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In Wilson golf clubs the player has equipment that rates "tops" in his own judgment and in the judgment of his friends—the *last word* in modern design and precise manufacture. And the Pro Shop displays merchandise of distinction and nationwide acceptance.

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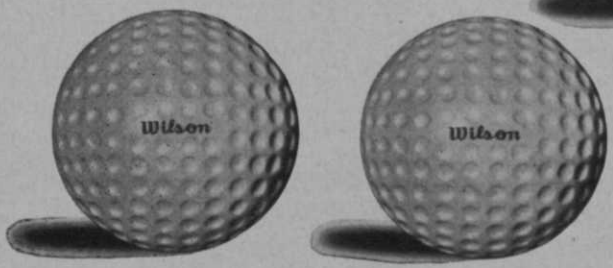

Spray the weeds to death!

HERE'S the simple, sure way to take out all broad-leaved weeds. Just spray on TUFOR solution—the clean chemical that is sure death to troublesome weeds. Grass is not harmed by TUFOR.

TUFOR is based on the famous 2-4-D chemical which kills broad-leaved plants only... but TUFOR is improved to restrict volatility; it stays where applied.

With TUFOR, you control the weeds the easy way—by spraying. No more digging or pulling. Ask your dealer for TUFOR or write us directly. It is economical and easy to use.

WITH TUFOR YOU GET THESE ADVANTAGES:

1. **Safer to use—less volatile than regular 2-4-D.**
2. **Completely soluble—does not settle out.**
3. **Non-inflammable.**
4. **Does not irritate skin or corrode spray equipment.**
5. **Kills leaves, stems and roots completely.**
6. **Grass sprayed with TUFOR is not poisonous to animals.**

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WATCH DRAINAGE

As Turf Problem Source

By DR. JAMES TYSON
Research Associate in Soils, Michigan State College

Dr. James Tyson

★ IT IS obvious when water stands on the surface of a fairway or a green sufficiently long to interfere with play or until it kills the grass, it is necessary to remove it through some kind of an engineering project to produce good playing conditions.

Tile drains and open ditches will take care of most such problems on fairways and in the roughs. Wide grassed ditches or waterways through which fairway mowers and other equipment can work are ideal for areas where the removal of water is only necessary on special occasions.

Tile drains sometimes fail to function because the backfill is too impervious to let water get to the tile. In such cases lines should be dug up and backfilled with coarse material like gravel or coarse cinders, at least in the lowest part of the poorly drained area.

The need of drainage is not so noticeable when the water does not stand on the surface in pools but merely fills the voids in the soil excluding air and interfering with the free exchange of air. The resulting effect is just as deadly as surface flooding for although water is essential for the growth of grass it is equally necessary that grass roots be continuously supplied with fresh air. If the soil air is not constantly being renewed from the atmosphere, carbon dioxide replaces the oxygen causing the plants to turn yellow and eventually die. Wherever poor drainage conditions exist the turf becomes thin and yellow.

Factors Affecting Greens Drainage

The downward movement of water through a green or through any soil is dependent upon the number of large pores available for the free movement of water. It is through these same large pores that air moves since the supply of these in the voids of the soil complement each other, i.e., that portion of the voids that is not filled with water is filled with air. The small pores absorb and hold water against the pull of gravity so the air supply in a green is in the large pores.

A very important fact that is often forgotten is that the least pervious layer in a green is the one that determines the rate of downward flow of water. Whenever a pipeline is blocked the free movement of water is impeded and the total movement of water in the line is determined by the rate at which it can pass the smallest part.

Coarse-textured soils have the greatest number of large pores and therefore allow the freest downward movement of water, whereas clay, clay loam, and silt loam soils contain very large numbers of extremely small pores. Water movement is usually slow in them. However, if these soils are in a granular condition, as sometimes occurs under general agricultural conditions, they contain many large pores and are well drained. Under conditions of excessive packing when soils are wet, the air capacity of clay and clay loam soils may be reduced to almost zero. This condition is frequently found in golf greens constructed of too heavy soil. The soil is almost always wet and the constant packing when players walk on it puddles the soil and reduces the air capacity. The air capacity of one golf green was reduced from 25 percent to 4 percent by this constant tramping.

It is on account of the above problems that we have recommended for many years that golf greens be constructed of coarse sandy loam soil and that coarse sandy loam soil always be used for topdressing. The problems of maintenance would be greatly reduced by these simple factors.

