

J. F. CORNMAN

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UNITED STATES GOLF ASSOCIATION GREEN SECTION

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Turf Gardens and Experimental Work

In this issue we give a brief review of the principal experimental turf gardens in America. We frequently find men interested in such work who are not acquainted with the turf gardens in their immediate vicinity. It is hoped that this number of THE BULLETIN will serve as a guide for any who may be interested in observing some of the experimental work being conducted for the betterment of turf. We do not claim to include all turf gardens which may be carrying on constructive work, for it is recognized that there are many small but interesting turf gardens conducted by other experiment stations and on many golf courses. No attempt is made to evaluate the various gardens nor to give results obtained on each. The purpose is rather merely to point out the location of each, the type of work, and by whom it is being conducted.

It will be noted that the turf gardens are divided into two groups; experimental and demonstration. The experimental gardens are all supervised by institutions whose business it is to conduct experiments, and in most cases they receive some financial aid from the United States Golf Association Green Section. On the experimental turf gardens new grasses, new chemicals, and new methods may be tried out. A large proportion of these tests prove of little value and must be discarded. The occasional new development which comes out of all these trials must be further tested before being recommended for general use on golf courses or elsewhere. Although there is apparently much repetition of work at the various stations, this is desirable due to the different responses of grass to different treatments under unlike soil and climatic conditions. Beyond a certain point repetition leads to waste. It is the purpose of the Green Section to try to correlate the fundamental experimental work in order to avoid needless duplication of effort with its resultant dissipation of limited funds. As an example, it is proposed to continue to concentrate the principal disease work at the Arlington Turf Garden but at the same time to conduct some disease studies at other stations on a small scale.

Each of the new series of demonstration plantings on golf courses is intended to serve as an intermedium between the experimental work and the golf courses in the immediate vicinity of the planting. These will give the experimental men an opportunity to further check their results under more varying conditions. At the same time they will "take home" the experimental work to men interested in turf production throughout the country.

No doubt all this work will meet the usual objection from the super-practical man that these plots do not represent actual putting green conditions. The answer is that we all recognize that they are not actual putting greens and no effort is being made to make them

such. This work may well be compared with the experimental work in the automobile business. Before being adopted, the improvements in engines and body parts are worked out by engineers and mechanics in experimental laboratories and on machines quite different from the highly polished and be-cushioned product of the show window or boulevard.

Demonstration Turf Gardens on Golf Courses

By John Monteith, Jr.

During the season of 1928 the Green Section established 15 new demonstration turf gardens on golf courses in different sections of the country. These will be supported and cared for by the local clubs, under the direction of the United States Golf Association Green Section.

It has been recognized for a long time that soil and climatic conditions exert such important influences on plant growth that recommendations based on tests in one locality may need modification under somewhat different local conditions. This has been found to be true in growing most plants, and as a result the State agricultural experiment stations and the United States Department of Agriculture have established many branch stations throughout the agricultural districts. The purpose of these new demonstration turf gardens is to extend the Green Section experimental work by providing a series of plots near several golf course centers. There it will be possible to reproduce under various local conditions some of the most promising experimental work of the turf gardens at the Arlington Experiment Farm and a few of the State experiment stations where golf turf work is under way. These series of plots are distributed as follows:

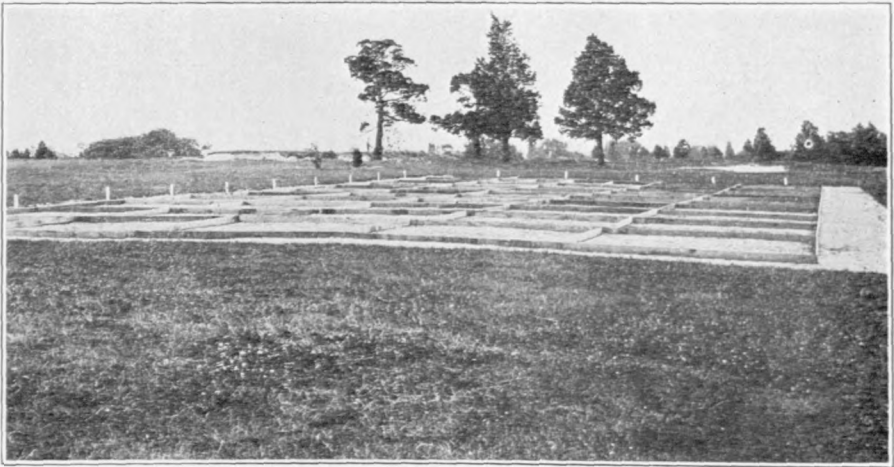
Minneapolis:	Interlachen Country Club.
Chicago:	Olympia Fields Country Club.
Grand Rapids:	Municipal.
Detroit:	Detroit Golf Club.
	Lochmoor Club.
	Meadowbrook Country Club.
Pittsburgh:	Oakmont Country Club.
	Allegheny Country Club.
Boston:	Charles River Country Club.
Metropolitan District:	Morris County Golf Club.
	Upper Montclair Country Club.
	Wheatley Hills Golf Club.
	Century Golf Club.
Atlantic City:	Country Club.
Richmond:	Country Club of Virginia.

Similar plantings have been made on the grounds of the Agricultural Experiment Station, Amherst, Mass., and on the campus of Leland Stanford Jr. University, Palo Alto, Calif.

Each series consists of 55 plots, each 10 by 10 feet, requiring an area for the complete set of 50 by 110 feet. It is recognized that there are several objections to small plots, but these objections are overcome by the advantages of lower cost, more uniform soil conditions, and more direct comparisons. These plots are all numbered and are planted in practically the same order in every locality. The arrangement is such as to bring together the plots that will be most interesting for comparison and also to condense into a small series

as many of the interesting features of experimental work as can be arranged. This is done also with the view to simplifying the plan in order that the plots may be cared for with least expense and with the least possibility of confusion.

