

The British Golf Greenkeeper



No. 358

March 1975

15p

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The British Golf Greenkeeper

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Front Cover Picture

THIS WEED spraying outfit by Cooper Pegler & Co. Ltd., Burgess Hill, Sussex, is equipped for low volume selective work at controlled pressures with up to 6 ft. coverage. One filling can cover 1,000 square yards.

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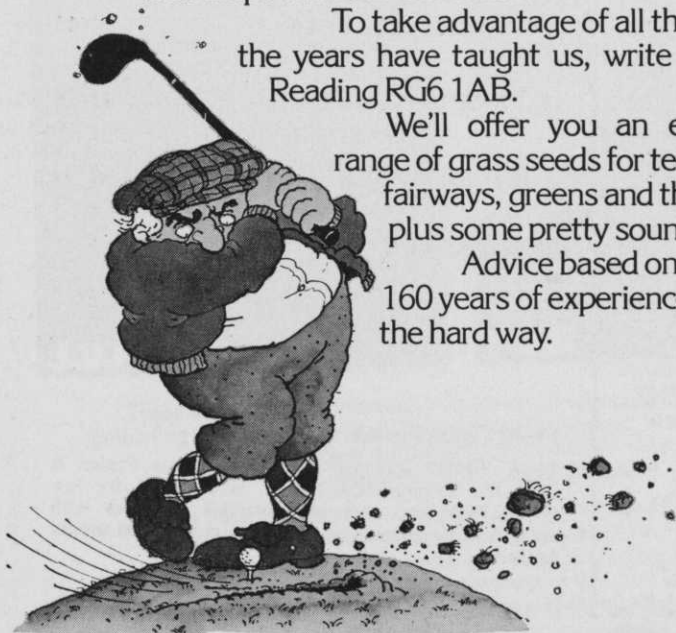
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Keeping weeds out

THE BEST way of ensuring a weed free turf is never to let the weed in. Killing weeds is not the problem it used to be, but there are such things as resistant weeds, and in any case application of weedkilling chemicals involves extra cost in labour, materials and equipment.

Some check to grass growth is likely, discolouration of the turf is possible, and real damage can be caused by accidental overdoses. And, of course, treatment may involve some interference with play.

When preparing the seed bed for a new turf area, every effort should be made to get the new turf off to a clean start by physical or chemical fallowing, using of paraquat and diquat for example, or by soil sterilisation. The last involves the use of suitable sterilants such as methyl bromide or basamid. Great care is needed in the use of these materials because of mammalian toxicity risks, and the treatment is expensive, so that in practice only greens are likely to receive it.

New turf on insufficiently cleaned land often shows a variety of broad-leaved weeds and weed grasses. Where practicable that is, on greens, weed grasses should be got out by hand as soon as they appear—there are no reliable selective grass-killers yet.

Many of the other weeds are likely to be annuals which are eliminated by mowing—one of several good reasons for ensuring regular mowing from the beginning. As to the remaining weeds, it is usually wise to avoid being over-anxious until the grass is well established. Individual large docks and the like can be hand weeded to avoid possibly detrimental use of chemicals.

Special herbicides have been developed for treatment of young turf where this becomes essential but even the use of these should be the subject of careful consideration. The main chemical concerned, ioxynil and morfamquat, are present in proprietary products which

• **J. R. ESCRITT, Director of the Sports Turf Research Institute, tackles problems of weed control on golf courses.**

must be used only in strict conformity with the instructions on the label.

Mixtures of fine grasses should be treated only when the sward is fairly well established and regular mowing has begun, but coarser mixtures based on ryegrass may be treated a little earlier, once they have achieved at least two or three expanded leaves.

Normal selective weedkillers can be used, possibly at reduced rates, when turf has become reasonably well established, at least six weeks and preferably six months after germination.

General management has a considerable influence on the composition of a sward and accepted principles of good management can go a long way to keeping out weeds including moss. Fertiliser treatment, possibly including sulphate of iron, watering, mowing, and top dressing, all affect the composition of the sward. Top dressing alone can introduce an awful lot of weeds if it is not sterilised.

One can reasonably deduce that a good defence against weed problems is a good greenkeeper!

On greens hand weeding of the odd weed is **not** outdated; it can be very convenient and prevent a real problem from arising. Regular scarification or "vertical mowing" not only prevents excess fibre formation but also adversely

[Turn to Page 7]

The 100,000 Hole Golf Course

Better aeration
means
better golf

Aeration, properly carried out, creates conditions which will produce a better sward and consequently a better playing surface. Proper aeration allows air to circulate more freely around the roots thus assisting respiration.

