

ordinary conditions to keep the turf in good condition for seven days.

The fact that you have installed a water or irrigation system does not mean that the turf should be drenched continually, giving the player the most unfair lies—in not on a soggy turf. Do not over-water. Give the turf the amount of moisture it requires, never an excess. Water-logging, through excess moisture is surely in store for those who practice excessive watering. This condition is not so easily remedied either.

On the other hand, we have the other extreme; the man who persists in sprinkling, that is, moistening the soil to a depth of about $\frac{1}{4}$ -inch. This method, naturally, of course, brings the feeding roots close to the surface in search of the moisture, where the hot sun just naturally burns those fine roots up. Every successive sprinkling is naturally more and more sapping the life of the plant. Turf treated in this way does not respond quickly to treatment for recovery.

DRAINAGE IS MOST IMPORTANT

FOR those contemplating irrigation systems, their first thought should be adequate drainage; without it, irrigation will be a failure, unless you have a sandy sub-soil. There must be an outlet for the excess water or a soggy water-logged condition will be the result. It is necessary that the soil be porous to allow air and moisture to penetrate.

Soggy conditions are aggravated through the necessary mowing of the fairways. The continual rolling with even the lightest mowing equipment, eventually gives you a sealed top soil, excluding all air, thus resulting in unhealthy turf.

The next factor is an adequate water supply. The mains must be large enough to maintain equal pressure at all points of the system. Up-to-date hose systems including the water supply and pumping plant will cost between \$20,000 and \$60,000 to install, depending on local conditions. The lower-priced systems, of course, are those where conditions have made it possible to reduce the cost through natural water supply, or, where booster pumps are used instead of elevated or underground tanks, and where installation of the piping is on or near the surface of the ground.

The higher-priced systems are where the piping is laid below the frost line, necessitating the



Concealed or Pop-Up Tee Sprinkler

Special Engineering Service For Turfed Areas

TOPOGRAPHICAL MAPPING

Golf courses require accurate topographical maps to record every detail of the course facilities. The delineation peculiarly required for golf topography is best portrayed by Miller engineers who are used to ground and aerial-ground mapping for drainage, irrigation, and layout. If you lack complete maps, write Miller for prices.

DRAINAGE

Soil technology—the field and laboratory examination of soils—and the interpretation and practical application of these to turfing. If you doubt the wisdom of your expenditures for soil conditioning and fertilization, or if you have a soils problem to solve, send for a Miller engineer.

SOIL EXAMINATIONS FERTILIZATION PROBLEMS

Drainage of difficult soils demands the highest degree of engineering skill, experience, and soils technology. The reputation of Miller engineering was first established in the successful solution of intricate drainage problems. When your drainage system fails, or if you are planning substantial drainage construction, you can give finality to this facility by having Miller engineers design your work.

WATER SUPPLY

The water supply requires careful engineering to secure low cost water. Long experience in developing water supplies under widely diverse conditions has peculiarly fitted the Miller organization to cope with the hydraulics and economics of your water supply.

LOW COST IRRIGATION

The Miller one-man hoseless, tee, green and fairway water systems cost little more to construct (if any) than good hose systems. If you are contemplating fairway irrigation, we suggest that you consult with Miller engineers in order to secure the most and best for your money, and avoid the mistakes common to locally engineered projects.

"TROUBLE SHOOTING"

For over ten years the Miller organization has carried on an advisory maintenance and consultation service, meeting and overcoming troublesome turf situations. When you have on hand trouble which is likely to prove embarrassing, write, phone or wire for

Wendell P. Miller & Associates
CONSULTING ENGINEERS

— Soil Technologists —

105 West Monroe St.

Chicago, Ill.

85 East Gay St., Columbus, Ohio

Grass Seed
Fertilizers
Rollers
Distributors
Buckner Sprinklers
Toro Equipment
Milorganite
Arsenate of Lead

J. Oliver Johnson, Inc.

World's Largest Golf Course Equipment House

Morgan-Huron-Superior Sts.

CHICAGO, ILL.

