

1973

## Spring 1973

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Raymond J. Lukens

T. C. Byerly

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**SPRING 1973  
CONFERENCE ISSUE**

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Spring 1973

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## PLANTING TREES AND SHRUBS THAT WILL ATTRACT BIRDS AND ADD BEAUTY TO YOUR GARDEN

Gunnar B. Jonsson

Nothing looks quite so naked as a newly-built house without some landscape planting. It is much like a room without furniture or a bookshelf without books. We are accustomed to seeing most buildings outside the inner cities with at least some foundation planting; any house without plants seems to be an oddity. Plants contribute much to the aesthetics of every landscape. However, poor planning and planting can, at times, be as bad as having no plants at all. A little forethought and careful choosing can make a great difference in a garden over the years. There are literally thousands of plants available to the average gardener. This article will discuss the planting of some of the more colorful trees and shrubs, in particular those that will attract birds.

Birds contribute to the variety and enjoyment of a garden. In the spring their calls and songs fill the air; in the winter watching their feeding antics can become an absorbing pastime. During the summer months they serve a more practical purpose in helping to rid the garden of insect pests that attack lawns, flowers, and people.

Birds are attracted to shrubs and trees, especially those that bear brightly colored fruits and berries. While adding to the landscape beauty of the garden, various shrubs and trees provide the places where birds can feed, nest, sing, and find protection from their enemies.

Proper landscape design is important not only for garden beauty but also for attracting birds. There are several principles to consider when preparing the garden design. The greatest concentration of birds is found where two types of habitat meet. In wildlife management this is known as an "edge." An "edge" exists naturally where woods meet open fields or is created in the garden where trees and shrubs meet lawn areas. Birds like variety and the greatest variety is found in such "edges." Different shrubs and trees serve different purposes; some provide food, others shelter, and still others both food and shelter. The best design allows for a mixture of plants. However, while one is interested in planting in order to attract birds, care must be exercised not to create an overly-planted jungle. Designing a garden is much like arranging furniture. Each chair, table, or lamp in a room is positioned where it is most useful and where its beauty can best be seen. In a garden plants should be similarly placed where they serve the best advantage. A good rule to follow is to plant the larger trees in the background, medium-sized trees and shrubs in the middle, and the smaller shrubs in the foreground.

Important also in proper designing is to allow adequate spacing. Plants grow not only taller, but also wider. During the years while shrubs are filling out, flowers can be planted to fill in empty spaces. There are many flowers that are attractive to birds.

A third idea essential to an attractive garden is simplicity. To many plants, and especially too many kinds, will make a disorganized-looking garden. In a small garden, it is better to have more of each kind than to have many different kinds.

When is the most ideal time of the year to plant trees and shrubs? Although plants that are set out in the early fall often grow faster than those planted in the spring, thorough planning can be done during the preceding winter months when the leaves of other plants in the garden have fallen.

What plants should be chosen for the garden? The variation of color, shape, size, leaf texture, and flowering is endless. Flowering crabapples, hawthorns, flowering dogwoods, and the Russian olive are small-sized trees that will add year-round beauty to any garden as well as provide food for many birds. Each variety of these trees differs in flower and leaf color. Although these trees drop their leaves during the winter, their shape has an interesting appeal when viewed against the snow.

Shrubs may be picked for either deciduous or evergreen habits. Among the deciduous shrubs, those especially

(Continued on Page 4)

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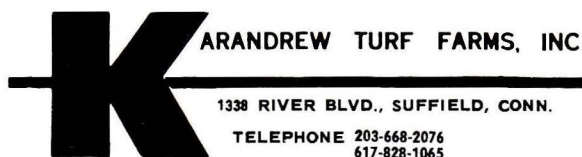
beautiful and attractive to birds are the many viburnums or cranberries; autumn olive with its silvery underleaves and red berries; the popular honeysuckles; and the many shrub dogwoods such as the red osier. Not to be overlooked are the many evergreen shrubs. Some of the best are the hollies, the cotoneasters, and the mahonias. Junipers provide berries and good cover for many birds.

Berried vines, such as the bittersweets, the pyracanthas, and Virginia creeper will add beauty to the garden.

Landscape designing can be a challenge and will bring beauty and birds to your garden. Experimentation can be fun. There are many shrubs and trees from which to choose. Help in designing can be found in the many garden books and encyclopedias. Further suggestions for attracting birds are available from nurserymen and bird societies.

### SOME POPULAR TREES AND SHRUBS

"Cornus" sp.	Flowering dogwoods	White or pink flowers. Prefer partial shade.
"Crataegus" sp.	Hawthorns	Showy, small, flowering trees. Very beautiful.
"Elaeagnus angustifolia"	Russian olive	Silvery leaves, small tree.
"Malus" sp.	Flowering crabapples	140 species available. Small fruits best for birds.
"Amelanchier" sp.	Shad-bushes	Tall-growing. Berries will attract up to 50 species of birds.
"Berberis" sp.	Barberries	Good for hedges. Very attractive foliage.
"Cornus stolonifera"	Red osier dogwood	Red branches. Very colorful against snow.
"Cotoneaster" sp.	Cotoneasters	Small evergreen shrubs. Good for borders.
"Elaeagnus umbellata"	Autumn olive	Tall shrub. Underside of leaves silvery. Bright red berries.
"Ilex" sp.	Hollies	Evergreen, with red fruit. Plant several together.
"Lonicera tatarica"	Tatarian honeysuckle	Bird favorite. Can be grown practically anywhere.
"Mahonia" sp.	Mahonias	Excellent evergreen shrubs. Leaves purple and red in winter.
"Viburnum" sp.	Cranberries	Conspicuous flowers, bright red fruit in fall. Plant several together.
"Celastrus orbiculata"	Oriental bittersweet	Vine, red-orange berries in fall—may be used in vases.



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Reprinted from *Proceedings of Scotts Turfgrass Research Conference, Vol. 2, October 1971.*

## MODE OF ACTION OF THE DISEASE ORGANISM

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Recent contributions to the study of turf pathogens have been substantial. Four processes have been partly described: (a) arrival of the pathogen at the site of infection, (b) penetration of the grass, (c) growth in grass tissue, and (d) build-up of inoculum for an epidemic of disease. In addition to what is known, areas of little knowledge also will be emphasized. An understanding of the mechanisms by which pathogens cause diseases is necessary in order to devise more effective measures for control.

### Arrival of the Pathogen at Infection Site

When disease breaks out in an area, the pathogen is usually not freshly introduced, but is already established. In a new lawn, the source of pathogen is infected soil, sod, or seed. Once the disease breaks out, infected clippings can be distributed by foot, mower or other equipment to uninfected areas of turf. With rust diseases, the fungus is carried in the air.

