USGA Research Grants — 1955
(Proposed)

Institution	Amount of Grant	Duration	Purpose of Grant
Colorado A. & M.	$1,000[1]	1 yr.	Scholarship and Plot Work.
Texas A. & M.	2,000[1]	1 yr.	Conclusion of soil study.
Rutgers	2,000[1]	1 yr.	Conclusion of thatch study.
Rutgers	1,080	1 yr.	General support of turf research.
Kansas State College	1,000[1]	1 yr.	Evaluation of species under arid conditions.
U. of California (Davis)	2,000[2]	1 yr.	Support of fellowship.
U. of California (Davis)	250	1 yr.	Merion bluegrass seed production study.
Purdue University	2,000[1]	1 yr.	To be determined.
Ga. Coastal Plain Exp. Station	1,000[1]	1 yr.	General support of turf work.
Ga. Coastal Plain Exp. Station	4,000	1 yr.	General support of turf work.
Rhode Island University	1,700	1 yr.	*Poa annua* control study (fellowship).
Rhode Island University	1,350	1 yr.	General Support of Turf Research.
Penn. State University	1,800	1 yr.	Study of 2,4-D effects on grasses.
U.S. Dept. of Agr. (Beltsville)	1,000	1 yr.	Herbicide screening.
Florida University	1,500	1 yr.	Nematode study (fellowship).
UCLA	300	1 yr.	Study of soil amendments.
Oklahoma A. & M.	500	1 yr.	Collection and evaluation of bentgrass strains.
Western Washington Exp. Sta. (Puyallup)	500	1 yr.	To be determined.
Total, 1955	$24,980		

Additionally, 20% of Regional Turf Service fees in southern California retained there for research.

[1]National Golf Fund Allocation.

[2]$1,700 from National Golf Fund.
300 from Research and Education Fund.

MERION BLUEGRASS SEED PRODUCTION

Merion Bluegrass, a naturally occurring selection of common Kentucky bluegrass, has proved to be a superior turfgrass in many areas of the United States. Demand for Merion Bluegrass seed has created considerable interest in its production among some California seed growers and it is being tested and evaluated by the University of California as a seed crop for that state. The following is a progress report of these tests by the University of California, College of Agriculture, Department of Agronomy, Davis, Cal., dated January 11, 1955, supported in part by the United States Golf Association Green Section.

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Dr. D. S. Mikkelsen, Assistant Agronomist in Agronomy.

There has been no experimental work to determine the best soil types for maximum seed production of Merion. A number of trial plantings by farmers in various areas of the lower Sacramento Valley suggest that the more easily worked soils are to be preferred. The possibilities of production on clay soils have not been adequately explored. Soils that are in poor physical condition and have low water penetration capabilities should be avoided.

Growth Habits

Merion Bluegrass is a perennial sod-forming grass that spreads by underground rhizomes. Formation and growth of these rhizomes appear to be most active during the warmer portions of the year. New shoots originating from above-ground portions of the plant seem to develop more actively during the spring and fall. As fall approaches, with cooler weather and shorter days, the terminal ends of the rhizomes and rhizome branches turn upward and start to emerge from the soil surface. On loamy type soils, rhizomes have been seen emerging from the soil at distances up to 17 inches from a parent plant. Rhizomes from crowns of plants growing in heavy, compacted soils with dry surfaces seem to encounter difficulty and produce short, stunted growth.

Tests indicate that new growth originating from shoots and rhizomes should be encouraged for seed production. Under no circumstances should this new growth be interrupted by such management practices as clipping or grazing. Clipping trials for the 1953-54 season indicate that fall clipping reduces seed yields—clipping after the latter part of October reduced yields by as much as two-thirds.

Time of Seeding

A combination of short days and low temperatures has been shown to be necessary for flower initiation.[1] Results of tests at Davis suggest that new plant material originating after approximately the early part of November does not produce flowering tissue the same crop year. Plant material originating in the late fall, but before early November, produced some seed heads, but so few in number and so small in size that they were of doubtful value as a seed crop.

These studies would indicate that to obtain the maximum seed possible under the climatic conditions at Davis the plants should be encouraged, by proper irrigation and fertilization, to go into the fall period with the maximum possible vegetative growth.

Field seedings made as late as November generally will produce little or no seed the following spring. Established plants from late fall seeding must be carried through the next winter, with a seed crop expected the second spring from time of seeding. Seeding trials indicate that plants started in the field by at least the first of September and grown under good moisture and soil fertility conditions will produce a reasonable seed crop the following May or June. Such an early seeding may produce enough seed the first year to compensate for the first year's operational costs.

