Jim Watson

PROCEEDINGS

SECOND ANNUAL

NEW MEXICO TURFGRASS CONFERENCE

Oct. 4-5, 1956

Sponsored by

Agricultural Experiment Station — Agricultural Extension Service

NEW MEXICO COLLEGE OF AGRICULTURE AND MECHANIC ARTS

UNITED STATES GOLF ASSOCIATION

NEW MEXICO TURFGRASS ASSOCIATION

Foreword

Second Annual New Mexico Turfgrass Conference

Fifty-six individuals registered for the Second New Mexico Turfgrass Conference held at New Mexico A & M College on October 4-5, 1956. There were a number of individuals attending the meeting that did not register. Many of these were students in Agriculture from New Mexico A & M.

Those attending the meeting gave an excellent cross section of people working either directly or indirectly with turf. There were nine representatives from golf courses, nine from nurseries and turfgrass farms, seven from parks and cemetaries, eight from colleges and high schools, eight commercial dealers in turf supplies, four Extension personnel, four from military installations, and three Agronomy Department personnel.

Dr. Marvin Ferguson, U.S.G.A., Green Section, acted as program chairman. We wish to commend him on the excellent way in which he handled the sessions to bring out the best in each paper presented. There were many nice comments on the conference, and we hope each individual received some good from each paper.

We wish to take this opportunity to thank all industrial and educational representatives appearing on the program. We especially wish to thank the U. S. Golf Association, Green Section for helping arrange and to carry out the conference.

We regret that it is necessary to publish these proceedings with two papers missing. These two papers had excellent material which will be badly missed.

SECOND ANNUAL NEW MEXICO TURFGRASS CONFERENCE

New Mexico College of A & MA
Sun Room, Milton Hall
State College, New Mexico

October 4 and 5, 1956

October 4

8:00 ..... Registration

10:00 ..... Welcome
Dr. R. B. Corbett

10:20 ..... Announcements and Appointment of Committees
Mr. Fred Day

10:55 ... General Turf Observations Made During the Summer of 1956
Mr. Clarence E. Watson

11:30 ..... The New Mexico Nursery Act in Relation to Turfgrasses
Mr. Dallas Rierson

Noon

1:00 ..... Let's Look at the Grasses
Mr. Jack Kolb

1:40 ..... The Three Enemies: Thatch, Compaction, and Grain
Mr. Tom Mascaro

2:20 ..... Let's Educate the Public to Proper Turf Management
Mr. W. J. Wiltbank

2:40 ..... Coffee Break

3:05 ..... What Makes Turf Outstanding
Dr. O. J. Noer

3:45 ..... Field Trip on Campus
Mr. Fred Day and Mr. Jack Bramble

6:30 ..... Banquet

October 5

8:40 ..... Progress Report on Weed Control
Mr. J. E. Gallagher

9:20 ..... Business Meeting
Mr. Fred Day

10:10 ..... Coffee Break

10:30 ..... The Use of Commercial Fertilizers on Turfgrasses
Dr. S. C. Vandecaveye

11:00 ..... How We Maintain Turfgrass and Ornamentals at Los Alamos, New Mexico
Mr. Carl Freeman

11:40 ..... Conference Summary
Dr. Marvin H. Ferguson

GENERAL OBSERVATIONS MADE ON TURF DURING THE SUMMER OF 1956

Clarence E. Watson 1/

General observations made on turf during the summer of 1956 were extremely varied. Some of these observations were normal occurrences, while others might be classed as unusual. This was a year that good turf management was necessary to produce a good grass cover.

Temperatures played a very important role on turf grass reaction this summer. The month of June and the first weeks of July produced warm days, but had cool nights. The warm season grasses such as Bermuda and Zoysia do not thrive well under such conditions. As a result, Bermuda was an extremely poor example of a good turf grass, unless very good management was practiced. During this period of cool nights, the owners of lawns covered with cool season grasses were literally crowing at their ability to grow grass. The cool season grasses such as Merion bluegrass, red fescues, and ryegrass were developed in the Northeastern or Northwestern section of the United States; therefore, they are well adapted to the conditions that occurred during June.

The later part of July had some extremely hot days and warm nights. The Bermuda grass that had been well managed began to grow vigorously. Turf that had been poorly managed gave little growth response during this period of hot weather. The cool season grasses suffered extreme damage from the high temperatures. Large spots were burned out completely, leaving bare areas for weed invasion. Lawns seeded from prepared mixtures containing such cool season plants as red fescues, ryegrass, bluegrass, and clovers lost many of the components of such mixtures. In areas where the high temperatures killed the cool season grasses, the clover moved in to replace it.

The Las Cruces Country Club had bent greens that became weakened and in such areas Bermuda grass has invaded. The Bermuda is now established and can only be removed by destroying the entire area. Bermuda grass can become a problem if the cool season grass is allowed to deteriorate through mismanagement.

It should be remembered that southern New Mexico is a marginal area for growing cool season grasses. Only by the very best of management can a beautiful turf be maintained through the summer months. It has been estimated that the cost of maintaining a green in excellent shape for one season is approximately $3,000. If a lawn owner has the money and inclination to grow a cool season grass to look like a putting green, he will find there is nothing more beautiful.

A severe grub infestation may have contributed more to turf troubles this summer than was suspected. The grub that was causing

1/ Assistant in Agronomy, New Mexico A & M College

the most damage was the Billbug larvae (Calendra phoeniciensis). This was the first time that it had been identified from this general area; however, it has probably been here for years without being detected. It is a relatively easy matter to grub proof turfed areas with the proper use of chlorodane or dieldrin. Approximately three and one-half pounds of 2% dieldien granules per 1000 sq. ft. should destroy the grubs that are present and prevent reinfestation for several years.

Another problem that gave trouble has not as yet been identified. It has not been determined whether the damage to grass was due to a disease or an insect. At first, the symptoms were thought to be those of downy mildew; however, no mildew spores could be found. Whitish colored spots occurred throughout several lawns in and around Las Cruces with almost immediate death occurring to the grass in those spots. Symptoms occurred on Bermuda, bent, lovegrass, and ryegrass.

Perhaps a report is in order on various Bermuda strains in an observational nursery in Mesilla Valley. The strains in the nursery are T-94 (Cynodon magennisii), T-82 (Ormond), T-8, T-35A, U-3, T-47, Tiflawn, Tifgreen, African, and Tiffine. Also, Emerald and Myer Zoysia were included in this nursery.

T-94 had the most vigor of all the Bermudas with perhaps too much vigor for most users. It had a fine texture with a nice dark green color. This strain is extremely susceptible to rust.