Let me cite a few case histories that I have had the opportunity to study:

A local golf course has a green in a beautiful location in a wooded bend of a river. The green is built on a sandy bank near the river. The builder placed a layer of approximately 3 inches of fertile river-bottom soil on top of the sand and then placed the top soil (a good sandy loam) over this soil. Whenever the weather is even moderately rainy this green shows all of the symptoms of poor drainage. The grass becomes thin and turns yellow. In-

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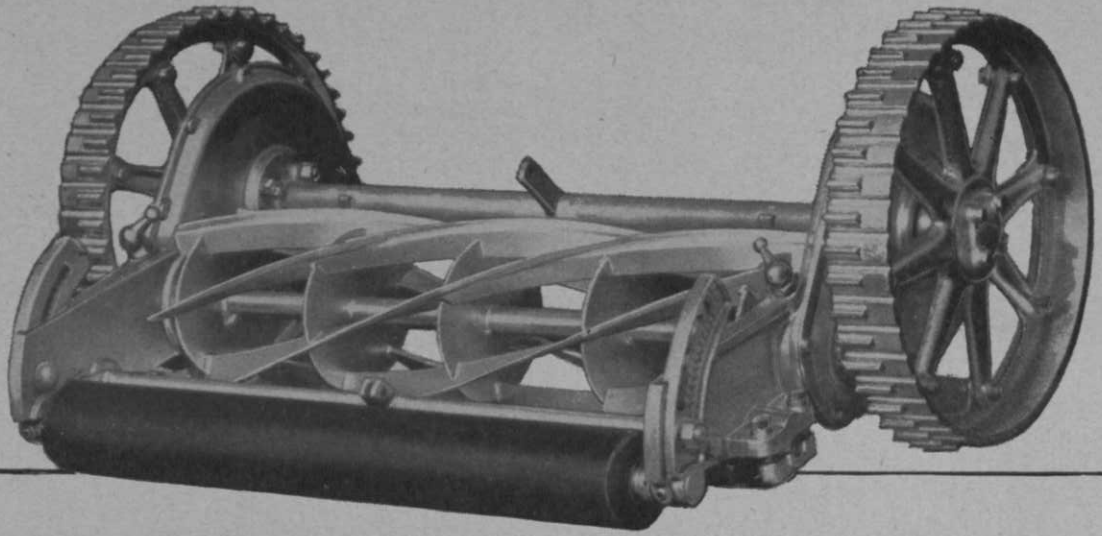

THE SPARTAN, AMERICA'S NEW GANG MOWER

In 1923 when we came out with the Super Gang mower, it was the first mower on the market to be thoroughly engineered to quality standards with such features as machine-cut hardened steel forged gears—oil tight housings—double-lipped reversible bed knives—large diameter 35C Rockwell tough alloy blades—and we saved the golf courses of America and Canada hundreds of thousands of dollars in upkeep expense caused by the frequent parts replacement on poorly constructed mowers.

Simplicity is the basic appeal of the new Spartan gang mower. Here is a mower which has all the strength, the ruggedness, and the good cutting qualities of the previous mowers we built, but it is so simple that an ordinary workman can take it down without special tools and do it quickly.

Remove four studs and the wheel comes off. By easily removing ten studs from the gear case cover, the entire drive mechanism is open for inspection and for cleaning. Overhaul time is reduced almost half. Special tools are not necessary.

Other good features are replaceable rims on the drive wheels —ball bearing rollers—and a beautifully flexible hitch which will cut over any irregular contour.

As Fred Hoerger, Superintendent of La Gorce Golf Club at Miami says—"the Spartan will top them all."

That's the way we feel about it and that's the way we think you will feel about it when you see and use them.

FOR USE ON GROUND OF HIGHLY IRREGULAR CONTOUR
THE NEW UNIVERSAL HITCH IS A PEACH FOR EXTREME FLEXIBILITY

The seven unit Universal Hitch shown is built of square tubular steel which is very light but very strong. It is made with hinged sections, is highly flexible, will follow the contours of the ground closely and do a clean job of cutting over humps or through hollows.

The square tubular steel construction means a saving in weight and a lot of strength and durability in service. This is extremely important on hilly ground because it permits the tractor to climb steep grades and saves considerable gasoline expense.

Built in 3, 5, 7 and 9 unit sizes it has an easy hand lever over center rear roller lift for transporting. It is equipped with self-locking hooks so a seven unit outfit can easily be put in trailing position for transporting over bridges or other narrow places, with a maximum width of slightly over seven feet.

For golf course rough and airfields it can be furnished with 21-inch drive wheels and four blade reels, and will cut from two to three inches above the ground.

The new 1946 Universal Hitch is the best one we have ever built by a mile and a half—and you will like it.

