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Relationship of the University to the Turfgrass Industry

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The relationship of the University of California to the turfgrass industry is the same as the relationship of the University of California to other industries of the state. The Division of Agricultural Sciences of the University is concerned with the problems of the turfgrass industry because the Division is that part of the University concerned with the problems of soil and water, plant growth, insects and plant disease, and all the other factors which enter into the problems of turfgrass management or the improvement of turfgrass culture.

Three years ago, the Federated Turfgrass Council of California prepared a statement on the Research and Extension needs of turfgrass. That statement of needs, based on a statewide survey of the industry, was a well prepared statement. It was widely circulated among the several Experiment Station departments and Extension personnel. It still serves as a basic statement of your needs and a guide to us in Research and Extension assistance.

The statement pointed out the importance of the problems of soils, irrigation, weeds, disease, and pest control, nutrition, growth regulators, wear resistance of turfgrasses, and breeding. It is a good example of co-operation between an industry and the Division of Agricultural Sciences. It has created understanding and has made for good working relationships between the industry and the University.

When a research or educational institution has responsibility in an area of agricultural subject matter, it has the responsibility to evaluate and integrate all of the complicated material from many sources and kinds of research and research centers. It likewise has the responsibility of projecting its program of research into basic fields so that through basic understandings it can develop programs of applied research and Extension assistance in the application of newer knowledge.

No single piece of research answers a single question or solves a single problem necessarily. The answers to the practical questions of the field are the results of the evaluation, interpretation and relating of the findings of many pieces of research, and often to a particular set of conditions or situations. This is a joint responsibility of the Agricultural Experiment Station and the Agricultural Extension Service. The successful utilization of such information depends upon the cooperation between the industry and the University. This type of service in many instances, and to some degree at least, is frequently performed by private industry, but the University remains the ultimate source of basic research knowledge and of cooperative and objective evaluation of research findings and responsible Extension assistance.

This places upon the University the necessity for the maintenance of a corps of workers, whether they be Experiment Station workers or Extension workers. The industry can be helpful in this respect. It can encourage young men to seek the kind of training which this type of professional work requires. It takes time to develop capable men, requiring years of training and experience. These men need to travel and observe. They need scientific and industrial communication. They need access to library facilities, because it is through research, study, and often practice in teaching that they grow in knowledge and ability to meet the complex problems of a modern world. It is necessary that the University provide these conditions for them, and the University more readily and more effectively meets this requirement when it has the support and the encouragement of industry.

Research needs the orientation and stimulation which comes from the field and from the industry. The statement of needs prepared by the Federated Turfgrass Council of California three years ago, cooperation with the local farm advisor, the work of the Extension specialist in providing a means for a flow of information from research departments to the field, and the counseling research workers with respect to field conditions, all tend to give this orientation and stimulation. Thus, the relationship of the University of California and the turfgrass industry is truly a cooperative one.

It was through a similar relationship with the agricultural producers of this country that institutions such as the University of California were able to assist in the unprecedented development of American agriculture. This agricultural development has been basic to the American economy. It is an economy of high, productive efficiency, producing food and fiber even in irritating surplus. This is a far step from the primitive agriculture of our early

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day and "one step ahead of starvation" which has plagued the human race ever since it appeared on the face of the globe. We are employing this same type of relationship as we are rapidly moving forward into the whole food industry -- into those fields beyond production, post-harvest handling, processing, packaging, and marketing of agricultural commodities. In doing this, we are again supporting and improving the economy of the nation and providing that better life through food for all. This same relationship developing with the turfgrass industry, is already producing the type of results it has produced in food production and is producing in food handling.

The needs of the turfgrass industry call for basic research. Before we can define the basic requirements of turf and provide the information necessary for sound and knowledgeable management decisions, we must understand the underlying facts and factors involved. No single department of the Experiment Station can accomplish this of itself. The department of Floriculture and Ornamental Horticulture on the UCLA and the Department of Landscape Horticulture on the Davis campus require the cooperation of other departments, the counsel of the Department of Agronomy, cooperative project undertakings with Plant Pathology, Entomology, Irrigation, Soils and Plant Nutrition, Biochemistry, and even Agricultural Engineering. We are making progress because we have excellent cooperation among these departments. Recent surveys of Experiment Station projects and undertakings indicate that there are somewhere between 40 and 50 such experimental activities now underway. There are turf plots in nearly 30 counties under the direction of the Extension Service.

