



Supt. Bill Martin treats soil from his "soil storehouse" area with a chemical conditioner. Later this treated soil is used as topdressing on aerified greens. Conditioner is applied to soil's surface in this plot, then rototilled in 3 to 6 ins. On the green it is dragged or rubbed into holes left by aerification device.

## Soil Conditioner Solves Compaction Problem

By **WILLIAM H. MARTIN, SR.**

Owner and Supt., Forest Hills Golf and Country Club, Cornelius, Wash.

**S**INCE the development of chemical soil conditioners was announced in December, 1951, golf course superintendents have watched cautiously to see how—and if—these materials might be used effectively in their own operations.

It has not been easy to obtain accurate, unbiased information about the new conditioners. Because many manufacturers of these materials used the home garden or agricultural markets as their chief targets, information with specific reference to golf course turf improvement has been sometimes fragmentary, sometimes contradictory. I have talked to many superintendents and club officials who were interested in the possibility of improving

their courses through use of chemical soil conditioners, but I have talked to very few who were willing to experiment with conditioners on the basis of present evidence—and present cost.

This is a first-hand report of how a chemical conditioner—in this case Krilium—performed at the Forest Hills G&CC, Cornelius, Ore.

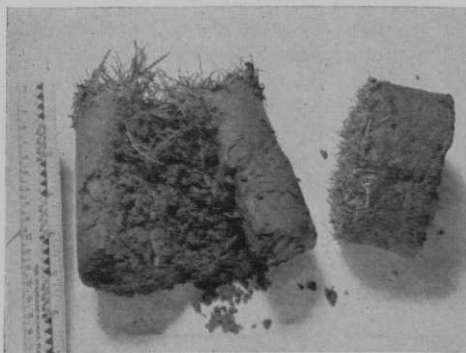
This account does not imply that a conditioner will perform identically on any course in the country; rather, it suggests that when turf and maintenance problems exist similar to those encountered on our course the superintendent may well consider the use of a conditioner on a dollars-and-results basis.

Here is the record:

Nine holes of our course were built in 1927. That date itself might not sound especially "ancient", but I recall that we used horse-drawn equipment to establish the nine-hole course. Of the 100 charter members, eight are still with us. Our membership is now several hundred, and the course is open year-round. In July of this year, on our 27th anniversary, we'll open a second nine-hole course. It is one of the last architectural jobs completed by the late Billy Bell.

Average daily traffic on the course, during our peak season, is 300-400 players. Our physical facilities consist of a large dining-room with stone fireplace, bar-room, two large locker rooms, coffee shop, and kitchen. The plant is carefully landscaped and has an attractive pool.

Because the performance of a chemical conditioner can be influenced by soil type, climate, and other environmental conditions, basic information of this kind is important. Our elevation averages 125 ft. Rolling hills go to a maximum of about 1000 ft. Our diversification of trees adds measurably to the beauty of the course. We have plenty of pine, fir and hemlock trees—some walnut and filbert—and every tree is surrounded by a different specie of tree. Our general climate is moderate,



The plug on the left, showing excellent root growth to a depth of 6 in., was taken from a green treated with chemical soil conditioner. The plug on the right shows a scant 3 in. root growth, the result of compaction and soil "layering" in an untreated green. Both greens received the same amounts of fertilizer and water.

with an average yearly temperature of 53.1°. Warmest January average is 39.4°; coolest August average is 55.9°. Winds are mild.

#### Year Around Maintenance

Our growing and cutting seasons extend through the full year. Our soil is princi-

pally a Hillsboro loam, 20 to 30 per cent clay. We have a moderate amount of brown patch and dollar spot, and we also have trouble with the perennial "problem child" of course superintendents; poa annua.

Our chief difficulty, however, comes from a source which many superintendents located in drought belts or rain-sparse areas, might call a friend rather than an enemy: rainfall. Our average annual rainfall is 40 to 45 in. Last year—the year in which we used a large amount of chemical soil conditioner—our annual rainfall was a whopping 57 inches.

Rainfall plus heavy player traffic led, through the years, to the inevitable problem: soil compaction. And on our steeper slopes—some of which are 30 degrees or more—our erosion problem was constant.

#### Battle Compaction

Compaction and poor drainage, of course, go hand in hand. They are somewhat like the "chicken and the egg." Compacted soil invariably leads to standing water—and dissatisfied club members. Without going into great detail, I can say that—to combat the drainage problem—we had used almost every traditional method of turf improvement, including aerification, rolling, careful seeding, top-dressing with soil as well as sand and peat, and other methods.

