



A well developed Bent Grass fairway at Milwaukee Country Club that is cut closely and fertilized regularly.

Controlling Factors in the Development of Better Turf

By O. J. NOER

The modern golfer is more critical of turf condition in every way than his predecessor ever was. At one time players were content when greens were perfect. Now, they demand the same kind of fairways and tees. They want weed-free roughs. Golfers expect a good lie for every fairway shot. There is an insistent demand for closely clipped fairways, since it is impossible to control the shot when there is grass between the club head and ball. Some players urge fairway watering to provide green grass all season and to make walking less arduous. They do not realize that water complicates fairway maintenance, especially when the existing grass or grasses are not amenable to water.

Bermuda grass and carpet grass in the South, and the bent grasses in the North are the only ones which will withstand constant close cutting. In the South, choice of grass is a simple matter because Bermuda and carpet grass make good fairway turf and perform exceptionally well on areas where soil conditions are favorable. Centipede and zoysia are possibilities, but widespread use is not likely for some years

to come. It will take time to demonstrate or disprove their worth. Both have their good qualities, but they may become even more matted over a period of years than Bermuda grass. Choice of grass is more difficult in the North because existing varieties have more serious drawbacks. Fescue and Kentucky blue grass cannot withstand continuous close cutting. They grow best when mowed at $1\frac{1}{2}$ inches or higher. Disease plays havoc with fescue during hot wet spells in midsummer, and leaf spot takes its toll of blue grass during cool wet weather. There are some good unwatered Kentucky blue grass fairways in places where soil and climate are very favorable. The turf is cut at about an inch in spring and fall, but in midsummer the mowers are raised to cut at $1\frac{1}{4}$ inches. Where coverage is uniform and the turf is dense these fairways satisfy the average golfer, even though the cut is seemingly high.

Dense Turf Suppresses Weeds

The discovery of 2,4-D focused attention upon weed control and created widespread interest in turf improvement. Many over-

looked the part played by dense turf in weed suppression and thought 2,4-D the sole answer to good fairways. Some clubs have learned the fallacy of that belief to their sorrow. The use of 2,4-D has speeded the turf improvement program by eliminating broad leaf weeds quickly, but they have come back in larger numbers, or their place has been taken by clover, crab grass, etc., unless something was done to develop a dense turf in the voids left by the weeds. Good fairways existed long before 2,4-D was known. It took a longer time to crowd-out weeds and develop dense turf.

There is a place for 2,4-D. It is a useful tool to speed turf improvement. Broad leaf weeds can be taken out quickly, then turf improvement is a matter of fertilization, with or without reseeding.

All permanent turf forming grasses spread by vegetative means to form a dense turf — provided environmental factors are favorable. This fact is the basis upon which any turf improvement or maintenance program must be formulated, yet this truth is either overlooked or ignored. Creeping bent and poa trivialis in the North and southern grasses, such as Bermuda grass spread by means of surface runners called stolons. The colonial bent grasses are said to spread mostly by short underground stems. The blue grasses, and fescues spread by underground stems called rhizomes. Failure of these grasses to spread and make good turf is the result

of one, or possibly several, unfavorable factors. Impoverished soil is common, and generally blamed first. Excessive acidity and other unfavorable soil factors; bad drainage, unsuited grasses, or the ravages of destructive insects and disease may be equally or more important.

Determine Cause for Poor Turf

A determination of the reason for poor turf is the first necessity before deciding upon an improvement program. The answer can be found on the property in almost every instance. For example, improvement from fertilization cannot occur if existing grass is unsuited to soil or climate. In that event, reseeding to introduce suitable grasses must accompany fertilization. Bad drainage or something else may be a contributing cause. A careful examination of the vegetative cover including grasses and weeds, and a survey of soil, drainage, and all other factors is the first task. Then it is a simple matter to devise a workable plan which will eliminate all adverse factors and transform poor or mediocre turf into a beautiful dense sward of grass.

Loam soils, ranging from sandy to silt loam, are best for fairway turf because of their capacity to hold and ability to deliver, capillary water and plant food.