The turfgrass research program at UCLA has one primary objective -- that is to develop, through experimentation, a fund of basic information on the growth and differentiation of the turfgrass plant. This involves studies of environmental factors affecting growth and ways and means whereby turfgrass may be improved. On the Davis campus an emphasis is placed on irrigation management, and through the cooperation of the departments at UCLA and Davis, a correlation is maintained so that the work represents complete and not piecemeal undertakings.

To study the grasses, it is necessary to study turfgrass ecology. On the UCLA campus, this is being accomplished through the use of controlled environmental growing chambers, greenhouses, and field plots. Studies are underway with soil mixtures to determine methods of retaining adequate infiltration rates of water and to avoid spots where drowning-out occurs. The general area of turfgrass physiology currently includes studies of grass nutrition, salinity tolerance, arsenic toxicity, growth regulators, aeration of turf, and long-lasting nitrogen sources.

Two years ago we added to our staff a plant pathologist whose primary interest was to be with the control of turf diseases. At the present time, we depend almost exclusively on the use of fungicides. Additional control measures are urgently needed, but these cannot be developed until we obtain a more thorough understanding of the various turf pathogens, the diseases which they cause, and the factors which influence their development. This member of our staff is therefore emphasizing a basic program of research involving the determination of the several pathogens causing turf damage in the various climatic zones of the state. He is studying environmental, soil nutrition and microbiological factors which influence disease and is preparing to investigate control measures in relation to the environmental and cultural practices affecting disease susceptibility and resistance. Varietal resistance to disease and control measures for turf disease generally need further work. It seems likely now that because our department of Plant Pathology is well staffed with outstanding workers on fungicides and well equipped to conduct basic research, such work may soon be extended.

During 1960 the frit fly caused severe and widespread damage to golf greens in the warm areas of southern California. While this has been known to occur for many years, 1960 was the first time in recent years that damage has been reported. It is incumbent on us to begin an investigation of "why" in order to determine "how" we can prevent this damage. A new species of mite causing severe damage to bermudagrass has been found from Los Angeles to El Centro. Lawn moths are a serious and perhaps the most important pest of turfgrasses. They represent a continuous problem on golf courses. The consolidation of the departments of Plant Pathology and Entomology at UCLA with those on the Riverside Campus will allow us to expand our work in both pathology and entomology. It will enable us to re-evaluate properly currently used insecticides, test new materials, and enjoy the cooperation of the Department of Biological Control in the testing of insect pathogens.

This brief review of our research indicates how closely it is adjusted to your needs as expressed in the statement of the Federated Turfgrass Council of three years ago. It points out the effectiveness of industry and University cooperation and the possibilities for improvement and problem solutions which result from such cooperation.

It can readily be seen that no single individual can possibly undertake the development of a research program to meet all of these needs. It requires close cooperation of many men, highly trained in specialized fields, working together to develop sound information and satisfactory methods which can be applied by turf management. This is the advantage in research possessed by the University of California.

The research worker's first responsibility is to his research, and his first interest lies here. While it is true that he needs to visit the areas of the state in order that he may better understand the actual problems of turf culture, he must be protected to pursue his investigations

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in his laboratory, his greenhouse, and on his experimental plots. The University of California has adopted the policy of headquartering its Extension specialists with the Experiment Station departments in order that they may be associated with and become keenly aware of the research underway, the problems encountered, and the progress made. This equips them to evaluate better and interpret the findings of research and better assist the farm advisors in the counties.

The farm advisor is your first local contact. Through him, you have access to all the resources and facilities of the University. Behind him lies the strength of the University. Conveniently located in your community, he can study your problems with you. He can relay to you and help you apply the knowledge and information of the University. He can call upon the resources of the University in the more difficult situations.