© Reg. J O J Inc. 1928

NOW is the time to
prepare to
**IRRIGATE YOUR FAIRWAYS
THIS SUMMER**

Remember, it is the way you irrigate them that counts. Water properly applied will carry your course through the driest season, and, as you know, a well-kept course is always a popular course. Keep your fairways in June condition the season through with

**BUCKNER
SPRINKLERS**

There are more Buckner Sprinklers and valves in use on the golf courses of the United States than all other makes of similar equipment combined. Only superior performance could create this overwhelming preference. Write for literature.

**BUCKNER
MANUFACTURING CO.**
FRESNO - - CALIFORNIA

Factory Representatives

P. L. Baldock, 631 Crosby St., Pasadena
Gordon Buckner, Piedmont Hotel, Oakland
Buckner Irrigation Company, Nixon Bldg., Chicago

Eastern Engineering Representatives

Wendell P. Miller and Associates, 105 W. Monroe St., Chicago

opening and filling of ditches; the erection of an elevated tank or the burying of pressure tanks; the construction of reservoir; or building of lakes; the drilling of deep wells; installation of pumping equipment and erection of pump houses.

My idea of a well-built and installed hose system, would be a 6-inch loop main of cast-iron pipe with caulked joints; four-inch laterals, also of cast-iron; leads to greens, tees and fairway outlets of 2-inch galvanized pipe. These sizes will assure an equal pressure at all points. The piping should be placed below the frost line. An elevated tank should be at least 130 feet high and of not less than 100,000 gallons capacity, preferably 200,000. If water supply is direct from wells, pumps of not less than 500 gallons a minute capacity should be installed; the water to be pumped into a lake, with a capacity of 4,000,000 gallons.

THE AMOUNT OF WATER USED PER DAY
The amount of water used per day on an 18-hole course is between 25,000 and 500,000 gallons—for the average season between 2,250,000 and 45,000,000 gallons. It is obvious then that an adequate water supply is necessary. Intelligent operation of the hose system is just as necessary as the system itself.

The third and last method of irrigation is the hoseless or pop-up system. They are practically new in the East and Middle West, but, have been in successful operation on the California courses for several years. If Joe Mayo was here, he would tell you the hoseless system solved the irrigation problems on the coast. I will venture to say they will very soon solve our irrigation problems here.

Everything is in favor of the adoption of the hoseless system here. They have now been developed to a high point of efficiency; the experimental period is over; in fact the installation cost is now about the same as for a hose system.

The points in favor of a hoseless system are: The saving on hose and sprinkler purchasing; the saving on labor, and uniform coverage of the entire course, while with the hose system, much over-lapping is bound to result during the night.

POP UP IS ONE-MAN SYSTEM

The pop-up system is a one-man system. One valve controls one or more fairways, depending on the volume of water available. This means the system would not be in daily use during dry periods.

It will be so much easier to regulate the amount of water the turf requires, especially for green sprinkling. Think what that means in a more thorough control of the moisture supply during humid brown patch weather; also during the dormant or resting season of the turf.

The cost of changing an up-to-date hose system to a hoseless would not, I will venture to say, be more than the cost of a five-year hose supply and labor cost. I am for this system because it will reduce costs and maintain high standards of maintenance, and would advise those contemplating new irrigation systems to go into the hoseless systems thoroughly, and be sure when you have chosen, that is the one best adapted to your requirements.

Look well—before you decide.

One more important matter in this irrigation system problem comes to my mind. I say *important*, advisedly—this is the matter of a ground plan—a plan of the entire irrigation system, showing valves, shut-offs, drains, etc. *This plan to be framed and hung in the pump-house in plain view.*



Safe for Night Sprinkling *The Lark!*

Set them at sundown! The LARK is safe for night sprinkling. Wind won't stop it. Its gearless action is positive, never-failing. It covers evenly from center to outside circumference on any pressure. That is why it causes no puddles. Spray screw in adjustable nozzle breaks up main stream. No large drops to dig out top-dressing.

The LARK is made of long-lasting brass—all except the roller-base and hose pipe.

Try the LARK 10 days under all conditions. Money-back guarantee.