Developing Good Turf

Good turf can be developed on clay loam and clay soils, but there are many complaints when the grass is sparse. The jar



Excellent, unwatered Blue Grass fairway, fertilized each fall; cut at one inch spring and fall and one and a quarter inches in summer.



Fairway badly in need of lime and fertilizer. Note thin, weed infested turf.



Unfertilized Blue grass fairway showing heavy infestation of dandelion.

when the club head strikes hard, bare soil is terrific. The impact almost knocks the club out of the players' hands. Some golfers think a heavy dressing with sand is the answer because it is easy to play a shot when the ball rests on light textured soils, such as sands and sandy loams. Sanding solves the player's problem, but is not the answer. It affects water movement in the soil adversely and complicates summer maintenance. The development of dense turf — by fertilization and watering if needed — to form a surface cushion for the ball to rest on, is the best and cheapest way to provide better lies.

Sandy soils present the real problem. Their low water-holding capacity makes it impossible to keep turf during summer heat and drought. Furthermore, they are low in plant food, particularly nitrogen, because plentiful aeration speeds destruction of organic matter. Here again top-dressing is usually advocated. A thin layer of heavier soil does not solve the problem. Fairway watering, together with fertilization to stimulate growth and help curb weeds and clover is more effective. It is less expensive, too. Where irrigation is impossible, the only alternative is to encourage fescue. It stands drought better than any other fairway grass. Little or no water should be used on fescue and it should not be shaved with mowers.

There are a few courses where all or parts of fairways are pure peat to variable depths up to ten feet or more. Uneven settlement occurs at first because the peat is loose and spongy. As decomposition occurs, the peat becomes more compact. After a few years, rapid decomposition stops and surface contours change very little. By that time the original surfaces have become very rough. Mowers scalp the knobs and

fail to cut grass in the depressions. Golf balls invariably stop in the long grass at the bottom of a deep depression. The lies are extremely bad and exasperating to the golfer. Leonard Bloomquist at Superior Golf Club in Minneapolis solved the problem very simply. Creeping bents always predominate on peat fairways, even on the unwatered ones. He cross-disced the rough peat fairways enough times to cut the sod into small pieces. The disced areas were then levelled with a road grader and rolled lightly. The creeping bent stolons in the sod pieces started growth and developed a turf rapidly. The first fairway to receive this treatment was still level twelve years afterwards.

Proper Drainage

Obvious drainage needs are generally provided. But damage from seepage is seldom recognized. Poor turf along slopes or near the base of hillsides is usually caused by seepage. Damage occurs in spring or fall. Kentucky blue grass and fescue disappear, whereas moisture-loving creeping bent grass and poa trivialis survive. Tile lines to intercept seepage must precede fertilization and reseeding. Their direction should cross the line of flow. The other alternative is to use moisture-tolerant creeping bent grasses.

It is a simple matter to confirm or reject seepage as an unfavorable factor. Three or four test holes, four or five feet deep, placed at intervals from top to bottom of the hillside will tell the story. They should be dug with a post hole digger in the fall and lined with small drain tile. Then it is possible to observe and measure the water table during late fall, winter and early spring. Standing water in the tile, up to or near the top is evidence that tile drains are needed to intercept seepage waters.

When blue grass or fescue winterkill in slight depressions which are almost imperceptible — knotweed, clover, or plantain take possession. Tile drainage is not the answer. Drains never function when ground is frozen. Improved surface drainage, or the use of water-tolerant creeping bent is the obvious solution.

Watering the Fairway

Grass turns brown and fairways become hard under foot during dry weather. Older members complain of fatigue from walking on hard, baked ground, and the younger ones crave green turf all season. Members



Heavy growth of clover on closely mowed, unwatered fairway which is not fertilized.

clamor for water to keep the grass green and to make walking less arduous. They think water is the sole answer to the fairway problem. One fairway, an approach, or a landing area is watered for a season to test and verify their contention. Then the water system is installed.

