Research Report
Years 1953-1958/1959 June

Mr. Joseph C. Dey, Jr.

Marvin H. Ferguson

January 6, 1959

Dear Joe:

We are pleased to forward herewith two copies of a report of research done as a result of grants administered by the USGA since the beginning of the Regional Turf Service in 1953.

I feel that the accomplishments listed are quite impressive even though this list does not tell the full story. In the case of every grant we might say that the first accomplishment is "an increase in the knowledge." This increase of knowledge is an extremely important contribution even though it is neither specific nor tangible.

On December 30, I sent you a compilation of suggested research projects - a "want list." There were 147 individual suggestions in the compilation. Of this number, 127 suggestions concerned areas of research in which USGA grants have been used to support investigations within the past six years. This fact seems to indicate that research funds have been used to support the most needed types of research. It further indicates that the problems are far from completely solved.

It is difficult to place a monetary value on research accomplishments and it is difficult to exact full value from every research grant. It does seem to me that the progress made in this six year period is worth many times its cost.

Sincerely,

Marvin

Marvin H. Ferguson

MHF:s
cc: Mr. William C. Chapin
Green Section Staff - Mr. Holmes
encl.

PROJECT: Study of Merion Bluegrass Seed Production Problems.

Duration: 3 years (1953-1955)

Station: University of California at Davis

Total of USGA Support: $1,000 (USGA $500 - Jacklin $500)

Specific Accomplishments: The following findings were reported:

1. Fall clipping reduces seed yields by as much as two-thirds.

2. Little seed is produced in the spring following a late fall seeding. A seed crop may be expected the second spring. Seed planted before September 1 will result in a fair crop the following spring.

3. One pound of seed per acre in 30-inch rows will produce an excellent stand for seed production.

4. Experiments with rates of nitrogen and frequencies of irrigation demonstrated that greatest yield comes from most frequent irrigation and highest rate of nitrogen.

5. Seedling plants of Merion suffered damage from applications of 2,4-D. Later applications controlled weeds and did not damage Merion seedlings.

6. Phygon XL at the rate of 10 lbs. per acre gave excellent control of rust.

Findings of this study are reported in greater detail in the April 1955 issue of the USGA Journal.

PROJECT: Irrigation Studies

Duration: 2 years (1954-1955) - One grant to cover a 2-year period

Station: University of California (Davis)

Total of USGA Support: $1,000

Specific Accomplishments:

1. An increase in the knowledge of effective rooting depths of major turf grasses in good soil.

2. Experiments provided evidence to substantiate previously held theories on irrigation frequency and amount. Briefly, watering should always be done before available soil moisture is used to the full extent of the effective rooting depth, and the water application should be sufficient to bring the entire soil profile to field capacity. Amounts and frequencies vary with soils, grasses, and evapo-transpiration rates.

PROJECT: Irrigation Studies - Fellowship

Duration: 3 years (Study was begun in 1958)

Station: University of California (Davis)

Total of USGA Support: $6,000 ($2,000 per year 1955-56-57)

Specific Accomplishments:

1. One experiment was inaugurated in 1958 dealing with the variables irrigation frequency, time of day, and nitrogen rates and sources. These plots were inoculated with four disease organisms to determine the effect of treatment upon disease incidence.

   Results were negative.

PROJECT: Improvement of Physical Properties of Soils in Ornamental Plantings.

Duration: 3 years (1954-55-56)

Station: UCLA

Total of USGA Support: $1,200*

Specific Accomplishments:

1. A method of preventing compaction has been devised. In this method a layer of sand of suitable quality of a 4" depth is placed over well-tilled soil and the sand is used as a seed bed. This is an alternate method of minimizing compaction problems and when used on existing greens is less expensive than complete rebuilding.

2. In connection with the devising of the above method there has been an improvement in the understanding of the manner in which compactive forces are exerted in the soil; of oxygen diffusion rates in putting green soils; and of the seriousness of compaction in relation to water infiltration.

3. The determination that potassium frit, a ceramics industry by-product, is a suitable material for supplying potash in sandy soils over a relatively long period of time.

*A $300 grant had been made in 1951 and 1952 also.
No record in our files of a grant in 1953.