The 55 plots are arranged 5 plots in width and 11 in length. The 5 plots at one end are designated as optional plots, in which tests are to be made of different grasses or fertilizers which are of more restricted local interest. In some cases this set is being increased to provide more room for testing out local strains of bent or various soil mixtures, as well as fertilizers. Ten of the plots are used for testing various putting green grasses. In some cases these plots have been divided so that a plot may be planted with two grasses, or with the same grass from seed originating in different regions. In this



The demonstration plots at the Country Club of Atlantic City

group there is a comparison of red fescue, Chewing's fescue, annual bluegrass (*Poa annua*), Rhode Island bent grown in three different localities, German mixed bent, seaside bent, velvet bent (both from seed and vegetative planting), and four strains of creeping bent planted by the stolon method. It is planned to keep these plots mowed at putting green length, and all will receive the same fertilizing, watering, cutting, and other treatments. This group will give anyone an opportunity to compare the various grasses commonly used on putting greens as grown under identical conditions without the usual variation in soil and treatment, which is found when one tries to compare turf on two or more different putting greens.

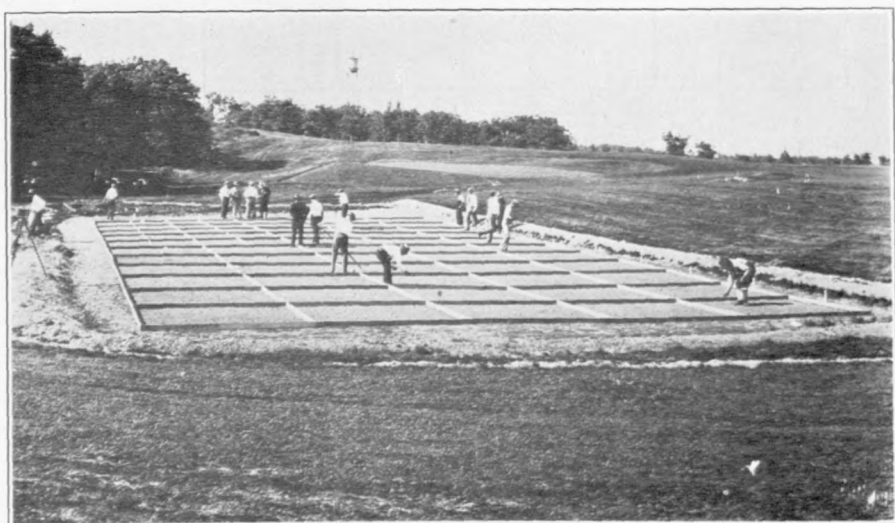
Fifteen plots will be devoted to experiments with various fertilizers, both organic and inorganic. Four of these 15 will be used as checks and will receive no fertilizer whatever. Each plot will receive one fertilizer, and none other, over a period of years. The check plots are so arranged that each of the fertilizer treatments will have one side adjoining an unfertilized piece of turf. One can then stand in the center of this area and within a distance of 30 feet can see the response of turf to 11 different fertilizer combinations. Since nitrogen is such an important factor in turf production, these fertilizers

PLAN OF DEMONSTRATION TURF GARDENS

	A	B	C	D	E	
1						Optional.
2	Red fescue. Chewing's fescue.	Washington. Metro-politan.	R. I. bent Wash. grown. Colonial bent.	R. I. bent.	Velvet bent seed.	
3	Annual bluegrass.	Virginia. Columbia.	Seaside bent.	German mixed bent.	Velvet bent stolons.	Trial plots of putting green grasses.
4	Sewage sludge.	Poultry manure tankage.	Check.	Sulphate of ammonia.	Compost and sulphate of ammonia.	
5	Check.	Nitrate of soda.	Urea.	Phosphate of ammonia.	Check.	Fertilizer experiments on putting green grass (seeded German mixed bent).
6	Complete fertilizer 6-12-4.	Complete fertilizer 12-6-4.	Check.	Lime and sulphate of ammonia.	Bone meal.	
7	German mixed bent.	German mixed bent.	German mixed bent.	Metro. bent stolons.	Chewing's fescue.	Putting green length.
8	Ky. blue and redtop.	Ky. blue and redtop.	Ky. blue, redtop and Ger. mixed bent.	Ky. blue and redtop.	Chewing's fescue and Ger. mixed bent.	
9	Ky. blue, redtop and Chewing's fescue.	Ky. blue and redtop.	Ky. blue, redtop and Ger. mixed bent.	R. I. bent.	Chewing's fescue and Ger. mixed bent.	Fairway length.
10	Bone meal.	Lime.	Check.	Sulphate of ammonia.	Sewage sludge.	
11	Check.	Manure.	Complete fertilizer 6-12-4.	Complete fertilizer 12-6-4.	Check.	Trial plots of fairway grasses.
						Fertilizer experiments on fairway grasses (Kentucky blue-grass and redtop mixture).

¹ Soil in plots 7A and 8A poisoned with arsenate of lead before seeding.

will be applied at rates which will give the same amount of nitrogen for each plot, with the exception of the 4 check plots and one other which will receive no nitrogen. It is planned that the fertilizers will be weighed accurately and distributed by the Green Section, to be applied by those in charge of the individual plantings. No fertilizer was added before planting, and soil was selected so that the turf in each case starts out evenly. After the grass has become established, fertilizers are to be applied at certain intervals. The grass used in this fertilizer group is German mixed bent, since this will give an opportunity to observe the response of the several different bents in the mixture rather than one particular species or strain of grass.



Planting one of the Green Section's series of demonstration plots on the course of the Interlachen Country Club. The planting was done by the local greenkeepers' association

In the two plots below the fertilizer series there is a test of the effect of arsenate of lead in the soil on German mixed bent. Both of these plots are seeded with the same amount of seed from the same bag. Everything else is equal, with the exception that the soil on one of the two plots was treated with arsenate of lead at the rate of 5 pounds to 1,000 square feet. These two plots will serve to indicate the value of arsenate of lead in controlling earthworms, weeds, and grubs under local soil conditions.