T-82 gave good growth but not as vigorous as T-94. This strain is medium textured with the best color of all the Bermudas. The main objections to this grass is the upright growth, susceptible to wear, and is not drought tolerant.

T-8 is one of the poorest of all the grasses. The texture is medium to coarse with extremely poor color. It did have some drought tolerance.

T-35A is a fine textured grass with a vigorous growth and a light green color. It is not drought tolerant and can withstand some wear. It will require mowing often and close.

U-3 does not seem to be well adapted to southern New Mexico. The vigor is very poor compared with other grasses. The color is excellent; however, the texture is about the same as common Bermuda. It does have excellent winter hardiness.

T-47 is a coarse textured Bermuda with excellent color and other desirable turf qualities. It is extremely wear resistant and drought tolerant. The stolons lay close to the ground and requires much less mowing than other Bermudas. It does not throw seed heads nearly as readily as common Bermuda.

Tiflawn is extremely coarse textured and has very few good turf qualities. Can not be recommended for New Mexico.

Tifgreen is a very fine textured grass with an excellent pea green color. The stolons lay close to the soil, thus requiring less mowing than ordinary. It will not withstand wear and drought nearly as readily as T-47. It should be excellent for greens and home lawns where heavy traffic is not a problem.

African is a fine leaved strain with a pale green color. It will not stand heavy traffic or mowing. It tends to burn out during the summer in southern New Mexico and has very few desirable turf characteristics.

Tiffine is a fine leaved strain with fair color and good vigor. It is not drought tolerant nor wear resistant. Frequent mowing will be necessary for this strain.

Other strains will be included for observation during 1957. Some of those to be included are Uganda, Murray grass, Bermuda from Iran, Royal Cape, Barberspan, Skapplaass, Cynodon incompletus, Cynodon bradleyi, and twenty selections from Holloman Air Force Base.

Speech given by Dallas Rierson
Director-State Department of Agriculture
to
The Turfgrass Conference

THE NEW MEXICO NURSERY ACT IN RELATION TO TURFGRASS

Dallas Rierson 1/

Mr. Chairman, and gentlemen, it is certainly a pleasure to have the opportunity to discuss with you the New Mexico Nursery Act and parts of this law which I believe will be of interest to you. First, I would like to say that this is not a new act, but was actually passed in 1937. However, due to the lack of funds for enforcing the act, very little has been done up until the past year.

One of our big problems is getting those concerned acquainted with this act, and working with them in meeting these requirements. Actually, the New Mexico Nursery Act covers most all plants, and parts of plants used for propagation except field, vegetable, and flower seeds, and even includes cut flowers. Sometimes when we use the term "nursery", those handling floral stock and other material for propagation feel that they are not included, but the definition within the law is very general and gives almost complete coverage to this type of material. The main protection afforded to the nurseryman, as well as to the consumer, is from the standpoint of keeping out insects and disease and, in the case of turfgrass, noxious weeds.

I would like to mention some of the requirements for shipping into the state of New Mexico. Any out of state concern wishing to

1/ Director, New Mexico State Department of Agriculture

ship into New Mexico, must file with us a copy of their state inspection certificate and must purchase New Mexico permit tags from this office. I might add that we are one of only two states which require out of state people to purchase permit tags. The other is Florida. This really has no advantage for us and is quite inconvenient for out of state people wishing to ship into this state, since they must also attach a copy of their own state certificate. I hope that we can correct this during the next Legislature.

Those wishing to ship within the state are required to file an application for inspection, which is made by our nursery inspector; and they, too, must purchase tags to be attached to each package shipped within the state. Also, anyone wishing to sell any nursery stock must have an inspection before offering it for sale. It may be of interest to some of you that shipments into Arizona or California must have, in addition to the usual inspection, an inspection for Ozonium Root Rot, and a certificate certifying to the freedom from this must be attached to shipments into these states.

For the past three months we have been working with the Nurserymens' Association in an endeavor to lay the foundation of a new nursery law to be presented before the next Legislature, and which will correct many of the faults of the old law. Copies of a tentative proposal have been sent to the Florists' Association and the garden clubs. We plan to meet with representatives from these groups in order to work out a final proposed act which will better meet the needs of New Mexico.

I have covered rather briefly some of the highlights of the Nursery Act and how it might affect you; and in order to avoid discussing points which might not be of interest to you, I may have overlooked others which you might have in mind. I would prefer at this time, to have a question and answer session, if it is agreeable with the chairman ..... (after questions). Again, I want to express my thanks for the opportunity to discuss with you the nursery act; and, if, at any time we may work with you, we will be glad to do so.

LET'S LOOK AT THE GRASSES

J. L. Kolb 1/

Factors which contribute to production and development of desirable turfgrass under a given set of environmental conditions include, first, the inherent characteristics of the grass itself, and secondly, the environment and use conditions to which the grass is subjected. Likewise, management plays a most important role in the production of good turfgrass. A good manager often will be able to produce satisfactory turf, even though the grass with which he is working may be inferior. On the other hand, the very best of turfgrasses may often fail to develop into satisfactory turf in the hands of a poor manager.

1/ Agronomist, Toro Manufacturing Corporation, Minneapolis 6, Minnesota

Let's look at the grasses then from the standpoint of a few of the major factors responsible for the variations occurring in the production of turfgrass.

A Look at the Grasses with Respect to Climate

Basically, grasses may be divided into two broad groups; namely, cool season and warm season grasses. This broad classification applies to perennial and annual grasses, whether they be considered as desirable turfgrass species or weeds.

Cool season grasses are those which make their maximum growth during the cooler parts of the year; i.e., in the spring and fall in the northern regions, and in the late fall, winter and early spring in the South. Examples are bentgrass, bluegrass, fescue and ryegrass.

Warm season grasses are those which make their maximum growth during the warmer parts of the year; i.e., in the late spring, summer and early fall in the South and borderline areas. Examples are Bermudagrass, Zoysia, St. Augustine and centipede. Most of these grasses do not survive (over winter) in the northern areas. Warm season grasses initiate growth near 55°, attain their maximum at about 90° and then growth gradually declines, almost ceasing at 120°. Cool season grasses, on the other hand, initiate growth at slightly above 32°, and attain their maximum at approximately 86°.

Unlike the gradual decline in growth exhibited by warm season grasses, as the temperature increases, the growth of cool season grasses drops off rapidly and when the temperature reaches approximately 98°, growth activity has practically ceased.

A Look at the Grasses with Respect to its' Roots

Roots are influenced greatly by the condition of the soil in which they are growing. This soil should have desirable pore space distribution, be abundantly supplied with available nutrients, be periodically replenished with water, and be sufficiently permeable to permit good drainage.