PROJECT: Cool Season - Warm Season Grass Combinations in Turf

Duration: 3 years (1956-57-58)

Station: UCLA

Total of USGA Support: $1,500

Specific Accomplishments:

1. Evaluation of various bermudagrass-bentgrass combinations indicate that
    a. Relatively slow-growing bermudagrasses such as Sunturf and U-3 are the only ones with which bent can compete.
    b. It is necessary to mow the bermuda very closely and to control thatch.
    c. Penncross bent is a better strain for overseeding than is Seaside.
    d. Further studies of this problem should be of a fundamental nature in order to obtain more facts concerning the nature of growth of the two species.
2. Pensacola Bahiagrass and tall fescue are being recommended in Southern California as a good coarse-textured turf for playing fields, large lawn areas, and roughs of golf courses.
3. A large collection of Poa annua and Poa bulbosa types from all over the world have been planted for evaluation. Many are quite promising as winter grasses for use with bermudagrass.

PROJECT: Establishment of Plots and General Support of Turf Research

Duration: 3 years (1954-55-56)

Station: Colorado State University

Total of USGA Support: $2,300

Specific Accomplishments:

In a comprehensive report issued in August 1958, research at this station was described under three headings, (1) Irrigation, (2) Turf Weed Control, and (3) Fertilizer Demonstrations. The USGA and National Golf Fund were listed as contributors of funds along with five other organizations.

General conclusions:

1. Irrigation

   a. In 1956 and 1957, plots receiving medium rates (1.1 inches of water per week) were nearly as good in appearance and yield of clippings as plots receiving high rates (2 inches per week).

   b. Low rates (.3 inch per week) produced poorer turf during dry periods.

   c. Weights of roots were greater in plots receiving minimum irrigation than in plots receiving high rates.

   d. Weights of clippings were greater with higher moisture levels, but when clipping weights were compared with inches of water applied, it was found that more clippings per inch of water were taken from plots receiving medium rates.

PROJECT: General Support of Turf Work

Duration: 1 year (1954)

Station: Florida Agricultural Experiment Station

Total of USGA Support: $500

Specific Accomplishments: Not identifiable

PROJECT: Seed Mixture Studies

Duration: 2 years (1954-1955)

Station: Cornell University

Total of USGA Support: $600

Specific Accomplishments:

Experiments confirmed previously held theories about the value of "nurse" grasses. They usually are just fillers and for most turf in the Northeast, the only species that contribute to the quality of a mixture are the permanent grasses such as Kentucky bluegrass and red fescue.

PROJECT: Nematode Investigations

Duration: 4 years (1955-1958)

Station: Florida Agricultural Experiment Station

Total of USGA Support: $5,000

Specific Accomplishments: The following findings have been reported.

1. Experiments in which vats were inoculated with one species of nematode (Trichodorus sp.) were observed for population trends. A cold winter in 1957 reduced the population greatly. Higher populations were found in the 6-12 inch zone than in the 0-6 inch zone. This is the nematode which causes stubby roots.

2. Investigations on putting green turf during 1957 and 1958 provided the following information:

   a. Populations of nematodes representing the genera Criconemoides (ring), Hoplolaimus (lance) Belonolaimus (sting), and Dolichodorus (awl) increased an average of 200% in the period from August 1957 to August 1958, despite a nematocide treatment in late August of 1957 and a prolonged cold winter.

   b. Treatments with Nemagon showed a marked decrease in populations of the nematodes listed in (a) eight weeks after treatment, but this decrease was accompanied by a very rapid increase (1960%) in the population of the stubby root nematode (Trichodorus.)

PROJECT: General Turf Research

Duration: 5 years (1954-1958)

Station: Georgia Coastal Plain Experiment Station

Total of USGA Support: $19,500

Specific Accomplishments:

1. Investigations supported in part by this money include:
    a. Weed Control
    b. Grass breeding
    c. Nitrogen source studies
    d. Disease control
    e. Gibberellic acid studies
    f. Shade and cutting height effects
    g. Tifgreen establishment methods
    h. Insect control (ground pearl)

2. Tifgreen bermudagrass was released in 1956. However, it should be noted that the cross which resulted in this hybrid was made in 1951. This grass is the most widely planted improved Bermuda for putting greens in the South.