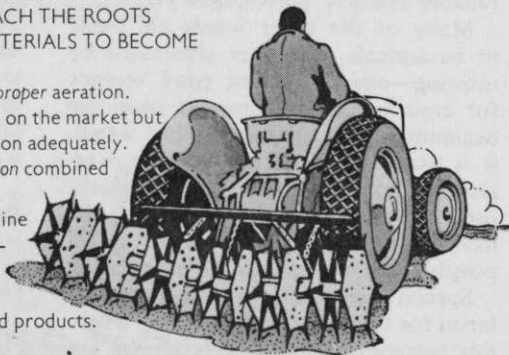
In addition it also * ENCOURAGES BACTERIAL ACTIVITY * PROMOTES A VIGOROUS ROOT GROWTH * IMPROVES SURFACE DRAINAGE * RELIEVES COMPACTION * AIDS ARTIFICIAL WATERING * ASSISTS FERTILISERS TO REACH THE ROOTS * ENABLES TOP DRESSING MATERIALS TO BECOME INTEGRATED WITH TOP SOIL.

Remember, however, it must be *proper* aeration.

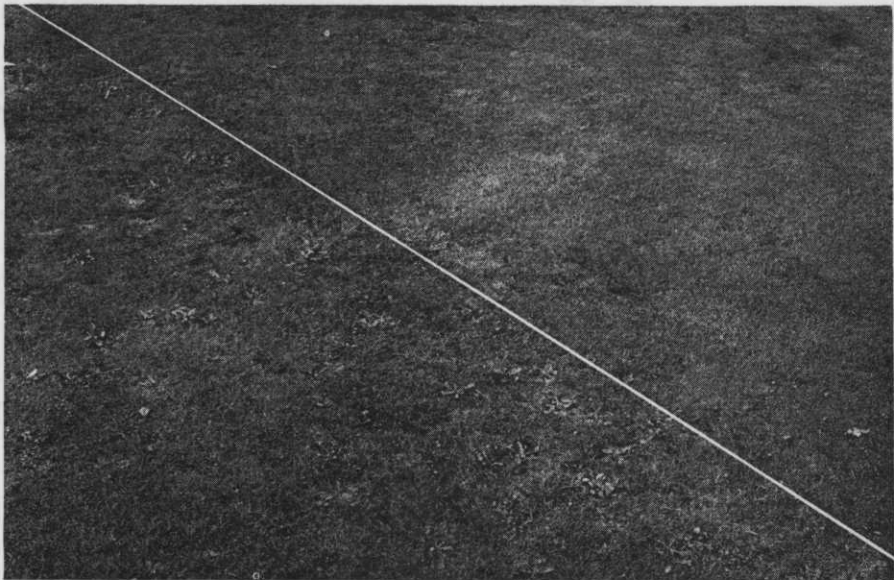
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From sowing to mowing
Parkers



TURF to the right of the line has been sprayed with selective weedkiller; that on the left is untreated.

[Weed Control from Page 5]

affects weeds such as clover and yarrow. In addition, it helps to reduced, or at any rate to restrict development, and disguise the appearance of patches of Yorkshire fog.

Nowadays killing broad-leaved weeds in established turf is a relatively simple task, but moss is a special problem, it is not eliminated by normal selective weedkillers. Management, including height of cut, plays a great part in moss control, but when there is a real moss problem mercurised moss killers suitable for the season are of great value. They are rather expensive and so are normally used only on greens.

Selective weedkillers will deal with most broad-leaved weeds. Their active ingredients are chemicals usually referred to as growth regulators, which are absorbed mainly through the leaves, but also through the roots, and act as poisons for susceptible species, upsetting normal growth processes and distorting



WHEN there are only one or two weeds on a green, this is still the best way of removing them.

growth. At first there were only two chemicals—2, 4-D and MCPA—and these were more or less competitive, covering almost the same range of weeds. Nowadays there are other chemicals available, including 2, 4, 5-T, mecoprop, dichloroprop, fenoprop, dicamba and 2, 3, 6-TBA.

[Turn to Page 9]

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[Weed Control from Page 7]

The chemicals are available as proprietary products which may contain more than one of the chemicals so as to ensure that a wide spectrum of weeds is controlled. It is obviously useful to know the names of the weeds causing trouble so as to ascertain whether they are listed on the label of the chosen product. The label should, of course, be read carefully and the instructions carefully adhered to.

