The Practical Approach to Fairway Turf Renovation

By O. J. NOER

(The third article of a series on fairway turf.)

The theoretical aspects of turf improvement, discussed in the two preceding articles, are important. With an understanding of them, one can determine the cause of poor turf and devise a plan of improvement. From the practical standpoint, each operation must be performed in the proper sequence, otherwise failure and disappointment are sure to follow.

Late summer and early fall is the best season to renovate neglected fairways and start a systematic program of improvement. This is especially true in the crabgrass belt, embracing the region from Philadelphia and Washington through Cincinnati, Louisville, St. Louis, and Kansas City. Only by utilizing favorable growing weather throughout the fall, and again in spring, is it possible to produce turf which can resist reinfestation the following season.

Farther north, where summer heat is not excessive, improvement programs can begin in spring. By fertilizing then, grass starts to thicken immediately; but where supplementary seeding is desirable, that part of the program should be delayed until fall.

In the Bermuda grass region the program should start earlier because Bermuda grass grows best during warm weather. Where weeds are not a serious problem, nitrogen should be applied generously in late spring, when broadleaf weeds are bad — 2,4-D should be used immediately before or after fertilization. If crabgrass infestation is heavy on some courses the program should not start until June or July. Sodium arsenite or arsenic acid are the cheapest materials to control it. Treatments should start at the time seedheads begin to emerge. Fairways should receive nitrogen in quantity then and again in August.

Field Survey is Essential

A careful field survey, augmented by chemical soil tests, should be made before the program is devised. The survey should include an examination of surface and subsoil drainage. Soil conditions with regard to uniformity of color and physical condition or texture, erosion, compaction, etc. should be noted. The grasses constituting the turf population should be identified. Turf density and the amount of weeds and clover should be estimated. Chemical tests should include soil reaction, and quantities of available nutrient elements, especially phosphoric acid, potash, calcium, and magnesium. A knowledge of past maintenance practices, particularly with respect to the frequency of mowing, height of cut, lime and fertilizer usage, water practice, etc., is most useful. After gathering this information, a program can be devised with full assurance that it will succeed.

Drainage

Needed drainage should be decided upon first. All tile lines should be installed, or at least the main ones, and provision should be made to add laterals and complete the system as soon as possible.

Bluegrass and fescue winter kill in low spots due to ice and standing water. Creeping bent is the grass to use, otherwise add soil to level the area.

Side hill seepage on hilly courses is responsible for more poor turf and heavy infestation of crabgrass and clover than most people suspect. Tile lines on hillsides must cross the direction of slope. They must be sufficiently deep to intercept seepage flow and trenches must be backfilled to within 8 or 10 inches of the surface with coarse material, either gravel or cinders. Without the porous trap to collect water and lead it to the tile, pressure from above drives the water across the tile. It breaks out along the base of the hill and keeps the surface wet despite the tile lines.

Occasionally the water table is near the surface and cannot be lowered sufficiently

to permit the installation of tile. On such areas surface run-off is depended upon for drainage. It is foolish to expect Kentucky bluegrass or fescue to survive and form turf. Bent is the best grass for these locations. Seaside or native creeping bent is best for damp areas, otherwise Colonial bent will do.

In northern regions where Kentucky bluegrass and fescue winterkill in pockets and depressions, surface drainage must be corrected by plowing and resurfacing, or by additions of soil to level the surface, otherwise bent grass must be used. The bent can be seeded, or the spots planted vegetatively with stolons of native strains which grow wild along adjoining streams, and other wet spots. The customary procedure is to loosen the surface soil by cross discing, scatter the stolons, and disc them into the soil. Then the area is firmed by light rolling. Top-dressing is helpful, but not absolutely necessary. Fertilization before scattering stolons speeds turf formation. The rate for organics should be 1,000 to 1,500 pounds per acre, mixed fertilizer should have a high nitrogen content. The rate of application should be about 400 pounds per acre, and should be followed a month later with about the same amount.

Seeding

Where existing turf is uniform but thin, and consists of suitable grasses, reseeding is not necessary. Fertilization alone will produce good turf, even though the existing stand of grass is exceedingly thin.

The three-gang Aerifier is a useful tool on fairways. Besides using it to improve soil conditions and to remove surface matted turf it is fine for preparing a seed bed before introducing bent into fairways by seeding.