It is not the purpose of the University to tell turfgrass management what to do, but rather to provide the information and assist in its interpretation and application, in order that management may make sound and competent decisions of scientific validity. The management decisions in the turfgrass field impose upon those responsible for the management of turf a tremendous burden of decision making, requiring knowledge and judgment. They must meet the demands of the turf within the limitations imposed by its use. When the greenskeeper determines upon his program of close mowing of the putting green, he knows he is initiating a practice detrimental to the vigor of his grass, but knowingly doing so he must be prepared to meet the problems of disease which are likely to follow and institute those practices which favor vigor in other ways. It is important, therefore, that he understand his soils and the nature of water penetration, the basic principles of grass nutrition, how to adjust his fertilizer program, and how to control diseases, pests, and weeds. It is through research that we can understand these grasses, that we can define the water requirements, that we can know the nutritional needs, that we can control the disease, weed and insect factors. It is upon the basis of this information that the greenskeeper can develop his program in a manner that will best serve his purposes.

This meeting is evidence of the good working relationships between the University and the industry. It is a demonstration of local interests working with the farm advisor and commanding the full resources of the University in an educational meeting from which progress cannot help but be made. May I congratulate you upon your organized approach and may I express to you the appreciation of the University for your support and cooperation. May I point out that it is through this cooperation that we in California will make progress in the important field of turf culture.

Salinity in Relation to Turfgrass

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Turfgrasses, like other kinds of plants, are damaged if soluble salts build up in the soil. The first symptom of injury, if the salinity problem is only marginal, is simply a reduction in growth rate. Other than this, the plants give no clues that they have run into trouble. This effect of marginal salinity on turfgrass might even be considered desirable on first thought. However, it should be realized that any weakening of a plant caused by salinity increases the vulnerability of the plant to attack by diseases, pests, etc. Marginal salinity problems, moreover, can quickly change to severe ones resulting in leaf scorch and finally the death of the plants. Keeping salts from building up in soil is, therefore, as important a part of turfgrass management as fertilization, irrigation, and disease and insect control.

In any good turfgrass management program, some salts are applied to the soil; this is unavoidable. Salts are added in both fertilizers and irrigation waters. The source of most of the salt added, however, is the irrigation water. The salt content of irrigation waters used on turfgrass in southern California, expressed as electrical conductivity (abbreviated as EC x 10), ranges from a low of about 500 micromhos, to a high of around 4000 micromhos. Relating this to turfgrass, this means that the quantity of salt added to 1,000 square feet of turfgrass in one year ranges from about 60 pounds up to almost 500 pounds, assuming 3 feet of water are applied annually. Generally in less than one year's time enough salt is added in irrigation water to cause a salinity problem with turfgrass, unless good water-management practices are used to prevent salt accumulation in the soil.

Removal of salt from the irrigation water by treatment prior to use might appear to be the solution, but for turfgrass this would be prohibitive in cost. Neither is there any likelihood of any technological break-through that would make this operation practical for turfgrass in the future.

We must accept the fact then that salts come along as part of a package deal in the purchase of irrigation water

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and most fertilizers. No chemical will neutralize or otherwise render these salts harmless to plants once they have accumulated to excessive levels in the soil. The problem, therefore, becomes one of developing management practices that will prevent salts from building up in the soil to levels that will cause plant damage.

To do this, it is essential that the soil be leached, or rinsed, periodically to move any accumulated salt down and out of the root zone. This is the only means of avoiding a salinity problem. Rainfall in southern California cannot be counted on to do this leaching job for us. As a result, turfgrass managers must irrigate heavily enough periodically to wash any accumulation of salt past the plant roots.

This is much easier said than done in some soils; in others it occurs as a matter of course, without any special attention. Generally leaching is most easily accomplished in uniform, relatively coarse-textured soils with good drainage. If drainage is a problem, whether it be due to a high water table, compaction, soil stratification, or excess exchangeable sodium in the soil, advice from qualified sources should be sought to correct or improve the situation. Good drainage is an absolute necessity if salinity problems are to be avoided. In some extremely fine-textured soils, the normal rate of movement of water through the soil is so slow that special irrigation practices must be employed to move salts below the root zone. Development of thatch will also make leaching more difficult.