Fairway watering has been eminently satisfactory on some courses, and a dismal failure on others. Like most new devices, fairway watering has suffered most from its greatest boosters. It will not become accepted practice until the relationship between water, fertilization, and cutting is clearly understood by club officials and members. Unless the club is prepared to carry the additional financial burden of extra cutting, and fertilization besides the cost of water and its application, the club had better forget about fairway watering. The over-all increased expense, including interest on the investment and depreciation of the water system, will be \$3,000 to \$5,000 or more per year for an eighteen hole course.

The cost of water is negligible when there is an ample supply on the property. The outlay for power to operate the pumps

becomes the only expense. But, where water must be purchased, the cost may be considerable. Some clubs spend \$3,000 to \$5,000 annually for water alone. Local restrictions on the use of water for sprinkling in June, July, and August may deprive the club of water when it is needed most.

Irrigation eliminates water as a growth-retarding factor. It increases the demand for plant food by providing optimum moisture at all times. Unless enough fertilizer is applied every year, a marked increase in weeds and clover is sure to follow. In other words, fertilizer is more important than water. If a club cannot afford both, it is more sensible to use fertilizer and build good turf, rather than water copiously and soon have poa annua, clover, knotweed, chickweed, and other weeds only. Many clubs have learned this truth from bitter experience.

Fertilizer requirements vary, depending upon soil type and plant food content, fairway acreage, kind of grass, length of growing season, etc. Most clubs err on the side of too little rather than too much fertilizer. At one eastern club where fairways have exceptional turf despite long time watering, it is routine practice to fertilize three times each year, in April, June, and September. The fertilizer used furnishes 50 pounds elemental nitrogen and 25 pounds phosphoric acid for each application. Obviously, the maintenance budget is not skimped, yet the club spends wisely because there is a full membership with a long waiting list.

After deciding to water, a careful survey should be made to see that fairways contain suitable grasses. If fescue predominates and the soil is heavy, it is sure to disappear within a year or two after watering starts. Even Kentucky blue grass will not survive under heavy watering and persistent close mowing. Then poa annua, clover, and weeds will overrun the fairways, even though fertilization is adequate. Turf will be reasonably good during the cool spring and fall seasons when poa annua is at its best. As it weakens in early summer, clover and knotweed become bad and predominate until temperatures moderate in early fall. Fairways with pure stands of fescue or Kentucky blue grass should be reseeded before watering starts to introduce more desirable grasses. Common practice is to use colonial bent.

Grasses for Northern Courses

In the early days it was customary to use fescue liberally, along with variable a-

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individual treatment is a big part of the successfully handled pro job. It's simply a case of thinking of the other guy or the woman. The answer to handling the golfer is no more abstruse than the explanation the idiot gave when he found he lost a horse. You remember that old yarn of the dope saying he figured out what he would have done if he were a horse, doing the same thing, and there the horse was. If that policy works on a whole horse it will work on any part of same that happens to be represented in a club's membership. The pro is hired to get the right answer without requiring members to hand it to him. He merely has to out-guess the members and do it first. With what he should know about his job that should not be a difficult problem in mind-reading.

CONTROLLING FACTORS

(Continued from page 44)

mounts of Kentucky blue grass. Some architects included small quantities of south German mixed bent seed because it was the only type of bent seed available at that time. When the Green Section was formed, Dr. Piper advised seeding with Kentucky blue grass because it is the common turf grass in northern areas. The recommended mixture was eighty per cent Kentucky blue grass and twenty per cent red top to provide cover while the blue grass was becoming established. This combination was in common use for twenty years or more. Turf was reasonably good, provided it was not cut too close. The use of lime was frowned upon during that era. When Kentucky blue grass was used on strongly acid soil of low phosphorus content, it failed or the fertility deteriorated rapidly with the disappearance of the blue grass. Then weeds, poa annua, and clover took over. Kentucky blue grass never makes a dense, tight turf, so it is always hard to keep clover out of it. Generous fertilization and high cutting are the most effective means.

