their knowledge. The large turnout at local, regional and national seminars and conferences is an example of the quest for information. Many turn to the USGA agronomist, to agronomists in the universities, as well as to fellow superintendents.

The period of the early 70s has seen a number of superintendents enter the field who have graduated from turf management schools. The evolution from greenkeeper to golf course superintendent has been slow but steady. The 70s will see this accomplished. The new pressures that have been heaped on the superintendent by federal and state regulations will probably start those in the profession searching for a new title, one that better describes his position. This might already be in the making, because one of the GCSAA surveys taken during the development of the Certification Program indicated that there were 99 titles used by superintendents of clubs (property manager, golf supervisor, outdoor operations man). A high percentage of these titles in use indicates a definite trend toward the suggestion of management.

Today's golf course superintendent's responsibilities can be divided into three categories which are scientific, managerial and technical. This will not apply to all situations because of the variations of the organization at each club. Some golf facilities have sufficient activities to employ a managing superintendent (companies owning more than one golf facility), but the average club seeks a superintendent with the ability to manage and yet possess the scientific and technical skills necessary to produce a good, playable golf course. Contract maintenance may become more prevalent in the late 70s.

In February, 1972, GCSAA recognized 47 golf course superintendents who had completed all the requirements of the newly adopted Certification Program. This program was developed to give the golf course superintendent who chose to become involved the opportunity to gain additional recognition. The program requires a superintendent to be a Class A member of GCSAA for three years and successfully complete a six-part examination. The six sections include questions on the

THE GCSAA dedicated its new Headquarters Building in Lawrence, Kansas, on January 12, 1974. Present for the ceremonies were nine past Presidents and the current Executive Committee of the GCSAA.

following:

1. The Golf Course Superintendents Association of America—its purpose, history and activities.
2. Game of golf and the official rules.
3. Turf managing procedures and all related aspects.
4. Pesticides; State and Federal regulations will require this very soon.
5. Business administration—budgets and recordkeeping.
6. Other management skills; human relations, recruiting, training and supervising personnel, and public relations.

To-date, 157 golf course superintendents enjoy the designation of "Certified Golf Course Superintendent."

The vocabulary of the 70s was broadened to include Occupational Safety and Health Act, Environmental Protection Agency and the Energy Crisis. Each of these has required major adjustments in maintenance, and even now the full impact is not known.

In every case the superintendent has reached out to get the information necessary for him to perform his duties. Coupled with the energy crisis is the money crisis. It has been around a long time, but again seems to be rearing its ugly head most prominently in the last year. In a

recent discussion with the Club Managers Association, monthly dues figures of up to $210 were discussed. It was concluded that, at most clubs, this would exceed what the membership would be willing to pay. In our area there has been an annual increase in cost of approximately 7 per cent for golf course maintenance, and the other departments' costs are comparable.

The energy crisis this year alone has increased the cost of our fuel 25 per cent, fertilizer 50 per cent to 100 per cent, utilities 15 per cent, freight and transportation charges 10 per cent. The list is endless. If the superintendent is to check the cost and avert even higher costs, he must analyze his schedules, purchase and service equipment efficiently, work closely with the club professional and manger, be ready to present a program to the governing body that will provide good playing conditions, and yet check the money crisis and conserve energy.

The early 70s has seen competition develop among clubs to provide fence-to-fence turf made possible by highly sophisticated irrigation systems. These systems never allow turf to cycle from saturation to wilt. Clubs have required that turf be mowed daily and at extremely low heights. Most golf superintendents will welcome the opportunity to develop realistic programs aimed at growing healthier turf and ridding themselves of the spiral of competition. Along with the restriction of energy for maintenance equipment, we may also find a reduction of power to run golf cars. The decisions that lie ahead must be based on the total good for club operations. Along with his ability to manage course maintenance, the superintendent must have a general knowledge of all club operations so that he is capable of understanding the need for compromise, particularly during the energy crisis.

GCSAA will take an active part in preparing the superintendent for the 70s by making programs available to him in order to improve his skills and knowledge. The new GCSAA Headquarters Building is located in Lawrence, Kans., and was dedicated January 12, 1974. Our education programs at the International Turfgrass Conference will reflect general management practices. The equipment show will feature the newest equipment with special interest placed on items that meet OSHA specifications—safety, noise, etc. GCSAA Seminars will be on current topics. The next one planned will be on pesticides, but our program will be flexible and will accommodate needs.

The Certification Program will be emphasized and publicized both to the golfer and the superintendent. The 70s may see qualifications for superintendent employment to include requirements of being certified. A consultant has been engaged to advise GCSAA and their Chapters of EPA legislation. Our periodical, *The Golf Superintendent,* will continue to carry timely articles and conceivably will expand "The Thinking Superintendent" feature for an exchange of ideas. Information brochures are in the making, and we are presently collecting energy-saving ideas that will be published shortly. The Association will expand its membership, and the programs offered will benefit more clubs. The Association will continue to support research at leading universities. Young people will be encouraged to come into the field through a program of scholarship grants to deserving turf students.

The Golf Course Superintendent of the 70s has no choice but to take advantage of every possible tool which is available to broaden his knowledge. The competition from other departments in the club, the competition from other sports for the recreation dollar make it mandatory that the golf course be in top condition at all times.

There are conflicting opinions of how the energy crisis will affect play on the course. It is my opinion that golfers will use their facility more often and that many new people not now playing regularly will begin in earnest. This, coupled with a possible reduction of energy and a slower economy, offers the golf course superintendent a real challenge.

Hopefully, the 70s will bring about the realization that the superintendent must have executive, as well as scientific and technical skills. Many times it has been said "The golf course superintendent is the most important person on the staff of a club. He is in charge of the only asset we have to sell—the golf course." I wholeheartedly agree.

The USGA Green After 15 Years

by **R.L. DUBLE**, Texas Agricultural Experiment Station, Texas A&M University

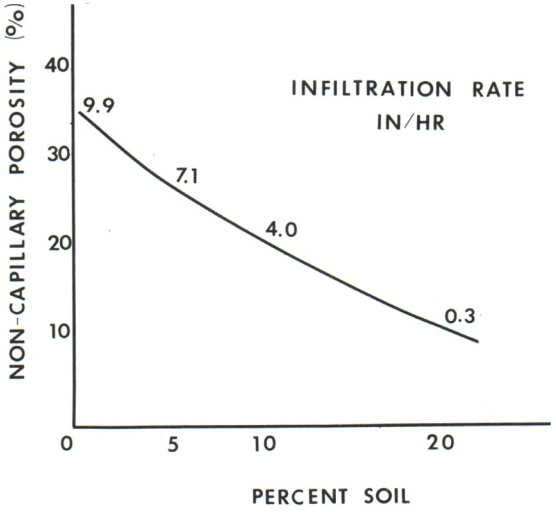
The area of soil mixtures for golf green construction has been extensively researched in the last 15 years. The USGA Green Section may be largely credited for initiating and supporting research work in this area. Specifications are based on research evidence collected during the 1950s were first published by the Green Section in 1960. These specifications, when followed by a contractor, resulted in golf greens that were tolerant of heavy traffic and were manageable with respect to water and nutrients. Modification of the specifications by the architect, the contractor, or the superintendent usually resulted in greens that were difficult to manage. John Madison, turf researcher at the University of California at Davis, stated in an article on USGA golf greens that "given the USGA specs for green construction, 90 per cent of the people would feel they could make changes and improve on them."

The USGA specifications were not proposed as the final or ultimate solution to green construction. Rather, continuous upgrading of the specifications was a part of the original plan, and research on methods and materials for green construction was continued. Increased interest in golf created heavy traffic on the nation's overcrowded golf courses during the 1960s, and construction of new golf facilities soared. Automatic irrigation systems added to the compaction problem associated with traffic, since greens were often overwatered. This combination of wet soils and heavy traffic reduced the quality of turf on many golf greens. The Green Section Staff became concerned that the original specifications may not be adequate to carry this extra traffic load and still maintain playability under wet weather conditions. Observations of greens constructed with a sand-organic mixture in place of the sand-soil-peat mixture suggested that a higher infiltration rate might be desirable in green mixtures, particularly for bentgrass. Also, contractors complained that installation of the 1½ inch layer of coarse sand between the gravel and the soil mixture was too expensive and time consuming to include in the specifications.

Research was initiated at Texas A&M University in 1970 to investigate soil mixtures with higher infiltration rates, requirements for a sand layer above the gravel, and nutrient and water retention capacities of high sand mixtures. This research was supported by the USGA Green Section Research and Education Fund, Inc.