In three plots there is to be a test of the influence of cutting putting greens at different heights. One of these plots is of mixed bent seed, another is planted with creeping bent stolons, and another with fescue. One-half of each plot will be cut with the mower set low and the other half of each will be cut with the mower set high for putting greens. It is hoped that this series will throw some light on the question of the most desirable height for cutting these three different types of putting green turf.

The remaining 20 plots are to be devoted to fairway experiments. Five plots are used for different grasses or mixtures commonly used for fairway turf. Ten plots, planted with a mixture of Kentucky

bluegrass and redtop, are used for testing fertilizers. Three of these 10 will be used as check plots without any fertilizer, and the others will receive periodic applications of different fertilizers in a manner similar to that outlined above in the fertilizer series on putting greens. Two plots will be used for testing the effect of arsenate of lead on fairways in a manner similar to the test on putting greens. For this test a mixture of Kentucky bluegrass and redtop is used. Three plots are devoted to tests of the most desirable height for cutting fairway turf. Three different mixtures are used, including Kentucky bluegrass, redtop, German mixed bent, and fescue.



Finishing the planting of the demonstration plots on the course of the Country Club of Virginia, at Richmond

In most cases it has been possible to obtain seed from the same source to provide for planting all of these different series. Therefore, if the fescue, for instance, fails in one locality and thrives in another, it will indicate that the difference was due to local conditions rather than seed differences, since both were planted from the same bag of seed.

In most cases the demonstration will be placed under the direct care of a practical greenkeeper and the work on the plots will be done by the regular golf course staff. This will probably serve to remove some of the "mystery" in which individuals try to enshroud some of the experimental work done by the Green Section or experiment stations.

Hazards should be visible. They should not be so severe as to discourage bold play. In general, they should not penalize to the extent of more than one stroke.

"A tee is almost as important as a green. If the tees on a course are kept in good shape one may be sure to find the greens well cared for; they are unfailing barometers, as it were."—Walter J. Travis.

The Arlington Turf Garden

By John Monteith, Jr.

The events leading up to the establishment of the Arlington Turf Garden were recounted by the late Howard F. Whitney, formerly president of the United States Golf Association, in an address of his delivered at a meeting of the Green Section in Washington, July 21, 1921. Mr. Whitney said:

"It appears from authentic records that Dr. W. S. Harban was the first golfer who went to the United States Department of Agriculture for technical assistance in regard to green turf problems. This was in 1906, when he first met Messrs. Piper and Oakley. Two years later, when Mr. Charles B. MacDonald was building the National Links near Southampton, Long Island, he encountered such serious problems in attempting to grow satisfactory turf on the old sand dunes that he applied to the Department of Agriculture for help,



Arlington turf garden as viewed from the air. Photographed in August, 1927

The central portion, 224 by 128 feet, is used for experiments with grasses kept at putting green length. At the right of this area are nursery rows of some of the most important strains of creeping bent, which are propagated for distribution of material to member clubs of the Green Section. At the upper right are rows of various selections of grasses.

The area at the upper left is now used for lawn experiments.

which was of course accorded. In studying the difficult turf problems at the National Links, the Department scientists came to the realization that the existing knowledge on the subject was very far from adequate and that extensive experimental investigations were necessary. Unfortunately, no funds were available for the purpose; but in cooperation with many golf clubs a considerable amount of investigation was undertaken by the Department men. Much of the information thus garnered formed the basis for a long series of articles in the golf journals by Messrs. Piper and Oakley. The first appeared in January, 1913. These articles were immensely helpful, but in the meantime the needs of the golf clubs for information and advice were increased enormously. In the spring of 1915 the Execu-

tive Committee of the United States Golf Association waited on the then Secretary of Agriculture, Hon. David F. Houston, and requested additional help in solving the problems of greenkeeping. The committee pointed out that about \$10,000,000 a year was being spent on the establishment and maintenance of turf by golf clubs, and it was believed that through ignorance half of the money was wasted. As a result of the appeal, the turf experiments were begun at Arlington, in the spring of 1916, the results of which having already been of the highest value."

The Arlington Turf Garden is located on the Arlington Experiment Farm, which is operated by the Bureau of Plant Industry, United States Department of Agriculture. This farm is located near Washington between the Arlington National Cemetery and the Potomac River. A large part of the funds for the turf garden work is contributed by the United States Golf Association Green Section. In recent years the Arlington turf work has been growing, and there is now an area of nearly 30,000 square feet kept cut at putting green height. The soil is of a clay type, which is unfavorable for turf production, and therefore is typical of the soil found on a great many courses in the East, where difficulty is experienced in producing and maintaining good turf.

The garden is divided into small plots 8 feet by 8 feet, giving the whole area a checkerboard-like appearance. In each of these plots different grasses and chemicals are tested. Most of the early work with stolon plantings of creeping bent was done at this garden, and there still is a large section devoted to various strains of both the creeping and velvet bent planted by the vegetative method. In addition to these tests there are plots of various grasses obtained from seed from different sources. About one-fourth of the turf garden is used for experiments with various fertilizers, particularly on bent grasses. These plots are used for observations as to the effect of the fertilizers on fine turf as well as their influence on common weeds of putting greens. Most of the Green Section experimental work on diseases has been conducted at the Arlington Turf Garden and a large area is still used for this purpose.

One section of the garden serves as a demonstration of different grasses used on putting greens. This area is not used for any experimental work but is maintained as nearly as possible like putting greens on golf courses. It receives top-dressing, fertilizers, disease remedies, and other treatments, as needed, to keep the turf in as good condition as possible throughout the season. On these plots it is possible for a golfer to compare the putting qualities of different grasses as well as the different strains of bent planted vegetatively.

In addition to the turf section there is a nursery section maintained by the Department of Agriculture in which various grasses are grown in rod rows. These offer an interesting comparison of the many grasses used on golf courses as well as in agricultural work. In one section of the nursery there are rows of several strains of bent maintained for distribution. Stolons from these rows have been sent out for several years to golf clubs, experiment stations, or individuals located throughout the United States and many foreign countries.