Reseeding is justified when a different grass is needed to produce better turf, or to speed turf development after killing weeds, clover, or poa annua, or badly infested areas where there is little or no grass left. The necessity for reseeding before starting to water fairways of pure fescue or Kentucky bluegrass has been mentioned. Colonial bent grass should be introduced into these fairways.

Until recently it was customary practice to use a mixture of Kentucky bluegrass, red top, and Astoria bent for reseeding fairways in the North. Now that bluegrass and red top are high priced, the trend is toward bent grass only. Astoria bent has performed well and is still the favorite, although Highland bent is being used by some. Many lots of low priced Colonial bent contain rather high amounts of Seaside or other creeping bents, and are

Some greenkeepers prefer to use an alfalfa and grass disc seeder. The fairway is aerified first, then disc seeded and Milarsenited for the last time.

cheaper for that reason. Since Colonial makes a more upright growth, and is less apt to mat, it would seem best to purchase it and not use combinations with Seaside, except in spots which stay continuously moist. Rates of seeding vary from 20 to 50 pounds or more per acre. From 20 to 30 pounds is the customary quantity, although several courses have secured exceptional stands of bent on poa annua infested fairways with 80 to 100 lbs. of seed per acre. This may seem wasteful but results have been good.

Some use an alfalfa and grass disc seeder. Others prepare a seed bed by cross-spiking several times with a three-gang fairway spiker. The Aerifier has been used successfully alone or followed by spiking. A wheelbarrow seeder, or the cyclone type, is used to sow the seed. Light rolling follows to press the seed into the soil. The Aerifier or gang spiker, alone or in combination, gives the quickest coverage because seed is distributed uniformly over the area. It is said to take more seed.

The alfalfa grass disc seeder is faster and often less annoying to players. It is an excellent way to introduce a different grass into the turf, and also when there is considerable grass worth saving. Fescue grows best when seeded a trifle deeper than other grasses, so disc seeding is the best way to cut the seed into the soil. Deeper seeding may be necessary with alta fescue also. The discs are spaced 4 inches apart, so cross-seeding is advisable. The machine

will sow as little as 20 to 25 pounds of grass seed per acre. The seed is fed through a flexible tube into a shoe attached to the disc and finally dropped into a narrow slit cut by the straight disc. Seed is placed below the surface, where downpouring rain will not wash it away. Heavy soils must be moist, otherwise discs will scratch and not cut into the surface. This is not a disadvantage because seed needs moisture for germination and growth.

With either method, fertilizer should be applied before seeding, that is before spik-

Preparing a seed bed with fairway spike disc before applying Milarsenite for the last time. After discing two times or more seed is planted, fairway rolled and last treatment of Milarsenite is made.

ing, or before disc seeding. With ample phosphate and nitrogen, a good stand of grass can be obtained with lower seeding rates. That fact was clearly established on test plots conducted in Washington, D.C., some years ago by A. E. Rabbitt. At least 100 pounds per acre of actual phosphoric acid should be applied, and an equal amount of nitrogen, especially on light colored soils. These amounts are equivalent to 500 pounds per acre of 20 per cent grade superphosphate and 1,500 to 2,000 pounds of organic nitrogenous fertilizer, such as cottonseed meal or Milorganite, or half a ton of 5-10-5, or 4-12-4 to furnish the phosphoric acid. Additional nitrogen should be used after growth starts when mixed fertilizers are used which contain two to three times more phosphoric acid than nitrogen.

Weeds and Weed Control

Where weeds are scattered and few in number, they will disappear automatically as turf density is increased by systematic fertilization. But when weeds, clover, and poa annua exceed perennial grasses, the use of weed killers, or herbicides, in addition to fertilizer is justified.

On courses where dandelion, plantain, and buckhorn are the weeds, the use of 2,4-D to eliminate them, accompanied by fertilization is the logical procedure. Applications can be made in spring or early fall. Good results can be obtained either time, provided weeds are in active growth, and the soil is moderately moist. Some prefer fall, because new seedlings produced from seed that year, and the old plants are killed. Spring treatment may bring crabgrass or clover in regions where either one is bad. This occurs only when grass is sparse and large voids or bare areas are left after weeds are killed; or when fertilizer is not used to make the grass spread and develop a dense turf.

