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Front Cover Picture

This month's cover shows Sand Injection being carried out by Cambridge Soil Services on a well-known First Division football pitch. With acknowledgements to
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Tee Shots

The British Association of Golf Course Architects had a serious discussion about the shortage of skilled greenkeepers when it met in December. The Architects see the problems especially because of that critical period between completion by the contractors and opening for play when maintenance has to be of a very high standard. Even more tricky is the period between completion by the contractors and acceptance by the client. Contractors, like everybody else, find it hard to get skilled men and, since considerable travel may be involved, their possibilities are even more limited than for a golf club.

It is clear that one fundamental difficulty lies in the organisation of golf itself. Responsibility is split between four national golf unions and a rule-making body. These five come together in a thing called CONGU which is neither a type of eel nor part of darkest Africa but a Council which apparently has no executive powers to act in the general interests of the game.

Nobody can blame the Greenkeepers Association for this situation

nor for failing to try to meet it. Ten years ago the Greenkeepers Association foreseeing the future started its Apprenticeship Scheme, the only trade in the country which trains apprentices with no help whatever from its employers.

In October, the British Golf Greenkeepers Association arranged a Turf-grass Symposium at considerable cost to itself and with the help only of two firms interested in supporting greenkeeping for its own sake. The only other conferences of this type are those (apparently rather select) organised by research bodies and weed control.

Ireland, too, is beginning to feel the pinch and there are talks going on concerning the setting up of an instructional course at an Agricultural College near Dublin.

The Department of Employment is concerned at the situation and is thinking of setting up a pilot scheme for training young men just too old for apprenticeship.

Meanwhile, golfers happily go on playing, making more courses, putting up bigger prizes and organising more matches. Instead of blasting out of the bunker, golf is burying its head still more deeply in the sand.

THAT PARIS TRIP

Although the A.G.M. was favourable, so many Sections have since expressed no interest (one in fact, positive antagonism) that we have obviously been wasting time, postage, and print.



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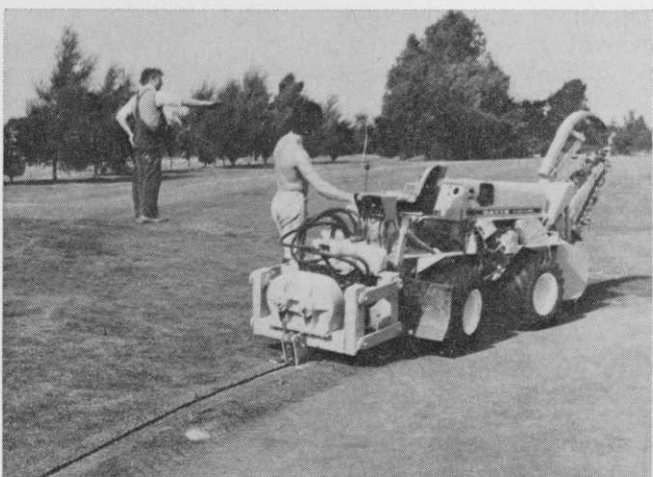
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SOIL WATER MOVEMENT

Dr. A. N. EDE

Land and Water Management

The Golf Course provides a microcosm of all the various conditions which are connected with the soil, including the principles of how water moves in the soil. On an average course you have an example of each of these conditions. When I am talking about the soil, I mean the soil profile, the soil in depth.

The Chairman has already mentioned two points that I wanted to pick on about how important it is going to be for us in the future to pay full attention to principles and I do not think we have always done so in the past. Firstly, he tells us that 500 courses are needed; 40 are being built. With the pressure on planning that there is to-day, it is inevitable that a large proportion of those courses will be on soils which are not ideal for the purpose. This is where a very thorough knowledge of how to manage those soils, how to improve the water management situation, is a vital prerequisite for a successful course as well as for a pleasant game. The second point from your introduction, Mr. Chairman, which I should like to pick on, is the question of maintenance. There is a lot of expertise available at present (some of it sitting in this hall) on how one can apply remedial action to the soil, so that the management of turf grass becomes simplified and the Greenkeeper's task facilitated. Maintenance, aeration of the fairways and greens can be improved a great deal and it is going to be essential in my view, to so simplify the task of those looking after a golf course, that they can attend to more routine duties.