L. R. NELSON MFG. CO., Inc.
1730 S. WASHINGTON ST. PEORIA, ILL.

FEED *systematically* to develop the grass you have

Grass is a heavy feeder and must have an abundant supply of plant food for its proper development. When the available plant food in the soil dwindles, grass cannot maintain a healthy, vigorous growth. That is why you find thin spots on many fairways—the grass is undernourished.

Follow a systematic maintenance program. Feed your course well. Give it the nitrogen, the phosphoric acid, the potash it needs in Armour's Special Turf Fertilizer, the complete fertilizer that's made especially for golf course use. Let Armour's Special Turf Fertilizer develop the grasses you have. Let it help you put the course in shape for heavy play.

Well-developed turf on fairways and greens means satisfied golfers—more play—greater revenue.

Write for the booklet, "Solving the Turf Problem." It tells how to use Armour's Special Turf Fertilizer to improve your golf course.

Twenty-one conveniently located plants insure prompt deliveries



Armour Fertilizer Works

General Offices

111 West Jackson Boulevard
Chicago, U. S. A.

Carolina Greenkeepers Organize



Two-day meeting of those interested in turf culture brings about birth of a new organization. A large and enthusiastic attendance assures success.



WILLIAM C. FARBER
President



WALTER J. CARTIER
Secretary-Treasurer

THROUGH the efforts of Walter J. Cartier, superintendent of the Charlotte Park and Recreation Commission, a two-day meeting of Carolina greenkeepers and others interested in golf course maintenance was held at the Charlotte Country Club the latter part of February. The result was the organization of the Carolina Greens Association and the election of the following officers: President, William C. Farber, Forest Lake Club, Columbia, S. C.; First Vice-President Frank Maples, greenkeeper, Pinehurst C. C.; Second Vice-President, R. V. Stout, manager, Hamilton Lake Golf Club, Greensboro, N. C.; Secretary-Treasurer, Walter J. Cartier, Charlotte, N. C.; Corresponding Secretary, Ramsey Dulin, executive secretary, Myers Park Club, Charlotte, N. C.

An interesting program was carried out including visits to golf courses and round table discussions with speakers of national reputation. Perhaps the most outstanding highlights in the program were the discussion periods led by Donald Ross, nationally known golf course architect; E. S. Draper, golf course architect and landscape engineer of Charlotte, and O. J. Noer, of the Milwaukee Sewerage Commission.

It is stated that the association will determine to keep very careful records of seeding, types of fertilizers and results gained, as well as feeding and its results. Many of the greenkeepers intend to establish test plots for the growing of various kinds of seed under different treatment and to make definite reports to the association at regular intervals.

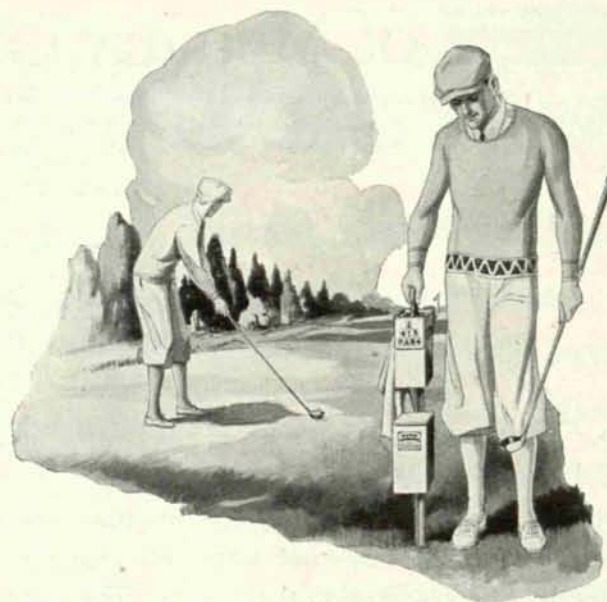


GROUP OF GREENKEEPERS AND TURF CULTURE EXPERTS AT THE CHARLOTTE, N. C. COUNTRY CLUB

This is the first organization of its kind ever attempted in the middle south, and is bound to be of great assistance to the golf and country clubs of that section. The next meeting will be held at the Starmount Golf Club, Greensboro.

List of Delegates Attending the Greens Association Meeting at Charlotte, N. C.