Turf is a unique crop, and its uniqueness makes it easy for the pathogen to travel to the site of infection. The plants are arranged in a close compact carpet of thickness three-sixteenth of an inch in putting greens to two inches or more in lawns. The entire crop is wetted daily with dew because the vertical arrangement of leaves provides no canopy to prevent the formation of dew on other parts of the plant. Also, the vertical fibrous structure of the carpet is conducive to formation of large amounts of dew.

### Air-borne Inoculum

The common air-borne pathogens are those that cause rust and powdery mildew. Others whose spores may travel by air are the leaf spotting and blighting fungi—"Helminthosporium," "Collectotrichum," "Cercospora" and "Fusarium." Aeciospores of rust pathogens are carried

long distances by air from the alternate host to leaves of grass. Urediospores produced on grass are air-borne also. Conidia of the powdery mildew pathogens are carried by breezes or propelled by rotary mowers and settle on leaves of grass. Stripe smut disease produces a black cloud of chlamydospores which, when propelled by rotary mowers, drifts into the house and is a problem for homeowners.

We have trapped Conidia of "Helminthosporium" from air one foot above the turf, because spores of "Helminthosporium" are large, compared with those of mildew and rust pathogens, the pathogen may travel short distances in the air down-wind from the disease site. Conidia of "Fusarium nivale" are blown by wind from the source of production to new infection centers (Couch, 1962).

Spores are discharged into the air from infected turf when it is dry. Thus, transport of air-borne spores is restricted to clear days from mid-morning to early evening when the turf is free from dew. Moisture on diseased leaves retain the spores and prevents them from becoming air-borne. We do not know if spores borne in moisture can become air-borne upon drying. If only spores that are formed without free moisture become air-borne, spore production and transport will have to be accomplished during the same day. This information is critical in devising a proper schedule for applying foliar-protecting fungicides.

Hyphae of "Fusarium," "Sclerotinia," "Helminthosporium," "Pythium," "Rhizoctonia" and "Colletotrichum," grow out from diseased tissue when the tissue is moist. During epidemics, it is common to find hyphae growing from leaf to leaf on dew covered grass. The extensions of hyphae into the air between leaves may be

(Continued on Page 7)

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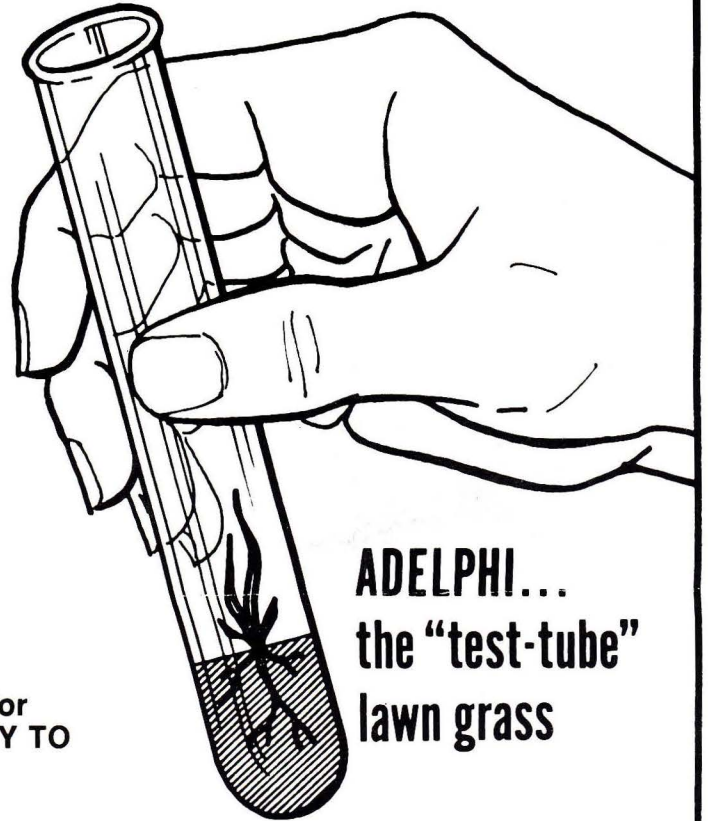
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considered a mode of airborne inoculum over minute distances.

### Water-borne Inoculum

Water contributes to the transport of inoculum in two ways: (1) spores, hyphae and sclerotia are carried to the host by flow and splashing rain drops; and (2) mycelium is encouraged to grow in water films, drops of dew and guttation droplets on the host to uninfected sites. Water-borne inoculum is a major means of transport for turf pathogens.

Spores of "Helminthosporium," "Colletotrichum," "Cercospora" and "Fusarium" may be splashed from the source to uninfected turf. The force of a rain drop, the distance of travel and the importance of inoculum traveling in splashing drops of water are not known. Such information may be important in choosing the size and speed of water droplets when irrigating turf.

Fungi grow and move in a water environment on sod. Zoospores of "Pythium aphanidermatum" swim in films of water to uninfected turf to cause grease spot disease (Kraft and Endo, 1966). "Rhizoctonia solani" grows saprophytically in moisture on turf. Drops of guttated water at the ends of cut blades are important in brown patch disease (Rowell, 1951). Wet turf is important for mycelium of "Helminthosporium vagans" to invade the crowns of bluegrass in spring (Couch, 1962). The requirement of soggy turf for snow mold diseases is indicative of the necessity of a water film for the pathogen to reach the grass.

### Refuse-borne Inoculum

The distribution of contaminated clippings and soil over turf by foot or implement occurs when sanitation procedures become lax. Both Pythium blight and melting-out diseases have appeared in streaks on putting green turf where small amounts of clippings have been allowed to dribble from the grass catcher or mower when golf course greens were groomed. Mowers may carry inoculum from one green to another. On several occasions, melting-out disease has been restricted to greens that were mowed with the same mower.

### Penetration of the Grass

Fungi are restricted to particular sites of entry and gain entrance by certain physical and chemical means. Rowell (1951) has shown that "Rhizoctonia solani" enters leaves of bentgrass through the cut ends when the grass is clipped. Unclipped grass inoculated with hyphal fragments did not succumb to disease. Couch and Bedford (1966) have reported that "Fusarium roseum" can invade turf grass through the cut ends of leaves. Disease has been observed to progress from the cut end of bluegrass leaves that were placed in a moist chamber and dusted with spores of "Curvularia" spp. The fact that wounds from mowing can serve as sites of entry for pathogens emphasizes the need for sharp mowers to avoid enlarged shredded wounds of grass leaves.

"Fusarium nivale," "Corticium fuciforme" (the cause of red thread disease), "Helminthosporium vagans" and

H. "sativum," can enter grass leaves through the stomata (Couch, 1962; Mower, 1961). Presumably, most fungi capable of growing appressoria can, by chance, penetrate the leaf by way of the stomata. In the process, the hyphae from germinating conidia or mycelium form a pad or appressorium which presses against a stomate and inserts a peg through the pore. Once inside of the stomatal cavity, the fungus grows hyphae of normal width. Activity of "Helminthosporium" is restricted to the stomatal cavity with only a few parenchyma cells being invaded (Mower, 1961). With "Helminthosporium," entry into bluegrass through the stomata is a minor mechanism for disease initiation.