The use of colonial bent, mostly Astoria type, started with the development of large scale seed production in the Pacific Northwest. Seed mixtures for original planting, or for re-seeding, contained five to fifteen per cent colonial bent. The balance was Kentucky blue grass and red top occasionally with some fescue. The use of bent received a setback when chinch bugs started to invade fairways in the eastern part of the United States, because the bent grasses fared worst. Treatment with tobacco dust was

expensive, and none too effective. Now that DDT and Chlordane give good control at reasonable cost, the bents have regained favor. The tendency is to use the bent alone for reseeded during renovation of poor fairways because Kentucky blue grass and red top seed have become too expensive. Rates of seeding vary from 15 to 40 pounds per acre, and occasionally more.

The Astoria strain of colonial bent has performed well, especially when lots free from Seaside were obtained. Red tag and uncertified seed contain more creeping bent than the blue tag seed, and are less desirable for that reason. The Highland strain of colonial bent is being recommended by some. It is said to be more drought-tolerant than Astoria, because it grows on higher and dryer land in its native habitat. It has a different green color, and is said to be a trifle coarser in texture.

Creeping bents are considered least desirable because of their tendency to become matted and to produce a fluffy turf. Strains differ in this respect; Washington is especially bad, but Arlington (C-1) and some others produce excellent fairways. The development of desirable types is needed especially for use on watered fairways. Under irrigation, creeping bent grasses eventually take possession. Fluffiness can be prevented by frequent mowing and close cutting. The turf on creeping bent fairways should be thinned periodically by cross-discing, or by the use of the West Point aerifier, or a rotary hoe.

Another objectionable feature of creeping bent is its tendency to overrun the roughs along the edge of watered fairways. Players have a justified complaint about impossible lies when the ball is just off line. This strip of bent should be treated as semi-rough, and should be mowed a trifle higher than the fairway. Usually one round with the fairway gang is enough.

Bent on Unwatered Fairways

The notion that bent grass will not persist on unwatered fairways is general. The fact that patches of matted creeping bent die during periods of prolonged drought is the reason for the belief. Colonial bent and some creeping bent strains can survive long periods of drought. The unwatered fairways at Clovernook and Kenwood in Cincinnati contain a high percentage of colonial bent which has persisted for many years. The same is true at Camargo, even since watering stopped there. These fairways are well fertilized

and play well, even when brown, because of the uniform turf coverage.

No grass makes a better fairway than Bermuda when it is adequately fertilized and cut close. Fairways can be watered without serious trouble from crab grass and clover, provided enough nitrogen is used to keep the turf dense and tight. Fairways infested with these pests can be renovated by sodium arsenite treatment to kill the crab grass and clover, followed by the generous use of nitrogen to make the Bermuda spread and form dense turf. Carpet grass makes good turf on moist, low-lying areas in regions where climate is suitable for its growth.

Grasses for the Semi-Arid West

Irrigation is required in this region to produce really good fairway turf. Then blue grass or combinations of it with bent can be used in the cooler northern part, and Bermuda grass in the southern section. Where water is not available, or the amount is limited, buffalo grass is customarily used in the south and fairway strain of crested wheat in the north.

Mowing Practices

Golfers prefer and usually demand closely cut fairways. Grass is never cut short enough for them. The ball must rest on

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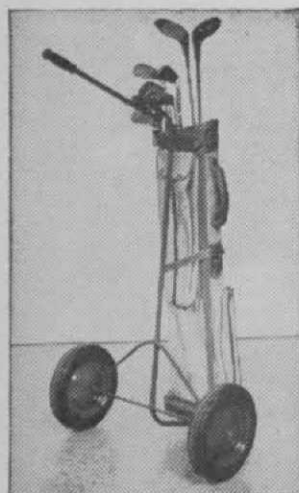
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top of the turf and not down in it. The club head must make clean contact with the ball in order to control its flight. These are reasonable requirements of fairway turf. The problem is simple in the South because Bermuda will withstand close clipping. The same is true of bent fairways in the North. Both should be cut at 1/2 inch or less. The situation is different with Kentucky blue grass and fescue. They cannot withstand continuous close cutting. Complete surrender to the golfers' demand for short cut fairways is suicidal. Turf deterioration together with weed and clover infestation is sure to occur. Higher cutting is necessary with some grasses so they can manufacture carbohydrates (principally sugar, starch, and cellulose). This is the principal function of green leaves. The process is called photosynthesis, because it occurs only in daytime. The energy needed to cause carbon dioxide and water to unite comes from sunlight. But the two combine only in the presence of chlorophyll, which is the green substance in the leaf. During sugar formation, free oxygen is liberated. Plants purify and enrich the air we breathe. They absorb carbon dioxide and liberate oxygen.