W. P. Kistler, greenkeeper, Charlotte C. C., Charlotte, N. C.
 J. A. Simmons, foreman, Charlotte C. C., Charlotte, N. C.
 J. P. Traynham, greenkeeper, Greenville C. C., Greenville, S. C.
 Dan Carroll, Charlotte C. C., Charlotte, N. C.
 Ralph H. Hall, engineer, Charlotte Park and Recreation Commission, Charlotte, N. C.
 C. W. Zaun, Toro Mfg. Co., Jacksonville, Florida
 Joe Crayton, Charlotte, N. C.
 Elton W. Sault, greenkeeper, Charlotte Park and Recreation Commission
 J. L. McClintock, manager, McClintock Corporation, Charlotte, N. C.
 W. A. Scoggin, greenkeeper, Guilford College, Greensboro, N. C.
 T. H. Antrim, greenkeeper, Sedgefield C. C., Greensboro, N. C.
 M. R. McLaren, Toro Mfg. Company, Minneapolis, Minnesota.
 O. J. Noer, Milwaukee Sewerage Commission, Milwaukee, Wisconsin.
 C. C. Boshamer, manager, Statesville Golf Course, Statesville, N. C.
 William C. Farber, Forest Lake Club, Columbia, S. C.
 C. K. Hutchison, manager, Mammoth Oaks, Charlotte, N. C.
 Bill Gobel, professional, Municipal Golf Club, Charlotte, N. C.
 Wm. Crichton, professional, Lenoir, N. C.
 Herman Atkins, professional, Sedgefield C. C., Greensboro, N. C.
 Dugan Aycock, professional, Green Valley Golf Club, Greensboro, N. C.
 Clarence Callaway, professional, Columbia, S. C.
 James B. Orgehart, president, Forest Lake Club, Columbia, S. C.
 P. D. Smith, Spartanburg, S. C.
 Louis Mayes, Charlotte, N. C.
 T. D. Camp, greenkeeper, Charlotte, N. C.
 I. J. Tuttle, representative, Dixie Culvert & Metal Co., Atlanta, Ga.
 Marshall Crichton, professional.
 B. W. Clark, Durham, N. C.
 J. W. DeArmon, Statesville, N. C.
 D. G. Adams, city engineer, Spartanburg, S. C.
 R. V. Stout, manager, Hamilton Lakes Golf Club, Greensboro, N. C.
 T. B. Leftwich, manager, Green Valley Golf Club, Greensboro, N. C.
 Ellis Maples, greenkeeper, Southern Pines.
 Frank Maples, greenkeeper, Pinehurst, N. C.
 Donald Ross, golf architect, Pinehurst, N. C.
 F. D. Hobart, superintendent of grounds, Davidson College, Davidson, N. C.
 E. S. Draper, golf architect, Charlotte, N. C.
 Reese A. Coltrane, assistant greenkeeper, Guilford College, Greensboro, N. C.
 Walter J. Cartier, superintendent, Charlotte Park and Recreation Commission, Charlotte, N. C.
 Raymond W. Wrenn, greenkeeper, Greensboro, N. C.
 F. H. McCain, greenkeeper, High Point, N. C.
 Earl Clark, greenkeeper, Reidsville, N. C.
 Ben Robertson, greenkeeper, Reidsville, N. C.
 Joe P. Sexton, greenkeeper, Duncan Park, Spartanburg, S. C.
 J. B. Caskey, Spartanburg, S. C.
 R. A. Wilhelm, golf architect, Charlotte, N. C.
 L. H. Moss, representative, Swift & Co., Greensboro, N. C.
 Dr. J. F. Fonder, scientific research department, Swift & Co., Chicago, Ill.
 Arthur Ham, professional, Charlotte Country Club, Charlotte, N. C.
 Ramsey Dulin, executive secretary, Myers Park Club, Charlotte, N. C.
 W. F. Bailey, Highpoint, N. C.
 Fred Newnham, professional, Greensboro, N. C.



A Quick Bath!

STIFF bristles . . . soapy water, revolving, twisting ball between brushes . . . it's done! Clean as a whistle in a moment's time and not one bit of paint removed. The old sand box is a thing of the past. Your members want Lewis Washers because they see them and use them nearly everywhere they go. The caddies want them, too . . . because it takes but a moment to do a thorough job. Lewis Washers are low in cost and last almost indefinitely . . . yet they are invaluable aids to good, sound golf . . . they make lost balls easily found, they improve the appearance of the course.