The components of the USGA green include medium and coarse textured sand, organic matter, clay or clay loam soil, pea gravel and tile drains. The pea gravel is spread over the tile drains and subsoil which has been graded to correspond to the desired finished surface. The pea gravel should have a minimum depth of four inches. A 1½-inch layer of coarse sand is spread over the gravel. The medium textured sand, organic matter and soil are mixed uniformly at a ratio described by the USGA Soil Lab at Mississippi State University and placed over the coarse-textured sand layer. Early specifications described a soil mixture of sands were examined in combinations with peat and soil. Sand textures for golf green that had a ½ to 1½ inch-per-hour infiltration rate after compaction. However, slight errors in mixing or in calculations could result in greens with an infiltration rate of less than ½ inch per hour. In order to find mixtures that resulted in greater infiltration rates but that held adequate water and nutrients, quantities and qualities

FIGURE 1.



mixtures have been studied by several workers. David Bingaman, at Purdue University, established that size, shape, and distribution of sand particles are important criteria for evaluating sands for golf greens. Dr. Ray A. Keen, at Kansas State, found that ¼ to ½ mm diameter sand provided greater root development, better playing surfaces and had more latitude for management than coarser textured sands. Dr. J.M. Duich, at Penn State, notes that different combinations of particle sizes may be used to achieve the same results, but that the voids or pores must not be plugged. Dr. John Madison, at California, concluded that fine- to medium-textured sands with a narrow size distribution were best suited for golf green mixtures. With this information at hand a medium textured sand with most of the particles ½ mm in diameter was selected as a reference material, and coarser and finer textured sands were included for comparison (Table 1). Golf greens were constructed in the laboratory and in the field with 70, 80, 85 and 90 per cent sand by volume; 20, 10, 5 and 0 per cent clay loam soil by volume; and 10 per cent peat moss by volume, respectively. The profiles were compacted, planted and maintained for several years. The coarse textured sand was very close to establish a turf and resulted in a drouthy golf green profile. The fine textured sand (most of the particles between 0.1 and 0.5 mm in diameter) was fast to establish, but the profile held excessive water and remained soggy or became very hard after drying. Infiltration rates were very low on mixtures with 20 per cent soil and on the fine textured sand profiles (Table 2). All mixtures using the Lakeland sand had infiltration rates of less than 1.0 inch water-per-hour and held excessive water. If this type of sand were to be used, the depth of the profile would need to be increased to 16-18 inches. Although the type of soil included in the mixture had little apparent influence on the infiltration rate, the clay or clay loam soils increased the water and nutrient retention of the profile. Also, the well aggregated soils, such as the Houston clay loam and the Lake Charles clay, are less likely to migrate or move through the profile than the soils with a weak structure.

Table 1. Size distribution of the three sands included in the investigations.

Particle size (mm)	Concrete[1] sand	Brick[1] sand	Lakeland[1] sand
5-2	20	0	0
2-1	15	5	0
1-0.5	31	30	5
0.5-0.25	24	53	40
0.25-0.10	6	12	45
0.10	2	0	10

[1] Commercial washed and screened concrete and brick or mortar sands.
[2] Native soil.

Likewise, soils high in silt or very fine sand particles are undesirable from the standpoint of particle migration. The medium textured sand (brick sand) produced excellent quality golf greens with 80, 85 or 90 per cent sand; 10, 5 or 0 per cent soil and 10 per cent organic matter. These greens were covered six weeks after sprigging bermudagrass or eight weeks after seeding bentgrass, moisture retention averaged greater than two inches of available moisture and filtration rates ranged from four to nine inches per hour. Such greens could be played immediately after a heavy rain, yet held enough water to support growth for three to five days after irrigation. Measurements of available water showed that the perched water table created by the USGA layered profile increased available water by 20 per cent in the 12 inches of soil mixture.

Measurements of bulk density and porosity indicated that the surface few inches of soil suffered most from compaction. The surface layer of mixtures containing more than 10 per cent soil became very tight and water movement through the layer became negligible. Mixtures that contained 5 per cent soil, 85 per cent sand, and 10 per cent peat moss were ideal from the standpoint of porosity and water movement. In all examples studied the percentage of non-capillary porosity, which functions in water movement, decreased as the percentage of soil in the mixtures increased (Figure 1). The greens constructed without soil, 90 per cent sand and 10 per cent organic matter or 100 per cent sand, were very high in non-capillary porosity but were very low in capillary porosity which is important in water retention. In other words, the total porosity of the mixtures did not change appreciably (41-44 per cent) with changes in per cent soil, but the size distribution of the pore space changed greatly. Again, all evidence suggests that 5 to 10 per cent soil with a medium textured sand is ideal with respect to water movement and moisture retention.

Table 2. Infiltration rates (hydraulic conductivity) of undisturbed golf green profiles.

Sand—Soil components	Sand — Soil — Peat Ratios 7-2-1	8-1-1	8.5-0.5-1	9-0-1
Concrete sand—Houston clay loam	1.1	3.8	2.5	10.0
Brick sand—Houston clay loam	2.1	3.2	4.0	9.0
Brick sand—Norwood silt loam	1.0	3.5	4.0	9.0
Brick sand—Lake Charles clay	3.0	5.1	6.5	9.0
Lakeland sand—Houston clay loam	0.1	0.2	0.4	1.0
Lakeland sand—Norwood silt loam	0.1	0.3	0.4	1.0

Although the nutrient retention of the high sand golf greens are much less than native soils, mixtures containing as little as 5 per cent soil and 10 per cent organic amendments have adequate nutrient storage capacities for golf greens. Mixtures with 10 per cent soil had slightly greater nutrient holding capacities, but 20 per cent or more soil was necessary to significantly increase nutrient retention. However, such mixtures were undesirable from the standpoint of water movement through the profile. Nitrogen and potassium are the most readily leached plant nutrients; however, slow-release formulations of nitrogen that meet the requirements for turf are available. Ureaformaldehyde, IBDU and Milorganite are all excellent N-sources for golf greens with a high sand content. Less than 10 per cent of the N applied from these sources at rates of two to three pounds N per 1,000 square feet is lost through leaching (Table 3). Nitrogen release from a combination of these materials can be calculated to meet the requirements of bermuda grass or bentgrass turf. As much as 40 per cent of the applied N from inorganic sources such as ammonium nitrate may be lost through leaching. Although potassium is also leached from the soil mixtures, it can be readily replaced by bi-monthly applications of K_2SO_4. Many sands contain enough K-minerals to supply the requirements with only infrequent applications of K fertilizers.

The final phase of the re-evaluation of the USGA Green Section specifications involved the requirement for the 1½ inch coarse sand layer between the soil mixture and the gravel. Golf greens with and without the sand layer were constructed in the laboratory and in the field. Measurements of nutrient and water retention, infiltration rate and particle migration showed that the sand layer was not essential if materials of the right size distribution were used. However, if the sand used in the soil mixture was too fine, or the gravel too coarse, the layers did mix and the perched water table was destroyed. In all of the profiles, grass roots, clay, and organic matter helped to stabilize the soil particles and prevent their movement into the gravel. At the conclusion of the investigation, the soil profiles were dissasembled, and where medium textured sand and pea gravel were used, a very sharp boundary was found between the soil mixture and the gravel, both with and without the coarse sand layer.

A possible alternative to the layer of coarse sand between the gravel and soil mixture, a fibrous mat approximately 1 mm in thickness, is being investigated at Texas A&M University. The mat is less expensive and requires less time to incorporate and is more effective than the sand layer. It creates a perfect boundary between the two layers of materials, prevents clogging of the gravel, and does not interfere with water movement.

In summary, the most important considerations include the size distribution of the sand particles, the texture and structure of the soil, the nature of the organic amendment, and the size of the gravel. The sand must have the majority of its particles between 0.25 and 1.0 mm (16-60 mesh). Ideally, the majority of the particles would be in the range of 0.3 to 0.7 mm in diameter, but more practically, less than 5 per cent particles greater than 1.0 mm and no more than 20 per cent particles less than 0.25 mm in diamter. The soil should have a clay or clay loam texture and a well aggregated structure. Such soils require shredding and screening prior to mixing with the sand. Soil aggregates should pass a ¼ to ⅜ inch screen. The organic amendments should be finely divided, largely organic, and should increase the water and nutrient retention of the mixture. Also, the organic amendments, such as gin trash, wood chips, sawdust, and rice hulls should be well rotted or composted prior to incorporation in the greens mix. The pea gravel should range from ¼ to ⅜ inch in diameter. If larger gravel or crushed rock is used, a layer of pea gravel will be required prior to adding the soil mixture. Also, if fine sand is used in place of medium sand, a layer of coarse sand between the pea gravel and soil mixture will be required.

The success of the Green Section method of putting green construction is dependent not only upon proper selection of materials, but also on proper mixing and handling of these materials. Precautions must be taken to mix the materials uniformly in the recommended ratio and to see that the layered profile is not disrupted by equipment.

Table 3. Leaching losses of nitrogen (N) and potassium (K) from golf greens fertilized at 3 lbs. N and K per 1,000 square feet from various N-sourcse and K_2SO_4.

Soil Mixture			N-losses (% applied)					K-losses (% applied)
Sand	Soil	Peat	Ammonium nitrate	Urea	Ureaform	Milorganite	IBDU	(124 days)
(% by volume)			(30 days)	(27 days)	(50 days)	(47 days)	(50 days)	
100	—	—	38.0	13.5	5.9	3.6	7.5	50
90	—	10	31.5	10.0	5.0	4.0	8.0	65
85	5	10	30.0	10.0	5.0	2.1	6.5	50
80	10	10	26.7	8.2	3.5	1.5	5.0	45
—	100	—	11.2	0.5	2.2	0.7	1.9	20

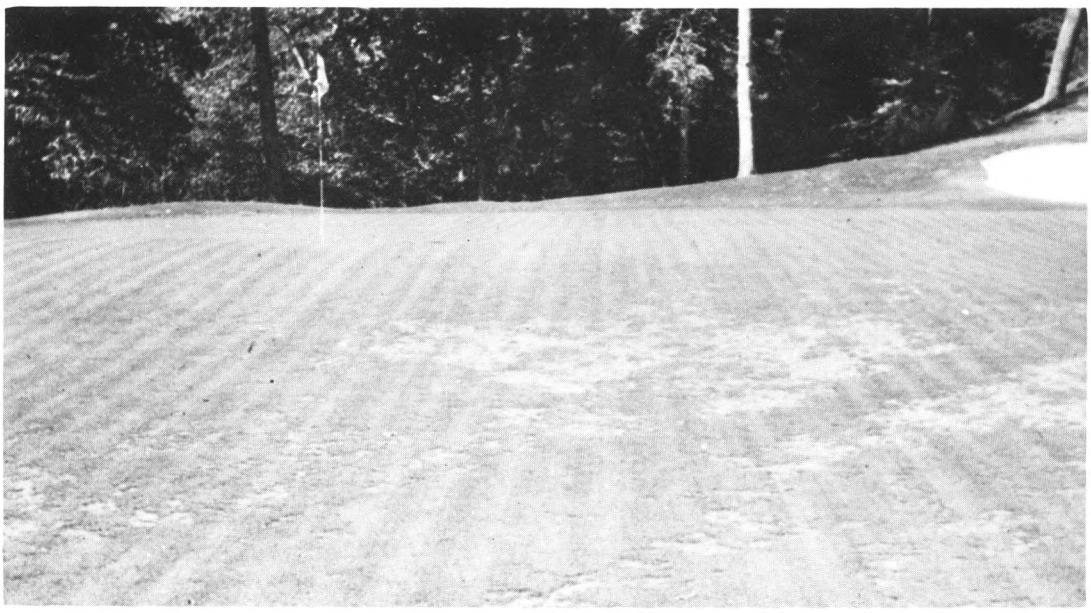
Periodic cleaning of main drain lines may reduce flooding problems.