3. Emerald Zoysia was released in 1955. This cross was made at Beltsville in 1949. This grass has found considerable favor in the South for use in lawns.

PROJECT: Fundamental Study of *Poa annua*, Chickweed and Crabgrass.

Duration: 1 year (1954)

Station: University of Illinois - School of Pharmacy

Total of USGA Support: $1,000

Specific Accomplishments: No report

PROJECT: Variety and Species Trials and Evaluation

Duration: 6 years (1953-1958)

Station: Kansas State College

Total of USGA Support: $3,900

Specific Accomplishments:

1. Twenty-five Zoysia selections have been made from a population of 1500 seedlings. Some of these are heavy seed producers and some show superior turf characteristics.

2. Approximately 5000 hybrid bermudagrass seedlings have been produced and are being evaluated.

3. Poa arida has been evaluated and found useless because of disease susceptibility.

4. One kind of dye (Dow's M-819) has been found to resist fading in intense sunlight.

5. Drouth tolerance studies permitted the following rankings:
   a. Warm-season grasses — buffalograss, U-3 bermudagrass, K-1-51 bermudagrass, Meyer Zoysia, Z. japonica, and African bermudagrass.
   b. Cool-season grasses — K-31 tall fescue, Kentucky bluegrass, ryegrass, Highland bentgrass, and creeping bentgrasses.

PROJECT: Turfgrass Demonstration Plots

Duration: 1 year (1957)

Station: New Mexico Agricultural Experiment Station

Total of USGA Support: $250

Specific Accomplishments:

Demonstration plots were established by student labor. Interest in truf was stimulated by this and other activities sufficiently to cause the legislature to provide funds for the support of a turfgrass research program.

PROJECT: General Support of Turf Research

Duration: 1 year (1954)

Station: Michigan Agricultural Experiment Station

Total of USGA Support: $300

Specific Accomplishments: Not identifiable

PROJECT: Collection and Evaluation of Bentgrass Strains

Duration: 4 years (1955-1958)

Station: Oklahoma Agricultural Experiment Station

Total of USGA Support: $2,000

Specific Accomplishments:

1. Eleven selections of bentgrass have survived screening sufficiently to be placed in simulated putting green tests. These are being compared with seven commercially available strains.

2. Twenty-two additional strains were selected during 1958 and will undergo preliminary screening.

PROJECT: Seed Production Studies with *Poa annua* and *Poa bulbosa*

Duration: 2 years (1954-1955). Only one grant was made but investigations extended over a two-year period.

Station: Oregon State College

Total of USGA Support: $500

Specific Accomplishments: The following findings were reported.

1. It was found that high seed yields of these grasses are possible and depend greatly upon rate of fertilizer and date of application. High yields of 1128 lbs. per acre of *Poa annua* and 1021 lbs. per acre of *Poa bulbosa* were obtained.

2. Plant height showed a response to fertilizer rate and date of application.

3. Suction harvesters would be advantageous with *Poa annua*.

4. Field curing is not recommended for commercial production in Oregon.

PROJECT: Effects of Various Aerifying Tools and Soil Conditioners on Water and Fertilizer Penetration - Fellowship

Duration: 3 years (1952-53-54) Records in this office indicate grants in '53 and '54 but apparently there was also a grant in 1952, as correspondence indicates this is a continuation.

Station: Penn State University

Total of USGA Support: $3,600 (for 1953 and 1954 only)

Specific Accomplishments:

1. The following findings have been reported:
    a. Mechanical aeration produces a 27 per cent average increase in the rate of the downward movement of phosphorus.
    b. On compacted soils, cultivation practices resulted in at least a 50 per cent reduction in run-off.
2. This fellowship provided for the advanced training of a student (Mr. Myles Nelson) in turf management.