Turf Studies at the Florida Experiment Station

By Charles R. Enlow

The inauguration of experimental work with turf grasses at the Florida Experiment Station, at Gainesville, dates back to 1922, when a series of lawn plots were set out. This particular work has grown, until we now have 15 plots being maintained under lawn conditions. Our turf plots at present cover about $\frac{1}{2}$ acre of land, but in addition we have 18 or 20 acres of land devoted to pasture experiments and from which we expect to obtain valuable fairway information. A contribution of \$900 a year toward the expense of the work is made by the United States Golf Association, additional funds being contributed, as needed, by the Florida Experiment Station. Our prevailing soil at Gainesville is Norfolk sand. In places we have stripped this to a depth of four inches and have substituted other kinds of soil. Our experimental work has consisted chiefly of testing a wide variety of grasses and many different fertilizers, also the seeding of winter grasses on permanent turf and alone. Approximately $\frac{3}{4}$ of the area in plots is cut with the putting green mower and the remainder with the lawn mower, the areas in pasture grasses being kept down with a horse-drawn mowing machine. A weed-control experiment is being conducted on the 15 lawn plots, consisting of a comparison of the effects of sulphate of ammonia and nitrate of soda, the former being applied at the rate of 1,000 pounds per acre per year, and the latter at 1,290 pounds. The applications are made once a month, and are equivalent to about 2 pounds of sulphate of ammonia and $2\frac{1}{2}$ pounds of nitrate of soda per 1,000 square feet at each application. On November 2, 1928, these lawn plots were planted with mixtures of winter grasses, consisting chiefly of Italian rye grass.

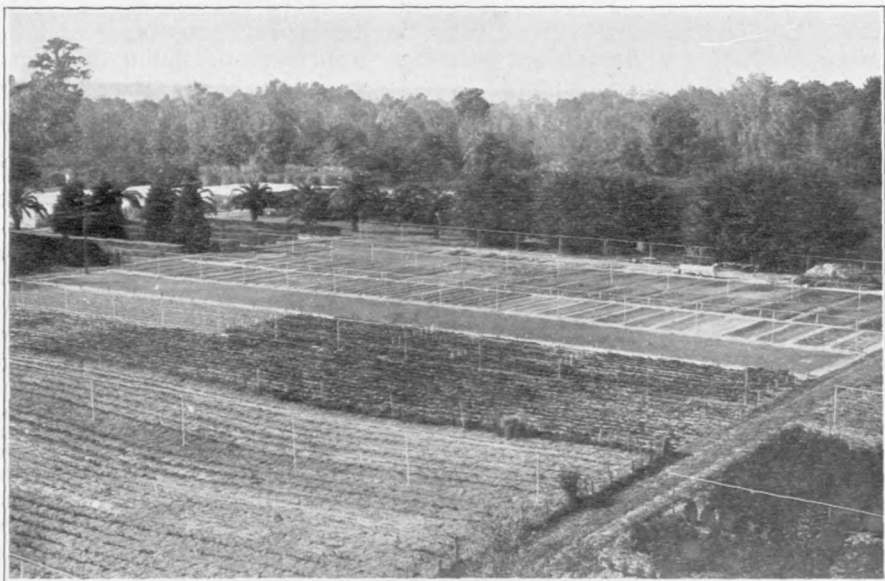
In April, 1925, our first fine turf plots were started. These consist of 5 plots, 10 by 25 feet in size, one-half of each plot being Norfolk sand and one-half Gainesville clay loam. They are planted with Atlanta Bermuda grass, Arizona Bermuda grass, St. Lucie grass, blue couch grass, and Manila grass, and are kept in putting green condition.

In February, 1926, 22 plots were set out for testing rates of application of sulphate of ammonia. These plots are 5 by 22 feet in size and are kept in putting green condition. There are 10 plots of Atlanta Bermuda grass, 7 of blue couch grass, and 5 of Manila grass. Two plots of blue couch grass and 2 of Atlanta Bermuda grass are left unfertilized as check plots.

A solid block of Bermuda grass was seeded in March, 1928, for testing different fertilizers. It is kept in putting green condition. A portion is divided into 18 plots for a source of nitrogen test, the following fertilizers being used: urea, cyanamid, calurea, nitrate of calcium, leuna saltpeter, sulphate of ammonia, nitrate of soda, phosphate of ammonia, dried blood, tankage, cottonseed meal, castor bean meal, poultry manure, and tung oil meal. Four of the plots are left unfertilized as check plots. A comparison of six special commercial fertilizers sold under trade names is also being made on this block of Bermuda grass, the applications being made four times a year. An inorganic equivalent of each of these special fertilizers is used on other plots, and on still others another equivalent of each is used in which one-half of the nitrogen is inorganic and the other half organic.

We also have a demonstration putting green, 25 by 36 feet in size, which was set out with Atlanta Bermuda grass on August 15, 1928. This is on Gainesville clay loam, and is fertilized as needed.

Our winter turf seedings for the current winter were made November 1, 1928. Four of our Atlanta Bermuda lawn plots were seeded respectively with Italian rye grass, Kentucky bluegrass, redtop, and bulbous bluegrass, leaving a small area of each plot unseeded as a check. Our solid block of Bermuda turf was seeded over its entire area with Italian rye grass. Our demonstration putting green has



Bird's-eye view of the experimental plots at Gainesville, Fla. Photograph taken December 6, 1928, from a water tower

The long strip near the center of the picture is the solid block of Bermuda grass which was seeded with Italian rye grass November 1. Next beyond this is seen a tier of 30 fine turf plots. The first 8 plots in the right of this tier are the winter grasses seeded alone. The bare plot fifth from the right is bulbous bluegrass carried over the summer but which failed to come up. Near the center of this tier are seen three dark plots; these received the heavy applications of sulphate of ammonia. The next tier consists of lawn plots, and just beyond this is another tier of fine turf plots, at the extreme left of which is the demonstration putting green

been divided into quarters and seeded to mixtures of redtop, Kentucky bluegrass, and Italian rye grass in different proportions. In addition to these seedings of winter grasses on permanent turf, we seeded 8 plots alone, consisting of redtop, Italian rye grass, perennial rye grass, Oregon rye grass, bulbous bluegrass, Kentucky bluegrass, annual bluegrass (*Poa annua*), and a seaside bent. Each of these plots receives two different fertilizers. In the fall of 1927 we also planted considerable bulbous bluegrass in order to ascertain the possibility of its becoming a permanent winter grass for both putting greens and fairways.