Soil testing can be very helpful in developing a satisfactory leaching program. By sampling the soil every few months and having the samples analyzed for electrical conductivity of the saturation extract (abbreviated as EC x 10^3) a running account of the amount of salt in the root zone can be obtained and irrigation practices can be modified accordingly. It is important that the soil samples be taken from the root zone. On putting greens this is generally the surface 2 or 3 inches. On fairways and general turf a sample of the surface 12 inches of soil should be taken. Information about suitable sampling tools and the location of commercial laboratories which offer salinity-testing service can be obtained from your local farm advisor.

All turf rass varieties grow well if the soil salinity (EC, x 10^3) is maintained below 4 millimhos. Very few varieties can be grown satisfactorily if the soil salinity exceeds 15 millimhos. Obviously, every effort should be made to keep the EC, x 10^3 below 4, for this provides a safety margin and permits a wide choice of turfgrass varieties that can be grown. If for some reason it is not possible to keep the salinity level below 4 millimhos., salt-tolerant varieties of turfgrass should be selected. Much of the information available for use as a guide in selecting salt-tolerant varieties is based on observations in the field rather than on experimental results. Nevertheless, such field observations do provide a useful rough guide to selection of salt-tolerant varieties until more critical evaluations of salt tolerance are made through research.

In table 1 several turfgrass varieties are listed in salt-sensitive or salt-tolerant categories, according to general field observations:

TABLE 1 – Salt tolerance of several turfgrass varieties, **based on general field observations.***

Salt Sensitive	Salt Tolerant
Colonial bents	Rye
Red fescue	Zoysia
Meadow fescue	St. Augustine
	Bermuda

Information from Dr. V. B. Youngner

Recently, at UCLA five varieties of turfgrass were studied to determine their specific salt tolerance, and these varieties are listed in table 2:

TABLE 2 – Salt tolerance of several turfgrass varieties, based on recent research at UCLA. *

Low Salt Tolerance	Medium Salt Tolerance	High Salt Tolerance
Kentucky bluegrass (4)	Alta fescue (7)	*Puccinellia (distans 14)*
Highland bent (4)	Seaside bent (10)	

Published in Agronomy Journal, Vol. 53, pp. 247-249 (1961). "Salinity Tolerance of Five Turfgrass Varieties" by 0. R. Lunt, V. B. Youngner, and J. L. Oertli.

The numbers in parentheses following the names represent the maximum salt concentration, i.e., electrical conductivity of the saturation extract, that the varieties can tolerate in the root zone and still maintain presentable appearance with regard to density and general quality.

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Soil Water Relations

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Irrigation management of turfgrass areas is largely based on the personal judgment of the irrigators. That these irrigators are to a degree successful is attested to by the many large areas of excellent turf which are now available for the enjoyment of Southern Californians. When a survey is made of the statements describing the irrigation management of turf, however, large differences appear to be evident. It is not the purpose of this article to attempt to resolve these differences, but a brief discussion of methods of irrigating evaluation and soil water measuring techniques may prove to be helpful.

In practice gardeners or groundskeepers use a variety of indices for judging when irrigation is necessary. The appearance of the turf, the resistance of soil to probing, and the wetness of soil as judged by feel are some of the methods commonly used. When these methods produce good results, they are not subject to criticism, but the characteristic of all such methods is that they are based on the judgment and interpretation of the people involved.

For quite a number of years, research work relating to horticultural and vegetable crops has been oriented to explore the use of soil moisture measuring instruments for guiding irrigation management. The results have been sufficiently encouraging that growers are adopting the use of such instruments under commercial practices.

It has been adequately demonstrated that soil moisture measuring instruments, called tensiometers, are able to indicate a property of the soil water in terms of readings on a numerical scale. Such an instrument consists of a porous ceramic cup placed on the end of a tube which in turn connects to a vacuum gauge. The cup, tube, and gauge are filled with water. The ceramic cup is inserted in the soil where plant roots are growing. As the soil water is depleted by root action, a greater stress or suction is developed in the water films around the soil particles which draws water out through the porous cup wall. This water withdrawal results in a higher reading on the gauge. When water is added to the soil by irrigation or by rainfall, the suction in the soil water films is reduced, water is free to flow back into the cup, and the gauge reading is lowered.

