

The Effect of Acidity on Turf and the Chemistry of Acid Soils

By O. J. NOER

THE FIRST fertilizer plats on this continent devoted to lawn grasses were started by the Rhode Island Agricultural Experiment Station. Sulphate of ammonia and nitrate of soda, alone and in combination, were used as the source of nitrogen. Superphosphate and muriate of potash were added to make a complete fertilizer.

The plats were laid down in 1907 and were fertilized continuously until 1942, when the experiment was concluded. The 55th annual report of the station summarizes the results in an interesting manner.

Turf on the nitrate of soda was unsightly because of its non-uniform character and invasion of weeds. The ones fertilized with a combination of nitrate of soda and ammonium sulphate were very slightly acid, and the turf was satisfactory.

There was considerable "winter kill" or dying out on the sulphate of ammonia plats. The soil was strongly acid, pH 4.0. The winter kill was first noticed in the spring of 1938. Very severe raking to remove the dead grass helped restore the turf so there were few vacant spaces by the end of the growing season. Without raking in June and September the turf on the acid plats would have died and disappeared. But recovery of the injured areas was very slow in 1939-1940 and 1941.

Raking showed that three times more clippings and dead grass accumulated on the acid soils (pH 4.0) than on the alkaline ones (pH 7 to 8). The slightly acid plats (pH 5 to 6) produced twice as much undecomposed grass as the alkaline ones. The accumulation of dead stems and roots produced a "sod bound" condition of the turf.

The action of sodium arsenite and lead arsenate, used for weed and worm control, showed that the grass on the acid plats was in a weakened condition. The turf on the sulphate of ammonia plats was damaged severely by both materials. Little or no injury occurred on the alkaline or slightly acid soils.

The concluding statements about these "old classic" plats, which were plowed under in 1942, are illuminating:

"The plats that received sulphate of ammonia continuously as the source of nitrogen rather than nitrate of soda remained free of weeds and it was from the results of these tests that the "weedless lawn" dream was realized by the discovery of a long sought fertilizer that would grow grass and kill weeds. This gave rise to the 'sul-

phate of ammonia era' in turf culture. But as more research was undertaken and further observations were made, it was found that continuous applications of either sulphate of ammonia or nitrate of soda were inadvisable, due to the high acidity produced by the sulphate of ammonia, and the alkalinity produced by the nitrate of soda. However, sulphate of ammonia, when mixed with an equal weight of limestone to prevent the soil from becoming more acid, proved very satisfactory, and was also superior to nitrate of soda in maintaining desirable turf."

Passing of "Acid Era"

The "acid era" in turf maintenance on golf courses died along with the grass in the disastrous season of 1928. During that memorable hot wet and humid summer wholesale loss of the bent grass on greens occurred throughout the North. On many courses the turf on all the greens disappeared almost overnight. When reason finally prevailed, it was realized that soil can become too acid even for the supposedly tolerant bent grasses. Lime was restored to favor. Slight acidity may be desirable, but all turf authorities concede that the maintenance of a dense turf is even more important in the control of clover, weeds, and poa annua than an acid soil.

Moss and a damp location are synonymous with sourness to most laymen. Both are associated with unfavorable conditions for turf growth but not necessarily indicative of a sour or acid soil.

The chemist separates all matters into three groups based on their chemical reaction. Substances may be acid, alkaline, or neutral. Vinegar, muriatic, and sulphuric acids are examples of true acids. Quick and hydrated lime, soda and lye are alkaline reacting substances, which are called bases by the chemist.

Salts are formed when an acid and a base react chemically. Muriatic acid and soda react to form sodium chloride. It is the salt used to season food. Muriate of potash, commonly used as a fertilizer, is formed when potassium hydroxide and muriatic acid react with each other. Many salts are neutral in reaction, but some are acid and others are alkaline. Aluminum and iron sulphate are acid in reaction, while calcium carbonate (limestone) and sodium acetate are alkaline.