Experimental work is now underway to determine how soil surface temperatures affect germination for mid- and late-summer seedings. Seedling emergence from winter and early spring seedings usually takes 20-26 days. Seedings made August 18 required seven days to emerge when planted not more than one-quarter inch deep on shallow beds kept moist by furrow irrigation.

Bluegrass seed is very small—about 2,177,000 seeds per pound. Because of this bluegrass should be drilled as close to the surface as possible. Planting studies[2] indicate that emergence of Kentucky Bluegrass from a heavy silt loam is 56 per cent when seeded on the surface, 46 per cent when placed one-half inch deep, and 9 per cent when placed one inch deep. There was no emergence when planted two inches deep or more. It appears that a planting depth of one-quarter inch or less would be the most desirable. Tests at Davis using seed with a laboratory germination of 83 per cent and seeded August 18, 1954,

[1] *Effects of Photoperiod and Temperature on Growth and Flowering of Kentucky Bluegrass.*
M. L. Peterson and W. E. Loomis
Plant Physiology, Vol. 24, No. 1, pp. 31-43, 1949.

[2] *The Emergence of Grass and Legume Seedlings Planted at Different Depths in Five Types of Soil.*
R. P. Murphy and A. C. Arny
Jour. Am. Soc. Agro. 31:17-28, 1939.

at one-quarter inch deep gave a germination of 78 per cent. The final count was made 15 days after emergence.

One pound of seed per acre, when seeded in September on a well-worked fine seedbed with good control of irrigation water, should produce an excellent stand. In 30-inch rows, a pound of seed per acre will give approximately 124 seeds per linear foot of row. Constant, even distribution of seed in the row is essential. Observations indicate that fall or winter seedings with a longer emergence interval may require a heavier seeding rate. Seed treatment to control loss from soil fungi is highly desirable; however, manufacturers' recommendations should be followed carefully.

Seed Formation in Bluegrass

Common Kentucky Bluegrass is made up of a very large population of individuals having generally the same major characteristics. Within this population it is possible to find individuals that, because of a particular chance combination of genes, exhibit one or more characteristics considerably different from the rest of the population. Merion Bluegrass is the result of one of these chance variations.

The normal process of fertilization does not occur 100 per cent in Bluegrass. Pollination takes places and is necessary for the formation of the endosperm, but fertilization is not always accomplished. Before fertilization can take place many of the macrospores disintegrate and the embryo sac develops from a cell of the nucellus having the same genetic composition as the mother plant. Plants produced by this type of seed will be identical genetically with the parent plant. This process, known as apomixis, is responsible for the retention of desirable characteristics in a strain or selection such as Merion. The degree of apomixis among strains and selections of bluegrass varies from approximately 60—to almost 100 per cent, the rest of the seed being produced by fertilization. The degree of apomixis in Merion is not as yet known, however, there are indications that it must be quite high. The off-type plants produced by fertilized seed are not Merion and should be removed from the seed field by roguing. Many of these off-type plants are stunted, slow growing, and weak. When mature, they produce a small, short, compact type of panicle. It has been suggested that most of these types will not survive under competition. It is possible that some off-types resemble Merion so closely that they are indistinguishable. Other off-types grow more rapidly and taller than Merion, producing typical Kentucky Bluegrass panicles.

In the fall of 1953, 9,771 single plants grown from breeder's seed were transplanted to the field and kept under close observation. In June, 1954, 80 of these plants were removed from the field because they produced a type of growth different from Merion. None of these 80 plants exhibited Kentucky Bluegrass characteristics; they were even much shorter and slower growing than Merion, with much more compact and shorter panicles. This first year's observation would indicate that apomixis in Merion is rather high, since only .81 per cent appeared to be off-types.

With practice and careful examination, Merion Bluegrass seed can be distinguished from common Kentucky Bluegrass. Generally Merion seed are shorter, plumper, and with the mid-nerves on the lemma less prominent. In examining seed, however, there are many borderline cases.

To check the amount of common bluegrass that may be found in commercial Merion, three lots of seed from retail outlets were examined. The results listed on the following page indicate that there can be a large amount of Kentucky Bluegrass type seed in commercial Merion, and that positive visual identification in separating these seeds is difficult, at least by the author.