See your Distributor

New Low Prices

1 to 10 Washers	\$5.50 each
11 or more Washers	5.00 each
LEWIS Tee Stakes	1.50 each
Waste Container	1.50 each
Tee Data Plate	1.50 each

Price, f.o.b. shipping point

Operation

The ball is inserted in an oblique slot in the hard maple paddle. A few easy strokes scrub it clean between two stiff brushes. The oblique slot causes the ball to rotate on each stroke, cleaning every side thoroughly. Only pure soap and water are used, no sand. A simple, sure, quick method of washing golf balls.



G. B. LEWIS COMPANY
 Dept. NG 431 WATERTOWN, WIS.

LEWIS GOLF BALL WASHER

Two Essentials for Better Turf

Cocoos Creeping Bent Seed
 Lecco, the Complete Grass Food

Information upon request.

THE LYMAN CARRIER CO. Granger, Indiana

Effect of Mercury Compounds and Arsenate of Lead on Soil Nitrification

By J. W. WHITE, *Professor of Soils*

Pennsylvania Agricultural Experiment Station

Read at the 5th Annual Educational Conference of the National Association of Greenkeepers of America, held at Columbus, O., February 3-6.

A STUDY of the bulletins of the United States Golf Association Green Section concerning recommendations for the development and maintenance of turf grasses brings out some interesting facts worthy of consideration at this time. The purpose of my paper, therefore, is to give you my impressions of certain recommendations found in those bulletins in addition to a discussion of the topic assigned to me. I trust that what I may say will not be taken as destructive criticism, but rather as helpful suggestions that may lead to a better understanding of the fundamental principles underlying the art of green-keeping and fairway management.

After a study of the bulletins in preparation for our first Greenkeepers' Conference at Penn State in 1929, I resolved to face the issues squarely even though my ideas may be entirely contrary to those previously presented. With your permission, therefore, I wish to review in general the recommendations given at our Penn State Conferences in 1929 and 1930.

The exacting demands of the green committees concerning the development of a perfect turf, free from weeds, lead to recommendations entirely contrary to the fundamental principles of soil fertility and these have led to disaster in many instances, especially in our Eastern states. The continuous and excessive use of sulphate of ammonia and the ban on lime and phosphorus have been the cause of most of your trials and tribulations. The evils of an extremely acid soil are too well known to the soil chemist to warrant its development as a means of weed control for a soil too acid to grow weeds cannot support a normal growth of turf grasses.

CONTROL WEEDS THROUGH VIGOROUS TURF

THE most logical means of weed control is through the development of a vigorous turf which leaves no room for weed invasion. The use of some form of phosphatic fertilizer and lime in moderation should under proper management attain this end. There is no logical reason to believe that golf grasses require fundamentally different treatment than is accorded those found in lawns and well-kept pastures. Grasses grown under very acid conditions and abnormally stimulated in growth by too frequent applications of ammonium sulphate are more susceptible to fungus disease and other injuries than is true of grasses grown under normal conditions. By that I mean soil conditions where the plant has the opportunity to assimilate plant food in accordance with the fundamental principles of plant nutrition.

It is our recommendation in Pennsylvania that the soil reaction should be maintained approximately between ph. 5.8 and 6.5 and that superphosphate should be applied each year and also that if necessary limestone should be applied at intervals to maintain the proper control of excessive soil acidity.

The amounts of phosphorus, limestone and nitrogen to be applied naturally vary with soil conditions. An annual application of seven pounds of superphosphate per 1,000 square feet should be sufficient under average conditions.

If sulphate of ammonia is used as the source of nitrogen, limestone should be applied at the rate of 75 pounds for each 100 pounds of ammonium sulphate applied. In other words, an annual application of 11.5 pounds of ammonium sulphate per 1,000 square feet requires the use of 8.6 pounds of limestone.