Most of the water and nutrients which plant roots are able to take up are made available to those plant roots by the extension of the roots into parts of the soil which have a sufficient amount of available moisture and a ready supply of nutrient elements. In other words, the plant root must seek out new supplies of moisture and nutrients, instead of these materials seeking the root; otherwise, it would soon utilize all the nutrients and water in a given area. This is one reason for having a healthy well fertilized grass with a vigorous root system.

A Look at the Grasses with Respect to Fertility Requirements

Fertility requirements on the grasses will be influenced by a number of variables. These variables will include the type of grass, the use to which that grass will be put, soil conditions, moisture supply, climate and past fertilization history.

Nitrogen is the key to successful fertilization, since it is the element most abundantly used. Other elements must be present in balanced amounts. Any element which is deficient could be said to be the most important element in the fertilizer program, since it will be the limiting factor of growth.

Nitrogen applications on heavy soils will vary from four to six pounds of actual nitrogen per thousand square feet per year. On lighter soils, the optimum amount may run as high as eight pounds of actual nitrogen per thousand square feet per year. These rates must be split into three or four applications.

A Look at the Grasses with Respect to Mowing

Height and frequency of cutting play a major role in the appearance and longevity of turfgrass.

In general, the coarser the leaf texture of the grass, the higher it should be cut. Continuous close shearing of a grass that should be mowed high will result eventually in loss of vigor and reduced stand. Kentucky 31 and Alta fescue are examples of coarse leaved grasses. Bentgrass is an example of a fine textured grass.

Texture is important because of its influence on the size of the food manufacturing plant or photosynthetic area. The greater the leaf area, the greater is the capacity of the grass for food production. Finer textured grasses have more leaf area, and accordingly a much higher food production capacity, even when cut closer than coarser grasses. In order to compensate for this difference, coarser grasses must be cut higher.

Mowing higher than the optimum level, on the other hand, may reduce the vigor and performance of the grass. Thatch will build up, appearance will decline, and weed invasion may increase.

In addition to height of cut, frequency of mowing is very important. In fact, these factors go hand in hand. A rule of thumb states that "no more than one-third of the growth should be removed in any one cutting." This means that a turf maintained at one inch should be cut before the growth exceeds one and one-half inches.

Proper mowing management, therefore, includes cutting the grass at an optimum height and often enough to avoid severe and excessive removal. Frequent light clipping will maintain the turf in a well groomed appearance without over-taxing vigor and condition.

A Look at Grasses with Respect to their Growing Habits

Grasses do not grow entirely from the tips as many plants do, but from meristematic tissues (growth producing region) near the nodes; thus the grass leaf is being moved up from the bottom. This type of growth is referred to as "basal growth." Basal growth is important from the standpoint of height and frequency of cut, as well as the amount of material that can be removed without damaging the plant.

As long as the tips of the leaves are clipped cleanly, the plant is not damaged; but if the growth producing region is removed, such as is done in severe cutting, the plant would then have to regenerate a complete new set of leaves, as well as a stem. With all conditions favorable, the plant may recover. There is some indication that ragged cutting, or leaves cut with a dull mower, will be slower to recover than leaves cut cleanly.

Summary

A look at the grasses is a look at turfgrass quality. Quality of turf is the result of many closely related and interdependent items. The type of grass used is only one of these. Factors such as weather, chemical and physical soil properties, management, and use have a direct bearing on the quality of the turfgrass ultimately produced. Inherent characteristics play a major role in the ability of grasses to produce satisfactory turf. Equally important, perhaps more so than genetic characteristics, is the environment to which a grass is subjected and the role it plays in the production of quality turfgrasses.

In summary, the quality of turf which an individual grass will attain is dependent upon a number of specific characteristics of the grass and how these are affected by its surroundings.

LET'S EDUCATE THE PUBLIC TO PROPER TURF MANAGEMENT

W. J. Wiltbank 1/

As all of you know, New Mexico is growing rapidly each year and has been for a number of years. This growth and expansion within the state has brought many good things to New Mexico - and many problems. Thinking back over the years which I have lived in New Mexico, I remember back to the years before the war when I was in school in Albuquerque. At that time, Albuquerque was still relatively small, and most people living there were people from the West who had lived in Albuquerque or the surrounding areas for many years. These people were basically familiar with the climate and soils of Albuquerque. In addition, most of the residential areas of Albuquerque were in the valley where the soil was fertile and productive. As a result, lawns and ornamental plantings were generally satisfactory.

Compare this situation to the situation of today. Albuquerque has grown by leaps and bounds. Many new residents are employed in industry in Albuquerque; and these people, in the main, are from the middle west, east, and south, where climate and soil are quite different from ours here in New Mexico. New housing areas to accommodate these residents have been built on sites where the soil leaves much to be desired. Many of these new home owners are having their first opportunity to plant and maintain landscape plantings, and this increases the problem.

1/ Extension Horticulturist, New Mexico A & M College

This situation is not confined to Albuquerque alone. Every urban area in New Mexico has the same problem to a greater or lesser degree. Lawn growers all over the state are having a great deal of difficulty maintaining good lawns with the outlay of time and money which they can afford.

The obvious solution to this problem is education of these people to the proper way for growing and maintaining a good lawn. All of us can think of occasions when a bit of good advice or a word of caution would have prevented a costly error. We can also think of times when the lawn grower has received too much advice or recommendations which were not suitable to the situation at hand. Popular home and garden magazines from the East and from the West Coast are filled with advice to the lawn grower. Much of this information is of a strictly local nature and does not fit our conditions in New Mexico. Many times the lawn grower does not realize this until the mistake has been made. We have also seen many lawn growers "sold" on overly-promoted products or on "fads" which have no worthwhile purpose in our lawn growing picture.

How can we overcome these difficulties and educate our home owners to proper turf management? Why is it important to us?

First, let's think about why this problem is important to us. I think it's important to all of us since good lawn and ornamental plantings mean so much to the beauty and attractiveness of our communities. Good lawn and ornamental plantings increase property values, attract new residents and visitors and make living more pleasant.

Education of the public to good lawn management is important to you professional nursery and landscape men because a satisfied customer is a better customer. Repeat sales from these satisfied customers are good for your business. Many times home owners purchase a lawn planting job on price alone. Education concerning what is needed for a good lawn, and its cost, gives the professional man a chance to do a good job, make a repeat customer and return a fair profit. The man who sells a poor job at a low price is soon left behind.

Education of the public to better turf is also important to you working with golf courses and public parks and grounds. People who know the amount of time, effort and money necessary to grow a good lawn will not abuse it. They will understand your problems and be more cooperative in their use of your turf areas.