The Turf Management Picture in 1973 As We Saw It

Panel Members: **WM. H. BENGEYFIELD,** USGA Green Section, Western Region.
JAMES B. MONCRIEF, USGA Green Section, Southern Region
ALEXANDER M. RADKO, USGA Green Section, Eastern Region
LEE RECORD, USGA Green Section, Mid-Continent Region
Moderator: **HOLMAN M. GRIFFIN,** USGA Green Section, Middle-Atlantic Region

GRIFFIN: Let's start off by asking our panel members what kind of turf management year 1973 was. What might have been done to prevent serious turfgrass problems last summer and what we might look forward to in order to improve management in the future.

RADKO: For the Northeast, 1973 was a year of extremes. We had extreme humidities, extreme heat, excessive rainfall and that combination is pretty tough to overcome and to avoid turf problems. With heat alone, we can fare quite well through the season. When there is heat plus humidity, it takes a lot of good management to make it go. But when you have rain added to the other two, then you've got some real serious troubles. Our types of soils are unable to handle the heavy tropical-type rainfalls we had last summer. As a result, the heavy rains brought into sharper focus the drainage problems of past years. With standing water on our turf, there is no way to avoid trouble at higher temperatures. Therefore, the big problem this year was concerned with main drain lines. Many were not of adequate size to



Pythium strikes again. One of the most difficult of all diseases to control, pythium is now found throughout the United States.

handle the tropical-type rains we experienced.

GRIFFIN: Adequate drainage is then the problem that was high-lighted in the Northeast this summer. What were some of the problems in the West last year?

BENGEYFIELD: Our greatest problem, 12 months year in and year out, is that of golfer traffic. We have courses that will average over 300 rounds per day every day of the year!

During the past year, we also found a greater interest from Green Committee Chairmen during our visits, and if you want to gain someone's attention, start talking about money. Because labor costs are continuing to soar, a good deal of time was spent last year in reviewing and discussing the use of labor-saving equipment. With labor costs still accounting for up to 70 per cent of the total budget, any device that will reduce labor requirements deserves consideration and study today. Unfortunately, many clubs are not taking advantage of new equipment developed by the manufacturers. We tried to highlight these equipment developments:

1) Labor saving attachments for three- or four-wheel scooters are now available, including fertilizer spreaders, spray tank, and boom and top-dressing spreaders. With the fertilizer spreader, for example, one man can fertilize 18 greens in less than one hour's time. With the spray rig attachment, one man can cover 18 greens in less than three hour's time whether it be fungicides, insecticides, herbicides, iron or liquid fertilizer. With the top-dressing attachment, top-dressing is again practical.

2) There is also increasing interest in going from seven-gang fairway mowers to nine-, 11- and even 13-gang fairway units. Labor efficiency soars. There seems to be renewed interest in pull-type fairway units rather than the hydraulic machines. And more superintendents are showing interest in the direct-drive mechanism to the reel rather than the wheel-gear-driven linkage.

3) The use of triplex putting green mowers for tee maintenance is definitely on the increase. It is a tremendous labor saver. The use of mechanical bunker rakes has been very well accepted, and many clubs are even changing the style and contouring of their bunkers to accommodate this piece of equipment.

4) The use of chemicals is on the increase for control of grass growth at tree bases. With labor costs up, it is difficult to justify the hand trimming of all tree bases every week or so.

5) Look for wider use of dyes and paints on bermudagrass fairways where ryegrass overseeding has been the practice in the past. With ryegrass seed prices skyrocketing, the dyeing technique is receiving considerable attention. There is a tremendous saving in costs and the playing quality of the golf course is not damaged in any way. From an appearance point of view, the dyes or chemical paints are not bad.

GRIFFIN: Well, two points have been made; that of traffic on the golf course and drainage. Monty Moncrief and Lee Record, what are your comments regarding the past growing year.

RECORD: In the mid-continent area, many

of our members want to play golf early in the season, before good growth is underway. When you have heavy play and bentgrasses are not responding because of cold, wet weather, you are going to have problems. Low temperature records were set in the Chicago area last May. We had similar growing problems from Cleveland through Detroit, Minneapolis, and into Iowa last year.

I think we are sometimes too color conscious in our turf management efforts. We try to have things too green too early. Good turf can still play well without being deep green, and it would probably be able to withstand traffic better. On courses where an effort was made for early spring greenup, they seemed to have more mid-summer problems.

Turfgrass diseases were a serious factor. In many of our areas, we could not control *Helminthosporium* on greens or other turfgrass areas.

GRIFFIN: So you would say that drainage, disease and traffic were all problems in mid-continent. What happened in the South last year?

MONCRIEF: Just name it and it happened to us! We experienced snows in the Mid-South where we have never seen snow before. Heavy rains up to 15 to 20 inches a day. A considerable increase in insect activity was most noticeable throughout the South and in the Caribbean Islands. The Southern pine beetle has moved in, and they're going to be worse than ever with a mild winter. Once a tree is infested, it is best to cut it down and haul it away as soon as possible.

GRIFFIN: I'm glad, Monty, that you mentioned the increased problem from insects. In the Mid-Atlantic area, they have really been on the increase during the past two years when mild winters have occurred. Insects have been out in force with Japanese beetles particularly active in the Washington, D.C., area. We are somewhat at a disadvantage in the Mid-Atlantic area because of the chemicals we are permitted to use.

MONCRIEF: We have had a record number of tornados in the South as well. At Athens Country Club, Georgia, we lost over 300 trees to tornados.

GRIFFIN: I don't suppose you would want to tell us what to do about tornados?

MONCRIEF: RUN.

GRIFFIN: Are the superintendents in your area having problems getting chemicals to fight insects, diseases or things of that sort?

MONCRIEF: So far we have not run into any great or serious shortages of insecticides or fungicides. It looks like fertilizers may be the chemical in shortest supply in 1974. This means the superintendent must become more concerned with his soil and soil types on the golf course property. Soil tests and their proper interpretation will be very important.

RADKO: The EPA is taking a harder look at chemicals of lasting residual. We are therefore being forced to use insect control chemicals with little residual effect. This is going to effect our budgets in the coming years. Chlordane at reduced rates can still be used, but the grubs are reportedly developing a resistance to it and this is going to be a problem in the future.

RECORD: Cutworms have been a serious problem for us. They can do a great deal of damage in a short period of time on a putting green. With the newer chemicals such as Diazinon and Sevin, we may find it necessary to increase the scheduling of applications in order to control these pests. Some have tried newer chemicals at recommended rates and reports have been received of a burn or slight singe to the turf. Superintendents are concerned by this. Insecticides must often be applied when temperatures are in the80-85degree range. We need more information and experience with the newer materials before we use them on a wide scale.

GRIFFIN: In Virginia we have had no problem in getting insect control chemicals as yet because the Virginia Turfgrass Council has gone to the State Legislature and had some influence in writing the regulations reasonably. Basically, the available chemicals have been doing a pretty good job for us.

BENGEYFIELD: With the acitivity of the EPA and possible scarcity of supplies and equipment, it seems the superintendent will have to anticipate his needs to a far greater degree than ever before. Instead of running down to a supply house for a case of chlordane or equipment parts on an "as needed" basis, greater planning and storage may be needed to insure turf management efficiency.

GRIFFIN: Do you see any differences between granular and liquid insecticide effectiveness?

RADKO: I think it depends on the type of insect you are going after. In the Northeast, the hyperoides weevil seems best controlled with granular applications.

Another point in grub and beetle control is the proper timing or planning of applications. If you wait too long to get into a good program or if you overextended the residual effectiveness of an insecticide, a sufficient number of grubs may develop. By mid-summer serious damage may occur. If you try to spray them out at that time, you may be wasting your time and money. You may discourage them a little but, you will not get the control you would through a good preventative program. My point is, if you're on a regular program, you can stay ahead of the grubs and not permit them to get

ahead of you.

MONCRIEF: We are getting much better results with nematicides injected into the root zone for nematode control. They have a residual effect of one to two years and give good control of nematodes on fairways, tees and greens.

GRIFFIN: In Virginia this year, I visited a course that had just treated fairways with diazinon and have never seen more grubs on the surface in my life. They were almost as thick as my thumb. They were dying by the thousands and it was not the place to be at the moment.

Dr. J. Callahan, at the University of Tennessee, has found granular chlordane to be unsatisfactory in control work on sod webworm. In fact, it kills some of the natural predators of sod webworm. He suggests using liquid chlordane rather than the granular form.

RECORD: When we fail to grub-proof fairways and rough areas for many years, grub populations increase. Many courses may now need a new grub-proofing program.