Miscellaneous experiments in weed control have been conducted with a mixture of sulphate of iron and sulphate of ammonia, in the eradication of nut grass and other pest grasses with chlorate of soda, and in the control of a small black billbug (*Calandra inaequalis*). Also some work is being done with various strains of centipede grass as possibilities for lawns and fairways.

Turf Experiments at the Massachusetts Agricultural College

By Lawrence S. Dickinson

Six definite and separate lawn and golf turf projects, together with a number of minor projects, are being conducted at the present time by the Massachusetts Agricultural College, at Amherst. For many years the station has conducted hay and pasture experiments which have furnished much information valuable on the growing of the finer turf grasses, but it was not until 1923 that the present projects were started. Perhaps it would be more correct to call this work "demonstrations" rather than "experimental projects," as it is being conducted under actual growing conditions and not under completely controlled environment. The information being furnished by the projects is easily understood by the layman; and because of the "practical atmosphere" confidence is placed in the results.

Project 1 consists of 24 plots one rod square laid out on one of the campus lawns in 1923. The object was to demonstrate the changes of vegetation as brought about by the continued use of various fertilizers and fertilizer combinations. Each plot is top-dressed twice annually (mid-April and mid-June) with its designated fertilizer. These plots are maintained as an ordinary lawn as to cutting and other general care. Very noticeable changes in vegetation have taken place during the five years, and surprising results as to the acid toleration of certain grasses and clover have been noted.

Project 2, started in 1926, is a combination of grass and fertilizer experiments. Twenty plots of different grasses are crossed with 6 fertilizer strips. Fertilizer series 1 received its nitrogen from sulphate of ammonia. Series 2 has an equal amount of sulphate of ammonia, as 1, but in addition acid phosphate. Series 3 is the same as 2, with muriate of potash added. Series 4 differs from series 1 in that the source of nitrogen is nitrate of soda and cottonseed meal instead of sulphate of ammonia. Series 5 and 6 are as series 4, with the addition of acid phosphate and muriate of potash respectively. Thus we have acid and alkaline reacting nitrogen, nitrogen plus acid phosphate, and nitrogen plus acid phosphate and muriate of potash, acting on 20 different grasses. These plots are developing a very mottled appearance, and much information as to the particular food requirements of the various grasses is being obtained.

Project 3 consists of 18 plots started in 1927, and 18 more in 1928. With the aid of recording instruments data are being obtained as to the possibility of accurately forecasting an attack of brown-patch, the susceptibility of various grasses to the disease, and the effect of the various controlling methods on the grasses.

Project 4 consists of 9 plots devoted to shade-enduring grasses and mixtures. These plots are growing under typical shade conditions and will be fertilized alike with a complete fertilizer.

Project 5 is a large turf nursery in which new strains are developed and propagated and seed tested under growing conditions.

Project 6 comprises 59 plots planted in 1928 in cooperation with the United States Golf Association Green Section. This series of plots is one of the number of such areas planted throughout the United States. That it will give valuable results is needless to say, and that the data assembled from all such plots will be very comprehensive is most certain.

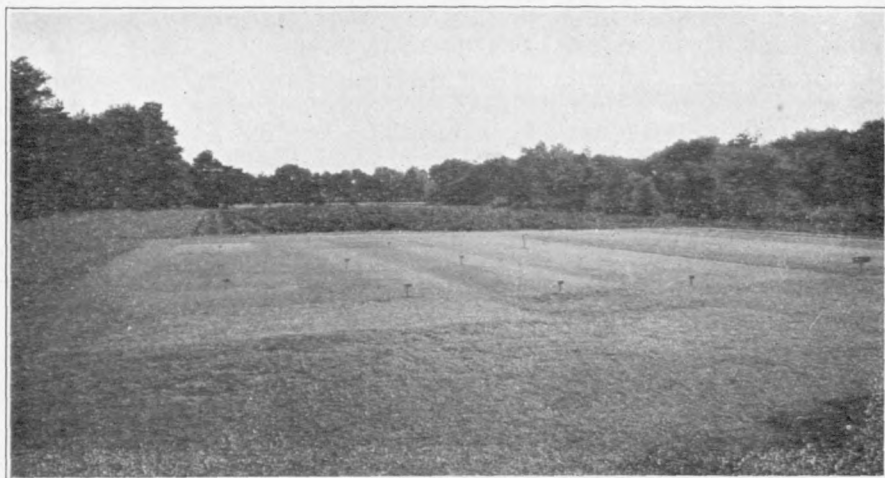
The area devoted to turf garden is about $1\frac{1}{4}$ acres. The soil for project 1 is gravelly loam over gravel; projects 2 and 3, light clay loam over hardpan; project 5, deep, light, sandy loam over yellow sand; project 6, clay loam over clay and hardpan.

These plots are valuable adjuncts to the teaching of turf culture and are visited by many persons during the summer months.