PROJECT: Investigations of "The Effect of 2,4-D on Various Species at Different Stages of Seedling Growth - Fellowship

Duration: 2 years (1956-1957)

Station: Penn State University

Total of USGA Support: $3,800

Specific Accomplishments:

1. Results of the study are published in a 75 page report.

   Some of the chief findings were:

   a. Fall applications of 2,4-D produced least injury to all seedlings and spring applications were slightly more harmful than summer treatments.

   b. Kentucky bluegrass seedlings tolerated a 1 lb. per acre application of 2,4-D at the age of 4 weeks. Tolerance ages for red fescue and colonial bentgrass were 6 and 10 weeks, respectively.

   c. When 2,4-D was sprayed on foliage and soil, injury was greater than when only foliage was sprayed.

2. This fellowship provided support for a graduate student in turf management. The student, Dick Schmidt, is presently engaged in turf research at V.P.I.

PROJECT: Colonial Bentgrass Improvement

Duration: Investigations begun in 1958

Station: Penn State University

Total of USGA Support: $2,000 initial grant

Specific Accomplishments:

1. A graduate student (Mr. Albert Dudeck) has been assigned to this study, beginning in July 1958.

2. No definite accomplishments reported, aside from the fact that a 500 plant nursery has been established.

Remarks: This is necessarily a long-range project. The present 2-year arrangement will provide only for the determination of the degree of self-fertility within this species.

PROJECT: Screening and Increasing Bluegrass Selections which May Provide Disease Resistant Breeding Material.

Duration: 2 years (1954-55) One grant was made to cover a 2 year period.

Station: Purdue University

Total of USGA Support: $1,000

Specific Accomplishments: None. The better strains studied and increased have been placed in further evaluation studies.

PROJECT: Nutrition Studies in Bentgrass with Emphasis on Carbohydrate Levels.

Duration: 4 years (1955-58)

Station: Purdue University

Total of USGA Support: $7,500

Specific Accomplishments:

1. One published report by Mr. James Beard, graduate student. Submitted for use in February issue of USGA Journal. This deals with effects of temperature on bentgrass root growth.

Remarks: This is a large and complicated investigation. It involves the factors of temperatures at various depths, moisture at various depths, light intensity and total incident light, relative humidity, the use of carbohydrate materials applied to the foliage and various levels of nitrogen supply. Data are taken on continuous recording instruments. Carbohydrate analyses are being done by paper chromo-photography techniques. Such an approach yields huge masses of data to be correlated and from which interacting factors must be extracted. Such a study holds a <u>possibility</u> of yielding excellent information. The question is, <u>when</u>?

PROJECT: Investigating Compatibility of Meyer Zoysia and Merion Bluegrass.

Duration: 2 years (1953-54)

Station: Rhode Island

Total of USGA Support: $600

Specific Accomplishments:

It was found that a reasonably good combination of these two grasses could be grown. However, the management given them was extremely important in determining the relative aggressiveness of the two species. A publication dated May 1956 by DeFrance, Hart and Mruk indicated that the Zoysias should continue to be considered experimental grasses in the New England area.

PROJECT: *Poa annua* Control Study

Duration: 2 years (1955-56) This was period covered by USGA grant but studies have been continued.

Station: University of Rhode Island

Total of USGA Support: $3,400

Specific Accomplishments:

1. Preliminary results indicate that neburon and disodium methyl arsonate were 50 to 60 per cent effective in preventing *Poa annua* re-establishment. Lead arsenate, chloro 1 PC, and alanap 1F were less effective.

2. In a 1958 Progress Report, Dr. DeFrance stated that further data would "be published early in 1959."

PROJECT: Support of Turf Research Program

Duration: 6 years

Station: University of Rhode Island

Total of USGA Support: $8,100. This is money contributed by N. E. Golf Associations, $1,350 annually.

Specific Accomplishments: These funds are merged with others. They have contributed to the accomplishments listed.

1. Grass seed mixtures known as University of Rhode Island No. 1 and 2 have been found to produce good wear resistant turf.

URI No. 1	URI No. 2
Chewings Fescue 50%	Chewings Fescue 40%
Kentucky bluegrass 25%	Kentucky bluegrass 30%
Merion bluegrass 25%	Merion bluegrass 10%
	Annual Ryegrass 20%

These mixtures, containing Merion bluegrass appear to require adequate fertilization, particularly high nitrogen and liberal limestone applications.