In the Chicago area, there are clubs reporting a nematode problem on greens and it is associated with a type of *Helminthosporium* we can't seem to control. Dr. Joe Vargas at Michigan State is working on the problem as well as pathologists in Illinois. Control with Dasanit at 3 lbs/1,000 square feet is suggested with two applications needed; one in the early spring and the other in early summer. This can do some damage to turf when cut at 3/16-inch to 1/4-inch as well as to your health. If used, it may be necessary to keep everyone off the golf course for two days.

GRIFFIN: There is a proposed Federal Law that will require you to stay out of any area treated with certain chemicals for one or more days depending on the chemical.

Regarding nematodes, we seem to hear more and more about them each year.

RECORD: Dr. Don White, at the University of Minnesota, did a detailed golf course study in that State and found nematode populations on most every course. I don't know if they were beneficial or detrimental types.

MONCRIEF: Nematodes are more a problem in our area along the Gulf Coast.

GRIFFIN: What about some of the other chemicals such as systemic fungicides? Are they being widely used?

RADKO: Yes, they are being used and to good advantage, but we must learn how best to use them. With any fungicide, its smart business not to use it exclusively, and this is particularly true with the systemics. They should be alternated with other types of fungicides for best results.

GRIFFIN: Dr. H.C. Couch, at VPI, recommends the use of no more than six ounces of any systemic fungicide in a year. He finds a slowdown in grass growth from their use. By going to heavier rates, we may be playing with a loaded gun, especially if a nitrogen fertilizer is used to speed up growth. This type of back and forth growth worries some of us. It's like walking a tight rope. The systemics have also been reported, by Rutgers University, as causing small, yellow circles on greens. They find this is caused by basidiomycetes. These might be cleared up by alternating another fungicide such as Daconil with the systemic material. Daconil is the only one I have heard about that checks the problem. Dr. J. Vargas, at Michigan State, also suggests using systemic and contact fungicides alternately.

RECORD: When something is new, we jump right on it. This has been the case with systemics. Many courses have gone to their use exclusively, but I think the best program is a well balanced one between contact and systemic fungicides.

We have a cool season rhizoctonia which seems to be cropping up more and more. In Minnesota and Colorado, we have found cool season pythium activity. New pathogens seems to be developing with greater frequency. But with common sense, good cultural management practices and the wise, judicious use of chemicals, we can probably bring most of these diseases under control.

GRIFFIN: We probably never will have any one broad spectrum fungicide that will work on everything.

MONCRIEF: Regarding strains of pythium, a three-year survey in Georgia and throughout the South has turned up 22 specific pythium species. We used to think there were only three or four. The researchers also found these things will move from a dormant stage to an active stage in 55 minutes when all conditions are right.

RADKO: We did have pythium activity in the Northeast as well this year. However, proper identification is important. Sometimes, a real severe dollar spot attack will be confused with pythium.

GRIFFIN: I don't think we can really identify a disease or even a strain or variety of grass with the naked eye. There are too many similarities.

Bill, can you tie in the activity of diseases with golf course construction and design?

BENGEYFIELD: The turf disease problem in the West is not nearly as intense as it is in other sections of the country. But without any doubt, good drainage is of the greatest importance in golf course design and construction. Good air drainage, especially across greens, is all too often overlooked or completely neglected by the architect.

Where nutrients are adequate, disease can be reduced. Here, an overlap of fertilizer resulted in sufficient nitrogen and dollarspot was eliminated (dark strip with knife).

RECORD: During the last several years, many clubs have become interested in fairway renovation and developing bentgrass as well as bluegrass fairways. It is an appealing idea. However, a new word has entered our vocabulary in turfgrass management; i.e., "inconvenience." The best time to carry out renovation is when it is most inconvenient to the golfer. Mid to late July is the time to begin. The project should be started early enough in order to accomplish the job properly. By waiting too late in August, labor problems, weather problems and other difficulties hinder the job.

MONCRIEF: Pre-treated seed for overseeding greens has done a great job. It is money well invested. The greens get off to a good start and the need for reseeding is greatly reduced. Different fungicides are being used in combination formulated by the different seed companies.

GRIFFIN: Weeds and weed control is our next subject. In my area, goosegrass, silver crab or hard crabgrass—they are all the same thing with different names—is the greatest weed problem I find. What is yours?

RADKO: Silver crabgrass is the toughest. But the past year brought out many more weeds than ever before due to the stress to the turf. The weed seeds were there waiting to grow anytime that weaknesses in the turf stand occur.

BENGEYFIELD: In addition to the usual weed problems, we have some unusual ones as well. Veronica for example, is a serious problem in the Northwest. We have *Paspalum distichum* increasing on courses in Northern California. In Southern California, some exotic weeds exist and kikuyugrass is the best example. It's a tough one and each year seems to gain more territory. Control is extremely difficult and actually achieved only through methyl bromide and soil sterilization. It forms a poor golfing turf because of its heavy, coarse and thatchy nature. It can spread by seed, stolons or rhizomes, and in spite of some considerable research, it seems to survive all attempts at chemical control.

We also have sand dropseed, a bunchy, weedy-type grass that survives in areas where there is low fertility and low irrigation levels. It can be controlled with the arsenate materials if one perseveres.

Spurge or milky purslane is another weed we come upon quite often.

RADKO: On spotted spurge in greens, the phenyl mercuries have done well for us, but the applications must be very carefully applied. One ounce of PMA plus no more than 1/5-ounce of 2,4-D per 1,000 square feet will

work. But it must be stressed, the work must be very carefully done and at the proper time. Otherwise, bentgrass injury may result.

RECORD: *Poa annua* is our biggest weed problem.

MONCRIEF: The best control for weeds is good grass. Good cultural practices will do much in a weed control effort. Our biggest problem is with silver crabgrass, *Poa annua* and regular crabgrass.

GRIFFIN: We have a wide divergence of opinion on the Green Section Staff regarding the use of tricalcium arsenate in turfgrass management. These differences are undoubtedly due to the wide variation in climatic and soil conditions under which we have seen it used. Let's have some comments on this matter.

RECORD: Dr. Bill Daniel of Purdue University has encouraged the calcium arsenate program. We have learned from his experiences. Throughout the mid-continent, many golf courses are on a tricalcium arsenate program. I recall one particular club last year where tricalcium arsenate was applied to fairways in June because of the wet and cool spring season. When heat and moisture stress came along in July, out went all of the *Poa annua.* Since these were bluegrass fairways to begin with, there was little chance to reseed them with bluegrass in July and this became a serious dilemma. On another course where tricalcium arsenate had been used for years, they have gradually been able to change their fairways to bentgrass turf. However, last summer they wanted to find out what level of arsenical material was in their soils in order to properly plan for the future. When tests for the aresenical materials were made at Purdue, no more than one-fifth of the total arsenical applications could be accounted for. Where did the material go since it is supposed to be insoluble? It is a difficult subject and we do not have all of the answers. The success of a calcium arsenate program depends to a large part on the superintendent. How much does he want to gamble? The program does take a good man; a strong man and a very educated membership to make it go.

GRIFFIN: We have seen success with tricalcium arsenate. The secret seems to be to put it on with a teaspoon not a shovel. It can be a very useful tool in our area.

RADKO: Yes, it has been successful, but over the years we have found that you're going to have to take your chances with any preemergence herbicide. We have been impressed with the use of calcium arsenate on small test areas in the Northeast for several years. The rates used are far lower than those being applied in the mid-west. The reason calcium arsenate is a good tool is that in fairway renovation work, something must be used to suppress *Poa annua.* As we know, Poa can come on very fast and can wipe out the entire renovation effort, and so we have seen good results with sensible applications of tricalcium arsenate.

BENGEYFIELD: We should first determine on what area of the golf course we are using tricalcium arsenate. If you are speaking mostly of fairways, tees and possibly certain approach areas—then I think it is a very effective and good material. But if you are talking about its use on bentgrass putting green turf and collar areas, the risk is far greater than a wise superintendent should be willing to take. For example, on a Western golf course last year, tricalcium arsenate was applied to 18 greens at the recommended rate in the fall of the year. By mid-winter, when this particular golf course receives its heaviest play, greens were not in good conditoin. The *Poa annua* was under stress and in some areas completely dead. The owner of the golf course was concerned and sought advice. One of the recommendations made was that he must "keep the faith." His reply was that he did not mind "keeping the faith" but first had to "keep the play." The point is, tricalcium arsenate on greens or anywhere can be very dangerous and embarrassing. In my judgement, the risk is not worth the possible gain. There are other ways of controlling *Poa annua* on greens.

RADKO: Well, in our area very few are using this material on greens. Its primary use is in fairway renovation work. There are so many variables involved with it that one must indeed be careful.

BENGEYFIELD: Yes, as more and more research is accomplished with the arsenical materials, we find soil and climatic influences so pronounced that the response is not always predictable or dependable. I think that's a point we should not overlook.

RECORD: In looking ahead to 1974, I'd like to suggest you can always add but you can't take away. This year will be the year to add light amounts of material from time to time to get us where we want to go.

GRIFFIN: We have touched upon many subjects and yet have many more we could go into. But our time has expired and I want to thank you all for your attention.

RADKO: Holman, before concluding, I would like to mention the importance of research and the efforts being made today by the O.J. Noer Foundation, the GCSAA Research and Scholarship Fund and the Green Section Turfgrass Research Fund. These agencies are working in cooperation with each other and through research, we will continue to make progress in turfgrass management.

GRIFFIN: Thank you, Al, and thank you gentlemen.

WHY TOP–DRESS?