Improvement was always short-lived, and since the course is open all year, our battle against compaction and inferior playing conditions has been constant.

Experience has shown that in our case a 16-20-0 fertilizer is most effective, and—naturally—we fertilized on a carefully established schedule.

#### Tip from Turf Scientists

When we decided to add another nine holes last summer we were faced with the fact that our previous turf improvement methods had, all in all, been both costly and relatively unsatisfactory. We knew, too, that the effect of chemical soil conditioners in alleviating soil compaction in soils with a clay fraction, such as ours, with its 20-to-30 per cent clay content, was pretty well established. And we knew that turf authorities at Washington State College, at Pullman, Wash., had proved that any layer-type approach to turf improvement was doomed to failure. Soil, sand and peat simply must not be handled so that distinct layers eventually are established. A slow transition between soil types is essential, yet daily traffic of 300-400 players makes creation of compacted layers almost inevitable.

In reviewing our problem, we found that Dr. Walter H. Gardner, of the Department of Agronomy, at Washington State College, had reported that "infiltration of water into turf may be materially restricted by soil compaction—so much so that under conditions of severe compaction most of the water added by normal sprinkling runs off or collects in low spots. Unless water is applied for very long periods of time, such compacted soils are not wet deep enough for the maintenance of turf grasses. For adequate infiltration the surface soil must be maintained in a porous condition. Some of the polyelectrolyte (or chemical) soil conditioners, when properly applied, have been found to stabilize soil aggregates against the puddling and slaking action of water and against disruptive mechanical forces. By so doing, the porosity of the treated soil and hence the capability for water intake are maintained high."

Among other scientists who have reported on water penetration of soil as influenced by chemical soil conditioners are Dr. Robert M. Hagan, of the Department of Irrigation and Soils, University of California, Davis, Calif., and Dr. L. E. Allison, of the U. S. Department of Agriculture Salinity Laboratory at Riverside, Calif.

On the basis of available information from qualified sources, plus an analysis of the economic factors involved, we decided to go ahead with the use of a chemical conditioner.

#### Analyze, Compare Costs

On first analysis, it might seem that this is a costly approach to turf improvement, but it is well to define just what is meant by "expensive" or "costly."

In the first place, we knew what our costs had been for sand, peat moss and the other materials that go into green construction and improvement. We knew, too, the use of these materials had been a continuous process. And we further felt that "cost" is a relative term, based on what improvement is deemed essential and what materials and labor are required to achieve it. On this basis, and assuming good performance by Krilium soil conditioner, we decided that use of the latter material would be less, not more, expensive than previous methods.

When we decided to put in a second nine-hole course, we found that four holes of our old nine would have to be relocated and re-built. So we were faced, in all, with construction of 13 new holes.

Incidentally, when we purchased the

land for the Forest Hills G&CC, in 1927 and laid out the original nine-hole course, we had an eye toward future expansion. It is wise for club-owners who start with a nine-hole course to purchase land and lay out the course with expansion in mind; nothing is more frustrating than the need for expansion and no room for it. And real estate prices have a way, in our times, of going up.

#### Tested Conditioner First

Before definitely deciding to use a soil conditioner on all 13 to-be-built holes we gave it a rigorous test on the No. 2 green of our old course, a severely-compacted



Badly eroded areas such as this existed in several areas of the Forest Hills G&CC where a chemical soil conditioner was not applied. Rains which caused this erosion had no effect on treated areas. Bill Martin, left, owner and superintendent of the course, points out the damage to Byron Reed, pres., Oregon-Washington Greenkeepers' Assn. This area was at the lip of a tiled drain which, theoretically, should have prevented erosion.

hole where standing water was often a hazard and nuisance.

We took soil tube samples, to a 12-in. depth, which showed severely compacted layers from the surface to a 3-in. depth. Grass roots could not penetrate this 3-in. layer of compacted soil, although soil below this upper layer was in good shape. So we knew that our problem area was the upper 3 inches.

#### Put Conditioner in Topdressing

Into some "spare" turf, in a plot from which we ordinarily take our topdressing soil, we roto-tilled conditioner at the rate of one pound per cubic yard of soil, when the soil had optimum moisture for good workability. (This figures out to a 50 sq. ft. plot, with conditioner worked in to a 6-in. depth.) This soil was then allowed to stand for 24 hours, while the conditioner's "bonds" were formed and the

*(Continued on Page 62)*

## BALLAD OF THE BIG STRONG PROS

(An earful of close-up on the boys at the PGA National course)

Reported by HARRIETTE W. CURTIN

(who is the ever-loving wife of Joe Curtin, professional at Indian Hill Country Club, Newington, Conn., and who tenderly dedicates her epic to the healthy merry and very active self-proclaimed invalids.)