There are three types of 2,4-D, the salt, the amine, and the ester formulations. All are good. The ester type is good for hard-to-kill weeds like bindweed, poison ivy, etc., but it is more likely to discolor or injure the grass than the other two, and drift damage to nearby ornamentals is more apt to occur. The salt and amine formulations are safer to use. Although the ester type works faster, and is said to be more effective on clover, there is very little difference in the ultimate result on broadleaf weeds. The trend on turf seems to be toward the amine and salt types because of the safety factor. From ¾ to 1½ pounds actual 2,4-D per acre are used customarily, with variable amounts of water, from 5 to 200 gallons, or more, per acre. The 2,4-D salts can be used dry, mixed with fertilizer, but the rate must be increased, using 2 to 3 pounds actual 2,4-D per acre.

The results with 2,4-D on annual chickweed and clover have been disappointing. They are serious pests on watered fairways. One application of 2,4-D checks but does not kill either one completely. Repeat treatments of 2,4-D often damage bent

Chas. Wilfong at Green Valley CC, Phila., shows lines of seeded bent in June 1949. Fairway was seeded in early October 1948.

grass permanently, so it is not the answer to clover and chickweed control on fairways with a high creeping bent grass population. Sodium arsenite is a better material to use, but two to four applications are needed. From one to two ounces per 1,000 square feet (roughly 2.5 to 5

(Continued on page 72)

stymied each time higher rates are mentioned because the membership at each meeting points to the facts that the clubs are running at a net profit.

It need but be said that it is high time for the manager and his committee and board to readjust their sights if they have not already done so to keep constantly on the watch and have ever before their mind's eye the question "Wither goest thou?"

THE PRACTICAL APPROACH

(Continued from page 36)

pounds per acre) are used each time by the spray method. When Milarsenite is used, several applications at 200 to 300 pounds per acre are needed. Late summer and early fall are the best times to eliminate chickweed, because reseeding can follow, when necessary, after killing the chickweed. Spring is a bad time when the infestation is heavy, because heavy infestations of clover or crabgrass may follow.

Knotweed is another hard-to-kill weed with 2,4-D after the seedling stage. Once it becomes stemmy, 2,4-D fails to give a good kill at ordinary dosages. It can be killed very easily with sodium arsenite at any stage of growth. Not over one ounce per 1,000 (2½ pounds per acre) is needed in the two-leaf stage. Spraying is best because there is not enough leaf surface to

Applying Milarsenite to kill clover, chickweed, crabgrass and to check poa annua before seeding Colonial bent grass into the fairway.

collect and hold a lethal dose by the dry method. Sodium arsenite is better than 2,4-D at this stage when grass is to be seeded into the area.

On watered courses where broadleaf weeds, clover, chickweed, poa annua and knotweed constitute the ground cover, complete renovation is best. The fairways should be sprayed in spring to kill broadleaf weeds, using 2,4-D at ¾ to 1½ pounds per acre. Starting in early July, sodium arsenite should be used three or four times at 7 to 10-day intervals to kill chickweed, clover, poa annua, and knotweed. The fair-

ways should be seeded with Colonial bent in late August or early September, just before the last treatment. Fertilizer should be applied first, then a seed bed prepared with the spike disc or Aerifier. The fairway should be seeded and the last application of sodium arsenite made.

Sodium arsenite can be applied as a spray or by the dry method. The spray treatments are more drastic on the grass and on the weeds as well. Dry treatments are safer and will not permanently harm the grass, provided the soil is sufficiently moist for growth to a depth of 4 to 6 inches, and rates of 3 to 4 ounces per 1,000 square feet are not exceeded. During warm weather, when temperatures exceed 80 degrees Fahrenheit, not more than 1 to 2 ounces per 1,000 square feet of sodium arsenite should be used by the spray method. Milarsenite is used at 200 to 300 pounds per acre when the temperature range is 70 to 80 degrees Fahrenheit, but when it is over 80 degrees, rates should be 200 pounds or less per acre.

The Rhode Island Station has obtained excellent crabgrass control with phenyl mercury acetate. High cost is its chief drawback for fairway use. New Jersey tested a number of products. Good control was obtained with phenyl mercury compounds, with potassium cyanate and other products. These new compounds may have a place in the weed control picture.

Chemical soil tests are helpful guides for determining need for lime, phosphate, and potash, but not for nitrogen. Need for nitrogen can be judged by turf condition, the amount of clover and weeds, and by the color and texture of the soil.

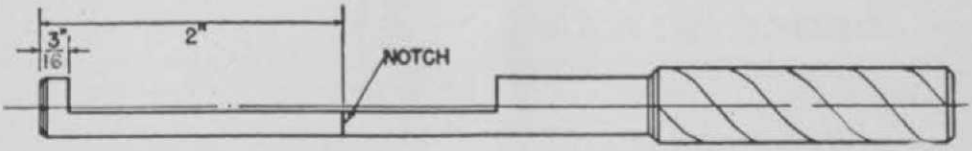
Chemical tests are meaningless unless the soil samples are collected correctly, and a dependable method of testing is used.