Experiments with Turf Grasses in Kansas

By J. W. Zahnley

In the summer of 1924, the United States Golf Association Green Section, through its chairman, Dr. Charles V. Piper, prepared plans for a series of experiments with turf grasses in cooperation with the department of agronomy of the Kansas Agricultural Experiment Station. The first plantings were made in the fall of that year. Since this beginning, the work has expanded and, under the direction of Dr. R. A. Oakley and Mr. H. L. Westover, has become an interesting and valuable experimental project. These experiments are financed cooperatively by the United States Golf Association Green Section and the State of Kansas. The Green Section contributes \$250 annually toward the support of the work. The State sets aside \$150 and in addition furnishes land, water for irrigation, horse labor, and compost material, and designates a member of the experiment station staff to direct the work. Hand labor, special equipment, and supplies are paid for from this \$400.



Turf garden at the Kansas Agricultural Experiment Station

The Kansas turf garden is located on the campus of the Kansas State Agricultural College, at Manhattan. The soil is a loam of the Wabash series, second bottom, nearly level, very fertile, and with fair drainage. The area is nearly surrounded by timber and subject to heavy dews which frequently remain on the grass until nearly noon except in very dry weather. Perhaps it is due to this location that considerable trouble is experienced every year with brown-patch disease.

The Kansas experiment comprises 86 plots each 10 feet square arranged in a solid block 100 feet square. In addition to the turf plots, several nursery rows are maintained for identification purposes and to supply planting material. On these plots 18 varieties and strains of grass are being tested, consisting of Kentucky bluegrass, redtop, buffalo grass, and 15 strains of bent. The Kentucky bluegrass and 1 series of 8 plots, making an area 10 feet wide and 80 feet long comprising 8 strains of bent, are cut at lawn or fairway height. This is done to determine the adaptability of the bents for lawns in this locality. The Kentucky bluegrass must all be cut high, because it is quickly destroyed by close mowing in this section. The remaining 63 plots are kept cut close with a putting green mower. Forty-two plots are devoted to tests of fertilizers. These consist of duplicate series of 7 plots each of bluegrass, German mixed bent, and Washington creeping bent. Each fertilizer treatment is applied cross-wise of the series in strips 10 feet wide, so that duplicate plots of bluegrass, mixed bent, and Washington creeping bent receive the same treatment. The remaining 21 plots of the 63 that are cut with the putting green mower receive compost and sulphate of ammonia.

The strains thus treated consist of the following: Washington, Metropolitan, Columbia, Virginia, Arlington, Vermont, Acme velvet, seaside, Cocos, Astoria, Narragansett, Rhode Island mixed bent, and redtop. Buffalo grass was originally included in this list, but owing to its failure to respond favorably to fertilizer and compost treatments attempts to make a putting turf of Buffalo grass have been abandoned. It may, however, be of interest to state that, under conditions of drouth as exist in central and western Kansas, Buffalo grass is well suited to fairways. It forms a firm sod, is extremely resistant to drouth, and is not injured by frequent mowing.

For the past two seasons experiments have been in progress to find a way to exterminate white clover from the turf garden by means of chemical sprays. Various chemicals recognized as herbicides and used in weed eradication have been tried. The results have been sufficiently promising to warrant a continuation of the work.

Very few projects at the Kansas Agricultural Experiment Station have attracted wider attention and interest than the turf grass experiments. The grass garden attracts many visitors and frequent inquiries are received through the mail regarding the bent grasses for lawns and putting greens. It is the unanimous opinion of those associated with the work at this station that it is fulfilling its purpose by supplying much needed and valuable information regarding turf grasses for this section of the country.

Turf Studies at the Central Experimental Farm, Ottawa

By G. P. McRostie

Our special experimental work with turf grasses was begun in the spring of 1924 by request of the Royal Canadian Golf Association, although previous to that time we had maintained a collection of bent grasses in the forage plant division of our regular work. There is now an area of about $1\frac{3}{4}$ acres devoted to this special turf work. So far the expense of the work has been taken care of solely with Federal funds, but cooperative work with golf clubs is now being inaugurated.

Centers for the multiplication and distribution of the most desirable strains of the bent grasses are also being established. In 1928 we distributed about 20 tons of stolons from the increase plots at the Central Experimental Farm at Ottawa.

Our soil is a sandy clay loam. The work now in progress includes experiments with different fertilizers, comparative tests of strains of creeping bent and velvet bent, comparative tests of seedsmen's mixtures and bent grass seed, and tests of various worm exterminators. As yet no experiments in disease control have been started, nor in heights of cutting. We keep about $\frac{1}{2}$ acre cut at putting green height and $\frac{1}{4}$ acre at lawn or fairway height.

Turf Experiments at the New Jersey State Station

By Howard B. Sprague

The first definite experimental work on golf turf at the State Agricultural Experiment Station, New Brunswick, was started in August, 1925, with the assistance of the late Dr. C. V. Piper. At that time an area of about 10,000 square feet was planted to stolons of Virginia bent grass and 1,000 square feet to stolons of Metropolitan bent grass. In the early summer of 1926, the area in Virginia bent was laid off in plots 10 by 10 feet in size.

Twelve types of fertilization were selected for study, and each of these was used separately on 8 different plots, thus making 8 series of plots with each series containing all 12 of the treatments. The treatments are as follows: No fertilizer, sulphate of ammonia, nitrate of soda, Ammo-phos, complete fertilizer, alfalfa meal, bone meal, nitrate of ammonia with sulphur at 2 rates (to make the soil acid), and nitrate of ammonia with lime at 2 rates (to make the soil alkaline). The fertilizer was first applied in the summer of 1926, and has since been added at equal rates of nitrogen per plot per season. These plots yield data as to the relative value of these various nitrogenous fertilizers.