The different behavior of salts in re-

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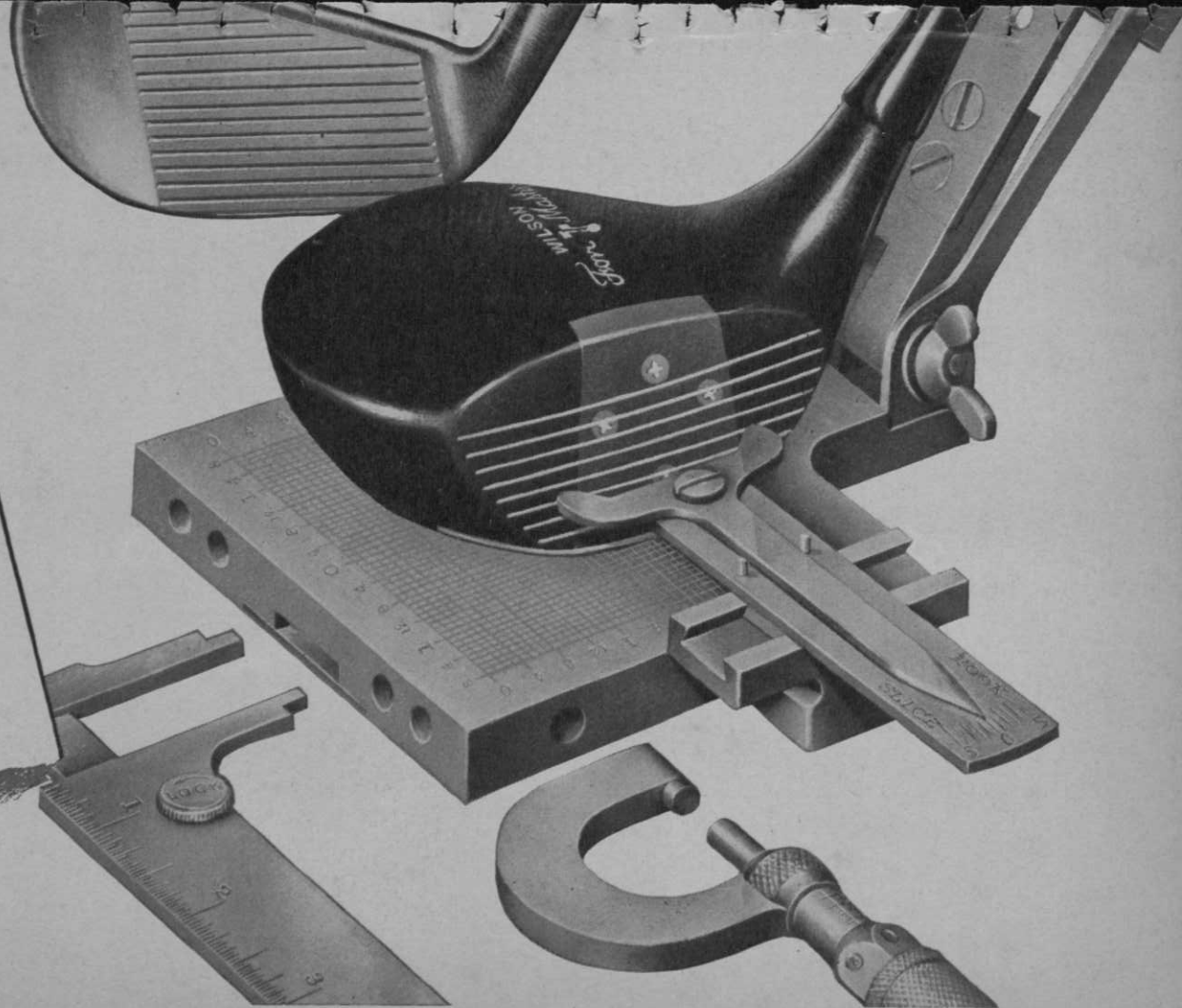
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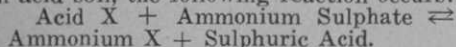
spect to reaction is due to the fact that acids and alkalis differ in strength, or in degree of acidity or alkalinity. Muriatic and sulphuric acid are strong, but acetic acid (the acid in vinegar) and carbonic acid, which is an important constituent of the soil solution, are weak ones. Sodium and potassium hydroxides are strong bases, but iron and aluminum hydroxides are only feebly basic. Salts formed when a strong acid and a strong base combine (for example, sodium chloride) are neutral. The salt resulting from the combination of a strong acid and a weak base (iron and aluminum sulphate, for example) is acid in reaction, and one formed from a strong base and a weak acid is alkaline. Carbonic acid is a very weak acid, so calcium carbonate is alkaline in reaction (pH 8.0 to 8.5)

Chemical Reaction in Soils

The solid silt and clay portions of the soil consists of complicated mineral salts, the aluminosilicates. These soil constituents have acidic and basic properties. Although relatively insoluble in water, they are capable of reacting with the soluble salts in the soil solution and with lime. They are the reservoir from which the "active" or soluble acidity is derived.