One of the biggest reasons why I think that education of the public is important to all of us in our turfgrass association is in the field of public relations. When the average home lawn grower realizes that we are interested in his welfare and anxious to help with his problems, we will all gain professionally, socially, and financially. This is something to which we can all look forward.

Now let's think about how we can accomplish this education of the average lawn grower. I think that we've made a big step in

this direction with the organization of our turfgrass association. Here we can talk over the many phases of turf growing and learn better ways to grow good turf. Through these discussions, we standardize our methods and eliminate confusion regarding recommended growing practices. There will always be differences of opinion and different ways to grow good turf, but our discussions can eliminate questionable and unworthy practices from the turf growing picture. Here we can hear from men trained and experienced in turf and learn the results of their research and experience. This, added to our own experience and knowledge, makes us able to advise and help other lawn growers in the state.

The next step is to make this information available to the home lawn grower. We can do this in many ways. Articles for newspapers and magazines, participation in lawn meetings, radio and TV programs and discussions with individuals are all good opportunities for educational work. All of these occasions give us an opportunity to point out good practices and increase interest in good turf. Many successful public meetings have been held with nurserymen, turf managers, research men, extension people, and home lawn growers combining their efforts to present a worthwhile program. Everyone gains from a good turf meeting.

The same applies to the other methods of education - cooperation is important. You are the most qualified men in your communities to advise on good turf. Share your experience and training with each other and with the home lawn growers of New Mexico.

WEED CONTROL FOR TURF GRASSES

J. E. Gallagher 1/

Any discussion of weed control for turf grasses can be divided into two parts - WHY and HOW.

The discussion on WHY, although equally as important, will require less time than the discussion on HOW. We want to control weeds for two basic reasons; they are obnoxious from an appearance point of view; and they interfere with play.

Let's look further into this objection to the appearance of weeds. Personal taste varies; what looks good to one man or one section of the country does not appeal to another, but I think we can agree on one point, and that is uniformity of population. A pure stand in most instances is more acceptable than a mixed population. I am thinking in terms of mixed texture and color. In many areas we have learned to accept turf substitutes - environmental or topographical conditions prohibit the use of turf grass. A clean stand of ivy, periwinkle, or dichondra is very desirable under a certain set of conditions. By the same reasoning, a pure stand of turf grass is equally desirable. A mixture of the two makes one a weed.

1/ American Chemical Paint Company, Ambler, Pennsylvania

It is such a mixture of textures -- that of broadleaf weeds in turf grasses -- which has produced a constant stimulus to agricultural research people to produce selective weed control chemicals which would remove the objected member of the population. Weed control for the standpoint of appearance is needed to provide uniformity of population.

Let us now consider the more practical reasons why we are interested in weed control - that of interference with play. Uniformity of texture here is most important; those of you who play golf know what effect a patch of chickweed or crabgrass in a green has on your putt. You have probably also searched for a ball on a fairway covered with white blossoms, whether they were daisy or clover. Those of you who are responsible for athletic field maintenance have seen the ill effects of large patches of matted bentgrass. The large cleat divots that litter a field following a ball game testify to poor footing which could have resulted in lost yardage, or even worse, ankle or knee injuries. It takes years to produce an all American, but one piece of bad turf can sideline him for a whole season. These are just two of many reasons why we practice weed control. But now let us move into the HOW of weed control.

Turfgrass weed control can be, and actually is, accomplished by many methods. In practice the best method is a combination of several. When we grow turf we are practicing effective weed control. Have you ever stopped to consider that every time you irrigate and fertilize turf containing weeds you are watering and feeding the very plants you object to? Think a minute about the time when weeds are most a problem, and you will find that it is in the spring and fall, just in time for your periodic fertilization. At these times broadleaf weeds are growing strong, and annual weeds, such as chickweed and crabgrass, are starting to germinate. During the warm growing season, all the water you supply may be growing crabgrass. Mother nature will provide a cover and since weeds more readily become acclimated, they will germinate first and grow faster, taking full advantage of all you supply. In brief, if you have weeds, it is because of something you are doing or something you are not doing.

Weeds are indicators - look over almost any athletic field and you will find knotweed growing right down the middle in the area of heavy compaction; look over a turf area that is operating on a low fertilizer budget and you find clover - provide enough N to grow turf, and clover will not be a problem. One sure way to produce crabgrass is to cut your turf low and overwater. Perhaps you can begin to see why I say that the best weed control program is a combination of many methods.

Sound, practical weed control necessitates that you recognize your problem - the earlier the better - prevention here is worth many pounds of cure at a later date. Recognizing your problem means first recognizing your weeds. Where we are concerned weeds are first, broadleaf or grasses; second, they are either annual, biennial or perennial. Most turf weeds are either annual or perennial.

Our annual weed problems are: chickweed, or poa annua as winter annuals and crabgrass as a summer annual; our major perennial weeds are dandelion, plantain, wild garlic, wild onion, clover and grasses such as quackgrass and Johnson grass.

The very fact that we know the classification a weed falls into almost immediately tells us something about its reproductive methods, giving us a start on a weed control program. Annuals must reproduce by seed - there is no other way. Stop an annual from setting seed, and you will control it. Perennials offer a greater problem; they can maintain their species in many ways; by seed, bulblet or tubers and rhizomes or stolons. You can control an annual, but you must eradicate a perennial.

Before I discuss actual weed control chemicals, let us first see if you are doing everything you can to grow turf. If you are growing turf, it is both theoretically and practically possible to maintain weed free turf. Let us consider the following points:

1 - Is the turf grass you are using, regardless of its purpose, the best choice for your area? Is it native or acclimated?

2 - Are you maintaining an adequate level of fertility for optimum growth?

3 - Are you providing adequate moisture; neither too much nor too little for optimum growth?

4 - Are you cutting that turf at a level which will enable it to fully utilize the fertilizer and moisture you provide?

5 - Are you providing all the other cultural practices such as disease control, aerification, and thatch removal necessary for optimum growth of that turf?

6 - Are you using and not abusing the turf?

If you can answer "yes" to all of these points, you do not have a weed problem, certainly not one that would be difficult to solve. Realistically, the demands on the part of the turfgrass user force us to answer no to many points and a compromise on any one will produce less than perfection.

The cultural weed control measures listed in those six points are what you must practice at all times. What I propose to discuss now is related to specific weed control problems.

PROBLEM

Last winter the Weed Society of America held its first national meeting at New York. There was one section, under the direction of Dr. Nutter, which covered the weed control problem in turf. At this meeting the top research and development men in the country presented papers on all phases of turfgrass weed control.