PROFESSOR J. W. WHITE
Penn State College

TOXIC SOIL CAUSES GRASS FAILURE

AT the time of the Penn State Conference it was pointed out that in many instances the failure of turf grasses during the summer months was due to the toxic effect of soil acidity and not to the invasion of fungus diseases. This was proven by the fact that mercury compounds even after repeated applications failed to restore the turf to normal color and vigor. However, an application of lime restored the grasses to normal condition. The evils of soil acidity brought about by the excessive use of ammonium sulphate were first noted on poorly-drained greens where there occurred an accumulation of salts.

Where it becomes necessary to use lime during the growing season it is recommended that limestone be used rather than hydrated lime since the latter has a tendency to cake and discolor the green while limestone particles being heavier should work in between the grasses and entirely disappear from view.

The statement that certain grasses have the ability to utilize nitrogen in the form of ammonia has not been entirely accepted in this country. In accordance with our modern conception of plant nutrition, most of our economic grasses depend upon soil nitrates as their source of nitrogen. The ability of certain grasses such as those of the agrostis family, which includes the bents, to grow under very acid soil conditions is attributed to their ability to utilize ammonia instead of nitrates. The speaker believes that the relative resistance to acidity of such grasses as those included in the agrostis family is due primarily to the fact that they are strong feeders of calcium. That is, they have the ability to utilize small amounts of calcium in forms and amounts unavailable to other grasses such as the Poa family which includes Kentucky blue grass.

UNDER sold conditions such as found on greens, fairways, pastures and lawns there exists at all times during the growing season a scarcity of soil nitrates; in other words, nitrates become a limiting factor in plant growth. This is due to several causes:

(1) Under sod there exists keen competition between the grasses and soil microorganisms for the available nitrogen present. The soil microorganisms use as their source of food or energy the old roots of the grasses which are high in carbon. These soil organisms require nitrogen in a definite propor-



Thousands of Dollars Invested in Greens . . . A Few Dollars Will Save Them From Destruction by Deadly Brown Patch

A carpet of green velvet—a perfect putting surface—that is what makes players proud of their golf club. It takes time and money to get turf into such perfect condition.

Then comes the deadly Brown Patch and works havoc. A very small investment will save all this.

Barbak 211—the perfect disinfectant will keep your greens free from Brown Patch. Tests of treated and untreated areas prove that Brown Patch will travel over an untreated area and come to a dead stop on the line precisely where Barbak 211 has been used.

As a preventative, Barbak 211 protects against Brown Patch for a longer period than ordinary disinfectants. One well-known greenskeeper places this at 42 days. As a cure, it checks the fungus immediately and quickly brings back a normal stand of turf.

Barbak 211 may be applied in solution or dry, mixed with a top dressing, sand or fertilizer and watered in. Write for further facts.

AMERICAN CYANAMID SALES CO., INC.
535 Fifth Avenue New York City



Barbak

TWO • 211 • ELEVEN

TURF DISINFECTANT

"Milorganize"

Your Course
with



Analysis:

NITROGEN (equivalent to ammonia)	6.0 - 6.5%
PHOSPHORIC ACID (P_2O_5)	2.5 - 3.0%
POTASH (K_2O)	0.25 - 0.5%
MOISTURE . . . less than	5.0%

The Nitrogen in Milorganite
is

**ALL ORGANIC
WATER INSOLUBLE
HIGHLY AVAILABLE**

Perfect Mechanical Condition
Best Carrier for Lead Arsenate

OUR SERVICE BUREAU and
LABORATORIES are at your Service.

*Our trade-mark on each bag is your
guarantee of high-grade material.*

**Milwaukee Sewerage
Commission**

Milwaukee Wisconsin

tion to the carbon assimilated in order to balance the composition of their bodies which, like the higher plants, contain definite ratios of carbon to nitrogen.

(2) Under condition of sod, especially in case of greens frequently rolled, nitrification is reduced to poor aeration; that is, the supply of oxygen in the soil atmosphere is insufficient to meet the demands of the nitrifying organisms.

(3) In case of extreme soil acidity the activity of the nitrifying organisms is considerably reduced. The optimum reaction for soil nitrification is between ph. 6.0 and 7.5.