Direct penetration of cuticle and epidermal layer of cells with the aid of the appressorium and infection peg is a common mechanism of many turf pathogens. Notably among these are "Helminthosporium," rust fungi, "Erysiphe graminis" and "Rhynchosporium secalis" (the cause of scald). In the process, appressoria formed at the terminals of germ tubes and hyphae, press against the cuticle and inserts pegs through the waxy cuticle and epidermal cells. With "Helminthosporium," the pegs go between the epidermal cells, and with "Erysiphe graminis" the peg penetrates into the epidermal cells (Mower, 1961; Couch, 1962). Zoospores of "Pythium aphanidermatum" form appressoria and penetrate roots of bentgrass by means of penetration pegs (Kraft et al, 1967).

The process of penetration requires moisture and nutrients and may be aided by extracellular enzymes of the pathogen. Conidia of "Erysiphe graminis" require humidity approaching saturation but not free water to germinate and make ingress. Nutrients from the host seem to be required because the presence of a grass leaf stimulates spore germination and appressorial formation. Humidity and free moisture are required for the penetration process of most pathogens. With "Helminthosporium vagans," the process takes place in 18 hours and free moisture is required (Mower, 1961; Lukens, 1970). Nutrients from guttated water stimulate spore germination and appressorial development of H. "sorokinianum" and "Curvularia" spp. (Endo and Amacher, 1964; Healy and Britton, 1968). The active ingredient in the guttated water is glutamine, a transient nutrient produced by turf in large amounts following nitrogenous fertilization of the grass (Curtis, 1944). The amount of guttation water increases with increase in water content of the soil. Thus, both soil fertility and soil moisture can play a direct role in the effectiveness of pathogenic fungi attacking turf grasses. The addition of glycine to spore suspensions of "Helminthosporium vagans" increases the number of leaf spots produced on inoculated bluegrass leaves. Most fungi carry nutrients in spores and other dormant structures, however, a supplement of certain nitrogenous materials from the host may encourage these fungi to penetrate the host.

Pathogens that macerate host tissue do so through activity of extracellular enzymes which degrade the cement between cells of host tissue. Several pectinases and cellu-

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lases have been found in bentgrass blighted with "Pythium ultimum" (Moore, 1965). The appressorial peg may penetrate, in part, by means of enzymic degradation of substances between epidermal cells. "Helminthosporium vagans" produces pectinases in vitro in the absence of glucose (Patil, unpublished data). Glucose inhibits synthesis of the enzymes and protects bluegrass against invasion by "H. vagans" (Lukens, 1968). Indeed, the chemical mechanism of host penetration by turf pathogens needs more investigation. The knowledge may be useful in devising measures for the control of the disease.

#### Growth of Pathogen in Grass Tissue

Growth of fungi in host tissue is accomplished by hyphae which grow into and between cells. The fungus invades by haustoria within the cell into which host nutrients permeate. The obligate parasites, "Erysiphe graminis" and "Puccinia" spp., grow haustoria without disturbing the delicate integrity of the host cell until the late stages of disease (Couch, 1962). "Ustilago striiformis" grows systemically within the grass plant without symptoms of disease. Hyphae of "Rhizoctonia solani" can ramble through leaf tissue of bentgrass with no outward symptoms until the water stress becomes acute and the entire leaf suddenly collapses. Rapidly wilted leaves turn black and cause the smoke ring typical of brown patch. "Helminthosporium" species which grow haustoria within host cells cause the collapse of the host protoplast shortly thereafter (Mower, 1961). With "Pythium," host cells collapse within an hour of penetration of the fungus (Kraft et al., 1967).

Hypha of "Helminthosporium" grow intercellularly through palisade and mesophyll of the leaf to the vascular system. Along the way, parenchyma and sclerenchyma cells are invaded by haustoria of the fungus. The presence of the pathogen causes collapse of host cells within a day of invasion. However, little necrosis proceeds beyond the space occupied by the fungus. This suggests that if toxins are involved in the death of the host cells, the toxins are not abundantly produced by the fungus and do not permeate beyond the immediate area of infection. On the other hand, with Victoria blight of oats, which is toxin-induced, yellowing extends to the terminals of leaves and stem from the point of infection (Luke and Wheeler, 1955).

The mechanism of invasion of host tissue determines, in part, the size and appearance of the lesion. Pinpoint lesions of "Pythium" on roots of bentgrass develop from the few cells that collapse immediately after invasion by the pathogen (Kraft, et al. 1967). Necrotic spots of "Helminthosporium" and other leaf-spotting pathogens arise from the limited invasion of the pathogen (Mower, 1961). Apparently, the leaf-spotting pathogens require moisture for further infection and the host cells that are collapsed lose water quickly and dry out. Pathogens that macerate tissue are able to extend the size of lesions because moisture is conserved in the macerated diseased tissue.

Succulent growth of grass from high soil moisture and high nitrogen fertility is conducive to Rhizoctonia brown

patch and Helminthosporium blights. Increase in disease by succulent growth may be caused, in part, by an increase in infectivity of the pathogen. The cuticle and walls of cells are thinner so that barriers to host infestation are weak. The pathogen can grow more rapidly in the enriched secretions of leaves of highly fertile turf. The production of simple carbohydrates from photosynthesis in succulent tissue is less than that from hardy tissue. The pathogens utilizing extracellular enzymes growing through host tissue are not hindered by sugars in synthesizing these enzymes. Melting-out disease of Kentucky bluegrass is a low sugar disease (Lukens, 1970). The area of foot-rot infection in turf is proportional to the percent of solar radiation shaded from turf (Fig. 1). The reduction in sugar content was consistent with the reduction in solar radiation. A short cutting height increases melting-out (Halisky et al., 1966). Leaves from turf of low cut contain less reducing sugar than leaves of turf of higher cut. Moreover, an analysis of data from disease and sugar content of leaves of five bluegrass varieties at two cutting heights gives a correlation coefficient of 0.96 (Fig. 2). An application of glucose to Kentucky bluegrass turf reduced the rate of disease development for about a month (Lukens, 1968). Hence, by altering the sugar content of grass leaves with shade, cutting height, variety and sugar spray, disease increased inversely with the content of sugar in the host.

Glucose sprayed to turf caused a delayed increase in disease. Apparently, the pathogen had grown saprophytically on the sugar in sod. Inoculum from this sugar-induced

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Fig. 1.