Dr. Ralph Engel discussed pre-emergence crabgrass control. He suggested that pre-emergence crabgrass was the best theoretical answer to one of our worst weed pests. Our goal, according to Dr. Engel, would be a single treatment which was simple, safe and sure. Let's see what is on tap in the pre-emergence crabgrass field. Last year DuPont's new butyl urea compound looked good in several areas. In general, a single application was not enough, and Professor Musser showed injury to fescue grasses with July treatments. This year's tests with this same material has shown considerable variation in results. The second material discussed was Chlordane. Much of the work with Chlordane has been done in this area, but last year's tests in the mid-west and east showed promising results. The rates of application ranged from 40-100 pounds per acre of actual Chlordane, and formulations varied from dry forms on vermiculite through pellets to liquid. Results in general were good. A third pre-emergence material is an old timer making a comeback. Lead arsenate is being used again. In the west a commercial formulation called PAX is being widely tested. Dr. Daniel's work at Purdue this year will show good results with both lead arsenate and calcium arsenate. Rates of 10 pounds per 1000 square feet are being recommended. One other product, ALANAP 1F, was tested last year, and this year results are consistantly good. This material is a vermiculite-fertilizer-napthylphthalamic acid formulation applied at 18 pounds per 1000 square feet. Three applications at monthly intervals are needed. Based on the test results of these materials what appears to be occurring is a trend toward attaching the chemicals to a carrier which will retain it in the germination zone. Fertilizers are being added to grow the turf as the crabgrass is inhibited.

Post-emergence crabgrass control was discussed by Dr. DeFrance of Rhode Island. Dr. DeFrance gave two primary objectives of post-emergence crabgrass control; first to kill the crabgrass plant and prevent seed development and second, not to injure turf grasses. The combined objective is a difficult one to achieve. Dr. DeFrance felt that the phenyl mercuric acetate formulations in his area offered the best chance to achieve the desired results. In the last two years another chemical has been developed and nationally tested which appears to offer possibilities of satisfying the combined objective. Disodium methyl arsonate, after three year's testing, has been found to control crabgrass effectively under a wide range of conditions. Because it is an arsenical, the factors of soil moisture and temperature are extremely important. A third post-emergence chemical this year is working out well is bluegrass country - Dick Stadtherr at the University of Minnesota is having excellent results with a potassium cyanate-MCP mixture. Potassium cyanate has been tested for many years; its selectivity on bluegrass makes it a good chemical to use for crabgrass control where a slight discoloration can be tolerated.

Dr. Grigsby of Michigan State discussed broadleaf weed control. He expressed an opinion that less broadleaf weed control was practiced than what might be expected based on the information available. Dr. Grigsby felt that fear of injury to valuable plants

was the major contributing factor. He suggested fall applications which, at that time, are successful on most broadleaf weeds and offer freedom from danger to sensitive plants. In this day and age plantain and dandelion should not be found in stands of turf. Bluegrass and Bermuda grasses are highly resistant to 2,4-D and 2,4,5-T which make it possible to use higher rates to control hard-to-kill weeds. Bents are somewhat more sensitive but repeat lighter dosages of $\frac{1}{4}$ to $\frac{1}{2}$ pound acid per acre will clean up many weeds; and as long as the bent is growing well, it will recover from the slight injury which might occur from an overdose.

Clover control was covered by Dr. Cornman of Cornell. The use of 2,4,5-T for clover control is now as well accepted as 2,4-D for dandelion control. The same precautions apply, rates of $\frac{1}{4}$ to $\frac{1}{2}$ pound per acre on bentgrass turf and rates up to 1 pound per acre on bluegrass or Bermuda. Fall applications produce best control, but good control can be accomplished with a spring application. Dr. Daniel of Purdue and Dr. Cornman of Cornell have both produced excellent test data to bear out the above recommendations. Dr. Cornman's best results occurred with a butoxy ethanol ester formulation of 2,4,5-T although other forms produced satisfactory results.

Dr. Daniel of Purdue discussed poa annua control. Many of you are familiar with his work and have read his paper in the golf course reporter. Dr. Daniel has been able to show that lead arsonate can effectively reduce poa annua. His analysis of the arsenic-phosphorus relationship explains many of the mixed results which occurred in the past. Dr. Daniel lists the following factors as favoring arsenic uptake:

1 - Low phosphorus availability level

2 - Cool weather

3 - Short days for photo-periodic activity

4 - Arsenic application prior to cool fall and cool spring periods

5 - Having arsenic carrying soil as the surface area

Dr. Daniel is continuing his work on poa annua control with new materials.

To briefly draw this discussion to a close, it can be said that top quality turf can be had through weed control. Weed control chemicals that can do a job are available, but you must <u>grow</u> turf if you hope to keep it weed free.

THE USE OF COMMERCIAL FERTILIZERS ON TURF GRASSES

S. C. Vandecaveye 1/

When rocks crumble by weathering the disintegrated mineral material becomes the parent material from which soils are developed. Soils are the natural medium for the growth of land plants. These plants have contributed more than any other factor to the chemical and physical characteristics of the great variety of soils as we now find them. The disintegrated rocks from which soils have developed contain very little or no life and form a relatively dead inert body. Soils in contrast teem with life. The microbial population of a small thimbleful of fertile soil is four to ten times the human population of the United States. Microbial life and activity rots the dead vegetable material that otherwise would soon clutter up the surface of the earth and make animal and plant life impossible. Although the soil is not a living body in the sense that it can not reproduce itself as plants and animals do, it functions, in many ways, like the animal body.

Like animals, the soil has a circulatory system. Water and plant nutrients are circulated through a network of interwoven channels in the soil body to feed the plant roots much as blood is circulated through the arteries and veins of the animal body to carry nourishment to all parts of the animal. Impairment or blocking of this circulatory system in the soil by waterlogging or inadequate drainage has a drastic detrimental effect on plant growth in that it prevents normal feeding of the plant roots.

The soil body also has a respiratory system. This body is permeated with numerous pores through which air is circulated and purified. The pores function like animal lungs through which the air is circulated and purified. Animals need purified air to carry on their life functions and so do plants. Anything that interferes with proper circulation of air in the soil body is detrimental to plant growth.

Finally, the soil body has a digestive system. Feed passing through the animal body is partially digested in the stomach, and the undigested remains appear as excreta. In the soil body dead plant and animal residues are partially digested by the microbial population, and what remains is a dark colored substance known as humus which is resistant to further decomposition. Humus contains nearly all the nitrogen present in the soil and holds much of the other essential plant nutrients. The nutrients thus held are prevented from loss by leaching and released gradually to feed plants as they need them. Humus also gives body and resilience to the soil body and keeps it in good physical condition. A soil that is in good physical condition is apt to have excellent circulatory and respiratory systems.