Samples from grassland areas should be taken to an exact depth of TWO inches, and the individual plugs should be of a uniform diameter. This is important because the soil is never disturbed on grasslands. Hence the content of available plant food decreases with depth. Results differ widely on plugs taken from the same spot but to DIFFERENT depths.

A good sampler, shown in the accompanying illustration, can be made from a discarded steel golf shaft. One with a heavy side wall should be used.

From eight to ten plugs per sample provide enough soil for making the tests, and insure accurate sampling. Moderate size samples cut mailing costs and simplify laboratory preparation of the sample for testing.

A clean new container should be used for each sample, otherwise the soil may become contaminated. Small paper bags (½ to 1-pound size) are excellent and may be obtained at any grocery store. Write the



A soil sampling tool for quick soil tests can be made from a discarded golf club shaft with a heavy sidewall, on an emery wheel. A shaft made of light stock will break easily. Make the cutting edge only 3/16 inch to facilitate removal of plugs as indicated in diagram. Cutting edge should be sharpened and slot above ground down just below center so plugs slip out easily. Notch or mark for measuring plugs should be just two inches from cutting edge.

name of the club, the fairway number, and the exact area sampled (landing area, approach, etc.) on the outside with a soft lead pencil. Never use ink or a hard pencil. Moist samples should be AIR DRIED before mailing, otherwise containers may break in transit, or labels become unreadable.

The soil in each sample should be uniform in texture (sand, loam, clay, etc.), in color (black, brown, grey, etc.), and should come from the same elevation (hillside, slope, high land, low ground, etc.). Never mix sand with clay, black soil with light-colored soil, or plugs taken from low ground with those from high land.

From four to six samples are enough from an 18-hole course located on level ground with uniform soil and turf. They should come from widely separated areas. When the soil, topography, or turf differ from one to four samples should be collected from each variant.

Lime

The need for lime should be based on soil reaction. The amount to use depends on the degree of acidity, the kind of predominating grass, soil texture, and the kind of lime available.

Soil reaction is now expressed in terms of pH. By this method the figure "7" represents a neutral soil, higher figures

THE pH SCALE		GROUND LIMESTONE LBS. PER ACRE			
"pH" IS THE MEASURING STICK OR THERMOMETER USED TO EXPRESS THE ALKALINITY OR ACIDITY OF A SOIL.		BLUE GRASS BERMUDA		FESCUE BENT GRASSES	
pH VALUE	DEGREE	SANDS & SANDY LOAM	LOAMS & CLAYS	SANDS & SANDY LOAM	LOAMS & CLAYS
ALKALINITY RANGE	VERY STRONG				
	STRONG				
8	MEDIUM				
	SLIGHT				
7	NEUTRAL				
ACIDITY RANGE	VERY SLIGHT 6.2-7.0	0	0	0	0
6	SLIGHT 5.7-6.2	1000	1500	0	0
	MEDIUM 5.2-5.7	2000	3000	1000	1500
5	STRONG 4.7-5.2	3000	4000	2000	3000
	VERY STRONG 4.0-4.7	4000	6000	3000	4000
4					

denote increasing alkalinity and lower ones increasing acidity. Differences are in multiples of 10, so pH 6 is 10 times, pH 5 is 100 times, pH 4 is 1,000 times, etc. more acid than neutral (pH 7). Soil having a

pH of 4.0 to 4.7 is very strongly acid, 4.7 to 5.2 is strongly acid, etc.

Kentucky bluegrass needs lime before fescue or bent. It takes more lime on heavy soil than on a sandy one to produce the same change in pH. All these factors are taken into account in the accompanying chart. Suggested rates are based on using a finely ground limestone. The price of it varies, depending partly upon the fineness of the grind. If hydrate is used instead, the rate should be reduced 25 to 30 per cent, because 70 pounds hydrate is equal to 100 pounds of pure lime carbonate in neutralizing value. Some firms in the eastern part of the United States make a mixture of equal parts ground limestone and hydrated lime and call it Agricultural Lime. It is a good material, but higher priced than ground limestone, because of the added expense for making hydrate.