Following are three important discussions on top-dressing techniques you will want to review. They are particularly concerned with putting green practices and the important role of top-dressing in good turf management. (Editor)

by **CARL SCHWARTZKOPF,** Mid-Continent Agronomist, USGA Green Section

To be sure we understand what is meant by top-dressing, let's start with a definition. Top-dressing is the application of a thin layer of soil or prepared soil mixture to a turfgrass area. Top-dressing is used to smooth and level the putting surface and/or modify the soil condition under the turf when used in conjunction with coring. It is an excellent help in restoring turf quality.

The need for and value of applying top-dressing should be determined by its usefulness in rejuvenating turfgrass. It may be essential to top-dress some greens that have been subjected to winter damage in order to restore putting surfaces that have become uneven due to winter play and frost action. When play or frost has been severe, several top-dressings may be required to get the turfgrass areas, especially greens, in top condition. When turf has become thin because of disease, insect injury, or loss of annual grasses, top-dressing is necessary. When the turf is thin and slight surface irregularities have a pronounced effect on the putting quality, top-dressing is needed. When preparing bermudagrass greens for winter overseeding, top-dressing is important.

Top-dressing has been proven very successful in renovating turf that has become stemmy or matted. Prior to the application, it may be helpful to power rake, vertical mow, or groove the turf. Where surface compaction is a problem, a regular program of coring and top-dress-

Mechanization is making more frequent and more accurate top-dressing possible and at reduced labor costs.

ing has been used to build a layer of improved soil under the established turf. But top-dressing will not permanently improve or correct poor turf resulting from poor surface drainage or other built-in problems. Top-dressing can require expensive soil mixes and can be time consuming. Therefore, it is advisable to use good judgment in determining where and when top-dressing can be used effectively. Although an exception to the rule, conditions exist where greens have been well constructed and established with a good strain of grass and have not been top-dressed in the last 28 years. Good day-to-day care has kept these greens in very satisfactory playing condition.

The quantities of material used and the frequency of top-dressing must be adjusted to the requirements of each green. If a single top-dressing application will not produce the required improvement or desired results, then plan on several applications. Heavy, uneven applications will cause severe injury; minimum quantities of material must be used when the turf is thin. Heavy top-dressing applications should not be used because there is not sufficient grass to stabilize the material that has been applied. Applications of top-dressing are usually made at three to four-week intervals. In sections of the country where summer temperatures are high, top-dressing should be limited to very light applications or discontinued until cooler weather prevails. During the spring, some Golf Course Superintendents top-dress with a dark colored material to absorb daytime heat and initiate growth when the evening temperatures and soil temperatures are still low. However, top-dressing with a dark colored material is not advisable for the newer greens that have a high sand content because of the likelihood of a layering or strata condition developing.

There are other benefits of top-dressing as well. These include thatch control, improved water and nutrient utilization, protection against winter injury, alleviation of compaction, and control of grain.

Let's spend just a moment looking at each one of these benefits in detail:

A—**Thatch Control:** With increased fertilization, vigorous varieties of grass soon form a spongy layer of thatch or mat. The light applications of top-dressing material intermixed with the plant material help to minimize the thatch or mat buildup. Top-dressing applications also encourage new microbial activity that breaks down the thatch and/or mat and converts it into valuable organic material.

B—**Less Disease:** The thatch, or mat, is an ideal environment for pathogenic organisms and undesirable insects. With a proper top-dressing program used to control thatch and/or mat, disease and insect activity is minimized.

C—**Improved Water and Nutrient Utilization:** Since top-dressing checks thatch and mat from accumulating by separating the plant residues, tight turf matting is prevented. Therefore, it is possible for air, water, fertilizer and chemicals to infiltrate the soil profile.

D—**Protects Against Winter Injury:** Top-dressed greens have fewer problems from desiccation and related forms of winter injury. It is believed that top-dressing protects the crown of the plant from the winter's drying winds and varying temperatures.

E—**Alleviates Compaction:** Greens that have been top-dressed have better "holding qualities" for the golfer. The top-dressing material physically supports the grass plant, thereby absorbing compacting forces. Top-dressing helps develop resiliency on heavily-played greens.

F—**Controls Grain:** Certain cultivars of grass, whether bentgrass, bermudagrass or *Poa annua*, will be more vigorous, more inclinded to be prostrate than others. Light top-dressing will help encourage upright growth and discourage grain.

Materials and Make-Up

by STANLEY J. ZONTEK, Eastern Agronomist USGA Green Section

With today's traffic and player demands, more thought than ever must go into the type of soil used for top-dressing greens. It would be a mistake to top-dress and not know what makes up the material you are using. As pointed out earlier, top-dressings can do much good for greens. However, top-dressing with the wrong type of soil can also do harm, especially with layering of a heavier soil (with high percentages of silt and clay) over a lighter soil (high sand content). The top-dressing soil should first be tested regardless of whether you make it yourself or purchase it premixed or custom blended. A mechanical anaylsis can easily be done by almost any state university for only a few dollars. It will yield a wealth of information that would otherwise be only a guess. I have heard it said, and I have said it myself when making top-dressing, "this soil looks pretty good." But what exactly is, "looks pretty good?" A mechanical analysis will tell us.

New matting equipment reduces manhour requirements and provides smooth putting surfaces.

A mechanical analysis will only tell us what the particle size distribution is, i.e., the percentages of silt, sand particle sizes and clay within the mix. It will not tell us what type of soil to use. This depends on the type of greens in question and what you would like to accomplish with the top-dressing program (thatch control, southern winter overseeding, etc.). Basically, there are two and perhaps now three categories of top-dressing soils to use on greens. Remember, the type of greens that you have and what you want to do with them will determine what category of top-dressing soil to use.

1—**Good Greens From Their Original Construction.** In this case we should continue to top-dress with the same soil mixture with which the greens were originally constructed. We don't want any layering caused by a different top-dressing mixture. In the long run, this could hurt the green. We want the same type of soil used so that the good homogenicity the green already enjoys will continue. This is where a mechanical analysis of the actual putting green soil itself is all-important. If we know what the greens' soil is made of, we can attempt to match the top-dressing to it.

2—**Poor Greens.** Generally the soil in this type of green has excessive amounts of silt and clay. It is hard underfoot, won't take water, suffers from ice damage during the winter and wet wilt in the summer. The turf is usually weak and shallow rooted. We know these greens all too well. They are our failure greens during stress periods in both the cool and warm season grass areas. If the situation is not completely intolerable, and if a diligent top-dressing program is followed using the right soil mixture, properly applied top-dressing may be an alternative to the work and membership inconvenience of reconstruction.

In this case, we would want to top-dress on an especially diligent program with a very sandy, well-drained soil. In essence, we are trying to build up a good soil profile on top of the poor one. The sandy soil mixes are basically the same as the soil used in the Green Section Specification green. We are essentially trying to build up a USGA type green *on top* of the old green. In some cases, this program may help save certain greens.

3—Recently some turf managers have felt that they could correct poor greens by frequent, light top-dressings with a "dirty sand,"—sand that contains a very small amount of silt and clay.

It is a critical procedure, and its success depends to a large extent on what type of "dirty sand" is actually used. The objective is the same: to build up a better soil profile for grass growth. Some work in this line is being tried now, both in the field and in universities.

To summarize; if you buy commercially available top-dressing soil, or if you make your own, have it and your greens tested. A mechanical analysis will determine exactly what you are using as well as what makes up the original putting green soil. With this information, a better understanding and decision can be made regarding your top-dressing mixes and program.

Don't be afraid of the sandy types of top-dressing soils, i.e., those containing 70-85 per cent mason's sand, 5-8 per cent silt and clay, and 10-20 per cent organic matter (peat or humus). These soils are indeed a tremendous departure from the old 1-1-1 mixes of sand, soil and peat used a few years ago. But in recent years, dramatic changes have taken place in golf. With heavier play and increasing golf course demands, turf management procedures and programs have also changed. Better top-dressing techniques and better putting green construction are but a part of your success in "Managing Turf in the 70s."

Top-Dress—But Don't Smother

by **WILLIAM C. BUCHANAN,** Eastern Agronomist, USGA Green Section.

When we consider the topic "Top-dress But Don't Smother," the question arises "How much top-dressing can be applied before the grass becomes smothers?" The answer may well depend on exactly who is being asked. A light top-dressing to one individual may be considered heavy by someone else. To avoid this type of problem, we should concern ourselves with specific amounts of material applied to a given area. In addition, we must concern ourselves with the intervals between top-dressings. The frequency of top-dressing applications is just as important as the amounts applied.

Top-dressing, like fertilization, is best applied at light and frequent rates throughout most of the growing season. Top-dressing applied four times a year will give superior results to two applications, even though the same amount of material is applied. Generally, top-dressing is done in the spring, the fall, or perhaps during both seasons. This timing is used to help grasses overwinter in the cool-season regions, and help with overseeding and growth in the warm season areas. The point we would make here is that turfgrasses can also benefit from top-dressing on a three- to four-week interval throughout the growing season, as well as in the spring and fall.

It is difficult to estimate the amounts of top-dressing being applied by guesstimating the thickness of the soil layer on the putting green surface. Some of the material will filter through the plant leaves while the rest remains on the top of the plant. Therefore, the following chart will offer amounts of top-dressing to be used per 5,000 square feet of putting surface in order to judge the amounts of top-dressing being applied to a particular area. These figures will be given in cubic yards of material per 5,000 square feet of putting surface:

Cubic Yards per 5,000 sq. ft.	Inches Depth on Green
.9 to 1.0	1/16
1.9	1/8
3.9	1/4

If your greens are larger or smaller than 5,000 square feet, add or subtract .4 cubic yards for every 1,000 square feet over or below the 5,000 square foot figure.