These observations would suggest the possibility that plantings made from a carefully selected and proven pure seed source should contain few, if any, Kentucky Bluegrass types. The above observations may also suggest that seed fields containing a large population of plants resembling common Kentucky Bluegrass may have been the result of mechanical mixtures with common bluegrass.

Lot No.	Visually determined as off-type or Kentucky Bluegrass seed (% by wt.)	Variants appearing from planting visually determined Merion type seed (% by number)	Merion types* appearing from planting of variant or Kentucky Bluegrass type seed (% by number)
3	1.18	6.6	33.3**
4	3.57	13.0	4.1
5	5.21	6.2	22.9

*These *appeared* to be Merion, however some, genetically, may have been variants.

**Only three seeds germinated; two expired before maturing, and the remaining was of the Merion type.

Irrigation and Fertilization

The Department of Irrigation cooperated in the studies during the 1953 season by using its Merion turf plots for seed production. Three irrigation treatments were maintained: wet—irrigated while the soil was near field capacity; intermediate—irrigated when about half the available soil moisture was used; and dry—irrigated when the grass showed signs of wilting. Low and high fertility plots, with and without added nitrogen, were superimposed on irrigation treatments. The plots with the highest nitrogen level and most frequently irrigated yielded the longest tillers and had the largest seed heads. Tiller and head size decreased with a decrease in the nitrogen level and frequency of water application.

Commercial seed was used in these plots, which contained variants other than Merion. During the previous year, these turf plots had been kept mowed to three heights —½ inch, ¾ inch, and 1½ inches. The low nitrogen plots to which no nitrogen was added and previously kept ½ inch high contained the least number of off-type or Kentucky Bluegrass type panicles. The highest number of off-type, or Kentucky Bluegrass type, panicles was produced on the previously high nitrogen plots to which more nitrogen was added.

Previously low nitrogen plots + No added "N" = 1.7% variant type panicles.
Previously low nitrogen plots + 80 lbs. "N" = 3.9% variant type panicles.
Previously high nitrogen plots + 80 lbs. "N" = 10.7% variant type panicles.
Previously high nitrogen plots + 240 lbs. "N" = 33.6% variant type panicles.
There appeared to be a slight trend toward a higher percentage of variant panicles in the ¾ inch and 1½ inch heights of cut.

Seed yield test plots established in February, 1953 were harvested the week of May 24, 1954. Results are tabulated in the table on the following page.

The dry treatment (F) approaches significance at the 5% level for the 1953-1954 season. There are indications that by proper manipulation of water applications plants may respond with a significant increase in seed production. No significant differences were found in seed index because of either irrigation or nitrogen treatments; however, the effect of nitrogen did approach significance at the 5% level. Work is being continued to explore these phases of seed production.

Weed Control

A smothering crop of fast-germinating broadleaf weeds sometimes develops in winter and spring seedings of Merion and is often difficult to control until Merion is large enough for safe use of herbicides.

Fertilizer Treatment		**Irrigation Treatment**			
Lbs. N per		*Nitrogen x Irr. Means*			
acre **		*Irrigation Treatments**			*N. Means*
	B	*C*	*D*	*F*	
0	38.3	48.8	39.3	48.9	43.8***
80	48.6	63.8	52.7	63.3	57.1***
160	73.4	76.8	67.7	107.1	81.3***
Irrigation Means	53.4	63.1	53.2	73.1	

Explanation of asterisks at bottom of following table.

	Cal. F	*Required F Value*		*L.S.D.*	
Treatments	*Value*	*5%*	*1%*	*5%*	*1%*
Irrigation	2.31	4.76	9.78	37.29	56.49
Nitrogen	42.37	3.40	5.61	9.82	13.31
Irrig. x Nitrogen	1.99	2.51	3.67	8.50	11.52

*Differential irrigation treatments began July 14, 1953, after which the following number of irrigations were applied until harvest May 24, 1954: B, 14; C, 8: D, 6: and F, 4.

**Total rate per acre from four split applications. One half indicated amount applied prior to August, 1953 and believed to have had little or no direct affect on seed yields.

***Highly significant at the 1% level.

Several tests were used to check the sensitivity of Merion to plant hormone type weed-killers and pre-emergence oil sprays.