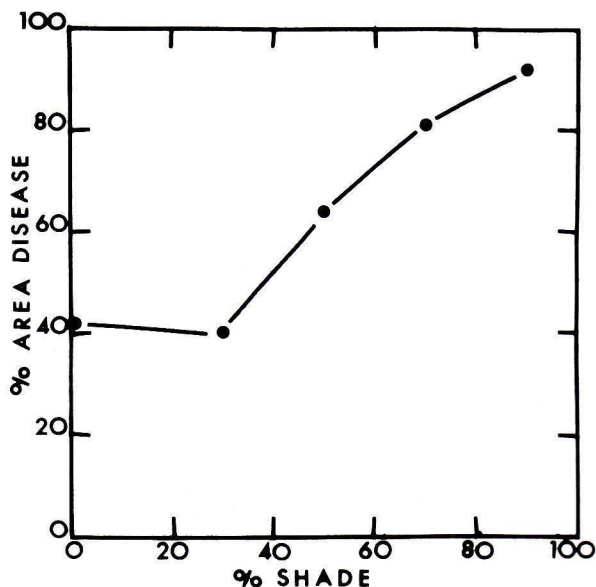


Fig. 1. Effect of shade on the incidence of infection of Kentucky bluegrass turf by "Helminthosporium vagans" after four weeks of treatment in May (Lukens, 1968).

Fig. 2.

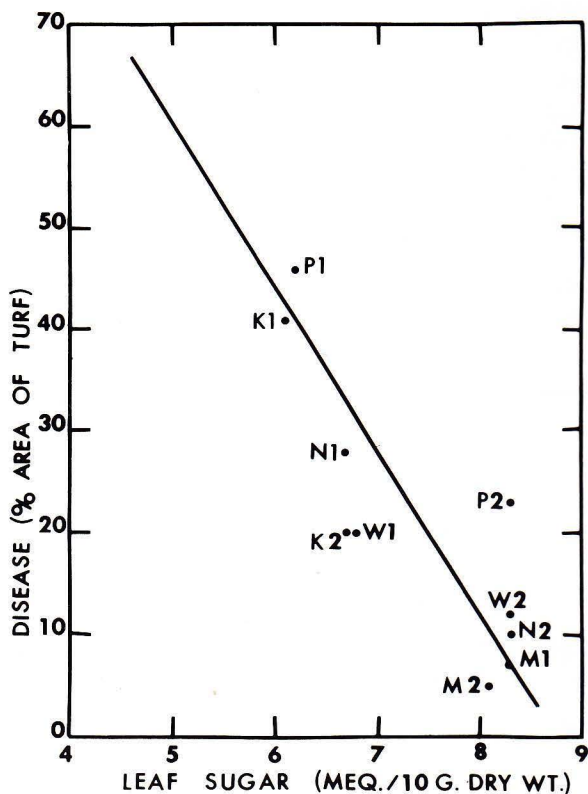


Fig. 2. Effect of leaf sugar on melting-out by "Helminthosporium vagans." Variety of bluegrass P = Park; K = Kentucky, N = Newport; W = Windsor; and M = Merion. Cutting height: 1 and 2 in. respectively. The curve is the regression line of leaf sugar on disease.  $b = 160^{**}$  (Lukens, 1970).

growth was sufficient to overcome the resistance of the turf conveyed by an increase in sugar content in the host. A sugar which conveys resistance to the host but does not serve as a carbon source for the pathogen is needed to effectively control this disease.

**Build-up of Inoculum**

Large amounts of inoculum are required to sustain an epidemic of disease. The inoculum is produced by the pathogen from mycelium in diseased tissue of the host or in refuse in the sod. The build-up of inoculum in turf occurs from several cycles of disease; each cycle requires about three days. In the disease process, mycelium builds up in lesions of a certain size. With powdery mildews, infection is superficial and the mycelial mat or stroma is produced externally on the leaf. Conidiophores grow out from the stroma and, shortly thereafter, conidia are produced. Pustules of uridiospores of rust are born superficially on leaves of bluegrass. With "Helminthosporium," the stroma is produced in the diseased tissue and conidiophores are borne on the outer surface of the host. With stripe smut, the fungus grows systemically from crown to leaves in which it produces a mass of black chlamydospores. The leaf ruptures and the spores are exposed to air currents.

Various pathogens that are able to live as saprophytes can produce inoculum on decayed clippings and organic matter in sod. Inoculum from overwintering material (Continued on Page 10)



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(Continued from Page 9)

may be sexual spores, asexual spores, sclerotia or merely hyphal fragments. Certain of these inocula are also produced during the growing season. Hyphal filaments of "Helminthosporium," "Pythium," "Fusarium" and "Rhizoctonia" growing from refuse to the host in moist sod are an important source of inoculum for disease. The amounts of hyphal inoculum from these sources is dependent upon moisture, temperature and the nutrition of the refuse.

Sporulation in fungi accompanies a change in growth of the fungus from filamentous to a budding type. In sexual reproduction, other habits of the pathogen enter the picture. With change in growth habit there occur changes in metabolism and, in turf, changes in response of the fungus to environment. "Helminthosporium vagans" grows mycelium at its maximum rate of 25°C. (Horsfall, 1930) and sporulates at 15°C. (Lukens, 1968). Hence, spore inoculum is produced by H. "vagans" most abundantly in cool weather and pathogenesis advances at a faster rate in moderate weather. These opposing effects of temperature may explain, in part, the lack of a clear relationship between temperature and melting-out disease (Bean and Wilcoxon, 1964).

### Conclusion

Mechanisms of fungal attacks on turf grasses have been described. The fungus, in the form of hyphae, sclerotia and spores, arrive at sites of new infection by air, water or debris. It infects a grass plant through cut ends of leaves through stomata, or directly through the cuticle. The fungus grows special structures — the appressorium and peg, for infecting grass. The development and functions of these structures require moisture, nutrients and possibly extracellular enzymes. Hyphae of the pathogen grow between cells of grass tissue and small branches of the hyphae penetrate into host cells. Haustoria, cells for absorbing nutrients from the host protoplasm, are produced inside of host cells by the fungus. Host cells tolerate

haustoria of obligate parasites, but they collapse when infected by haustoria and hypha of other pathogens. Fungi may kill host cells some distance away from the invading hypha by excreting substances that are toxic to the host. Soon after establishment in the grass plant, the fungus grows a mat of mycelium from which more inoculum in the form of hypha, sclerotia and spores are produced. Usually, epidemics of disease break out following several rapid cycles of dispersal, penetration, infection and inoculum production of the pathogen.

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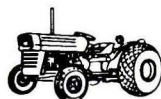
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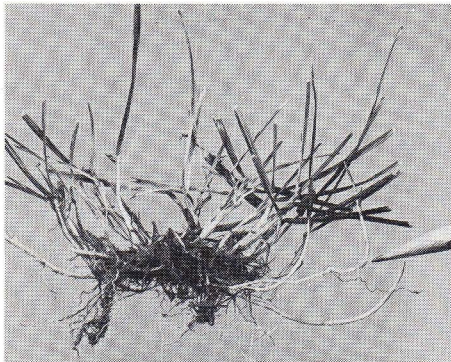
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Dr. C. R. Skogley examines a strip of Baron sod.