As a medium for plant growth, the soil is an extraordinary complex physical, chemical, and biological system. Like any complex living system, the soil body is susceptible to numerous

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disorders, each of which is detrimental to plant growth. When the soil is considered as a living body with its well organized circulatory, respiratory, and digestive systems rather than as a dead inert physical mass of broken down rocks, its complexities, as well as the many reasons for its numerous malfunctionings, can be better appreciated. One can begin to understand that the presence of a plentiful supply of all the essential plant nutrients in a soil is by itself not enough for normal plant growth. Proper functioning of the circulatory, respiratory, and digestive systems are of equal importance.

Among the native plants that have contributed most to ideal circulatory and respiratory systems in soils, the grasses take preeminence. That is one of the reasons the growing of grasses is so highly recommended for restoring the life giving functions of worn out soils. The tops and roots of grasses produce a plentiful supply of raw vegetative matter to be digested by the microbial population in the soil stomach. Humus, the chief by-product of digestion, is produced in abundance. This humus restores the soft crumbly structure of the soil and thereby greatly improves the circulatory and respiratory functions of the soil body. Humus also holds much of the plant nutrients to be released gradually for plant growth. Thus, the growing of grasses on relatively dead inert soil material over a short period of years transforms this material into a living soil body which now is an ideal medium for luxurious plant growth.

Soils in Arid Regions

Soils formed in arid, hot climates, as in many parts of New Mexico, produce comparatively little vegetation during the process of soil formation; and, therefore, very little humus is formed. As a consequence, the nitrogen content of these soils is low since nearly all the soil nitrogen is contained in the humus. The salts released from the decomposing minerals are not leached because of insufficient rainfall, and they accumulate in the soil. Soils developed under these conditions usually are rich in mineral plant nutrients, alkaline in reaction, very low in nitrogen, frequently shallow in depth, often rich in soluble salts which may accumulate in harmful quantities; and, in certain cases, the soil has excessive quantities of sodium in the clay mineral complex. The lime content of these soils is usually high. Unlike other salts, dissolved lime precipitates again as lime in the presence of carbon dioxide gas in the soil. The precipitated lime often accumulates and forms layers of caliche of various thickness and hardness as found in many soils in New Mexico. These layers restrict water and plant root penetration and the depth of the root zone when they are close to the surface. Thus, the problems most frequently connected with the growing of turf grasses in New Mexico are: excessive soil salinity which restricts plant growth, high sodium content in the clay mineral complex which causes poor physical conditions of the soil and, therefore, poor circulatory and respiratory systems of the soil body, shallow soils underlain by caliche or rock, high lime content which causes lime-induced chlorosis of

turf grasses and other plants, inadequate supplies of available nitrogen, and, in certain areas, inadequate supplies of available phosphorus.

Fertilizers for Turf Grasses

Keeping in mind that the soil is an extraordinary complex physical, chemical and biological living body, it must have properly functioning circulatory, respiratory, and digestive systems in order to perform adequately as a medium for plant growth. Obviously, success from the application of fertilizers is dependent first of all upon the proper functioning of these systems.

If the soil contains an excess of soluble salts, they must be removed by leaching. This is easily accomplished where an ample supply of good quality of water is available, and soil drainage is adequate.

Where sodium is in excess in the clay mineral complex, the sodium must be replaced by calcium. This is not easily accomplished but can be achieved by application of sulfur containing compounds such as gypsum, sulfur, or sulfuric acid. The sulfate resulting from these compounds reacts with the sodium in the clay mineral complex and produces soluble sodium sulfate which can be removed from the soil by leaching. The soluble calcium formed in the soil by reaction with these compounds, or added as with gypsum, replaces the sodium and restores a desirable physical condition in the soil body. This process of reclaiming sodium affected soils is slow and rather costly. It can be achieved successfully only in soils with good drainage and with additions of enough water to secure thorough leaching of the salts. For reasons of cost reclamation of soils strongly affected by sodium may not be economically feasible for golf courses and public parks.

One of the common malfunctionings of many soils in New Mexico is that caused by excess lime which results in lime-induced chlorosis. Bermuda grasses and many shrubs are highly susceptible to this chorosis. The symptoms on the chlorotic foliage are similar to those of iron deficiency. It has been established, however, that plant roots growing in calcareous soils are able to take up sufficient iron to supply the needs of the plants. The apparent iron deficiency is caused by immobilization of iron after it has entered the roots, or by faulty metabolism in the plant tissue. The disorder can be corrected by foliar application of iron in solution, or by additions of large amounts of soluble iron compounds, such as iron sulfate, to the soil. The beneficial effects of these applications are temporary and must be repeated too often for practical results. In recent years, special iron chelates and complexing compounds have been manufactured and tried out experimentally. The results obtained with certain of these compounds have been very encouraging. Owing to their newness, it has not yet been possible to ascertain their lasting effect. Should their effect prove to endure for several years, the bothersome problem of lime-induced chlorosis will, at last, be conquered in a practical manner.

Once proper functioning of the circulatory and respiratory systems of soils used for turf grasses has been secured by adequate corrective measures, proper functioning of the digestive system of soils covered with turf grasses is an easy matter. The roots and returned top growth of grasses supply ample raw material for humus formation which by itself contributes greatly to good circulatory and respiratory systems of the soil body. Turf grasses, however, require large amounts of nitrogen. Vigorously growing turf grasses which are clipped at intervals of about a week or ten days produce approximately two to three tons of top growth per acre per year on the basis of dry weight. These clippings contain about 2.5 to 3.00 percent nitrogen on the dry weight basis. If clippings are removed from the turf, as they often are, it means that about 120 to 150 pounds of nitrogen are taken away from the soil per acre per year. Many of the soils in arid, hot areas contain less than 2,000 pounds of nitrogen per acre. Only a small percentage of this nitrogen becomes available for plant growth in any one year. Hence, most of the nitrogen required by vigorously growing turf grasses must be supplied by applications of nitrogen containing fertilizers which should supply approximately 120 to 150 pounds of available nitrogen (N) per acre per year. Since most of the commercial nitrogen fertilizers contain their nitrogen in the water soluble form, the (N) is immediately available to grass plants. The result is flush, excessive growth for a short period of time, unless the fertilizer is applied in small amounts several times during the growing season. The advantage of using farm manures as a source of (N) is that the nitrogen is released slowly in available form. Grass growth, therefore, is less vigorous than from additions of equivalent amounts of (N) in commercial fertilizers, but the effect lasts throughout the growing season. This is a desirable feature which begins to approach the ideal condition of grass that remains green without necessitating frequent cutting. Sewage sludge is another form of nitrogen containing fertilizer which releases its (N) slowly over a prolonged period. Milorganite is such a fertilizer and has proved to be valuable in maintaining turf grasses in good condition.