With these figures in mind, top-dressing can be planned and applied on an accurate, knowledgeable basis. Once the desired amounts of material are known, calibration of the top-dressing spreader becomes the last requirement. With proper calibration exact amounts can be applied. Proper calibration of the new, scooter mounted top-dressing machines can make top dressing economically feasible again. This enables us to top-dress more frequently and use less material per application.

To illustrate, assume Superintendent Greenfield is initiating a top-dressing program. He has decided on the proper mixture and the amounts he wants to apply. His figures show his requirement will be about four cubic yards of material per green per year. He now is seeking the best results he can obtain from his top-dressing program. To realize these results, we suggest applying top-dressing four times during the coming growing season at a rate of slightly less than one cubic yard per 5,000 square feet. Thus, he would be able to apply his programmed four cubic yards of material throughout the growing season. Superintendent Greenfield will benefit more from this program than by applying the same amount of material in two applications. Of course, making one application at four cubic yards per 5,000 square foot green would not be good management. At the heavier rates, soil layers will form in the profile and there is a danger of smothering the turfgrass.

We realize top-dressing has been and still is an expensive procedure. Nevertheless, when it is done right, and with the assistance of new, efficient machinery, the cost per application is lessened and the results will more than justify the expenditures.

Fads And Fallacies

In The Name Of The Environment

by **ROBERT WHITE-STEVENS**, Bureau of Conservation and Environmental Science, Rutgers University

A few years ago Martin Gardner, the mathematical editor of the *Scientific American*, published a book entitled *Fads and Fallacies in the Name of Science* in which he recounted a series of anecdotes, clearly intended to be humorous, dealing with some of the crazy ideas of man, which unconfirmed by experimental evidence or practical field experience, became fads which captured the restless imagination of the people and gathered quite a following, fortunately for but a short period in each case.

Such fantasies usually arise from ignorance and fear of the unknown and establish their credence in prejudice and superstition. In the dawn of man when knowledge was very limited and danger and terror lurked at every moment and place, the only security to be found lay in amulets, charms, magic incantations and rituals and a virtual total reliance and belief in a shaman or witch doctor in whom, it was firmly believed, dwelt all knowledge necessary to cure the sick, to divine the hidden and to control all events to come for the benefit of the true disciple.

As the millenia swept past, these fakirs often regarded by their people as holy men, recognized they had a good thing going for themselves and protected their positions in society in any way they could consonant with preservation of their public esteem and dignity. The fortuitous dice of life fell often enough their way to reassure their disciples, and when the dice fell the wrong way they invariably explained it as the work of evil spirits and would expose a scapegoat in retribution. As intellectual enlightenment followed the ascent of man, he shed these superstitious fears, for awhile rather rapidly during the glories of Greece in the golden age of Pericles, but then he retrogressed for almost 2,000 years into the nightmare of the Dark Ages, once again to emerge into the Age of Reason in the Renaissance.

It was Galileo and his contemporaries who set the feet of men once again on the road to security through intellectual enlightenment. He it was who first recognized that one experiment correctly executed was worth a million opinions, and that one man who knows the facts can withstand the censure of a million who do

not know. Upon this single concept has arisen the vast arena of science, accelerating over the intervening centuries to where it stands today. Yet as Sir Peter Medawar has pointed out, "There is a gathering reaction to science in our time, particularly among the young," who, though happily secure in the munificence with which modern technology has garnished their "brave new world" with food and raiment and pleasure, nevertheless "wring their hands over the few isolated miscarriages of technology, while they take its benefactions for granted"—"and appear to be appressed with a sense of decay and regression—by a fear of the deterioration of the world through technological innovation." Artificial chemical fertilizers and pesticides are said to be undermining their health: the soil and sea are being irretrievably poisoned by chemical and radioactive wastes they are told; while synthetic drugs merely substitute one disease for another, and modern man oscillates continually under the influence of stimulants and sedatives."

This sense of despondency, of helpless incompetence, of suspicion and doubt prevails everywhere, preponderantly among the young people, and they are once again showing distinct signs of retrogression into the former intellectual void of superstition, fear and irrationality. As Sir Peter states "Once again there is a restless ambivalence about philosophical and scientific thinking as if the insufficiency of fact and reason has given a paradoxical validity to nonsense."

FADS THAT ARE FALLACIES

ORGANIC NATURAL FOODS

One persistent, though until recently, rather obscure fad is that foods produced naturally the "organic way" are more nutritious, better tasting, and ensure a longer, healthier life. For many years this belief has lain somewhat quiescent, kept alive by a few "nuts among the berries," but essentially ignored by the well-fed, satisfied and complacent majority. A few obscure magazines have kept the desultory flame alive and a few suppliers have provided the so-called organic foods for the true believers. Within the past few years the demand of organic naturally-grown foods has suddenly exploded, and it is estimated perhaps 1 per cent of the national food dollar or about $500 million is currently spent for organic foods.

Actually, of course, that with the exception of table salt, *all* foods are organic in the scientific term, and all foods with a few exceptions are produced "naturally." There is therefore no scientific definition of "organic" foods. To protect their position, the advocates of organic foods are now attempting to have a standard definition written into Federal law, for as it stands, any farmer, any packer, any distributor can place the name "organic" on any foodstuff regardless of how it is produced and not break the law. In fact, it is suspected by many food faddists that this is precisely what is occurring. The essence of such a law would require that all organic foods must be produced **without** the use of chemical fertilizers or pesticides (and some extremists demand without machinery, either) and that is be processed and handled **without** the use of preservatives, emulsifiers, conditioners, colorings or supplemental flavorings or nutrients e.g., vitamins, unless there are also "natural" and produced "organically.") Such a law is fret with pitfalls and exceptions and will be impossible either to obey or to administer, and will develop into a briar patch of deception, swindle, and shabby fraud.

For, firstly, crop yields of produce will plummet for lack of balanced mineral nutrition and the inevitable ravages of insects, disease, weeds and vermin. Secondly, quality will decline to levels which in many cases will prevent shipment across state lines due to illegal contamination from pest detritus, examples of which include insect eggs, larvae and frass; fungal infections, some of which produce carcinogenic, teratogenic, or debilitating mycotoxins; bacterial contaminants, most of which produce toxins, or in the case of milk, eggs, and meats, frank zoonotic disease readily transmissable to man; rodent hair, urine and feces which also frequently contain infective organisms. Thirdly, the price of such foods will be at least double the present cost and could readily reach four fold.

Fourthly, were such an absurdity to be thrust upon the farmer, the nation would rapidly collapse for want of food, fiber, and shelter. Hunger, destitution and despair would preside and social-political-economic anarchy prevail.

If all the animal manures and human and industrial wastes were to be spread evenly over all the arable lands in America, at inordinate cost, it would provide somewhat less than 15 per cent of the nitrogen, phosphorus and

potash now applied, and this is regarded as not more than 30 per cent of that which should be applied merely to maintain present fertility. From the economic, land management, nutritional, public health and socio-political standpoints organic farming would be a total bust, and the claims of its adherents are not only unscientific, they are irresponsible, ignorant and unthinkable.

There is not the slightest bit of valid experimental evidence to show organic foods are superior to those produced by scientific agriculture, and there are many valid reasons why they are inferior.

FERTILIZER CHEMICALS POISON BABIES AND CAUSE CONCERN

Recently a clamor has arisen that the drinking water of the nation, and much of the crop food, carries excessive levels of nitrate nitrogen, derived from synthetic fertilizers, which produces methemoglobinemia in infants (blue baby) and combining with digested proteins in the human bile forms nitrosamines which in turn induce cancer. Even though the evidence to support both these claims is virtually absent, nevertheless the claim is vociferously promoted by "scientists," who really know better, and eagerly publicized by the press.

In the first place the incidence of fatal methemoglobinemia in infants is so rare as to be approximately equal to fatalities from small pox vaccination, and but a fraction of those from aspirin tablets and penicillin. Furthermore, those which have occurred were traced to well water contaminated with organic manures from animal waste dumps or septic tanks. The incidence of intestinal carcinoma induced from fertilizer nitrate is pure speculation totally devoid of any unequivocal experimental evidence.

Finally, the percolation of nitrate nitrogen from fertilized cropped soils is actually less than from unfertilized cropped soils; while the levels of nitrates in our rivers, even those coursing the intensively cultivated areas of the midwest, are no higher today than they were at the turn of the century when virtually all nitrogen fertilizer was derived from animal wastes.

PHOSPHATE DETERGENTS AND EUTROPHICATION

Although it has largely subsided since the courageous and logical decision of Surgeon General Steinfeld to restore the use of phosphate detergents, the modern eco-prophets continue to intone against their use, aided and abetted by the manufacturers of proposed alternatives and the ubiquitous media.

The fact is that detergent phosphates contribute only about 15-18 per cent of the total phosphorus entering the environment and this total does *not* comprise the limiting factor in eutrophication. Actually carbonaceous residues and nitrogen primarily from municipal and industrial effluents are the major cause of eutrophication. In any case algae are a substantial contributing factor in the demineralizing of effluents and could be so managed as to purify potable waters, produce an animal feed comparable to soybeans, or produce a crude fiber useful for paper board manufacture or newsprint or even produce useful chemicals.

MERCURY AND LEAD IN THE ENVIRONMENT

It has long been known that both mercury and lead are toxic to humans and other vertebrates. Some historians contend that lead was a major factor in the demise of the Roman Empire, because the rich Romans stored their wine in lead flasks, ate off lead-glazed crockery and used lead piping in their houses. This continuous exposure to lead-induced plumbism as it accumulated in the blood-forming centers of the skeleton elicited early sterility and early death. In 19th century America, the people were still overexposed to lead from paint, glazed dishes and lead plumbing; but today such exposure has been substantially reduced. Analyses of human hair, where lead along with several other toxic elements—e.g., arsenic—tends to accumulate show a highly significant decline in lead, some 70-80 per cent, over the past century.