Ground limestone and hydrate are good products. Hydrate acts faster because of its greater solubility, and for that reason may scorch the grass, if the rate of application is too heavy. It must not be applied immediately before or after using a fertilizer containing nitrogen in the form of ammonia, that is, sulphate of ammonia, ammophos, or ammonium nitrate, etc. The hydrate reacts with these materials and liberates free ammonia, which is very toxic to vegetation, and escapes in the form of a gas. Lime hydrate tends to reduce the solubility of iron and the trace elements, such as copper and manganese. For that reason an application of hydrated lime exceeding one ton per acre at any one time is not advisable. The best procedure, when using it, is to apply a ton per acre each year until the desired soil reaction is reached. Then turf will not suffer ill effects because of an acid soil reaction, and a deficiency of trace elements will not occur.

Ground limestone is insoluble, but reacts chemically with the carbonic acid in

the soil solution to form calcium bicarbonate, which is partially soluble and moves down into the soil. Limestone never scorches the grass, and does not liberate enough free ammonia from fertilizers to damage grass. Formation of the bicarbonate is so slow that heavy rates can be

Applying agricultural lime to an acid fairway. On this course lime is worked in with a brush harrow.

applied without disturbing the availability of trace elements. From two to four tons, or more, can be applied at one time. Additional lime will not be needed for three to five years.

Ground limestone is produced in several grades, depending upon the degree of fineness, and is priced accordingly. The finely ground product acts faster, but effects are not as lasting. In regions where lime is expensive, the customary practice is to make lighter and more frequent applications of a finely ground product but where lime is cheap, a coarser ground limestone is used generously at infrequent intervals.

Sometimes acid soils are low in magnesium. Then the lime used to correct acidity should contain magnesium as well as calcium. Magnesium containing lime is commonly called dolomitic limestone, or simply dolomite. The dolomite used should contain not less than 20 to 30 per cent magnesium expressed as the oxide. The analysis is usually printed on the bag, otherwise it can be obtained from the manufacturer.

Spring, fall, and winter are the best times to apply lime. Ground limestone can be applied at any time, but it is unwise to use hydrate at rates exceeding 1,000 pounds per acre during the summer, otherwise it can be used at 1 ton per acre.

When soils are strongly acid, lime should be applied as long as possible before fertilization with phosphate. Otherwise, the phosphate may be fixed in the soil as relatively insoluble iron phosphate.

Fertilization

An effective fertilizer program is predicated upon the fact that nitrogen is the important element on established fairway turf. Phosphoric acid and potash play

secondary roles because clippings are not removed. As they undergo decay, they and other mineral elements in the clippings are released and taken up by the colloidal fraction of the soil. Phosphate has a marked stimulating effect on the root development of young germinating grass seedlings. For that reason it is important on new seedings, and on reseeding jobs during renovation.

Potash is seldom needed on loam or heavier textured soil. It may be required on peat and very sandy soil. A soil test is a useful guide. Heavy potash feeding without enough nitrogen may stimulate clover.

Where reseeding is not contemplated or required, need for lime, phosphate, and potash should be determined first. After requirements for them have been satisfied, turf improvement becomes a matter of nitrogen feeding.

Soil tests are helpful guides in determining need for phosphate, provided a dependable method is used. Some show need for phosphate which is not borne out by field results. Tendency in the past has been to over-emphasize the need for phosphate on established fairways. When tests show it to be low (75 pounds per acre or less by the Truog Method), an initial application of 75 to 100 pounds actual phosphoric acid should be made. This is equivalent to 400 to 500 pounds superphosphate, or 800 to 1,000 pounds of 5-10-5, or 4-12-4. After that a fertilizer containing one-third to one-half as much phosphoric acid as nitrogen will furnish enough, provided the rate per acre is sufficient to furnish 20 to 30 pounds actual phosphoric acid per acre. More may be needed on the occasional soil of extremely high fixing power.

Nitrogen must be used generously until turf of desired density is obtained. From 80 to 150 pounds per acre of actual nitrogen is not too much. This is equivalent to 1,500 to 2,000 pounds per acre of cottonseed meal or Milorganite. It is not safe to use that much nitrogen from soluble fertilizer at one time. The better plan is to apply about 40 pounds actual nitrogen and repeat with the same quantity a month or six weeks later.

Phosphate should be used generously before seeding or when reseeding established fairways, irrespective of the soil test. The fertilizer used should supply not less than 100 pounds per acre of actual phosphoric acid. Nitrogen should be used also in order to encourage vegetative growth.