Several advantages in connection with the use of such instruments are worthy of mention. Tensiometers measure a property of the water films in the soil and it is not necessary to interpret the readings for each soil type involved. Readings on tensiometers are in some ways similar to readings on thermometers. Just as a temperature difference influences the direction of heat flow from hot to cold, so do tensiometer readings show that soil water tends to move from regions of low to high suctions. In fact, using tensiometer readings to guide an irrigation practice is quite similar to the use of a thermometer or thermostat to control the heating of a building.

As indicated above, soil wetness as measured with tensiometers is related to conditions governing flow or movement of water. For this reason it is felt that such instruments measure the best single index of water availability to plant roots. Looking at the soil water system on a microscopic scale, when the water in contact with root hairs is taken into the plant, water some distance away from the root flows or is drawn toward the root and in turn is taken into the plant. The uptake of water by plants is a flow process, which is related directly or indirectly to tensiometer readings. (Where salinity is a factor it also influences water availability to the plant and it is not evaluated with tensiometer readings. Salinity is measured on a soil sample taken from the root zone by making a water extract of the sample and measuring the salt in the extract.)

Perhaps the greatest advantage of evaluating an irrigation treatment by the use of instruments is that, when a certain treatment is found to be favorable, this treatment can then be carried out in any location where similar instruments are used. Following soil moisture conditions in the root zone of plants by means of instruments is less dependent on personal interpretation.

Most of the information now available on the use of tensiometers has been obtained relative to crops other than turf. Recently, several different agencies have recognized the importance and magnitude of the problems relating to turf management and have started tests using tensiometers. It is probable that some changes in instrument design will be needed to adapt instruments for use under turf. The facts that turf rooting is relatively shallow and that in many places instrument gauges cannot be exposed above the turf are two of the special problems under study.

It must be recognized, of course, that irrigation is only one of many management practices and it must be carried out in coordination with mowing, disease control, and general use of a turf area. Until more investigations have been carried out it is too early to predict how useful soil water measuring instruments will be in the management of turf. Nearly everyone connected with the growing of turf recognizes the importance of good practices and the high cost of water and labor to irrigate. Any source of information which will contribute to better irrigation management is worth spending some time and effort exploring.

Patterns of Turfgrass Disease

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The goal of those engaged in plant pathological research is the understanding and prevention of plant diseases. Turfgrass diseases that cause millions of dollars of loss each year are most commonly the result of fungal attack. Bacteria, nematodes, and viruses are not yet recognized as playing an appreciable part in the production of turf diseases, although their potential importance must not be overlooked. Therefore, the parasitic fungi must be regarded as the most common cause of serious turf diseases in this country, and our most diligent efforts must be directed toward controlling these formidable pathogens.

During the last half century the general standard of quality for fine turfgrass has been raised considerably. Pathological problems unique to turf culture have become increasingly important. Although turfgrass is reported to be susceptible to attack by over 100 different fungus pathogens, only about a dozen are capable of causing appreciable damage.

Is turfgrass culture unique with respect to disease incidence and, if so, why? I think it is unique. In the first place, there is no system of agriculture that is more intensive and demanding. Once planted, turfgrass is meant to be relatively permanent; therefore, the cardinal agronomic principle of crop rotation cannot be practical. And yet, nearly all accumulated agricultural experience indicates that a monoculture crop system is detrimental to the growth of successive crops. In addition to the evils of continuous culture, turf is subjected to all forms of abuse and mal-treatment, and yet it is expected to grow and thrive. Some of these abuses are: 1) regular removal of a large portion of the photosynthetic surface by frequent mowing; 2) human traffic, cultivation, machinery, vehicles, athletic activities, resulting in soil compaction; 3) the choking effect of the continued accumulation of grass residue (thatch); 4) irregular watering practices; 5) irregular, infrequent, and sub-optimal fertilization or over-nitrification; and 6) too frequent application of herbicides, insecticides and fungicides.

The relation of these factors to the maintenance of healthy, vigorous turf needs clarification.