After carbohydrates are produced in the leaf, they are elaborated into protein, chlorophyll, etc. During fabrication of these complex plant substances, the sugar is transformed and combined with nitrogen, phosphorus, sulphur, magnesium, iron, etc. So when considering or discussing the fertilizer requirements of turf, it is important to remember that the primary raw product from which every other constituent is derived is manufactured by grass in the leaf blades. Any nutrient absorbed from the soil or from added fertilizer is effective only when the turf has enough leaf surface to produce needed carbohydrates. Grass must be cut high enough to provide the required leaf surface.

The fact that about 95 per cent of the dry weight of grass is carbohydrate, or its derivatives, further exemplifies the importance of sugar manufacture in the leaf. Only five per cent comes from the soil.

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From a practical standpoint, inherent differences in the growth habit of grasses should be taken into account in deciding upon height of cut. Kentucky blue grass, Canada blue grass, and the fescues creep by means of submerged stems. Their leaves grow erect. The bents and poa trivialis, spread by means of surface runners. Their leaves tend to grow horizontally. Consequently, these grasses can be cut closer with impunity than the blue grasses or fescues. Too high cutting of creeping bent is actually detrimental. It favors development of an objectionable thick surface mat. During dry spells this mat impedes the penetration of applied water, and by trapping surplus water it causes the turf to rot during hot wet spells.

It is best not to cut Kentucky blue grass and fescue closer than 1-1/4 to 1-1/2 inches. The preferred practice for lawns is to approach the higher limit. On golf courses they are usually cut at 3/8 to 1 inch in spring and fall, and at 1-1/4 inch during summer. Average players and many of the better ones are content with such fairways, provided grass coverage is uniform and the turf is dense. It means cutting often so grass will not become unduly long before the next time it is mowed.

On theoretical grounds at least, there is good reason to allow blue grass and fescue to make as much growth as possible at the start in the spring, and to keep it high for a short time in order to permit the plant to produce the maximum quantity of sugar. It is the time of greatest demand because new roots and most of the rhizome develop-

ment occurs in spring. After that and in fall when weather is cool and grass grows rapidly, no harm will result from somewhat closer cutting. Mowers should be raised and grass cut higher with the approach of summer. The extra growth insulates and shades the ground, thereby reducing the loss of moisture from direct evaporation. Consequently, the turf stays green longer and survives drought better. Shade also helps discourage clover and crab grass.

Mowers can be raised at any time, but should never be lowered drastically in hot weather. The only safe way is to lower the cut slowly, just a little each week.

Fairways must be cut oftener when mowers are set to cut fairly high. Turf cut at 1/2 inch is only 1-1/2 inches long even after grass grows an inch between cuttings. Fairways are still playable. However, when the turf is cut at 1-1/2 inches, the grass is 2-1/2 inches by the time it is mowed again, provided the interval between cuttings is the same. Then fairways are unplayable. Golfers complain bitterly about bad lies, say they can't find the ball in the long grass and become furious.

The switch to colonial bent in the North permits continuous close cutting of fairways, which is what the golfers want. Even with close mowing, it and creeping bent have enough leaf surface to produce ample carbohydrate. The height of cut should be adjusted to prevent the formation of a surface mat, otherwise serious trouble is likely during bad weather.

(to be continued in May issue of *Golfdom*)

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