The one form of exposure over which there may be rightful concern, particularly in congested cities, is lead from auto exhausts. However, the tetra-ethyl lead in the gasoline, which is highly volatile and constitutes a hazard to

those who continually inhale it, emerges as heavy, non-volatile lead oxide particulates from the exhaust. Studies in our laboratory reveal such effluvia settle to the ground rapidly within a few yards of the highway. In center cities, however, such particulates can remain suspended for fairly long periods following issue from auto exhausts, and are inhaled by the pedestrians nearby. How serious this really is we are now trying to determine, but regardless of our findings, it is just common sense to reduce this avenue of exposure as much as is feasible.

It must be balanced against the power needs of the people, however, which will be substantially curtailed if no lead at all is to be permitted in gasoline. It now seems probable that a combination of low-leaded gas plus lead absorbers in the exhaust system can meet the tolerances that will be required. There is, of course, the possibility that some non-metalic anti-knock adjuvant will be discovered which is totally degradable and which could be added to gasoline to replace tetra-ethyl lead.

The use of mercury in industry, medicine, dentistry and agriculture has increased enormously during this century. With the development of atomic absorption, analytical equipment assay methods have sharply increased in precision. This has led to determinations of minute levels of mercury in a variety of organisms in the environment. The impetus for such surveys arose as a direct result of several clear-cut cases of mercury poisoning among humans. The most serious of these was the Minimata Bay incident in Japan, where several dozen people developed mercury toxicity from eating fish caught from the bay, into which it was discovered a chlorine manufacturing plant was dumping mercury wastes in considerable quantity. Later, several children in one family in the Southwest developed chronic mercury toxicity which was traced to pork that had been illegally fed stolen grain treated with an organic mercurial and intended for planting. A number of other similar cases have been reported in Canada, England and Sweden. In all cases the mercury contamination was derived either from industry, or treated seeds where massive exposure doses occurred.

Mercury was found at levels of 0.6-1.0 ppm in canned tuna fish and fresh-frozen swordfish. Alarms were promptly trumpted across the press and broadcast media, and for a while sales of both tuna and swordfish were suspended. The FDA set 0.5 ppm of mercury as the tolerance level in foods, and the tuna business nearly collapsed. When it was later determined that tuna and swordfish caught nearly a century ago and preserved as museum specimens also carried levels of mercury from 0.5 to as high as 2.0 ppm, the flurry of public consternation somewhat subsided. But not before both industry and agriculture were thoroughly castigated for polluting the environment with yet another chemical.

The facts are that apart from the isolated and reprehensible incidents such as Minimata Bay, the great bulk of environmental mercury is produced in nature. It is estimated that there are over 300 million tons of mercury in the oceans, to which man has contributed less than 100,000 tons from all sources including gold mining, the biggest source. Evidently man has been consuming mercury in his fish food for millenia, but since he was not aware of it, it did not harm him. Furthermore, Americans carry around in their teeth over a quarter million pounds of mercury amalgam in fillings, which they ingest steadily with their food. Approximately 150,000 pounds of pure mercury is installed annually into human mouths in the United States alone, which does not seem to do them any particular injury.

There is no question mercury is toxic in certain forms, and it can circulate in the environment by microbial conversion to methyl mercury to an extent not hitherto realized. As an element it is completely undestructible and has a half life of virtually infinity. It is also true that a great deal more information on the toxicology of mercury, is needed, particularly on chronic exposure to vertebrates and in combination with other toxic metals such as lead, cadmium, selenium, etc. There is, however, some evidence that selenium tends to antidote the toxicity of mercury, at least within certain limits. Nevertheless, there is no reason to panic over mercury poisoning on the basis of the very skimpy and equivocal evidence of its environmental hazard to date.

AIR POLLUTION

Air pollution in center cities and such traffic-congested areas as the Bos.-Wash., Chi.-Pitt., and San.-San. strips in the east, center and west regions of the country respectively, is a serious economic problem amounting to a cost of upwards of $4 billion per year. Most of the hazard, however, arises from gases which cannot be seen and therefore does not worry the public. Visible smoke on the other hand, disturbs people very much, although most of it consists of solid particles that fall out swiftly.

Some of the eco-prophets claim such will

eventually block-out the sun and induce another ice age, others conversely claim industrial and auto effluvia will create a greenhouse effect from excess carbon dioxide and cause infra-red light to be captured, raise the planet's mean temperature, cause the ice caps to melt and flood every coastal city in the world. One can, of course, subscribe to either theory, but the probability is that neither will occur.

When the Islands of Krakatau, off Indonesia, exploded volcanically in 1883, a 6,000-foot mountain blew 50 miles (261,000 feet) up into the stratosphere carrying over 300 millions tons of ash and pumice, which lingered there for several years before it finally descended to earth. This contamination of the atmosphere was greater than the emissions of all the factories on earth for 100 years, yet it had very little effect on the earth's climate, except for creating brilliant sunsets.

PESTICIDES

There is probably no area of man-made chemicals which has received more vituperative attention from eco-activists than has that of pesticides. Although attacks on these useful implements in modern agriculture, food processing and distribution and in public health management have been made since the inception of pesticides, it was just a decade ago with the publication of Rachel Carson's *Silent Spring* that a furor arose to the level of public

hysteria.

There are few fads in modern science which have encouraged more "shamans" to creep out from obscurity to do business once again at the age-old stands than has the public fear of pesticides. Extravagant claims made in Miss Carson's book and eagerly accepted as fact, were promptly proliferated, magnified and propounded to the multitude to warn of impending doom for man and his environment. Evidence to support many of these claims when carefully investigated was found wanting, whereupon a number of "scientists" fell furiously to work to produce "experimental" data to prove de post facto that Miss Carson was, of course, quite correct in her hyperbolic assertions.

There then followed an astonishing array of so-called scientific papers, some of which were published in journals, the editors of which really must have known better, that "proved beyond a shadow of a doubt" that pesticides, particularly the organo chlorines and specifically DDT:—

- — were accumulating rapidly in the environment all over the planet;
- — were being magnified in concentration and intensity through the food chain to levels toxic to virtually all higher forms of animal life, including man.
- — were killing off fish, mammals and birds at rates approaching extinction for some species.
- — were inducing cancers in man, teratomas in the newborn and mutants in wildlife.
- — were destroying the phytoplankton in the oceans, presaging the death of all ocean life and eventually of terrestial life as well through the breakdown of the oxygen cycle.
- — were inducing subtle changes in the reproduction of vertebrates, particularly birds, through disruption of essential egg shell formation.
- — were creating such violent dislocations of the natural eco-systems as to result inevitably in total catastrophe.
- — were, in short, hastening the inexorable doomsday of mankind and his environment.

As each of these dire predictions emerged, fortified by "scientific evidence," which upon a subsequent more rational analysis was often found to be based on artifactual techniques, invalid statistical reduction and illogical interpretation, the popular press eagerly fanned the flames of public consternation with abundant and sensational coverage.

Conference after conference has been held over the past decade—some in an atmosphere of objective inquiry, but many in an aura of witch-hunting ritual, to assess the available evidence, sift the facts from fancy and issue virtually excathedra reports designed to assess the real hazards extant in the use of pesticides versus the real benefits attributable to their correct use. Curiously it did not seem to make any difference whether the conferees were authentic, qualifed authorities in the fields of chemistry, toxicology, statistics, food technology, entomology, etc. or not. If the issued report favored the original Carson theme, it was hailed as an indubitable confirmation of her divine revelations, and its authors acclaimed as "Daniels brought to judgment"; a conference or committee that failed to hold to the Carson line, and insisted upon reviewing the experimental evidence with objectivity and scientific precision, such were condemned as non-scientists, conspirators with agribusiness, heretics and unbelievers. The general public was ardently persuaded to cast them and their report aside, if not entirely out of the public arena.

Legal hearings and court cases were promoted with much publicity and fan fare, and when the judgment fell to the side of the continued use of pesticides as it invariably did, on Long Island, in Wisconsin, in Washington State, in California and most recently at the seven-month, penetrating, EPA hearings, in Washington, D.C., then these judgments, too, were discarded and obscured by vast clouds of fulminations and generated public clamor.

Considered, objective and completely unbiased conclusions and points of law were submitted by Examiner Edward Sweeney, and DDT was found, within approved registered use, to be no hazard to man or his environment, to be no demonstrated cause of cancer or the demise of wildlife. Rather, on balance it was found to be a distinct asset to man in food, fiber and shelter production and in the maintenance of public health. These conclusions, too, were rejected unceremoniously as contrary to the public weal. Such a decision can only be regarded as made in obeisance to political expediency. It reduced the long tenuous hearings, testimonies, and cross-examinations, and the extensive lists of entered documents to a farce.

The case made against DDT, and by inference its related pesticides, is one that could be as easily fabricated against any compound, any product, any process, any individual or any organization as the principles employed and adhered to so fanatically leave nothing just, nothing secure, nothing sacred. This is Lysenkoism in its ultimate expression, for the actual evidence reveals beyond dispute that when used properly with the recommendations of the approved registered label, DDT:—

The tussock moth (and its egg mass) has caused tremendous fir forest damage in the Pacific Northwest since the EPA withheld use of DDT. The U.S. Forest Service says these forests cannot withstand another year of experimenting with new controls.