Despite the excellence of the range of selective weedkillers successful results very much depend on the greenkeeper in the following ways:

FOLLOWING the instructions on the label;

CHOOSING the right product;

TREATING in the right season (usually late spring and early summer) and in the right weather conditions—fine warm weather

when the soil is moist and growth vigorous. It often helps to link weedkilling with fertilisation, applying the weedkiller about ten days after the fertiliser when growth has been accelerated.

USING the right equipment (a suitable sprayer fitted with suitable nozzles) and ensuring uniform coverage so that no weeds are missed and no grass gets a double dose.

FOLLOWING up appropriately with repeat applications when necessary.

AVOIDING accidents like allowing drift on to flower beds round the club house.

The modern greenkeeper is provided with modern weapons but he has to be rather knowledgeable to use them properly.

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The Greenkeepers

No. 1 — JOCK GLASS

This is the first in an occasional series about greenkeepers and the courses they care for.

JOCK GLASS is the Head Greenkeeper of Thorpe Hall Golf Club at Thorpe Bay in Essex. The course is a flat open one although many new trees have been planted over the past few years. The club has over 600 members and a green-keeping staff of five.

Before working at Thorpe Hall, Jock was assistant greenkeeper at Prestonfield G.C. at Edinburgh from 1921-1934, when he took up his present position, completing 40 years service with the club this year. He was chairman of the BGGGA from 1949-1951 and again in 1961-1962. In addition he was chairman of the Southern Section for many years.

The club owns a Ransomes Hahn Triplex mower with all attachments, seven Auto Certes 18 in. mowers, 2 Marquis mowers, one ride-on mower and four Hayter rotary mowers. In addition there is a crop-guard sprayer for fairways, two small sprayers for greens and a Patisson self propelled spiker.

Other equipment includes 2 Fordson tractors, one with a front loader, another with a tip up trailer, a Ransomes 5-gang Sportcutter for fairways and a Ransomes 3-gang Magna for rough. Finally the club boasts a chain saw.

For a fertiliser Jock prefers Fisons Greenkeep 1 and 2, also sulphate of ammonia and iron and hoof and horn. For a fungicide he uses May and Baker Maysan fungicide and May and Baker Dicotox Extra weed killer.

With such a large playing membership one of the biggest problems is keeping greens and tees in condition. This is achieved by applying a complete fertiliser spring and autumn, with

monthly doses of sulphate of ammonia and iron with compost during the summer. There is also a fair amount of fusarium, which is kept under control with a fungicide. Thatch is another problem and much scarifying, spiking and slitting has to be done.

Although the course is only 200 yards from the sea it is on heavy clay and in some parts below sea level, causing it to become very wet in winter.

Drainage is controlled by ditches, one of them being the main drainage ditch for roads and farmland for miles around. After heavy rain this ditch overflows and floods the course in places making playing difficult. About three years ago an automatic sluice gate was installed which helped quite a lot. With this gate the water table can be controlled in summer, which helps keep fairways green with plenty of grass.

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Deep-seated problem

by D. B. HARGREAVES

WITH ALL sports turf the outstanding problem is getting rid of excess surface moisture and this involves getting the water through the top soil and then having somewhere for it to go. The latter is usually a matter of drains or drainage layers and is not the subject of this article. There is, however, little value in a drainage system if surplus water does not reach it or reach it fast enough.

Getting rid of surplus moisture is important not only from the direct point of view of providing good playing conditions which stand a good deal of wear, but also from the indirect point of view of allowing plenty of air to get to the plant roots. Poor aeration results in lack of oxygen in the soil.

It may be caused by compaction which pushes the soil particles close together, thus reducing the volume of pores in the soil. It may also be caused by an excess of water held in the soil pores thus displacing air. Commonly both factors are involved.

For root growth there must generally be at least 10 per cent air filled pore space in the soil. Oxygen in the soil is used up by plant roots and soil organisms and must be replaced by fresh oxygen from the atmosphere above the soil. Thus barriers to the exchange of gases such as a surface cap or a water-logged top soil will result in poor aeration.

Preservation of a good soil structure helps to provide sufficient pore space, to facilitate passage of surface moisture and to maintain conditions of good aeration in the soil. Unfortunately, the use of sports turf by players and the passage of machinery necessary to maintenance readily cause damage to soil structure and induce compaction. This

leads to wet surface conditions and increased susceptibility to damage.