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This will be your second and final reminder that the 1973 University of Massachusetts Fine Turf Conference will be held March 7, 8, and 9 at the Bay State West Motor Hotel. Anyone who has attended the conference in the past several years will note the change in location. The conference has grown yearly and the increased number of people attending has given us the opportunity to offer the convenience of expanded facilities and an easily accessible location. The Bay State West Motor Hotel can be reached from the north or south on Interstate 91 and from the east or west on the Massachusetts Turnpike to Exit 6 and then on Interstate 291 to

downtown Springfield. We sincerely hope that the modern facilities offered in Springfield will make every aspect of the conference more informative and enjoyable. Preregistration materials have already been mailed to those who attended last year's conference and anyone wishing to attend for the first time may register at the conference.

Two of the many outstanding speakers this year will be Mr. George P. Toma, Director of Field and Landscaping at Arrowhead and Royal Stadiums and Mr. F.W. Hawtree, Golf Course Architect, who will speak on British golf course architecture.

### WEDNESDAY, MARCH 7

—Morning—

11:00 Registration — 6th Floor, Lobby

—Afternoon—

#### GENERAL SESSION Springfield Room

Chairman: Robert Grant, Superintendent  
 Brae Burn Country Club

- 1:00 Welcome  
 Dr. Joseph Troll  
 University of Massachusetts/Amherst
- 1:15 Artificial Turf vs. Natural  
 Dr. Stanley C. Plagenhoef  
 University of Massachusetts/Amherst
- 2:00 Drainage  
 David Clement, Supt.  
 Crestview Country Club, Inc.
- 2:45 Break
- 3:00 Converting Fairways to Bentgrass  
 Joseph R. Flaherty, Supt.  
 Baltusrol Golf Club
- 3:45 Converting to Kentucky Bluegrass Fairways  
 Thomas Rewinski, Supt.  
 National Golf Links of America

4:30 Massachusetts Turf and Lawn Grass  
 Council  
 Membership Meeting

—Evening—

Free—A good time to look up old friends.

### TUESDAY, MARCH 8

—Morning—

#### GOLF COURSE SESSION Springfield Room

Chairman: Wayne Zoppo, Superintendent  
 Agawam Hunt

- 9:30 Grass and Our World  
 Dr. Thomas R. Soderstrom,  
 Associate Curator  
 National Museum of Natural History
- 10:15 Safeguarding Workers on a Golf Course  
 Harold Smith, Area Director  
 OSHA, U.S. Dept. Labor
- 11:00 Pine Valley  
 Eb Steiniger, Supt.  
 Pine Valley Golf Club
- 11:45 Lunch

## —Afternoon—

- 1:00 Grooming the Golf Course  
Melvin Lucas, Jr., Supt.  
The Garden City Golf Club
- 1:45 Turf Diseases of 1972 — Controls and  
Prevention for 1973  
Stan Zontek, Agronomist  
USGA Green Section, Northeast Region
- 2:30 Non-selective Weed Control  
John E. Gallagher  
Amchem Products, Inc.
- 3:15 Break
- 3:30 Soil Factors Affecting Arsenic Toxicity  
to "Poa annua"  
Dr. Robert N. Carrow  
University of Massachusetts/Amherst
- 4:15 Necessity of Golf Cart Paths and Traffic  
Regulations  
William Buchanan, Agronomist  
USGA Green Section, Northeast Region

## ALTERNATE SESSION —

Those not interested in golf course maintenance can attend the Alternate Session on general turf management.

## THURSDAY, MARCH 8

## —Morning—

ALTERNATE SESSION  
Berkshire Room

Chairman: Charles Mruk  
Hercules, Inc.

- 9:30 Herbicides for Turfgrass Areas  
Prof. John A. Jagschitz  
University of Rhode Island
- 10:15 A review of Turfgrass Fertilizers  
William Fines  
Corenco Corporation
- 11:00 Perspectives on Lawnmaking and Keeping  
Dr. Robert W. Schery, Director  
The Lawn Institute
- 11:45 Lunch

## —Afternoon—

- 1:00 Stadium Turf Maintenance  
George P. Toma, Director of Field and  
Landscaping  
Arrowhead and Royal Stadiums
- 1:45 Highway Turfgrass  
Dr. R. W. Duell  
Rutgers University
- 2:30 Break
- 2:45 Cemetery Maintenance (Rated XYZ — only  
mature adults admitted)  
Martin Stolpe, Executive Vice President  
Castle View Burial Park, Inc.
- 3:30 Application of Floriculture to Landscaping  
Prof. Alfred W. Boicourt  
University of Massachusetts/Amherst

## —Evening—

## Springfield Room

- 7:00 Banquet  
Fertilizing Your Sense of Humor for 1973  
Samuel H. Ramsay

## FRIDAY, MARCH 9

GOLF COURSE SESSION  
Springfield Room

## —Morning—

Chairman: Prof. John M. Zak  
University of Massachusetts/Amherst

- 9:30 Keeping Records  
Al Barauskas, General Mgr.  
Avalon Golf, Inc.
- 10:00 Planning Capital Expenditures  
Sherwood Moore, Supt.  
Woodway Country Club
- 10:30 British Golf Course Architecture  
F. W. Hawtree  
Golf Course Architect
- 11:00 North American Golf Course Architecture  
Geoffrey S. Cornish  
Golf Course Architect
- 11:30 Question Period

(Continued on Page 14)

(Continued from Page 13)

**CONFERENCE PLANNING COMMITTEE**

**Golf Course Superintendents Association  
of New England**

**Richard Blake  
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**University of Massachusetts  
Alumni Turf  
Research Committee**

Meeting of the University of Massachusetts Alumni Turf Research Committee was held at the GCSAA Conference on January 11, 1973.

The following slate of officers were proposed and elected:

- President: Paul O'Leary, Ekwanok C.C.
- Vice President: Robert Heeley, Quaboag C.C.
- Secretary: Frank Downey, Alfco Rokeby Co.
- Treasurer: Dr. J. Troll, Stockbridge School of Agric.
- Director: Karnig Ovia, Hop Meadow C.C.
- Director: Guy Tedesco, New Seabury C.C.
- Director: Fred Scheylhing, Mt. Kisco C.C.
- Director: John Madden, Engineers C.C.
- Director: George Thompson, Columbia C.C.
- Director: John O'Connell, Blue Rock G.C.

Dr. Joseph Troll, Dr. Robert N. Carrow and Professor John M. Zak submitted two research proposals to the Massachusetts Golf Course Research Fund Committee for discussion and recommendation. Both projects were approved for funding by the MGCRF. These investigations were designed to provide information on turfgrass fairway and tee areas. The studies were:

(1) Evaluation of the Adaptation and Cultural Requirements of Selected Turfgrass Species and Varieties. Robert N. Carrow, Joseph Troll, John M. Zak.

(2) Red Fescue Cultural Requirements and Adaptation. Joseph Troll, Robert N. Carrow, John M. Zak.