There's winter of rest for the worn,  
weary pro

At Dunedin fair on the Gulf Mexico  
Where the moss-draped trees and  
the tall palms sway

And the pro after summer can joy-  
ously play.

In the northland he labors at home  
club toil

On tee and course where a chop  
would broil.

There his every aim is his mem-  
bers' fun;

No play for him 'til his work is  
done.

Then comes welcome winter down  
Dunedin way

Where I listen to him, hoping he'll  
say

That he's found the secret to make  
my golf great,

But that I've not heard, most sad  
to relate.

Each gorgeous morn each relaxing  
brother

Will come to the club and all to  
each other

Will recite a long list of pitiful ills,  
Too bad for a surgeon, too bad for  
pills.

An athlete confesses in accents for-  
lorn

"I'm not very fit this beautiful  
morn,

"Painful bursitis is killing my  
shoulder,

"It really is hell when a fellow gets  
older."

Then the keen competition really  
gets hot

And each pro will relate the ills  
that he's got:

"I've phlebitis real bad in my  
only good leg;"

"Each finger I grip with is merely  
a peg."

"I'm woefully ailing from a hor-  
rible hook;"

And all other maladies found in the  
book;

Slicitis, topitis, missitis, rhinitis,  
arthritis,

Shankitis, neuritis, St. Vitus, putti-  
tus!

Through the medical catalog I hear  
them cry

And I wonder why they don't lie  
down and die.

Yes, and so help me, that's just  
how it goes

As they moan of themselves as the  
broken-down pros.

But hold, my good friend, shed not  
your hot tears

For these sportsmen famed, these  
poor aching dears,

Feast and they sing and gay stories  
they tell

And play their sick rounds remark-  
ably well.

All summer long no pains have  
they had

But in winter at rest they get ill-  
ness bad;

All are seven aches up on each  
other one

And enjoying themselves in the  
Florida sun.

## SOIL CONDITIONER SOLVES

(Continued from Page 44)

good structure and porosity of this soil were stabilized.

Meanwhile, we aerified the green, using plug-type aerifier with hollow tines. Aerifying in two directions we put a ½-in. hole, 4 in. deep, every 8 in. all over green.

The soil treated with chemical conditioner was then applied to the green at the rate of one cubic yard per 5000 sq. ft. and matted in with a commercial metal

foot-scraper mat so all "aerified" holes were well filled with treated soil.

In practice we found that this procedure actually entailed less labor than the older methods in which we had prepared and transported mixtures of soil, sand, peat, manure and other additives.

### Improvement in 60 Days

Watering and fertilizing were then carried out regularly, as the green demanded, based on periodical soil tests.

What happened?

By September the verdict was in. In just 60 days grass roots had improved noticeably, and not just in the holes made by aeration. They had grown down below the compacted area and were spreading out. Water infiltration was visibly improved; standing water was no longer a playing hazard. Movement of fertilizer, with water, was markedly increased.

And I have since learned that scientists at Ohio State University earlier proved that fertilizer benefits are greatly increased in treated soil. The Ohio State scientists, in replicated tests, have shown that fertilizer benefits are sharply reduced in compacted soil. The fact is that fertilizing compacted soil is often a relative waste of money.

Time and labor demands on the treated green were much less than on other greens, because more water could be applied at one time—and gotten into the root growth zone of the soil. Thus, deeper root growth was encouraged.

These improvements were so striking that we decided to use almost 2500 lbs. of conditioner in September when our building of 13 new holes was begun. Here again the record speaks for itself:

On September 8, 9 and 10 (1953) 13 greens, tees and aprons were treated. On the greens conditioner was incorporated at the rate of 2 lbs. per 100 sq. ft. to a depth of 6 inches in the original soil. No new soil was brought in. On tees and aprons conditioner was applied at the rate of one

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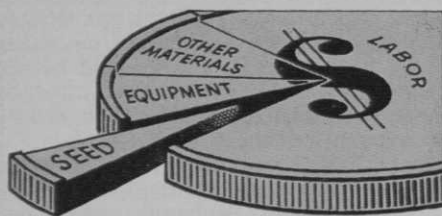
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pound per 100 sq. ft., to a depth of 3 inches. This was our procedure:

Conditioner was spread on the dry surface soil and roto-tilled once to proper depth. The area was then wet down, roto-tilled once more when soil was workably moist and allowed to stand. All grass areas, including fairways, were fertilized equally with a 16-20-0 mixture and rolled. Fairways were then seeded to a mixture of Highland Bent and creeping red fescue. Greens, tees and aprons were seeded to straight Highland Bent. All seeded areas were again rolled.