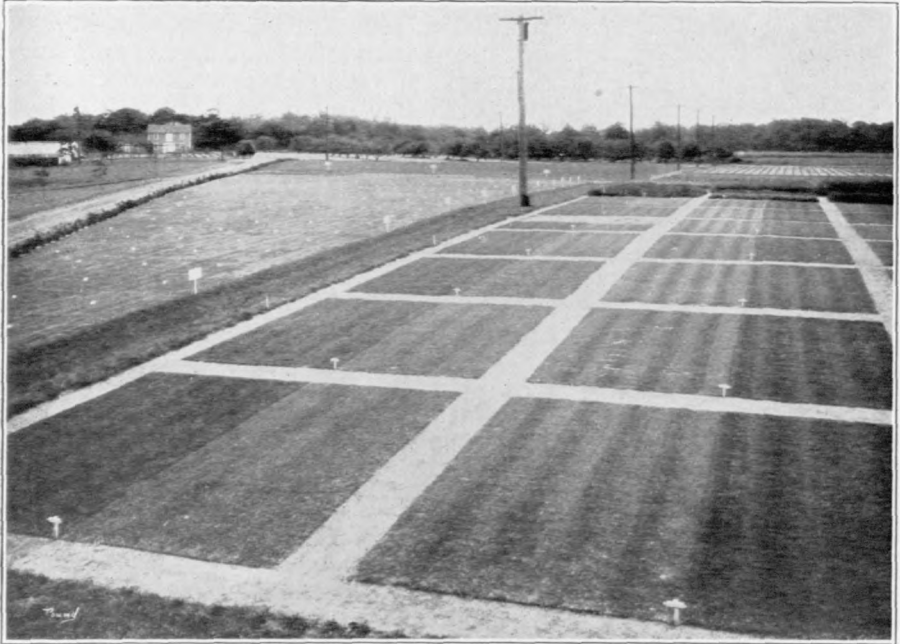
The first 3 of the 8 series of plots noted above are being used to test the effect of different proportions of sand in the top-dressing. Series 4 receives 15 pounds of arsenate of lead per 1,000 square feet during the season, the material being applied in the top-dressing. Series 5 is used for observations on diseases. Series 6, 7, and 8 have been set aside to test the long-time effect of the fertilizers used on soil acidity, abundance of weeds, abundance of clover, annual bluegrass, number of wormcasts, and the vigor and color of the grass.

In addition to the fertilizers listed above, such materials as sewage sludge, Nitrophoska, castor-bean pomace, and sulphate of ammonia in varying amounts are being tested on single plots.

The area in Metropolitan bent is being used to compare urea and cottonseed meal with sulphate of ammonia. All of the fertilizer plots on both Virginia and Metropolitan bent receive top-dressings made up of $\frac{2}{3}$ topsoil and $\frac{1}{3}$ sand. No organic matter is added, since this would tend to mask the effect of the fertilizers.

An additional area of Virginia bent is being used to compare the relative values of mushroom soil, barnyard manure, peat-humus, sewage sludge, and peat-moss manure as compost materials.

A group of 14 species and strains of grasses are being grown in plots 20 by 20 feet to observe the value of each in this climate. One-half of each plot is cut at putting green length and the other half at fairway length.



Experimental plots at the New Jersey State Station. Photograph taken in June, 1928

The 14 plots at the right of the telephone pole contain the experiment in height of cutting, each plot having a different kind of grass. At the left of the pole are plots of Virginia and Metropolitan bent kept at putting green height. These contain miscellaneous experiments, including comparison of fertilization treatments, use of different proportions of sand and soil in top-dressing, comparison of various compost materials, and the value of arsenate of lead. The plots are 10 by 10 feet in size

A nursery of turf grass selections is maintained which contains a number of strains of bent grass obtained from golf courses, lawns, parks, and pastures throughout the state. Some of these are promising enough to warrant trial under putting green conditions.

The United States Golf Association Green Section is now contributing \$600 a year for conducting these experiments; the balance of the cost is borne by the State Agricultural Experiment Station.

Our soil is a heavy silt loam grading into a clay loam at about 2 feet. It is a little below the average in fertility, but is well drained.

A New Experiment Station In Chicago

In September, 1928, a new experimental turf garden was started just north of Chicago. This garden will be under the direction of the United States Golf Association Green Section. It is located near Everett, Ill., on the Mill Road Farm Golf Course, the private course of Mr. A. D. Lasker.

About 20,000 square feet have been planted so far and the area will probably be increased early next season. It is divided into two distinct areas, one portion of which is devoted to experimental work and the other to demonstration plots. The experimental section is cut up into plots 8 by 8 feet, similar to the Arlington Turf Garden plots. Certain sections will be devoted to testing various fertilizers on both putting green and fairway turf. Other sections will be devoted to weed control experiments, various grass strains or grass mixtures, diseases, and similar problems. The demonstration portion has been



Planting the new experimental turf garden, Mill Road Farm Golf Course, Everett, Ill.,
September, 1928

planted in 12 plots 24 by 24 feet, using different putting green grasses. These plots will be maintained in good putting green condition and will enable visitors to compare the quality of the different grasses maintained under identical conditions. Most of the common putting green grasses, both seeded and stolon, have been planted separately in plots 8 feet square, where they can be kept in the best possible putting green condition for direct comparison with the larger demonstration plots. Nursery rows of the important golf course grasses will probably be available for comparison by early summer.

Turf Experiments at Nebraska College of Agriculture

By Fred V. Grau

In the latter part of September, 1925, Nebraska's first experimental turf garden was started in the Plant Museum of the University of Nebraska College of Agriculture, at Lincoln. This was made possible through the efforts of Dr. C. V. Piper, who at that time was senior agronomist in charge of forage crop investigations of the United States Department of Agriculture, and the cooperation of Profs. W. W. Burr and F. D. Keim, of the Nebraska station, who completed the arrangements. The shipment of stolons and seed was made from the Arlington nurseries at Washington, and the stolons were planted about the first of September. A good growth was made during the fall. All the grasses except the Acme velvet bent came

through the winter in good shape. The expenses of operating the turf garden are defrayed by funds furnished by the United States Golf Association Green Section and the Nebraska College of Agriculture. The field work is carried on by an assistant, usually a student, who is interested in this type of work. Dr. Keim, of the department of agronomy, personally supervises all operations.