To illustrate the type of transformations which occur in soils, the aluminosilicates can be represented by X. In an acid soil the mineral fraction can be called Acid X, and in a neutral or alkaline soil it becomes Calcium X, Potassium X, Sodium X, etc.

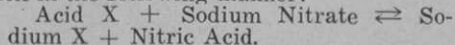
When ammonium sulphate is added to an acid soil, the following reaction occurs:



The active acidity of the soil is in-

creased because sulphuric acid is a strong acid and extremely soluble. Additional acidity results as the soil micro-organisms transform the ammonium radicle to nitric acid, another strong water soluble acid. Ammonium sulphate has more power to create acidity than any other fertilizer material. Ammonium nitrate, ammonium phosphate, and urea are acid forming also.

When sodium nitrate is applied to an acid soil it reacts with the acid clay complex in the following manner:



There is a temporary increase in active acidity, but the ultimate effect is to reduce soil acidity because Acid X becomes Sodium X. The nitrate is absorbed and utilized by the plant. All other nitrate fertilizers tend to reduce soil acidity.

Cyanamid is the trade name for calcium cyanamid. The nitrogen is converted into urea by the soil, provided the soil is not strongly acid. The nitrogen ultimately goes to the nitrate form. The calcium becomes lime hydrate. Whenever 100 pounds of cyanamid is used, it is equivalent to applying 70 pounds of lime. So soil acidity is reduced by cyanamid.

Superphosphate is the principal phosphatic fertilizer used on turf. It is a soluble form of calcium phosphate. In practice superphosphate does not have a marked effect on soil reaction. The tendency is to reduce the acidity because the calcium combines with the acid clay fraction (Acid X) to form a calcium clay (Calcium X). The phosphate radicle is taken up by the plant or reacts with soluble aluminum or iron to form the corresponding phosphate. Both are much more

(Continued on Page 56)



Range Ball Retriever

Fonken Mfg. Co., Burbank, Calif., now is in production of its ball retriever sufficiently to serve the enlarging market for the device which has been used on California practice ranges for about 4 years with marked satisfaction. The Fonken machine uses revolving plastic discs to pick up balls.