It is important to add that seeding was started on September 17 and finished September 25. There was 0.87 in. of rain September 26, with 0.23 inches falling in one hour. Almost 4.5 in. of rain fell between September 26 and October 10 (U.S. Weather Bureau figures). So it is obvious that the conditioner was given a severe test.

I should also add that the conditioner used was a professional-type formulation of "straight" conditioner, not the diluted formulation for treating smaller home garden areas. In treating larger areas the professional-type formulation is a good deal less costly than the diluted, home-garden formulation.

### Erosion Controlled

Despite the heavy rain within 10 days after seeding, we had no erosion on any treated area, including the 30 degree approaches to the greens, but on the untreated fairways, despite much less slope, we had considerable erosion and had to use straw to combat it.

The greens were and are much firmer than the fairways and have a much heavier stand of grass, though both greens and fairways received the same amount of fertilizer.

In a couple of months after seeding, grass on the greens achieved a 4-to-5 in. root depth, though in previous years grass had never gotten below the 3-in. compacted layer.

Our soil was never slick or muddy, nor did it have a crust.

Putting the project on a dollars-and-cents basis, I am almost sure that, with the heavy fall rains in 1953, we would not have been able to get in last fall to re-seed the greens. Resultant heavy erosion would have demanded re-seeding this spring, and we probably could not have played on the new course until the fall of 1954. As it is, we will be able to play on the new nine months earlier. Putting it bluntly, that's money in the bank.

This report has been substantiated by an inspection November 10, 1953, by Byron Reed, president of the Oregon and Washington Golf Course Superintendents Assn. and by four other course superintendents.

Byron visited us again January 22, in the midst of a heavy snow. Snow was cleared away and soil plugs were removed from two untreated greens and one treated green. Not only was root growth well down beyond the 6-in. level on the plugs removed from the treated green, but these plugs were not even muddy. Definite layering, shallow root growth and muddy condition were shown on the plugs taken from the untreated greens. Byron was further surprised when he learned that we had just lost a 15-in. snow the previous week.

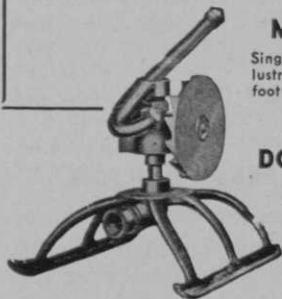
Byron said: "The four greens superintendents and I who visited the Forest Hills course in November, during a heavy downpour of rain, noticed immediately that we could walk on the treated greens and could not walk on the untreated fairways. We could not even inspect all treated greens, because we could not travel from green to green on the fairway.

"On the treated greens, despite the

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rain, no water was standing; on untreated greens and fairways water was plainly standing. We especially noticed the difference in grass growth and lushness, both on the surface and in plugs taken from various greens, between old greens and new, treated greens."

This evidence was recorded photographically, as I am skeptical enough myself by nature to know that golf course superintendents are a skeptical breed. We have to be. There is little room in our operations for casual, do-it-and-hope use of either time or money.

We have now definitely decided to use only conditioner-treated soil in topdressing the remaining old greens. I am sure that in a season or two the condition of these greens will be vastly improved. Since our own project was completed, we have been visited by as many as 50 golf course superintendents at one session. Among those who, I understand, are now using conditioner on their courses are Henry Land, president of the Northwest Turf Assn. at the Tacoma (Wash.) CC, and Glen Proctor, secretary of the association, at the Ranier G&CC, in Seattle.

I repeat that this report is not an attempt to "prescribe" conditioners, on a general basis, for any course. I certainly realize the great regional diversification of problems which confront golf course superintendents.

But it is time that a report of the practical application of these materials is made available to the many superintendents who try to keep abreast of new developments and techniques. It is time that the much-discussed "expense" factor is brought into proper perspective. With the background of the problems inherent in management of the Forest Hills course, and with time now elapsed for putting into the record the scientifically and practically measurable results of the use of a conditioner in our case, I feel that this report will be useful to members of our profession.

It is in that spirit that this report has been made.

## NEW GOLFERS PAVILION

*(Continued from Page 50)*

display rather unusual and unique in design in the use of a combination of materials and finish.

The cocktail lounge has three sides facing the golf course and are composed entirely of stationary and vented glass extending from convector height to the ceil-