In addition to these studies, several other investigations which will be applicable to fairway and tee turf are being considered or are in progress. These will be funded by other sources and include:

(1) Soil Modification with Aggregating Agents and Cultivation Practices of Turfgrass Soils (submitted for funding). Robert N. Carrow, Joseph Troll.

(2) Cultural Requirements and Adaptation of New Fine Turf Type Ryegrasses (submitted for funding). Robert N. Carrow, Joseph Troll, John M. Zak.

(3) Evaluation and Testing of Bioturf as a Soil Amendment for Alleviating Soil Compaction (in progress). Robert N. Carrow, Joseph Troll.

(4) Chemical and Biological Control of Snow Mold (in progress). Joseph Troll, Paul R. Harder.

(5) Evaluation of Turfgrass Chemicals (in progress but to be expanded). Joseph Troll, Robert N. Carrow, John M. Zak.

(6) Nematode Studies on *Poa annua* L. (proposed). Joseph Troll, Richard A. Rohde, Robert N. Carrow.

(7) Effects of Soil Type, pH and Soil Arsenic Levels on "Poa annua" L. Root and Shoot Growth (in progress in conjunction with Michigan State University.) Robert N. Carrow, Paul E. Rieke.

(Continued on Page 15)



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(8) Fixation and Form of Arsenic and Phosphorus in Soils as Influenced by Soil Type and Soil Reaction (in progress in conjunction with Michigan State University). Robert N. Carrow, Paul E. Rieke, Boyd G. Ellis.

We have also submitted a request and justification for a full-time turfgrass technician to Dean A. A. Spielman, College of Food and Natural Resources. Such a technician is of primary importance if we are to develop a turfgrass program covering the research, teaching and extension aspects.



(Continued from Page 10)

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# THE ENVIRONMENT AND AGRICULTURE

## ISSUES AND ANSWERS

T. C. Byerly

Much has already been written about our environmental problems. In the months and years ahead, we can reasonably expect the commentary on this subject—both oral and written—to continue proliferating.

If some of this commentary may be termed “fancy rhetoric,” it is only because man finds himself in a bewildering state of confusion as to what needs to be done, what can be done, and how to do it. Hugh Bennett used rhetoric to start a crusade. And because of it, we learned how to better manage our soil resources.

Whether we start with rhetoric or not, the issues involved must be properly identified—and then resolved through whatever mode of action suits best. In this paper I have undertaken to answer six questions that either directly or indirectly concern agriculture’s role in environmental quality.

### What is the environment?

Simply, it is the aggregate of surrounding things, conditions, and influences. But surrounding what? Surrounding me; surrounding you; surrounding us. Our primary concern is with the environment of which we are a part, of that of which our progeny for generations to come will be a part.

President Nixon, in his State of the Union Message, phrased it this way: “The truly significant environment for each of us is that in which we spend eighty percent of our time—that is, our homes, our places of work, and the streets over which we pass.”

But while each of our micro-environments may add up to the global environment, it is not likely that we can understand the global environment by limiting our studies to the niches in which we live.

The “space ship earth” analogy has some conceptual significance. The National Research Council’s Geophysical Research Board, in a report of a summer study of the role of ground-based research, describes the earth as “a giant spin-stabilized spacecraft” (6).

### What are the major factors and interactions determining the quality of the environment?

Whether urban or rural, global, terrestrial, aquatic, macro, meso, or micro, environments in which people live do have some common parameters. Somehow we must use measurements of these parameters in developing an index of quality.

A recent report (2) by the Environmental Studies Board of the National Academy of Sciences—National Academy of Engineering suggests that we must monitor and take account of changes in at least the following factors:

- Physical and chemical properties of land, air and water.
- Distribution of plants and animals in land, air and water.

- Land use, including diversity of purpose.
- Construction.
- Noise.
- Epidemiology of man, animals and plants.
- Evidence of environmental stress such as tranquilizer consumption and social behavior.
- Aesthetic.

Major determinants of the quality of the environment—in addition to the objective parameters and interactions—include perception of the environment by its inhabitants, perception of specific environments or habitats by others, and especially the perception of his own identity by each inhabitant.

The words aspiration, arrogance, expectation, jealousy, cooperation, conflict, anomia, and frustration describe ways man senses his environment and his part in it. Perception of the environment by any individual, his estimate of himself, the opinion of others—all are important to the individual’s estimate of the quality of the environment. To fully appreciate the importance of these factors, I commend to your reading an article in a recent issue of “Agricultural Science Review” by Sarah Shoffner of the University of North Carolina at Greensboro: “Self Concept: Its Role in Breaking the Poverty Cycle (9).” According to Shoffner, recent research has given new credence

(Continued on Page 18)

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(Continued from Page 17)

and validation to the old maxim: "To enlarge what a man can do, you must first enlarge what he 'thinks' he can do."

What is good environment? Eric Hoffer relates that he bought a copy of Montaigne's essays, a thousand pages, second hand for a dollar, in anticipation of being snowbound for a winter in the Sierras. He was. He read the book three times. That, he implies is how he learned to write — in a good environment (3).

I like the way Hoffer says things. Consider: "The uniquely human fact that discontent is at the root of the creative process, that the most gifted members of the human species are at their creative best when they cannot have their way, and must compensate for what they miss by realizing and cultivating their capacities and talents."

In this time of discontent, will the environment, the quality of life, provide the challenge required to bring together people of all ages, races, opinions, economic levels and cultures?

#### What is the present condition of the environment?

The NAS-NAE Environmental Studies Board report of its Environmental Study Group states: "The quality of our lives is directly related to the quality of our environment and the quality of that environment has deteriorated as our national affluence has increased (2).

There is no gainsaying the fact that our air is polluted, and increasingly so, with gaseous and particulate pollutants from burning fossil fuels in automobiles and other transport vehicles, in generation of electricity and household heating. Burning crop wastes, forest wastes, forest fires, trash and garbage, gases and fly ash from factory

stacks and refineries add their burden. Odors, too, pollute the air — some from agricultural activities.

Our waters are overburdened with sewage wastes, sediments eroded from roads, construction sites, and poorly managed farm, range and forest lands. Some nitrogen is leached from farm and forest lands, some pesticide chemicals are carried in runoff water and on sediment into our lakes and streams.

Our land is pocked with abandoned, worked-out surface mines—more than 3 million acres of them. Junk and other solid wastes pollute our landscape. And residues of pesticide chemicals—arsenic, lead, copper, mercury, organo-chlorines, and others—pollute our soils. Under and about feedlot areas, nitrogen in excess of any possible usage by growing plants becomes a pollutant to soil, air, plants, and water.

Noise and heat are pollutants growing in importance. As yet they are chiefly of local and urban origin.

Pollution is not a new thing. In many cases, pollution is simply over concentration at particular times and places. Pollution is a function of activity per unit area, of people, animals, industry. It is equally obvious that rapid industrialization of agriculture and the concomitant accelerated urbanization have resulted in deterioration of many urban and rural environments. Shifts in traffic patterns, growth in automobile and air traffic have impaired the quality of life.