To understand turf diseases and to be in a position to treat them intelligently, one should have an understanding of the basic principles of plant growth and the manner or pattern of disease development. One frequently finds injured turf being treated with expensive fungicides in an attempt to check a loss due to chemical injury, poor drainage, or some factor other than a pathogenic fungus. Such treatments are not only wasteful, but often they actually aggravate conditions and result in still greater loss. If a careful observer understands the fundamental factors which influence the growth of grass and at the same time encourage the growth of fungi, he is better able to understand why a disease develops at certain times on one green and not on the rest of the course, or one lawn and not another.

The majority of pathogenic organisms live in the soil and attack plants only when conditions are favorable. In general, each fungus causes a characteristic type of lesion on its particular host. The part of the plant that is penetrated differs with the species of host plants, as well as with the attacking parasites. The fungi may attack the leaves, stems, roots, rhizomes, stolons and seeds. A single plant may be attacked by more than one species of fungus at the same time, and may be injured by leafspot, blight, and/or a root rot. In some cases a leaf may be almost filled with mycelium before the cells collapse, while in others the infection is localized in a small area of the leaf. When the roots are attacked and killed, they are no longer able to function in supplying water and food, and the plant dies.

The importance of environment as a factor in the occurrence and severity of diseases can hardly be overestimated, since both the parasites and host plants respond to conditions of environment. For example, all fungi have a definite temperature below which they will not grow; an optimum, a point at which they make their best growth; and a point above which they will not grow. The host plants also respond to temperature, but their critical points of minimum, optimum, and maximum temperature may be quite different from those of the pathogen. When the optimum temperature for a particular fungus is much higher than the optimum temperature for the host, and a temperature is reached which is favorable to the host, the fungus grows abundantly, the resistance of the host may be decreased, and infection is likely to occur.

In addition, fungi have requirements for water, light, food, air and other conditions which may be different from the host plant. The resulting differences help to determine whether a host plant will be resistant or susceptible to infection.

It is of prime importance that correct diagnoses be made of turfgrass diseases, for without correct diagnosis, no disease can be treated intelligently. A treatment successful with one disease often is of no value with another.

The problem of diagnosis is often difficult due to similarities between the symptoms of certain diseases. In many cases, unusual environmental conditions so modify the usual symptoms that it may be difficult to recognize them merely from a printed description. The

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difficulty, however, is no greater than that experienced in identifying plants which may vary somewhat from the usual type of any species. Printed descriptions of any diseases, whether they be of human ailments or turf disorders, are merely guides which, in the hands of an intelligent reader, may be made to serve a useful purpose. In spite of the similarity of many symptoms of turf diseases, the problem of distinguishing between them is by no means as difficult as it may appear. However, after turf has been dead for a few days it is often impossible for the expert as well as the beginner to determine what killed it. The man who is on the alert has an advantage in diagnosing turf diseases, for he knows all the developments leading to the onset of disease from its earliest symptoms.

In the following discussion, descriptions are presented of the more typical symptoms of seven diseases with sufficient detail to enable the alert observer to make his own diagnosis. If he can correctly and quickly diagnose these diseases, he may be in a position to promptly apply the remedies available for each disease, thereby avoiding aimless and costly methods of blindly applying fungicides for all browned turf.

1. Fusarium patch or pink snow mold- *Fusarium nivale*

Epidemiology and Diagnostic Symptoms: This disease usually makes its appearance during periods of cool, wet weather. It is most severe on heavy soils with a relatively high pH, and damage begins most frequently in the winter or early spring. Annual bluegrass *(Poa annua)* is the grass species most commonly attacked by *Fusarium nivale*. Creeping bent varieties are also susceptible, however. As the disease develops, small patches of grass (roughly 1-3 inches in diameter) are infected and first appear water soaked, gradually becoming bleached in appear ance. A very faint tinge of pink or white mycelium may be seen early in the morning around the edges of dead and dying grass shoots and blades. The fungus may penetrate as far as the crowns of the plant, but the attacked plants appear to die principally from leaf damage. Occasionally the characteristic pink or salmon-colored sporodochia may be seen on dead plants. These sporodochia serve well in the diagnosis of this important turfgrass disease.