(4) The presence of an excess of ammonium salts brought about as the result of poor drainage where large amounts of ammonium sulphate have been applied has been found to reduce nitrification. There are many other soil factors which may control nitrification such as excess of water, low temperature, and the presence of an excess of soluble organic matter and certain mineral salts. Of the heavier metals mercury and silver have the most pronounced effect in reducing the activity of nitrifying organisms. The effect of these metals is to precipitate the protoplasts or destroy the cell structure of soil microorganisms.

TREATMENT OF SOILS WITH MERCURY COMPOUNDS

IN order to gain further information concerning the controlling influence of mercury compounds on the activity of nitrifying organisms, the speaker applied to both an acid and neutral soil, mercury compounds commonly used for the control of brown patch and other fungus diseases of turf grasses. The soil used was taken from the ammonium sulphate plot of the Pennsylvania field experiments which had received a total of 2740 pounds of ammonium sulphate distributed uniformly over a period of 47 years. The soil has a ph. of 4.77. An equal portion of the same soil was treated with limestone in amounts sufficient to produce a neutral soil of ph. 7.0.

The field plot soil in addition to ammonium sulphate had received liberal applications of superphosphate and muriate of potash during the period of the field experiment. In addition to the mercury compounds, lead arsenate used for the control of grubs, was also included in the nitrification studies. One-half of each soil was treated with ammonium sulphate at the rate of 226 pounds per acre or 5.2

EFFECT OF MERCURY COMPOUNDS AND ARSENATE OF LEAD ON SOIL
NITRIFICATION

Results expressed as parts per million of nitric nitrogen produced in 14 days.

Materials used and rate per 1,000 sq. ft. of soil	Unlimed Soil pH 4.77		Unlimed Soil pH 7.02		Totals	
	No Amm. Sul.	Amm. Sul.	No Amm. Sul.	Amm. Sul.	No Lime	Limed
Untreated Soil	55	43	58	41	98	99
1/2 lb. Bichloride of Mercury	41	25	61	38	66	99
2 lbs. Bichloride of Mercury	44	26	61	41	70	102
1/2 lb. Calomel	46	30	52	38	76	90
2 lbs. Calomel	46	24	58	44	70	102
1 lb. Semesan	55	34	56	37	89	93
3 lbs. Semesan	45	28	60	38	73	98
11 1/2 lbs. Arsenate of Lead	59	45	62	40	104	102
46 lbs. Arsenate of Lead	94	4	66	38	139	104

pounds per 1,000 square feet of soil. The experiment was conducted for a period of two weeks. The accompanying summary shows the rate of application of mercury and arsenic compounds and the total nitric nitrogen produced in case of each treatment.

A study of the results shown in the accompanying table brings out the fact that on the unlimed soil, parallel to the condition found on many greens and fairways of our eastern golf courses, mercury has considerably reduced the activity of the nitrifying organisms. Arsenate of lead, on the other hand,

GET BUSY! Spring is Here

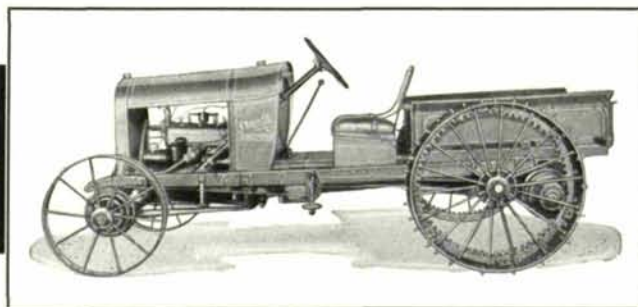
Let America's *lowest-priced* golf course tractor do *all* your work—quickly—economically. The Staude Utility Golf Course Tractor is speedy—light—powerful—easy to operate—and its repairs amount to almost nothing.

COMPLETE

with
Model A
Ford
Chassis

\$655

F. O. B. ST. PAUL



COMPLETE

with
Model T
Ford
Chassis

\$475

F. O. B. ST. PAUL

Staude Utility Golf Course Tractor

Manufactured Continuously Since 1916

Nearly 2000 golf clubs are using the Staude to tremendous advantage. This fact is its greatest recommendation. Its service is completely out of proportion to its low cost.