- is *not* a carcinogen, a teratogen or a mutagen.
- does *not* suppress the growth of phytoplankton in the oceans.
- has *not* reduced the bird life of any species, including raptors and brown pelicans to the verge of extinction.
- does *not* disperse universally in the environment by solution, by particulates, by evaporation or by organism magnification in concentrations which have any biological significance.
- does *not* persist in the environment indefinitely, but is actually biodegraded by many organisms both micro and macro, plant and animal and by many physicochemical factors as well including light, alkalis, and many mineral salts. In sea water it has a half life of some 15 days.
- does *not* impair egg shell formation in birds of any species, and does *not* affect carbonic anhydrase activity.
- does *not* interfere with the reproduction of any species of plant or animal except invertebrates, and among them it is surprisingly selective at correct doses removing pests without killing many beneficials.

The really astonishing point in this whole fad is that DDT is to be banned because it constitutes a hazard to man's health, yet its use is to be permitted in the event of a serious threat to man's health, for example in the event of a serious epidemic of typhus, malaria, encephalo myelitis, etc. Who is to maintain a substantial inventory in the face of zero sales is not of course considered.

Finally, the denouement of this extraordinary decision is to recommend a substitute for DDT, parathion, which is known to be hazardous and exceedingly dangerous both to man, livestock and wildlife, to persist in both fresh and marine waters as long or longer than does DDT, that is as toxic dermally and via inhalation as it is orally, that has a considerably less effective insecticidal spectrum and yet destroys beneficials at recommended dose levels as effectively as it does target pests. There have already been a large number of recorded deaths from parathion in contrast to DDT for which there is not one single medically annotated human death regardless of dose and despite the fact that at least one billion humans have been exposed to it for over 20 years.

It is clearly predictable that there will be, sooner or later, a tragic accident with parathion which will entail a large group of human fatalities. Who among the vituperative and tenacious opponents of DDT will answer for such a catastrophe. It is a sure bet like the shamans of old they will all look away or seek a scapegoat to protect their position.

At the present time it is hard to predict which way events with respect to pesticides will turn. Industry for one is heartily discouraged and is understandably steadily withdrawing from further investment in research and development of new pesticidal compounds. Research into biological controls though hopeful

and promising in a few isolated cases, is many years from meeting the challenge of total control of even the major pests of the 10,000 which plague man's crops, his livestock, his domiciles and his person. In the meanwhile there are now 208 million people to feed, clothe and shelter in this country alone, and many tens of millions beyond our shores who continue to turn to us for succor. Already the price of food is mounting, and as the pesticide armamentarium is reduced and their use constrained by increasing restrictions and costs, food and fiber prices will continue to rise.

Perhaps a serious of massive epizootics of insects and epidemics of disease among our crops, forests and homes will so incense the public to cause the administrators to reconsider the constraints and restraints they have laid upon the American farmer and let him once again return to his fields and orchards armed with the equipment and chemicals with which agricultural science has provided him. But this will be a grievous price to pay and the impact upon man and his environment will far exceed that fallaciously claimed to be due to the correct use of pesticides by the eco-faddists.

CONCLUSION

Fads and fallacies in the name of ecology, conservation and environmental protection have become rampant among the general public in recent years, promoted by authorities of questionable authenticity and intent. These fads and fallacies are reaching into the Halls of Congress and various state legislatures, and are becoming translated into laws, many of which are so scientifically unsound that they are, in fact, impossible either to obey or to administer. They can lead only to socio-political-economic chaos, or to a sharply declining standard of living for all Americans.

The public **must** be informed of the facts in each case, and the self interests of the vociferous prophets of doomsday be thoroughly exposed.

To effect this, I suggest 12 basic proposals:

1—That legislative decisions on scientific matters **must** be written based upon objective experimental evidence, and not upon unqualified opinions from vociferous self-appointed custodians of the public welfare.

2—That when scientific experimental evidence demonstrates a preconceived eco-activist supposition or assertion to be wrong, it must be given equal exposure to the public.

3—That there is no such thing as a scientific decision by the democratic process—there is no Truth by Referendum.

4—That it is more important to preserve the human life of this world than that of obscure species, many of which are probably en route to extinction regardless of the works of man.

5—That rationality and science require concern over probabilities mathematically delineated, rather than over every imaginary possibility of events that in all probability will never happen.

6—That **all** chemicals are both poisonous and innocuous depending upon dose, exposure route, frequency, and species, and that there is a biological threshold value for every chemical on every species.

7—That one good scientifically executed experiment is worth a million opinions.

8—That there is not the slightest difference biologically, chemically, or physically between two pure samples of a compound, whether synthesized by man or extracted from a natural source.

9—That all foods are "organic" and with but a few exceptions "natural." To claim "organically grown" foods are more nutritious than and superior to foods produced by scientific farming and thereby to justify charging substantially higher prices is a shabby fraud on a gullible and unsuspecting public.

10—That there is no such thing as a "balance of nature" as commonly depicted as a quiet, serene, peaceful and munificent existence for all creatures; that life is a constant struggle for all species in a nature which is "red of tooth and claw," and which provides the arena for the evolution of all species by the "law of the survival of the fittest."

11—That man enters the arena armed with intelligence, a memory, vertical stance and an optic-chiasmatic vision, with which he has exercised his hegemony, for a while at least, over all other living creatures on earth.

12—That the scientific method owes no allegiance to any political party, religious credo, ethical philosophy, ethnic group or material power, that it is simply a procedure of four steps

Observation
Deduction
Experiment
Induction or Prediction

That these steps are totally objective, replicable, calculable, and reliable; what is done with the issuing data and evidence may have ethical, political, or even religious intent and motive, but this does not reflect upon the method itself.

When science is subjected to irrelevant issues, such as fads and fallacies in the name of ecology it is non-science usually abbreviated to NONSENSE.

The Turfgrass Service of the USGA Green Section

Direct turfgrass advisory visits to USGA Member Clubs started in June, 1952. In the 22 years since then, the Green Section Staff has increased to eight specialists, and it has made over 25,000 golf course visits! Every USGA Member Club should be a subscriber, for you have information other clubs need and can use. Why not put this highly trained team to work for you on your course?

Every club subscribing to the Green Section Turfgrass Service receives the following benefits yearly:

1—Several direct conferences with a Green Section agronomist, in this manner:

A—A scheduled half-day, on-the-course consultation, followed by a written report from the agronomist to the Course Superintendent and Green Committee Chairman or club representative. Second visits are available at reduced cost if requested.

B—Consultation with the agronomist at local group meetings and turf conferences.

2—Assistance by correspondence and telephone.

3—A subscription to the USGA *Green Section Record*, dealing with golf turf affairs, six times a year, addressed to the Golf Course Superintendent. (This is in addition to the subscription sent to the Green Committee Chairman in connection with USGA Membership.)

4—A voice in the direction of turf research whose results benefit golf courses. The subscription fee covers all services and expenses; there are no extra charges for travel. (The fee for the Green Section Turfgrass Service is additional to dues for USGA Membership). A list of regional Green Section offices can be found inside the front cover.

APPLICATION FOR TURFGRASS SERVICE OF USGA GREEN SECTION
(Open to USGA Members only)

Date _____, 19_____

Full Name of Club or Course _____

Permanent Mail Address (street or box) _____

Post office _____, State _____ Zip_____

Application authorized by: _____ Title _____

Course Superintendent _____

We hereby apply for the Turfgrass Service of the United States Golf Association Green Section and certify that we are eligible for the class checked below.

We enclose the fee (see schedule below) for the current year ending December 31. The USGA *Green Section Record* is to be addressed to our Golf Course Superintendent (this is in addition to the subscription sent to our Green Committee Chairman in connection with USGA Membership).

This application is automatically continuous from year to year unless interrupted by advance resignation.

Check Proper Class:

_____ Less than 18 holes $250
_____ 18 to 27 holes $300

More than 27 holes:

_____ 36 holes $325
_____ Per regulation course in addition to 36 holes . . . . . $ 75

Please send receipted invoice

Requests to agronomists for second visits will entail an additional charge of $100. For the third or more requested visits within the year, an additional charge of $200 each will be made. Clubs will be billed in October for all additional visits during the year.

TURF TWISTERS

NO LYNCH PARTIES

Question: We plan to increase our rough area and reduce fairway widths this year. When is the best time to "contour cut" fairways and what height of cut would you suggest for the roughs? (Utah)

Answer: There will probably be a lot more rough on American golf courses this year than ever before. The best time to start fairway contour mowing for the grass as well as yourself will be this spring, just before growth starts. As to the height of cut for roughs, we would suggest somewhere between 1½ inch and 3 inches depending on density, type of grass, rate of growth, etc. Within this range, you should be able to get back to it (probably on a weekly basis) before a jungle or lynch party forms.

ON BLUEGRASS FAIRWAYS

Question: What is the best all-around Kentucky bluegrass for my fairways? (Pennsylvania)

Answer: In reality, there isn't—and perhaps never will be—a perfect Kentucky bluegrass. There are, however, many new improved varieties that have superior traits over the common types. All these new varieties have their strong and weak points. For best results, what we must do is to plant a mixture of Kentucky bluegrasses that complement each other. That is, what is one's weak point is another's strong point. When one variety is fading, the other is coming on strong, and vice versa. This blending of varieties sets up a dynamic equilibrium that should result in a good turf year-around.

OR IN BUNKERS

Question: During the playing season, what can I do to keep sand bunkers dry and still adequately irrigate greens and adjacent areas (California)

Answer: It's hard to please everyone, but here are a couple of techniques worth considering. First, of course, is to provide for good internal drainage within the bunker. Install tile lines this spring of necessary. Second, use a type of sand that drains well and does not carry a high percentage of fines; i.e., particle size below .25 mm. Third, raking (especially after irrigation) will usually help dry out the surface sand by mid-morning. Occasional deep raking (with a mechanical sand trap rake) also helps.