II. Helminthosporium leaf spot or blight and foot rot of *Poa pratensis* – *Helminthosporium vagans*

Epidemiology and Diagnostic Symptoms: This disease is important on perennial bluegrass species and can be very destructive under suitable environmental conditions, usually a wet spring followed by early, warm summer temperatures. In closely mown turf, *Helminthosporium vagans* can be responsible for the gradual disappearance of Kentucky bluegrass. Foot rot is most severe when turf is mown to a height of less than 3/4 inch; therefore, one of the best cultural control measures is to raise the height of cut to 1 1/2 or 2 inches or leave the grass uncut for several days. Symptoms of disease caused by *Helminthosporium vagans* include: (a) scattered circular to elongate leaf spots, 0.5 to 3 mm by 1 to 8 mm, with prominent reddish-brown to black borders, at first dark to light brown in the center but becoming straw colored to bleached white, (b) also a foot-rot stage where the whole leaf sheath is affected, the stem and crown are killed, and brown necrotic lesions form on the rhizomes.

III. Dollar spot – *Sclerotinia homeocarpa*

Epidemiology and Diagnostic Symptoms: This disease will make progress in hot, dry weather only if there are heavy dews; consequently, soil surface temperatures in the range of 60° to 70° F. are most favorable for the development of dollar spot. It is most noticeable when the grass is not growing rapidly, yet nitrogenous fertilization may increase the amount of dollar spot, not necessarily during the current year but in the next season of growth.

Injured areas may include turf of varied fescue, bentgrass and bluegrass composition. Diseased spots first appear brown, later bleached, and rarely greater than 2 inches in diameter; however, occasional coalescing may occur. In the area of central California, reports of the occurrence of this disease may be viewed with some skepticism unless made by a competent observer familiar with its symptoms, and preferably one with facilities for diagnosis by cultural methods in the laboratory. This disease has not been well recognized and is frequently confused with red thread and pink snow mold. The dying out of patches of *Poa annua*, scorching with fertilizer granules, and other types of injury may produce symptoms superficially resembling dollar spot.

IV. Grease spot – *Pythium* spp.

Diagnostic symptoms: This disease seems to be particularly troublesome in cool soil in the spring, especially in young stands. It attacks seedlings of many species, which initially appear water soaked and sometimes matted, eventually turn black, shrivel, and finally bleach. Tissues rot and collapse just at or above the ground surface. Patches up to 4 inches are affected, but in older turf it tends to form "streaks."

V. Brown patch – *Rhizoctonia solani*

Epidemiology and Diagnostic Symptoms: Inoculum in the form of sclerotia is prevalent in most soils; hence, outbreaks of this disease depend upon the presence of a susceptible host and favorable environmental conditions. Most species of bentgrass *(Agrostis)*, fescue *(Festuca)*, ryegrass *(Lolium)*, and annual bluegrass *(Poa annua)* are susceptible, while Kentucky bluegrass is reported to be less susceptible. Attacks have been observed on "dry" grass, indicating that air temperature may have an effect greater than free surface moisture. Late afternoon watering may accentuate this disease, since moisture may be more important as a modifier of air temperature than a direct factor for sclerotial germination and mycelial growth. Many investigators have found that mycelial

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growth and subsequent disease development were greater at low soil moisture and less at high, presumably due to decrease in soil aeration with increased soil moisture. Observations indicate that deficient, slow-growing plants may be predisposed to infection.

Brown-patch injury occurs typically in the form of a "smoke ring" of grayish-black mycelium from 1/2 to 1-1/2 inches wide, and delimits the patch when the fungus is actively growing. The leaves become water-soaked, blacken, collapse, dry out, and become light brown in color. The fungus spreads from a central point, leaving roughly circular wilted brown areas, usually from 1 inch to 3 feet in diameter but sometimes reaching 20 feet.

VI. Rusts – *Puccinia* sp.

Diagnostic symptoms:

1. Stem rust – *Puccinia graminis* var. poae. Oblong reddish or black pustules covering leaves, leaf sheaths and stem when severe. Readily identifiable.

2. Stripe rust – *Puccinia striaformis.* Elongate, effused citron-yellow to somewhat orangish "stripes" of small pustules which coalesce readily.

The degree of susceptibility or resistant reaction depends on variation within the grass species, but chiefly on pathogenic specialization (physiologic races) of the pathogen. Many species of turfgrass are susceptible.