#### What is agriculture's contribution to the quality of the environment?

It has become fashionable to cite the detrimental contributions of agriculture to the quality of the environment. Although this aspect deserves serious discussion and analysis, we tend to overlook the beneficial contributions—both actual and potential.

It is only because agriculture is efficient that we may hope to improve the quality of the environment, the quality of life. Consider our land resources, for example. We have more than 600 million acres of Class I—III land. Less than half of this is used for crops. Yet our wise use of this land, coupled with improved technology, has made us the leading agricultural nation in the world. The rest of this available land is used for trees and grass and living space; some unfortunately, goes under pavement every year.

From the viewpoint of potential contributions to the quality of the environment, consider, for example, the opportunities that exist for land planning to provide continuing open space near our cities. Of equal importance is the opportunity for planning the new communities which will be needed for the 100 million additional citizens who will be here in year 2000.

New cultural centers, locations for new industry, new service centers, new recreational centers can be planned to serve both local communities, the States, and the Nation. In addition to assuring land requirements for production of food, fiber, and forest products, we will continue to need coordinated programs for land and urban and industrial development, transportation, outdoor re-

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creation, flood prevention, water harvest, wildlife habitat, and natural beauty.

In my discussion of the undesirable contributions of agriculture to environmental quality, I shall incorporate essential concepts which I think may provide some of the answers we have been seeking. The key to implementing these concepts lies in the effective use of systems. In agriculture, a system can mean many things.

Every farmer is an ecologist of sorts. He manages an ecosystem, an agro-ecosystem, or several of them. As Kellogg and Orvedal (5) have succinctly put it: "Each farmer makes his own arable soil from either a natural soil or an old arable soil. He may change it only a little or he may change it drastically by reshaping the surface for water control, by adding fertilizers to correct plant nutrient deficiencies, by adding other materials to correct acidity or alkalinity or to improve the structure of the soil, or by tilling in depth."

The soil is a living system. Treated wisely, it may sustain man and his living associates, plant and animal, generation after generation, with steadily improving productive capacity.

We commonly think of agriculture in terms of types of farming — dairy, fruit, cash grain, cotton, and so on. Our thinking seems to have been focussed on commodities, not systems. But the systems are there. We have been busy building large scale, highly mechanized commodity production systems without sufficient regard for the agro-ecosystems in which commodities are produced.

Consider cotton, for example. The cotton agro-ecosystem is dominated by a rather uniform population of a single species.

Highest cotton yields are obtained in sunny, long season, irrigated areas. They require abundant, well-managed water, suitable soil, adequate fertilization, good genetic stocks, timely tillage, and pest control. Included in the cotton ecosystem are weeds, trash, trees, ditches, ditch banks, roads, fence rows, turn rows, farmsteads, and frequently, intermingled areas of other crops and woodlands and wastelands. The area included must be large enough so that the more significant populations can complete their life cycles within it. There is likely to be substantial movement of species into, within, and out of the system.

But when we concentrate our attention on a commodity production system—without proper regard for the cotton agro-ecosystem—undesirable things may happen.

In the San Joaquin, for instance, early pesticide treatment for lygus bugs may be followed by explosive bollworm infestations. But planting alfalfa strips and delaying lygus bug treatments permit parasites to help keep lygus bug populations in check without bollworm explosion.

In the Lower Rio Grande, bollworms and the tobacco budworm have developed resistance to pesticide chemicals. Omission of early season chemical pesticide treatment in 1969 was followed by yield increases of 20 percent. Pesticide application was halved.

These practices may be regarded as necessary compo-

nents of an effective cotton agro-ecosystem. We commonly refer to the whole system as integrated control. The kinds of integrated systems will vary from area to area, depending upon the kinds of pests present.

Ray Smith and his colleagues (11) at the University of California have developed concepts and practices for integrated control of cotton insects.

For a number of reasons, scientists are seeking to improve integrated control methods for cotton pests: (1) Cotton is heavily dependent on insecticides, (2) cotton insect pests require a variety of chemicals for their control, and (3) chemicals effective against one insect pest may kill the parasites and predators of another pest against which it is not effective. It seems certain, therefore, that integrated control will continue to play a dominant role in the whole cotton agro-ecosystem.

Table 1 shows the massive problem in disposing of animal wastes produced by livestock raised in large-scale confinement operations where wastes are not naturally dispersed. Figures in column 1, which are conservatively estimated, do not include livestock raised in small-scale feeding operations, nor those dispersed on farms and ranges. Note that the total amount of waste produced by large-scale livestock operations is approximately equal to that produced by the entire population of the United States (estimated at 204 million in January 1970). By 1980, I estimate that the quantity of animal wastes subject to mass disposal methods will be double what it is today.

A number of solutions have been proposed for meeting this massive disposal problem: (1) Composting and ulti-

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TABLE 1.—*Waste disposal problem for U.S. livestock raised in large-scale operations in terms of human waste equivalent*

The amount of animal waste produced by—	Is equivalent to the human waste produced by—
5 million feedlot cattle.....	50 million people
7 million milk cows.....	105 " "
100 million laying hens.....	10 " "
50 million turkeys.....	5 " "
400 million broilers.....	20 " "
10 million hogs.....	10 " "
2 million lambs on feed.....	1 " "
<b>Total equivalent.....</b>	<b>201 million people</b>

mate return to the soil, (2) settling, flocculation, dehydration, or other means of concentration coupled with ultimate return to the soil, (3) recycling, perhaps selectively, with or without processing as animal feed, (4) incinerating, and (5) "laissez faire"; that is, a do-nothing policy.

All of these methods have defects. In many cases, the cost of waste disposal will exceed the value of the waste to the user. These costs may be reflected in the price of the product or in taxes.

Systems with which we are concerned include the energy system; one burgeoning component of it is electricity. The Office of Science and Technology estimates that 255 new plants will be needed by 1990. They will have a capacity of one million megawatts — three times the capacity of the 3,000 plants now existing. It is probable that 160 plants will have cooling towers by 1990.

Thermal pollution will become a major issue. Location

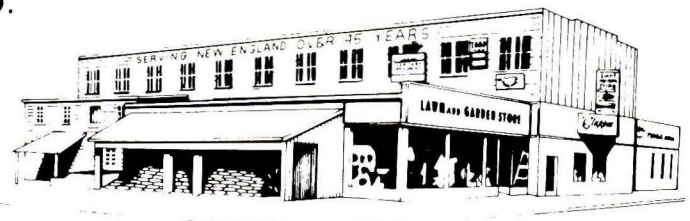
of new plants and burial of transmission lines are already environmental issues. Economic and social costs and benefits will be debated throughout the land. This will inevitably be one of the major environmental issues in rural as well as in urban America and in the world (8).