TORO MANUFACTURING CORPORATION

MINNEAPOLIS 6, MINNESOTA

FOR LONG AND FAITHFUL SERVICE STANDARDIZE ON TORO MOWERS

Watch Drainage

(*Continued from Page* 53)

vestigation shows the sandy soil underneath to be perfectly dry. The 3 inch layer of fine soil is practically impervious to water. Attempts have been made to improve drainage and aeration conditions without removing the sod, but eventually this green must be reworked to mix the layer of fine soil into the sand or else to remove it.

On another course the owner constructed a green in a wooded corner. The soil was a heavy clay in that vicinity. This soil was used to build the green and no provisions made for drainage. Every season this green was thin and yellow. Dollar spot attacks were frequent and severe. Finally it was reworked. Tile drains were installed, backfilled with sand. Sand was added to make a coarse sandy loam topsoil. This is a good green at the present time and maintenance is much easier.

A golf course that had well-constructed greens had a series of greenkeepers who tried to economize for the club by topdressing the greens with a mixture of muck and clay loam because the club had a large area of each on the course. In time, all of the greens on this course have shown the effects of poor drainage. The last two greenkeepers have managed to recondition a couple of the worst ones which immediately reduced the care and attention needed to maintain them in good playing condition, but there are several more that need reconditioning to complete the job.

Sandy Soil Cemented

Sometimes poor drainage is found in greens constructed of apparently quite sandy soil. On a course in northern Michigan the green is composed of sandy soil in which the sand is quite fine. When this was mixed with a little organic matter and a very small percentage of clay it produced a more or less cemented condition which did not permit the free percolation of water. Tile drains at strategic spots and backfilling with coarse sandy gravelly soil cleared up this situation, where the grass was very yellow previously.

On the same course we found a green located in a position where it was being continuously saturated with seepage water from hills on two sides. Interceptor tile drains were installed and the green became healthy and easy to maintain. Previously the grass was thin and quite yellow.

I have in mind 2 other greens that present more difficult drainage problems.

These are on 2 different golf courses but the conditions are almost identical. The greens were built near water hazards. These are small ponds fed by small intermittent streams. During seasons of heavy rainfall the water table is so high that the greens become waterlogged, the grass turns yellow and begins to get very thin. I have recommended changing the position of the greens to higher locations. In one case it has not been feasible. However, this green was raised about 3 feet and is considerably improved although it is on a mucky base and will eventually settle somewhat.

Although the drainage of fairway areas is important I am not too concerned about them because I know that whenever they interfere with play the management will see to it that they are drained.

However, let no greenkeeping superintendent be guilty of placing any layer of material in a putting green either in its construction or as topdressing that will in any way interfere with the free percolation of excess water and the free movement of fresh air to the grass roots, that the greens may always be green and healthy.

Air Drainage

Air drainage as a factor in the production and maintenance of turf is not as frequently a problem as is water drainage. By air drainage is meant the free movement of atmospheric air. The places where it is most frequently encountered is in wooded corners where the prevailing winds cannot hit, and in low pockets or valleys.

The main damage to turf has been the fact that in the hot summer months conditions in an area of poor air drainage favors the growth of disease-producing fungi and are less favorable to grass. The humidity is usually high and the grass does not dry as quickly as where there is free air movement.

The problem has received some attention, but since it is not as common as some other problems no great amount of work has been done about it. The treatments consist mainly in cutting an opening through trees and shrubs towards the prevailing winds to allow the free movement of air in cases where a dense stand of trees is the contribution factor.

Large fans have been used to give air movement in pockets and low areas where there has been no way to allow nature to do it. There are many airplane propeller types of equipment which have been used for this purpose. Undoubtedly many more will be on the market in the near future.

Paper prepared for GSA meeting.

Modernize Your Course

(*Continued from Page* 47)

that we so vitally needed at that time.

I don't know what system you use to fertilize greens, but you can't do it in a few hours; at least I have never found anybody who could. If you used a soluble fertilizer, you would go out and apply it in your sprayer perhaps, or if you used a combination of materials, maybe you use some kind of fertilizer distributor.

Bag Seeder for Fertilizing

We hit on the idea of a centrifugal seeder, a small bag type, that you hang on the shoulder, such as the cyclone seeder. You put a few pounds of fertilizer in it, go across the green 2 or 3 times, whirling the crank, and your green is fertilized, but you want to go in several directions and adjust the feed on this hand distributor in such a fashion that you will perhaps go over it three times, and you can do that very easily.

I am not exaggerating when I say that one man can go out and fertilize eighteen greens in this manner in half a day. I have seen it done, and I have done it plenty of times.