In recent years, attempts have been made to manufacture nitrogen fertilizers with qualities similar to those of dried and pulverized sewage sludge. Various treatments of urea with formaldehyde to make a product known by the name of ureaform have resulted in a nitrogen fertilizer with qualities in rate of release of available (N) approaching more nearly those of farm manure and sewage sludge. The product contains about 38 percent (N), and experimental results obtained with this product have indicated that this fertilizer may be well suited for the maintenance of turf grasses in vigorous condition without excessive flush growth.

Another plant nutrient deficiency for turf grasses that may occur in certain New Mexico soils is available phosphorus. This deficiency can be expected to occur more frequently in the future as grass stands get older. Phosphorus deficiency is easily corrected by the application of any of the phosphate fertilizers available in the market. This may consist of the common superphosphate which

contains 18 to 20 percent phosphoric acid (P_2O_5) or of any of the concentrated superphosphates containing from about 40 to 48 percent (P_2O_5). Applications of these fertilizers at the rate of 60 to 80 pounds of (P_2O_5) per acre once a year or in alternate years is ordinarily sufficient to correct phosphorus deficiencies.

In certain areas of the United States soils are deficient in available potassium, but such deficiencies are rare in New Mexico soils. Should soils be found that are deficient in available potassium for turf grasses, it would be necessary to correct the deficiency by applications of potash fertilizers.

It should be emphasized that satisfactory results from the use of any commercial fertilizer for turf grasses as for any other plants can not be achieved unless the soil functions as a living body in which the operation of the circulatory, respiratory, and digestive systems is not impeded by abnormalities of the physical and chemical properties of the soil. Correction of any such abnormality is a prerequisite to successful results from applications of fertilizers.

PLANNING AND COST ACCOUNTING OF TURF AND ORNAMENTAL MAINTENANCE AT LOS ALAMOS

Carl Freeman 1/

Mr. President; Gentlemen,

I was asked to talk to you on the planning and cost accounting of turf and ornamental maintenance at Los Alamos. On reading the program I see that this was reduced to "How We Maintain Turf and Ornamentals at Los Alamos". Actually, Gentlemen, we do it the same way you all do. Just work like Hell.

However, we do indulge in a very accurate cost accounting in all phases of the work we do. Intensive advance planning is required in order to stay within the cost estimated and from which your budget is made.

The Zia Company, for whom I work, is charged by the United States Atomic Energy Commission with all the maintenance at Los Alamos, New Mexico, except for a very minor portion. Los Alamos is a town of about 13,000 people. All buildings and grounds are the property of the U. S. Government. Residential buildings are rented by the people. Business's are let as concessions by the Government. Naturally, in a town of this size, there are public recreation areas such as Parks, Ball Fields, Picnic grounds, Playgrounds, Public Lawns, and Parkways. Lawns around large apartment buildings are also maintained by the Zia Company. Altogether, the Zia Parks Department is charged with approximately 100 acres of lawns, 1500 acres of meadows and open areas within the town site and several sections of wooded land within the experimental areas.

1/ Director, ZIA Parks Department, Los Alamos, New Mexico

There are three items that form the basis for cost accounting in the Zia Company. They are the (1) work-order, (2) time card, and (3) equipment time card. The work order request is the initial paper work, outside of routine maintenance, upon which any work is done. It is the same form as the work-order and, therefore, often becomes the work order itself with a number assigned to it by the accounting department. Upon this work order you will find the address where the work is to be done, the crafts involved, and a description of the work which is to be accomplished. In cases where many crafts are involved, a co-ordinator may be necessary. It is through this work order request that the amount of work on any area is controlled by the superintendent.

The time card serves as a record as to whether that particular man worked or not and also how many hours he put on a work-order. This is kept and turned to the time-keeper by his foreman.

The equipment time card handles the equipment which is used for any given job, just as if the equipment was a man. It has an hourly rate established; and whenever it is used, the amount of time is entered on the card by the custodian of the equipment, signed by the foreman using the equipment, and the card is turned in with the personnel time cards. Both cards serve as the basis for charges against the work-orders listed on them.

In order to perform the multitude of duties called for by the diversified areas, the Parks Department is organized into various groups. The work performed by these groups are divided into 1-Routine maintenance, 2-Extraordinary maintenance, 3-Programmed, and 4-Emergency maintenance. It is easy enough to plan to water two or three times a week and to mow once a week. Definite men are assigned the job of watering and also mowing. As these duties are routine in nature and must be performed at regular intervals, a standing work-order code number is assigned this type of work.

In the case of a cave-in over a sewer line, the work becomes extraordinary as it may be expected but is definitely not routine. A special work order is obtained from the accounting office and the work performed by the Parks work-order section. All labor, material, and equipment used in performing this task is charged to this work order number.

Under programmed maintenance would come your top-dressing of lawns with manure or the replacement of shrubs that died the last year. This is planned in advance, and a general date is set for its inception and completion. Again, a special work-order is required.

In the case of emergency work, such as flood damage, the required people are put to work, and a work order is then requested.

Let us take the work of one particular day, say in February, when we will top-dress lawns with manure. In order to discuss

this day's work, we must take a look at the planning for this day that started a year ago. We have decided that the lawns will be top-dressed with manure in the Spring of 1957, and that this will be included in our budget for that year and which will be submitted to the Atomic Energy Commission in April of 1956. From records of previous years, we know the requirements in man-hours, by type, quantity of material, and number of equipment hours, as well as the type of equipment that is going to be needed to perform this job. We submit it as such. It is up to the budget officer to convert it to money. This is done because wages have a habit of rising, and the cost of material fluctuate from year to year. The total of man-hours by type to perform a specific job changes very little.

We estimate that we are going to need 3000 cubic yards of manure to top dress 100 acres of lawn. The material must be on hand by December 31 because the winter months of December and January curtail hauling enough manure at a reasonable cost. We estimated that it would cost us about $4.00 per cubic yard. Therefore, $12,000 must be placed in the budget for expenditure between July 1, 1956 and December 31, 1956.

In February it will require 30 man-hours of labor to shred and spread the manure, 3 operator hours, 6 drivers, and 6 truck hours to haul per acre; 3 shredder hours, 3 tractor hours per acre. The budget officer, after figuring up the various types of hours, places this amount of money in your February expenditures.