The Unesco Chronicle for November 1969 quotes Moscow University Professors Kalinin and Bykov as follows: "Power is now generated and consumed by industry at such an accelerating rate that this will seriously affect the earth's heat budget. If power generated increased annually by ten percent, in 100 years it will have an effect comparable to that of solar radiation."

#### What is being done to improve the quality of the environment?

Insofar as public responsibilities are concerned, the several Federal agencies involved in this area have been committing sizeable resources—both human and mone-

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TABLE 2.—Estimated expenditures on agricultural pollution in 1969

Pollutant	USDA		DOD		DHEW		USDI	
	R. & D. Action Loan		R. & D. Action Loan		R. & D. Action Loan		R. & D. Action Loan	
	Million dollars		Million dollars		Million dollars		Million dollars	
Sediment.....	4.0	289.3	7.0	0.2	186.8		1.3	51.6
Animal waste.....	1.5	0.8				0.5	0.4	0.7
Processing wastes.....	1.8	0.9	2.0			0.5	0.3	12.0
Plant nutrients.....	1.6	1.2				0.1	0.1	2.6
Forest and crop residues.....	1.4	24.3	0.1					0.3
Inorganic salts and minerals.....	1.2	1.6	14.0					1.7
Pesticides in the environment.....	45.9	15.0				7.5	2.5	1.9
Air pollution related to agriculture.....	1.4	10.0				3.6	2.0	
<b>TOTAL.....</b>	<b>58.8</b>	<b>343.1</b>	<b>23.1</b>	<b>0.2</b>	<b>186.8</b>	<b>12.2</b>	<b>4.6</b>	<b>8.2</b>

USDA: U.S. Dept. of Agriculture.

DOD: Dept. of Defense.

DHEW: Dept. of Health, Education, and Welfare.

DI: Dept. of Interior.

Source: See Literature cited (10).

TABLE 3.—Pollution research in the U.S. Dept. of Agriculture, State agricultural experiment stations, and cooperating forestry schools

Pollution or subject area	1966	1977
	<i>Scientist-man-years</i>	
Animal and domestic wastes.....	27	140
Processing wastes.....	30	133
Infectious agents, toxins, and allergens.....	197	270
Sediment.....	96	254
Plant nutrients.....	200	275
Mineral and other inorganic substances.....	44	95
Radioactive wastes.....	0	10
Airborne chemicals and particulates.....	41	114
Noise.....	1	7
Socioeconomic aspects.....	2	32
Systems analysis.....	2	6
<b>Total.....</b>	<b>640</b>	<b>1,336</b>

tary—to the cause (Table 2). Obviously, we have not committed enough. In an effort to match the projected needs with the vast scope of the problems, a joint USDA-State Task Force reviewed current research programs, needs, and opportunities in 1968. Aside from the very large continuing research effort on pest control, the Task Force identified a total of about 660 scientist-man-years (SMY's) devoted to research on other forms of pollution in 1966 (Table 3). They projected a need for 1,336 SMY's in 1977—more than double the 1966 effort (4).

The Task Force clearly saw the need for systems analysis in solving pollution problems. It also noted a deficiency which still limits the application of systems analysis—a monitoring network such as that proposed under the International Biological Program, a global network

of environmental monitoring and local monitoring to guide the systems analysis of local problems.

The report quotes Biniek and Taylor (1): "When the general problem of waste management and environmental quality is viewed in total, it becomes obvious that solutions to one resource pollution problem may intensify other resource problems. Transfers of pollution problems to other subject matter areas, or legal or bureaucratic jurisdictions are not solutions in any relevant sense."

#### What kind of environment do we want?

Dreams of utopia founder for lack of definition and agreement. It is simple to identify an environmental defect, sensory perception takes care of that. But it is diffi-

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cult—probably impossible—to describe an environment all people would consider ideal.

Criteria and standards for important environmental parameters, such as for air and water quality, are useful and feasible. But may not focussing on such specifics divert us from considering the quality of the aggregate environment of which each of us is a part?

Data on the ratio of green open space to that covered by buildings and pavement are useful. But again this is a reductionist approach to the environment and it can be misleading. Green open space can be a helpful sink for carbon dioxide for other products of industry. But in the city, green plants may be made hideous by pollutants.

Josh Lederberg, in his January 24 column in the Washington Post quotes Karl Popper (7) who wrote: "Social life is so complicated that few men, or none at all, could judge a blueprint for social engineering on a grand scale . . . accordingly, adopt the method of searching for and fighting against, the greatest and most urgent evils of society, rather than searching for, its greater ultimate good."

Lederberg goes on: "Today we have just one reason to voice an exception; (from Popper's argument) the survival of the human community on earth may be utopian ideal.

"For its realization, we have little experience, tools, training or organization. We lack even the will to proceed with the long range global planning to meet the realities of today's poverty and tomorrow's revolution of hunger and unfulfilled expectations."

This is indeed a sobering indictment.

But let us look at our proven competence, at our way of doing things. With all Americans, perhaps with all people, I am proud that "we," the people of the United States, her scientists, engineers, politicians, and especially her astronauts fulfilled the commitment made by President Kennedy that we would land a man on the moon before 1970.

Between now and the year 2000, over 100 million chil-

dren will be born in the United States. They way they grow up—and how—will, more than any one thing, measure the quality of American life in these years ahead.

We have a goal, a goal for each of us. Goals and roles. We in agriculture have played and must continue to play an essential role with respect to the quality of the environment and therefore the quality of life. In its role of supplier of food, fiber, and forest products, agriculture in the United States is technology-dependent. Land and labor have become junior partners—a reversal of traditional relations and a reversal which must take place in all the world.

President Nixon said, "The argument is increasingly heard that a fundamental contradiction has arisen between economic growth and the quality of life, so that to have one, we must forsake the other.

"The answer is not to abandon growth but to redirect it."

Elvis Starr, President of the National Audubon Society, put it another way in his speech to the San Francisco Conference of the U.S. National Commission for UNESCO. He said: "The value choices must be made first, and then the technologists and engineers brought into play, in support of these choices. Technologists and engineers are people, too, and as people they have responsibility for sharing in those value choices."

Of course, we've been making value choices and achieving them in agriculture since that art began. We planted in order to harvest. We cared for brood stock in order to harvest the offspring. We managed forest and range in order to achieve sustained yield. Our record of goal achievement—and overachievement—is remarkable.

But now—in the face of the environmental crisis confronting us—our value choices demand more caution, more refinement than ever before. As we attempt to resolve the problems of pollution, the systems we choose

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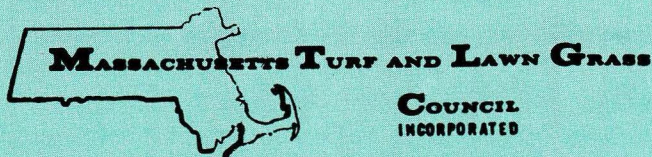
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must not only be technologically effective, but also both socially and economically acceptable.

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