The system overall must achieve better results. I shall now try and point out some of the principles.

First of all, a golf course, when you are speaking of greens and fairways, or for that matter any turfgrass, is affected in the same way as most other land in the country except we find modified water situations to our advantage. Our problem is the balance between the various quantities of water arriving at and leaving the site, the principal one of these being rainfall. It should be remembered that up to $\frac{2}{3}$ of the rainfall arriving at the surface of the ground can be lost by evaporation in the course of a season. Slightly less evaporation takes place on the Western side of Britain, but in general only $\frac{1}{3}$ of the rainfall has to be drained away.

It is rather like opening a current account in a bank. You open the account—that is the rainfall. Your wife has a cheque book and you look at the account at the end of the month and you find it has gone down. She has evaporated some of it and you don't get the benefit. The rest of it either passes into the plant system which is a vital part of the operation or passes into the ground which is a seasonal measure. It is taken into soil storage, and that storage goes on opening the top soil and the sub-soil. Later on some water may move away through seepage and work its way out of the system.

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is due to the fact that the infiltration rate which the ground is capable of withstanding is less than the arrival rate of rainfall. It is just the ratio of the two speeds. Clay soils, as you know, particularly when they have been heavily trafficked over, become less and less permeable. It is a useful thing to know that clay soils may have a permeability, (without relying on the soil structure—the cracks and crannies—or any artificial means such as sand slitting), one ten thousandth of the permeability of a well-constructed green.

This is the basic situation. You have rainfall arriving, evaporating—leaving, and some water penetrating. The question of how much depends on the soil and this is where the first stage of remedial action comes in. If you are not able to remove the water through the sub-soil naturally, and of course, many golf courses have this natural drainage in the form of chalk, then you have got to put in a drainage system. The real purpose of this is to modify the balance of the quantities of water arriving and departing and to create a new quantity. This will prevent the water table building up. This is satisfactory so long as the water can actually penetrate. There are charts to tell us how high the water table will rise above the drains in relation to the permeability of the soil and the distance between the drains.

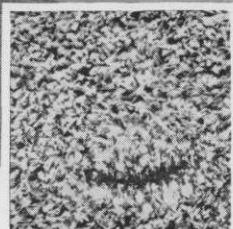
That is the first instrument of modification which is an essential one but it is not the only one that may be needed. You can get the situation where the surface of the soil requires a modification to allow water to enter quickly and so prevent considerable damage by poaching. Now the under-drainage situation with the water table is all laid down in calculations. You can modify it by putting gravel bands over the drains and so on; you can modify it by sub-soiling to improve permeability. We do not how-

ever, have a fully satisfactory method of calculation for removing water off the surface of the ground. It is not amenable at present to a proper calculation. One extreme of surface water drainage is ground covered with tarmac, like a carpark. What rate will the water have to be removed from that? There is no penetration at all, hardly any kind of evaporation. It has all got to run off by the surface and that rate is about 1" a day on average—one inch a day has to be taken off otherwise you are in serious trouble.

Now soils are not so severe situations as that, but we have got these arbitrary figures, one inch of water per day, the equivalent of one inch of rainfall coming onto the surface of the ground. Water which cannot penetrate has to be removed by surface drainage. In a peaty or sandy soil it may be a much lower figure, say 1/4" a day or even zero. But there are these arbitrary amounts which you have to cater for. Now, what has happened in more recent times is that instead of having to rely on the under-drainage with some sort of assistance to water penetration, there is now an instrument whereby one can insert vertical bands of sand at intervals through the top soil, which does enable one to achieve a new path for the water. When this rainfall arrives and you know it is not going to be evaporated off quickly enough and you don't want it hanging around, you can cut away about 3/4 or even 9/10 of that rainfall within a matter of a few seconds and you remove it from the surface of the ground. With the balance of the water totally upset, in your favour, you have then a much more favourable soil situation in which to deal with the tiny 1/8th part that is left. We have in fact got a very good basis for calculating this surface water removal operation. The sand slit itself is amenable to the same sort of calculating approach



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