Now that we have provided for material, labor and equipment, the Superintendent issues a work-order to the various crafts involved designating the work each craft will do. The superintendent can now govern the expenditure of money from his budget at the rate he desires and can control the cost of the job very closely. This day in February has arrived, and you see that your men are on the job. The foreman to whom you issued the work order yesterday or the day before takes his men out and starts top-dressing the lawns. You check and make sure the tractor, tractor operator, truck, and truck driver are on the job also. You probably contacted these people the day before. Sometimes it is advisable to contact these people as much as a week in advance so that there are no tie-ups.

At the end of the day your foreman turns in his time cards showing all labor charged against this work order and the equipment time also. Through the use of IBMs, if you deem it necessary, the costs charged against this particular job can be had the next day. The question comes up how do you take care of your overhead? That is the salaries of unproductive personnel, phones, repair of equipment, small tools, etc. This is done by loading the cost per man-hour directly with a certain percentage which is obtained from prior operations. This will take care of company overhead, your overhead, extra fringe benefits, insurance and so-forth. A regular monthly statement is sent to you by the accounting department showing just how you stand within your department in relation to expenditures and budgetary allotments.

This year we overran our budget in one item, routine maintenance. This was brought about due to the extreme drought we are experiencing. To support our request for more funds, we simply produced the records of the weatherman showing the normal weather conditions and those showing what has happened this year. So far, we have not had any trouble.

Attendance Register

Anderson, John - Public Schools System, Albuquerque, New Mexico

Bramble, Jack - Grounds Supervisor, New Mexico A & MA, State College, New Mexico

Brown, Charlie - Parks Department, Clovis, New Mexico

Chappell, Don - County Agent, County Court House, Las Cruces, New Mexico

Chew, Ed - Allen Arms Company, 315 Mills Street, El Paso, Texas

Day, Fred - Superintendent, Buildings and Grounds, New Mexico A & MA, State College, New Mexico

Edmonds, Rex - Ft. Bliss Golf Association, P. O. Box 6592, Ft. Bliss, Texas

Feather, Frank - Mesilla Park Plant Farm, Mesilla Park, New Mexico

Ferguson, Marvin - Southwestern Director, U.S.G.A., Green Section, Texas A & M, College Station, Texas

Foster, W. S. - County Agent, 524 U. S. Court House, El Paso, Texas

Freeman, Carl - Superintendent, ZIA Parks Department, 1199 45th Street, Los Alamos, New Mexico

Gallagher, John E. - American Chemical Paint Company, Ambler, Pennsylvania

Getchell, John S. - c/o Base Engineers Office, Sandia Base, Albuquerque, New Mexico

Goodman, J. G. - Sacred Gardens Association, Inc. 924 Raynolds Blvd., El Paso, Texas

Gordon, Jay N. - Farmington Golf and Country Club, Farmington, New Mexico

Green, Ellis - Superintendent, Parks Department, Clovis, New Mexico

Grandjean, Louis A. - Superintendent, Buildings and Grounds, New Mexico Inst. Mining & Tech., Socorro, New Mexico

Hager, Frank L. - Santa Fe Country Club, P. O. Box 211, Santa Fe, New Mexico

Halla, Frank - The Myers Company, 530 East Overland, El Paso, Texas

Hassinger, Robert L. - Flowerland Turf Farm, 717 Candelaria Rd., N.W., Albuquerque, New Mexico

Holdson, John - Rio Valley Greenhouse, 2000 Harzman Rd., S.W., Albuquerque, New Mexico

Hood, Rueben - Supervisor, Parks Department, City Hall, Farmington, New Mexico

Hoff, Gordon - Extension Agronomist, New Mexico A & MA, State College, New Mexico

Hueter, John - Hueter Nursery, 4317 Lomas Blvd., N.E., Albuquerque, New Mexico

Imboden, E. L. - c/o Buildings and Grounds Department, New Mexico Western College, Silver City, New Mexico

Jiron, Harry - U. S. Navy, White Sands Proving Ground, New Mexico

Juska, Felix - ARS, Forage and Range Section, Beltsville, Maryland

Kolb, Jack - Toro Manufacturing Corporation, 300 West 82nd Street, Minneapolis, Minnesota

Kottke, Willard - Superintendent-Pro, Ascarate Golf Course, El Paso, Texas

Landahl, Wm. L. - Parks and Recreation Department, City Hall, El Paso, Texas

Lessau, Heinz - College Golf Course, New Mexico Inst. Mining & Tech., Socorro, New Mexico

Mascaro, Tom - West Point Products Corporation, West Point, Penn.

Nance, Walter L. - New Mexico Military Institute, Roswell, New Mexico

Noer, O. J. - Milwaukee Sewerage Commission, P. O. Box 2079, Milwaukee, Wisconsin

Oliver, Wm. L. - New Mexico Military Institute, Roswell, New Mexico

Parman, Guy Z. - The Myers Company, 530 East Overland, El Paso, Texas

Pearce, Jerry - Van Horn Company, Van Horn Park, Ft. Bliss, Texas

Ray, Elie D. - Box 895, Holloman Air Force Base, New Mexico

Rockwell, L. W. - c/o Buildings and Grounds Department, New Mexico Western College, Silver City, New Mexico

Rystad, Grant A. - Sacred Gardens Association, Inc. 924 Raynolds Blvd., El Paso, Texas

Sanders, Bill - 425 Poplar Drive, El Paso, Texas

Sarabia, Joe L. - Las Cruces Country Club, P. O. Box 88, Las Cruces, New Mexico

Serna, Julian A. - Albuquerque Country Club, 601 Laguna Blvd., S.W., Albuquerque, New Mexico

Sheridan, Paul A. - Buildings and Grounds Department, University of New Mexico, Albuquerque, New Mexico

Smith, E. K. - 1712 Florida Street, Alamogordo, New Mexico

Smith, Russell P. - c/o Base Engineers Office, Sandia Base, Albuquerque, New Mexico

Thompson, Dexter M. - 318 San Juan Way, La Canada, California (E. I. Dupont Company)

Tejada, Jacob - Associate County Agent Leader, New Mexico A & MA, State College, New Mexico

Vandecaveye, S. C. - Agronomy Department, P. O. Box 306, State College, New Mexico

Watson, Clarence E. - Agronomy Department, P. O. Box 306, State College, New Mexico

Williams, Bill - Superintendent, El Paso Country Club, 400 Camino Real, El Paso, Texas

Wilson, M. L. - Agronomy Department, P. O. Box 306, State College, New Mexico

Wiltbank, W. J. - Extension Horticulturist, New Mexico A & MA, State College, New Mexico

Winchester, J. F. - Winesa Farms Company, Phoenix, Arizona

Wolfe, Robert - Rio Grande Nursery, 2535 Indian School Road, N.W., Albuquerque, New Mexico

Woodburn, Horace - Flinn Nursery, P. O. Box 504, Alamogordo, New Mexico