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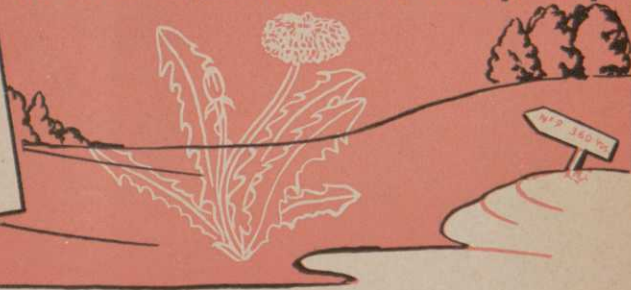
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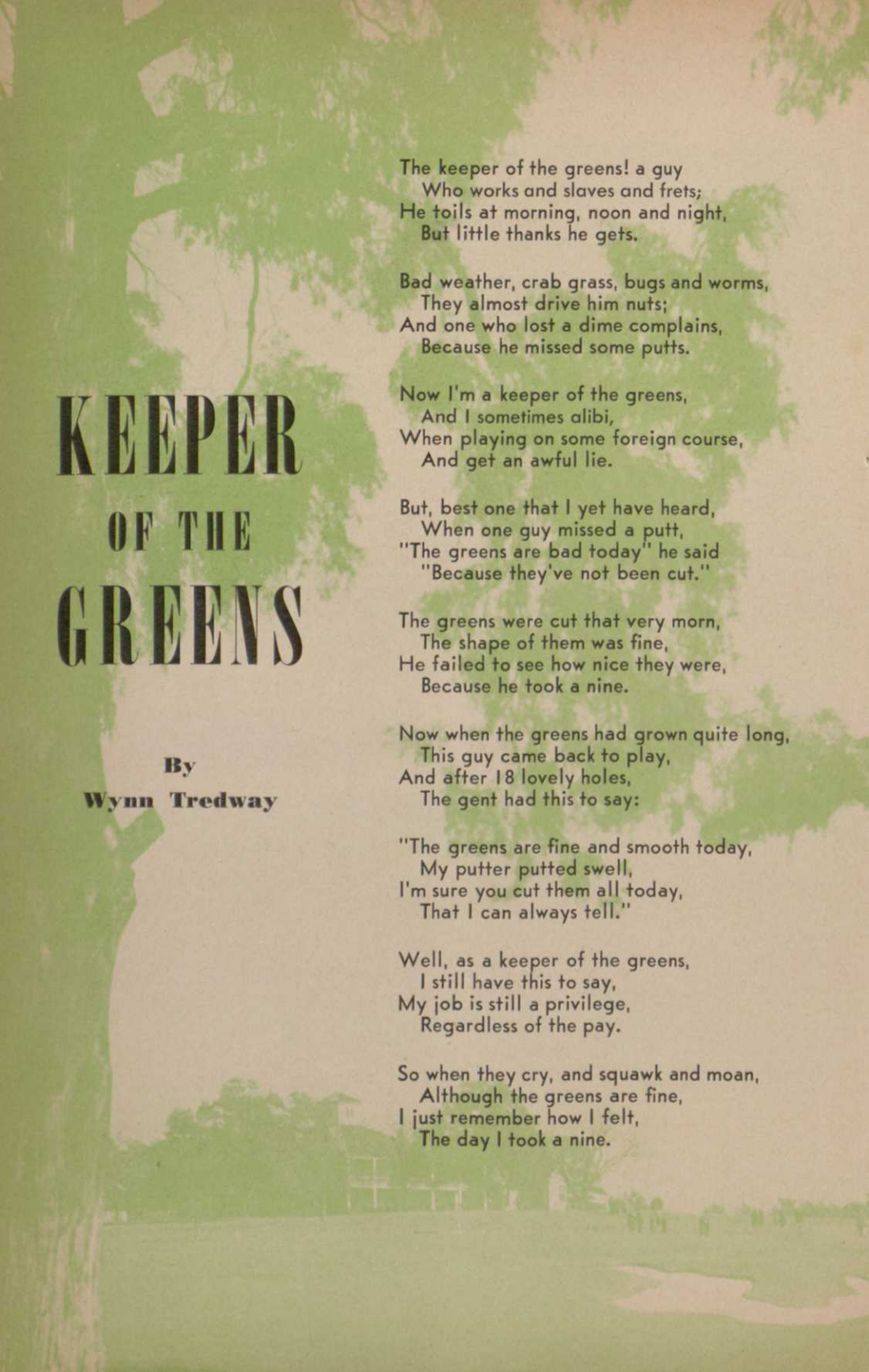
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KEEPER OF THE GREENS

By
Wynn Tredway

The keeper of the greens! a guy
Who works and slaves and frets;
He toils at morning, noon and night,
But little thanks he gets.

Bad weather, crab grass, bugs and worms,
They almost drive him nuts;
And one who lost a dime complains,
Because he missed some putts.

Now I'm a keeper of the greens,
And I sometimes alibi,
When playing on some foreign course,
And get an awful lie.

But, best one that I yet have heard,
When one guy missed a putt,
"The greens are bad today" he said
"Because they've not been cut."

The greens were cut that very morn,
The shape of them was fine,
He failed to see how nice they were,
Because he took a nine.

Now when the greens had grown quite long,
This guy came back to play,
And after 18 lovely holes,
The gent had this to say:

"The greens are fine and smooth today,
My putter putted swell,
I'm sure you cut them all today,
That I can always tell."

Well, as a keeper of the greens,
I still have this to say,
My job is still a privilege,
Regardless of the pay.

So when they cry, and squawk and moan,
Although the greens are fine,
I just remember how I felt,
The day I took a nine.



the

Talk

of the Golfing World

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Golf Museum Exhibit in New York Store Window

★ Rare golf books, curios and ancient weapons of the fair green belonging to the St. George's G & C C, Stony Brook, Long Island, its veteran pro Horace Fulford, and a member collector of such items, Jack Level, were on display in the windows of F. R. Tripler & Co., on Madison Avenue at 46th Street, New York from May 21st to June 1st. The unique display which includes an American book carrying a chapter on golf printed in Philadelphia and dated before the American Revolutionary War was arranged by Fred Stecker of Stony Brook, vice-president of the store.