2,4-D, N.C.P., and 2,4,5-T were applied at rates of ½ pound, 1 pound, and 1½ pounds acid equivalent per acre on April 4, 1953, to a stand seeded February 8, 1953. The plots were irrigated seven days after the applications. The plants averaged about ½ inch in height and were approximately in the three-leaf stage. Observations of damage and weed-kill were made May 29, 1953. In this test, 2,4-D and N.C.P. seemed to give a little better kill of broadleaf weeds than 2,4,5-T. One-half pound applications resulted in no visible damage to Merion; however, only about 50 per cent of the weeds were killed. One pound applications of 2,4-D, 2,4,5-T, and N.C.P. killed 80 to 90 per cent of the weeds, but caused some visible damage to the grass where water had stood around the plants after irrigation. The 1½ pound application produced the same type of damage to the grass and with no better weed kill.

On May 29, 1953, a second set of plots using the same materials in the same strengths were put out on the Merion plots containing a heavy stand of morning-glory. Observations made June 17, 1953 showed no visible damage to Merion. 2,4-D and 2,4,5-T were slightly more effective against the weeds than N.C.P.

To determine the effects of a pre-emergence application of a weed oil, two rows of Merion were drilled to a depth of not over ⅛ inch (many seeds visible on the surface) and two rows were drilled not over ¼ inch deep. The rows were seeded December 9, 1953, at .85 pounds of seed per acre. The oil-water-detergent spray was applied at the rate of 100 gallons per acre in two strengths on two 10-foot plots each on December 14, 1953. Stand counts were taken March 3, 1954, with results as shown in the table on the following page.

The spray applied on dry soil prior to sufficient rain for seed germination gave excellent control of weeds. It is also significant to note the differences in stand between the ⅛ inch and ¼ inch depth of seeding.

On March 5, 1954, a mixture of five quarts of Sinox-W in 100 gallons of water per acre was applied in a 10-foot strip across all four rows of Merion seedlings.

Merion plants per 10-foot row Av. four rows	Check	20%	40% Oil
Drilled ⅛ inch deep	114.5	106.7	65.5
Drilled ¼ inch deep	55.2	58.0	46.5

A count was taken April 14, 1954, with the following results:

Check = 87.5 plants per 10-foot row
Sinox-W = 77.7 plants per 10-foot row

There was some spot burning of the leaves, but because of the small size of the plants and the fact that no wetting agent was used, little spray material contacted them.

Disease and Insect Control

At Davis rust appeared to be the only disease affecting Merion. From observations it is believed that Merion is more susceptible to rust than common Kentucky Bluegrass. A heavy buildup of rust was noted on September 23, 1953, and again on April 14, 1954. Rust developed on the south side of all rows, and by May 10, 1954, nearly all plants were badly rusted, including the seed heads, resulting in poor yields from the seed plots.

Sulfur dust, wettable sulfur, Captan, Parzate-278, and Phygon-XL were tested for rust control. All except the dusting sulfur were applied at 10 pounds in 100 gallons of water per acre. A detergent or wetting agent was added to make the material spread and stick to the grass leaf blades. Phygon-XL gave excellent control of rust. There were no apparent results from the other fungicides. At the present time, the optimum application for control is unknown. It appears that Phygon-XL applications will have to be repeated to keep all plant parts covered as it grows, and perhaps after rains, which may wash off the protective coating.

European leaf mite infestations cause considerable damage during most of the warm summer period. Elgatol-318 or a systemic may be effective in their control.

Treat your caddie as you would your son.

CONTROL OF ALGAE

Question: My greens are somewhat thin and there is a dark blackish green scum growing on the surface. When this surface dries, the scum peels up and forms a sort of crust. What is this, and how do I control it?

Answer: The trouble on your green is caused by algæ. Algæ is a one-celled green plant which is present in the soil and which grows on moist soil surfaces. Vigorous healthy turf will control algæ because it does not grow where the ground is covered by turf and where water does not stand at the surface. The immediate control for algæ is to dust the surface with hydrated lime at the rate of about two to three pounds per thousand square feet. This will tend to dry the surface. Allow your greens to dry out somewhat. Spike the surface by some method so that you destroy the crust that has formed and so that the water moves into the soil rather than standing on the surface. When the turf begins to recover, you might topdress lightly with a topdressing material that is of a coarse texture. When summer is over, you probably will find that you have no more trouble with algæ. At that time you should correct the conditions that cause its growth by loosening the surface of the soil so that water infiltrates into the soil readily. Your watering program probably needs to be altered, so that you water more deeply and less frequently. Make sure that you have good drainage; that is, both surface drainage and sub-drainage. Usually when soil is in good physical condition, when a good watering program is followed, and when turf is maintained in a vigorous condition, algæ does not become a problem.