The Staude is thoroughly dependable. Long life and satisfactory service are built right into it. It will unfailingly answer all your requirements. Investigate the Staude before deciding upon any type of power equipment.

Sold on a Money-Back Guarantee through your local Ford dealer, golf supply house or direct from us

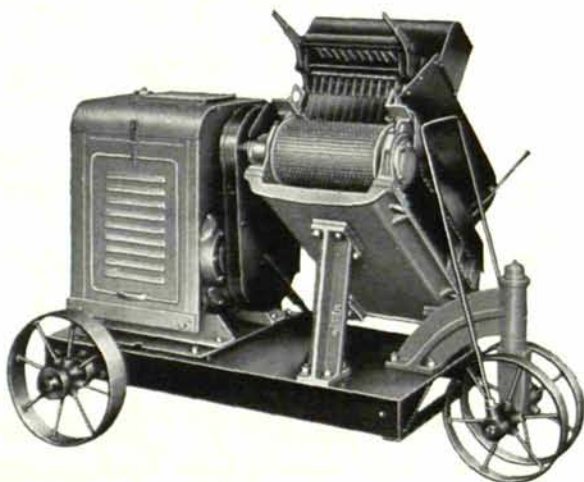
Write for Full Particulars and Easy Payment Plan.

E. G. STAUDE MAK-A-TRACTOR CO.

2630 University Ave., St. Paul, Minn.

THE ROYER COMPOST MIXER

*Saves in
Labor Costs*



**Read what the Chief of Parks of
the National Capital Says About
His Two ROYERS:**

PUBLIC BUILDINGS AND PUBLIC PARKS
OF THE NATIONAL CAPITAL

Washington, D. C.
February 9, 1931.

Dear Sirs:

Your communication of January 28 in reference to the two Royer Mixers which this office purchased from your company has just been received.

We first purchased a small model which proved so satisfactory that we decided to purchase one of the larger type mixers. The small mixer is being used permanently by the propagating gardens and greenhouses and the larger machine in the preparation of compost for lawn areas throughout the park system.

We have found that the Royer Mixers have *saved us considerable in labor costs* as it has eliminated all of the old hand-mixing methods.

F. T. GARTSIDE,
Chief, Park Division.

Write us for full particulars

Sold through leading golf equipment dealers

Royer Foundry & Machine Co.
158 Pringle St. Kingston Station Wilkes-Barre, Pa.

has stimulated the production of soil nitrates in the cases of each soil. The addition of lime, however, has eliminated the injurious effect of the mercury compounds as shown from the fact that on the unlimed soil the three mercury compounds reduced nitrification on an average of 25 per cent compared to only 1.5 per cent on the soil which had received limestone.

The reduction of nitrification in case of each of the three mercury compounds used was as follows: Bichloride 31 per cent, calomel 26 per cent, and Semesan 17 per cent. Arsenate of lead increased nitrification on the unlimed soil 40 per cent and on the limed soil 5 per cent.

CONTROL OF FUNGUS DISEASES MUST BE CAREFULLY HANDLED

IN addition to the factors already mentioned which may reduce the supply of available nitrates in the soil, we now learn that mercury compounds used for the control of fungus diseases also produce an injurious effect on nitrifying organisms in acid soils. The addition of lime, however, has been shown to overcome this toxic effect. The results of this experiment are presented to you with no idea in mind of discouraging the use of compounds of mercury necessary to combat fungus diseases of turf grasses, but rather to call to your attention the fact that such materials may reduce the available nitrogen of the soil especially in case of those soils which are in need of lime.

The slow recovery of grasses, often noted, following repeated application of fungicides, may be due to the reduction in the supply of available nitrogen in the soil as the result of injury to nitrifying organisms.

In conclusion may I say that today we are facing a new era in the scientific management of greens and fairways. The greenkeepers are turning to their state agricultural experiment stations for advice, gained as the result of many years of careful research. The soil chemist, the pathologist and the plant breeder are joining hands in an effort to aid those responsible for the development and maintenance of our American golf greens and fairways.

The results of various turf grass experiments initiated by the United States Department of Agriculture are beginning to bear fruit. Art and science, theory and practice are going forward hand in hand and there should be no conflict between.