2. Post-emergence control of crabgrass may be accomplished by organic mercuries and organic arsenicals.

3. A fertilizer mixture containing both readily available and slowly available nitrogen has been compounded. It is known as the

7. Gibberellic acid study: Two years' results have not been encouraging but injury from what appeared to be dollarspot healed more quickly in treated plots.

8. Clover control: 2,4,5-T (4 lbs. acid equivalent per gallon) applied twice at the rate of 1 quart per acre in late springtime was the most effective control.

PROJECT: Thatch Control Investigations

Duration: 3 years (1953-54-55)

Station: Rutgers University

Total of USGA Support: $6,000

Specific Accomplishments:

1. This grant provided support for the training of a graduate student, Mr. Charles Rumburg. Mr. Rumburg was awarded the Master's degree.

2. Mr. Rumburg's thesis contained the following conclusions (stated briefly).

    a. In 15 bentgrass plantings, there was a significant difference in the amount of organic matter to a depth of one inch. Piper velvet bentgrass turf contained a higher percentage of organic matter than any of the strains of creeping bentgrass.

    b. On a bentgrass turf mowed at 3/4 inch for 7 years there was no appreciable accumulation of thatch. Cultivation treatments produced no significant difference in organic matter.

PROJECT: Goosegrass Control

Duration: 3 years (1956-57-58)

Station: Rutgers University

Total of USGA Support: $6,000

Specific Accomplishments:

1. Support of a graduate student being trained in turf management, Mr. James Fulwider is presently preparing his thesis for the Master's Degree.

2. The following bits of information have been gained:
   a. Goosegrass requires high temperature for germination.
   b. Alternating temperatures (20° C - 35° C) and alternating dark and light are important in germination of goosegrass.
   c. These findings indicate the importance of a dense turf cover for insulation and shade.
   d. Chlordane gave very satisfactory control of goosegrass when used as a pre-emergence treatment.
   e. All rates of EPTC, simazin, neburon and TBA were too injurious to turf grasses.
   f. FW 450 showed promise of good control in post-emergence tests with little injury to turfgrasses.

3. This investigation is continuing. A final report in the form of Mr. Fulwider's thesis is expected this spring.

PROJECT: General Support of Turf Program at Rutgers

Duration: 4 years (1954-55-56-57)

Station: Rutgers University

Total of USGA Support: $4,930 - This does not include $600 contributed by Metropolitan Golf Writers' Association for an undergraduate scholarship.

Specific Accomplishments: Unknown

PROJECT: Studies of Physical Properties of Soils for Putting Green Use.

Duration: 6 years (July 1, 1953 to June 30,1959)

Station: Texas A. & M. College

Total of USGA Support: $12,000

Specific Accomplishments:

1. Development of laboratory techniques which permit reliable synthesis of putting green soil mixtures from any given sand, soil, and organic material.

2. The support of two students in their pursuit of studies leading to the Master's degree. Raymond Kunze - 1956, now studying for his Doctorate at Iowa State University; Leon Howard, candidate for Master's degree at Texas A. & M. in June 1959.

3. The development of techniques cited in paragraph one implies the gathering of a great deal of fundamental knowledge as a basis for these techniques. As a result there is presently a better understanding of the behavior of soils containing various kinds of clay, an increased knowledge of the amounts of clays of the several mineralogical derivations permissible in putting green soils, and a better understanding of the behavior of sands of differing textural characteristics in combination with representative soil types. Criteria have been established for judging the suitability of a synthetic

PROJECT: Turf Disease Control

Duration: 1 year (1958)

Station: Western Washington Experiment Station

Total of USGA Support: $1,000

Specific Accomplishments:

1. A plastic greenhouse has been constructed and a turf of Colonial bentgrass has been established.

2. A project on "Simplified Identification of Turf Diseases" is under way. Several pathogens (eight species with numerous isolates of each) have been assembled from a number of institutions in the United States.

3. A project has been initiated for the purpose of finding ways of reducing phytotoxicity of organic mercury compounds. Preliminary tests indicate that some nitrogen materials may accomplish this.

4. A project has been undertaken to determine the relationship of nutrition to Fusarium patch development. This is a greenhouse project. Fertilizer treatments have been underway since October 9.

Remarks: Progress at this station is quite impressive. The USGA grant was forwarded on September 2, 1958.


BEARD
COLLECTION