The turf gardens lie on a deep layer of Waukesha silt loam. This is an old alluvial soil and is well adapted for bent grasses. The fertility and texture of the surface six inches are well fitted for mixing it with sand and manure for composting. The ratio of the compost used is 2-2-1, sand, soil, and manure respectively. Sharp, clean, plaster sand has been used with good success.

The turf work at the Nebraska station is conducted on an area of approximately 10,000 square feet. Of this area there are 80 plots 10 feet square which are devoted to clipping, fertilizing, and disease-control experiments. The nursery stock covers 1,000 square feet. The remainder is occupied with newly seeded plots of new and promising strains of bent.

All fertilizers, with the exception of the lime, are applied three times during the season. Lime is applied in the spring only. Compost is the vehicle used to spread the fertilizers, thus accomplishing two jobs with one operation.

Comparative growth is measured by standardized clipping and weighing of the clippings each time. Weed growth is determined by digging the weeds and then drying and weighing them.

Turf Experiments at Rhode Island Experiment Station

By E. S. Garner

The Agricultural Experiment Station of the Rhode Island State College, at Kingston, commenced in 1905 a series of experiments with lawn grasses. The object, as then stated, was "to test the influence of different fertilizers upon the permanence of white clover and certain grasses and to compare the adaptability of different grasses and mixtures for lawns, golf-links and polo grounds."

Thirty-five plots, occupying an area of about $\frac{1}{4}$ acre, were laid out on a piece of fairly level ground. The topsoil of this land is mellow and friable, but is underlain by a plastic yellow silt loam which prevents excessive leaching. These plots have been mowed at ordinary lawn or fairway height. They have provided data for two station bulletins, and a third is about to be published.

In May, 1928, two new projects were approved. About $1\frac{1}{4}$ acres of new ground were taken. The soil is of the same type as that of the old lawn plots and has a degree of acidity of about 4.5 on the Ph scale. This land was divided into three sections, known as A, B, and C.

The first of the new projects is a study of the seed production of the bent grasses. The object in view is to determine the suitability of the bent grasses for seed production in Rhode Island. As very little is known concerning the factors influencing seed production, data will be obtained as to the quantity of seed produced from different species, varieties, and strains of bent. The uniformity and tex-

ture of the turf produced from the seed will be taken into consideration. Sections A and B will be devoted to this project. Section A has been planted with seed, or stolons, obtained from different sources. All of the strains used belong to one or other of the three species *Agrostis stolonifera*, *A. tenuis*, and *A. canina*.

These plots are maintained under putting-green conditions and provide a testing ground where the individual strains can be observed. Those which prove inferior are scrapped, the best strains being used for seed production. Next to each planted plot on section A there is an unplanted plot. The former will serve as a basis of comparison for each adjoining plot, as it is desired to see whether the vegetative characteristics of the pedigreed strains are transmitted through the seed. In order that this may be done plants from the plots are being grown in the greenhouse, enclosed so as to exclude the possibility of cross-pollination. Seed from these will be collected and the vegetative increase from the plants so obtained will be grown on one-half of each of the reserved plots and compared with them.

Section B is devoted to seed production and was planted with 12 varieties and strains of the above-named species. Some of these plots were planted with stolons and some with seed. Where seed was used it was taken from the same bags as contained the seed planted on section A. There are 4 plots of each kind, arranged so as to minimize such variations as might result from inequality of the environmental conditions. A record will be kept of the weight and percentage of germination of the seed produced by each tested variety. This seed will be used for planting the other half of the reserved plots on section A. It will then be possible to see to what extent cross-pollination has affected the characteristics of the strains, under field conditions where every facility has been afforded for this to occur.

The second new project is a study of the response of acid-tolerant grasses to fertilizer nutrients. The purpose of this experiment is to determine the minimum nutrient needs of the bent grasses for maximum hay and seed production, having regard to the law of diminishing returns.

Thirty-six plots have been laid out on section C, and 4 plots, 1 in each quarter section of the field, are receiving the same fertilizer treatment. Rhode Island bent was selected for this experiment, as being a well-defined and representative species within the acid-tolerant group of grasses.

It is thought that nitrogen is usually the limiting factor in the nutrient requirements of grasses, and the fertilizer rations have been arranged on that assumption. This station has found that certain cereals which are sensitive to active aluminum require three times as much phosphoric acid for normal growth in the local acid soils as in solution cultures. This is probably because the high aluminum content of these soils is counteracted by heavy applications of phosphoric acid. But since the bent grasses are not sensitive to acid-soil conditions, it is probable that they are also tolerant of aluminum, in which case they would not require nearly so much phosphoric acid for normal growth as the cereals. This belief was also kept in mind at the time when the fertilizer treatments were formulated.

Next year these plots will be allowed to grow up and to produce seed. Tables will be made to show the results of the different fertilizer treatments in the yield of hay and seed, per pound of fertilizer.

AS WE FIND THEM

This is the season when the budget makers assemble to chart the financial seas.

One committee of the shekels is determined to have the most elaborate and expensive equipment in existence. "Machinery saves labor," it argues, "so let's cut down on all wages to help pay for the machines."

Other committees have learned that complicated machinery calls for some intelligent and well-paid help on the staff. Cheap, careless help around elaborate machinery makes the proverbial bull in the china shop look like a sick calf. A Rolls Royce requires something more than a Ford chauffeur.

Other guardians of the golden hoard have decided to make a big allotment for expensive chemicals to prevent all the pests of turf even though they recognize they have no one on their staff who knows how to use chemicals.

In time they may learn, as other committees have learned, that the worst pest of turf is cheap help with an unlimited supply of high-powered chemicals. Compared with that kind of a pest, brown-patch, grubs, and the like look like blessings. When the "baby cries for Castoria" some committees apparently would put the kid in a barrel of it.

Another committee has decided on a new club house although the course is admittedly in miserable condition.

It is argued that when members become thoroughly disgusted with the turf around the course and get all "het up" about the management it is well to have a luxurious and comfortable building where they may retire and vent their wrath. Most of the golf in some clubs is played in the club house anyway.