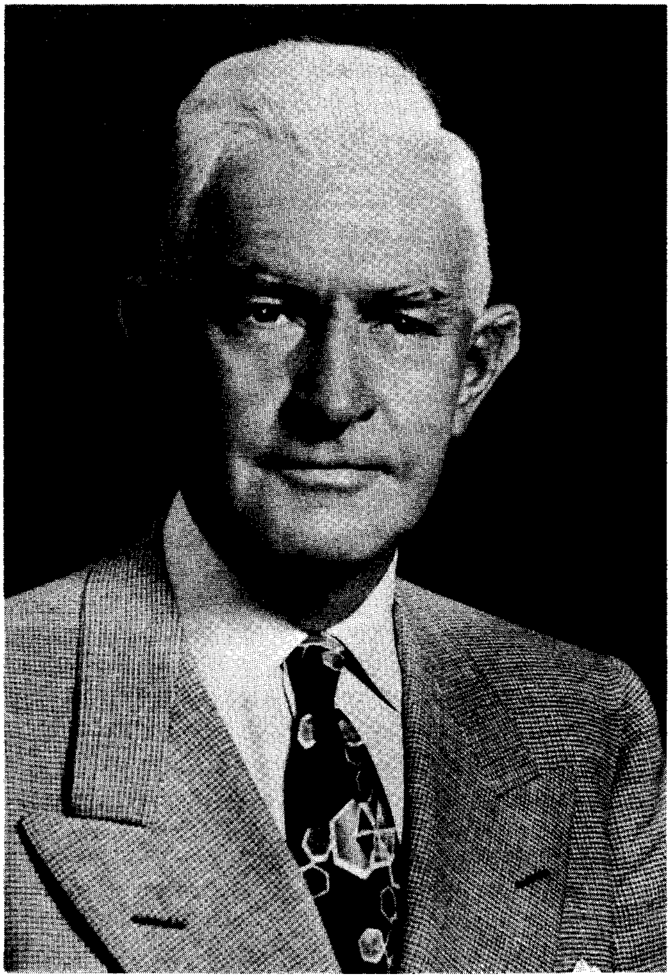
VII. Red thread – *Corticium fuciforme*

Epidemiology and Diagnostic Symptoms: This disease occurs on low fertility turf and attacks *Festuca sp.,* particularly *F. rubra* (red fescue). However, bentgrasses and annual bluegrass are sometimes affected. The most noticeable symptom is the presence of coral-pink or red outgrowths (stromata) of the fungus. In wet weather, with abundant mycelial production, the patches are slimy to the touch and assume an over-all reddish tinge. This coloration is partly due to the presence of pink stromata and pink mycelial incrustations on the leaves and shoots, and partly to the pink color assumed by the foliage. Readily recognizable.

WHAT IS A WEED?

There are a number of different definitions of a weed. Webster's dictionary defines a weed as – "Wild growth, as rank grass undergrowth, etc.", or "Any plant growing in cultivated ground to the detriment of the crop or to the disfigurement of the place." Other common definitions are, "a weed is a plant that is out of place," and "a weed is a plant that has no economic value."

That which may be a weed in one situation may be the desirable species in another. Dichondra is a weed on the bermudagrass golf course fairway while to many a home owner bermudagrass is the weed in his dichondra lawn.



C. C. SIMPSON

Mr. Colin C. Simpson died September 20, 1961 while on a fishing trip in Idaho. Mr. Simpson, past president of the Los Angeles Country Club and the Southern California Golf Association, was well known and highly respected by many in the Southern California Turfgrass Industry. He lead the efforts to form the original Turfgrass Advisory Committee in Southern California and later helped to organize the Federated Turfgrass Council of California. Mr. Simpson served as President of the Turfgrass Advisory Committee from its inception in 1948 until it was reorganized into the Southern California Turfgrass Council in 1956. In this capacity he did more than any other individual outside the University to develop the Turfgrass Research program at U.C.L.A.

Memorial services were held at Forest Lawn Memorial Park on September 26, 1961.

Robbins, Bellue, and Ball state in their book, *Weeds of California,* that 63 percent of the weeds they mention are introduced species. Many of the most noxious weeds of the state are in this group of aliens.