It is also good to emphasize that in this type of distributor it is almost necessary to use a pellet type fertilizer. It is also a good idea to remember that this should be done after cutting rather than before. If not, some of the material will be picked up by the mower. Before you do your cutting following the fertilizer application, the material should be either pulled into the green or water applied to wash it down so it will not be taken off with the clippings.

Survey for Mechanized Upkeep

Many of the places on the golf course were mowed by hand because there were certain high spots, and if they were cut by the fairway outfit it would produce scuff and unsightly places. Therefore, they were cut by hand or some other long drawn out method. So we decided to eliminate as many of those as possible. We drove our equipment over these areas a sufficient number of times to indicate where the high spots were, and then we lowered those high spots, which opened up an entire new area to mechanized equipment.

That includes the areas around the greens and tees and many other places where we could improve the situation.

I believe the architect and anyone who constructs a trap, must bear in mind the landscape, in addition to where it fits into

the game itself. Many of them go all out on a limb, and try to depict nature in the raw, where nature isn't raw at all, so we wind up with traps that perhaps belong out in the Rocky Mountains, on seaside areas, and vice versa.

If you want to imitate Nature I see no reason why you should go to such extremes. If you should pick a stone up out of the brook you couldn't find the irregular shapes that you get in traps. Nature has worn that stone into smooth contours. If you look out at the desert or seasore, such as Long Island, you will see sand dunes with smooth regular curves that are just as natural as nature can make them. So I see no reason why we should go into so many letter S contours and shapes that make it so difficult for our equipment to get in to take care of it.

I would say that a good many of the facings of the traps that are now in turf should be reduced to such contours as can be cut with mechanized equipment.

We have a lot of traps that are built up with small grass islands, and the traps themselves are rather small. The islands can be eliminated and the small traps combined in one large trap. The steep sand facings should be reduced where the erosion is a problem and also where the sand will not stay up.

I studied that problem a little bit, and I don't think it is practical to use sand on a facing that exceeds a 30 per cent grade slope. I would prefer to keep it below that. Sand will not stay up there satisfactorily and it requires too much handling.

You can eliminate traps which have no purpose, which were used in days gone by. Fill them up. Eliminate the work that is required to keep them maintained and also which interfere with the poor player who needs every advantage that you can give him.

I was surprised to find the reason for a good many of the knolls and hammocks. In 75 per cent of the cases there was a tremendous stump under them, or a rock. If it is impractical to eliminate them by hand, use dynamite. It is not a costly operation. It can be done. Not only that, but the material that you salvage from rock can be used to excellent advantage if you have water holes.

I can illustrate that by the fact that I have done that myself, and you would be surprised how you can not only landscape around the water hole but it eliminates

those troubles that required so much labor.

Drainage is another thing that will pay dividends. Playing areas after a long rainy period are not suitable for play and you cannot get in to cut them in many instances. If your course has any income at all for green fees, imagine just what you are losing when those spaces are out of play, when those areas cannot be cut. If the drainage that you put in there will clear up those spots so play can be resumed and your equipment can get in there, naturally in time the green fees are going to pay for it.

In my place there are three or four fairways around the lake. If we had a prolonged rainy spell you couldn't play on those fairways. We have green fees and we have quite a lot of it. It was therefore to our advantage to get those fairways open to play as soon as possible, not only to satisfy the membership but also to cut down the cost of maintenance. We couldn't drain those areas because they were too low. The lake was in the way and there was no place to drain it. We were confronted with the problem, so this is the way we solved it. We dug a hole in the ground about 8 feet deep and put a concrete pit in it. We drained all the areas around that lake into this concrete pit, and then put a pump in there and pumped the water out into the lake. You would be surprised how we got those fairways in play.

Hilly spots are another item on some of our golf courses. We have treated those by landscaping, by putting in groups of trees which beautify the place and cut down the maintenance required.

Willow trees around water holes will keep the bank from falling in. One year we had 10 feet of bank fall into the lake from being undermined all along the fairway. The trees from the rifle range and the rock we salvaged from blasting have completely eliminated that and it is a beautiful hole.

You can't leave weed control programs out of the picture for reducing maintenance. If you haven't got weeds and clover in your fairways it is going to cut down the maintenance. You have to take care of weeds at some time or another. If you let them accumulate it is going to cost that much more to get rid of them.

No discussion on modernizing the golf course for efficient operation of equipment would be complete without including the facilities for keeping the equipment itself in efficient operating condition. This is just as important, if not more so, as any of the physical changes which we might make for efficient maintenance. Too many of our golf courses are inadequately equipped with shop facilities for repair, to say nothing of the comfort for the men who are employed in the shop. No matter