In the volume for 1770, Benjamin Rush, a friend of Franklin, describes and discusses the Scottish pastime and quotes a Scot dignitary to the effect that golf's health-giving qualities will add 10 years to a person's life. A second exclusively rare unit is dated in the mid 1880's before golf was played in this country. The author of this little volume, believed to be the only copy in the country, urged that Americans take up golf. Other literature embraces a Spalding golf guide from the mid 90's, the first American book of golf instruction dated 1895, the first books of instruction and annuals published abroad and Regiam Majestaten, the Auld Laues and Constitution

of Scotland of the sixteenth century in which it was decreed that "na man sould play at the golfe, under paine of fiftie shillings because it is estemed to be unprofitable sport for the common gude of the realme and defence thereof." (The British were the better archers and the Scotch kings wanted their brethren to practice at it solely for warring purposes.)

Two balls made of pigskin stuffed with feathers attest to the wisdom of the Scot in looking for a long time for his ball, for the process of golf-ball making in those days was an intricate and expensive one. The Scot would look for a lost sphere for an hour and play his ball to the finish even though the seams gave way. The "featheries" gave way to gutta percha spheres around 1848. The making of balls was one of the chief trades in St. Andrews, the cradle of the game.

The weapons of those days in the exhibit include the demon driver, the long spoon by Forgan of St. Andrews, the short spoon, the approach spoon by Tom Morris, the niblick, the brassie by Forgan and the wooden putter.

Oldtimers will be surprised to find in the collection that the hero of youngsters of the 90's, Frank Merriwell, was a golfer and there are two Tip Top

This Tripler window featured famous figures in golf's history.

Worsinger photo



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This window of Tripler's golf museum exhibited ancient weapons and curios.

Weeklies with hair-raising golfing stories, one Frank Merriwell's Brassie Shot and the other Frank Merriwell's Caddie, in which the Yale student athlete and daredevil visits St. Andrews.

In the collection are the first magazine article in this country on golf, posters from golf's early days, one of which depicts golfers being arrested on the links for breaking the Sabbath laws by playing on a Sunday, and Kay's Edinburgh Portraits in which there is a chapter devoted to the Cock o' the Green, the most rabid golfer of his day, who even played by candlelight. Once his wife trekked to his course carrying his supper and tried to shame him into leading a normal life, but in vain, the golfingest bug of his day kept right on pelting and chasing his feathery. The early American golfing posters were

mostly of the feminine variety.

According to golf book and curio collector Level of Elmhurst, New York his library has some 3000 volumes devoted to the game and hardly a day goes by but what he makes some new discovery which some day will be of immense value to the golfing historians. The first history and the first bibliography of golf remain to be compiled and the real origin of the game and its early days are still lost in the mists of antiquity.

Also shown is a collection of original creations in putters. Each is of some special design to overcome some real or imaginary fault which has kept the owners from hitting the cup. These rare and interesting golf relics were assembled from the collection of the late Tom McNamara, second in the National Open Championships of 1909, 1912, 1925.

Les Cooke Dies

★ Leslie L. Cooke, 66, member of USGA executive committee, chmn, Implements and Ball committee, and former pres., Western GA, died June 4 in Evanston (Ill.) hospital following an illness of several weeks. He is survived by his widow, a daughter and 3 sons. He had retired from active business as head of several trade schools some years ago. He was one of the finest gentlemen sportsmen and his passing is a deeply felt loss to the hundreds in golf who enjoyed the delight of his friendship.

Morley, Greens Vet, Dies

★ John Morley, a founder and for first 6 years president of the National Assn. of Greenkeepers, died recently in a Youngs-

town, O., hospital. He was 79 at time of his death. He came to the U. S. from his native England when he was 11. He was in the steel business and insurance prior to entering club management. He made his appearance in the club business in 1897 as mgr. of the Basslake club, Geauga county, O. In 1915 he went with the Youngstown (O.) CC as supt. of the course, which position he held until his death. He was active in civic and political affairs in Ohio. As an official of the greenkeepers' organization he visited more than 200 courses and was exceedingly helpful with practical advice. Col. Morley was a widely known and beloved leader in greenkeeping. He was vigorous and valuable in golf as a campaigner for high standards of golf course maintenance and due recognition of the qualities and achievements of his brother greenkeepers.