The effects are obviously most marked on the less sandy soils such as clays or silts. Such soils, even under the best conditions, transmit water only slowly so that they are, as a result, more easily damaged.

In agriculture, improvement of soil conditions can be achieved by ploughing up and cultivating, but obviously sports turf is meant to be a permanent "crop". Nevertheless, despite the difficulties, it is generally appreciated that some kind of top soil cultivation to give improved moisture transmitting and aeration characteristics is required for sports turf.

With demands for ever-increasing amounts of wear tolerance, the need for effective action is increased, and there is thus an ever-increasing requirement for the use of efficient aeration machinery by means of which over-compaction in the soil can be relieved (or, better still, prevented from developing) since this means stronger grass and better drainage, less mud and increased tolerance of wear.

Further, routine maintenance involving sufficient attention to this problem can greatly reduce the amount of the kind of wear which involves costly renovation at the end of a playing season.

On the majority of fine turf areas and a very large proportion of other sports turf areas such as football fields, hockey pitches, and golf fairways, routine treatment with suitable implements penetrating to about 4 in. is common practice, and the benefits have been well proved by experience.

There are, however, numerous situations on football fields etc. where deeper penetration is necessary. This is

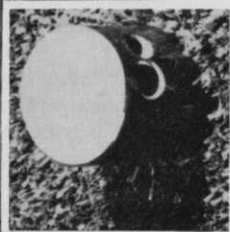
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The 18th at 5.30 am!

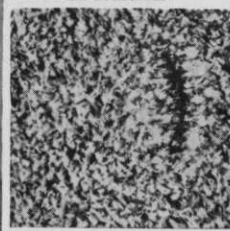
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[Deep cultivation from Page 13]

particularly so where sports turf constructed relatively recently has been sown down under conditions of inadequate cultivations. Deep aeration should not be required for well constructed new fields in the first year but unfortunately sometimes it is.

Much thought has been given to the required shape and form of tines to make the large hole necessary for deep penetration with a view to ensuring the quickest and most beneficial effects. In order to break the compacted earth to a depth, a shattering effect needs to be produced, but obviously with the minimum of surface disturbance and interference with play.

Solid or hollow tines do not produce this shattering effect because their action is to cause sideways displacement of soil into the walls of the hole produced. This is the whole effect with round solid tines and part of the effect with hollow tines.

Observations on the holes produced by flat bladed tines led to the adoption of larger flat, pointed tines capable of producing a deep shattering or cultivating effect. These tines do cause some minimal surface disturbance, especially when compaction is severe.

A chisel shaped root development

tine produces a rather less deep but uncompacted hole of large area below the surface. It is clean at the point of entry under almost all conditions and is, therefore, capable of being used in a regular maintenance programme even on areas in regular use.

The two tines referred to are shown in figures 1 and 2, together with penetration diagrams based on plaster casts of actual holes. It will be seen that these holes have a large volumetric capacity for the immediate acceptance of surface moisture or of applied top dressings. Their shattered condition encourages rapid movement of both air and water to the roots which are thus able to grow much better. Increased root development leads to improved soil structure and to increased drought resistance. Some of the principal benefits to be gained from the use of machinery to improve deep aeration of the soil can be summarised as follows:—

- Deep holes with uncompacted walls.
- Shattering of the top soil to a depth.
- Improved passage of moisture.
- Improved penetration of air and easier exchange of soil air with the atmosphere.

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Fig. 1. Deep Cultivating Tine

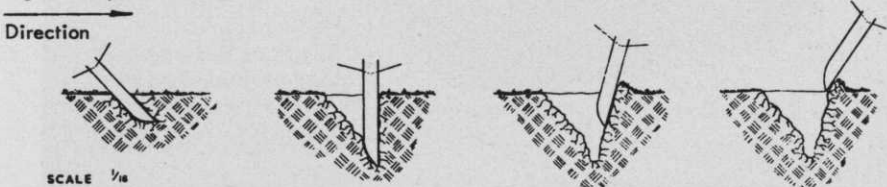
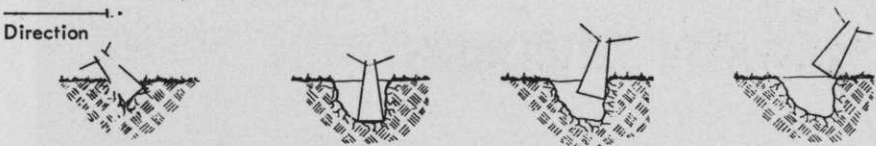


Fig. 2. Root Development Tine



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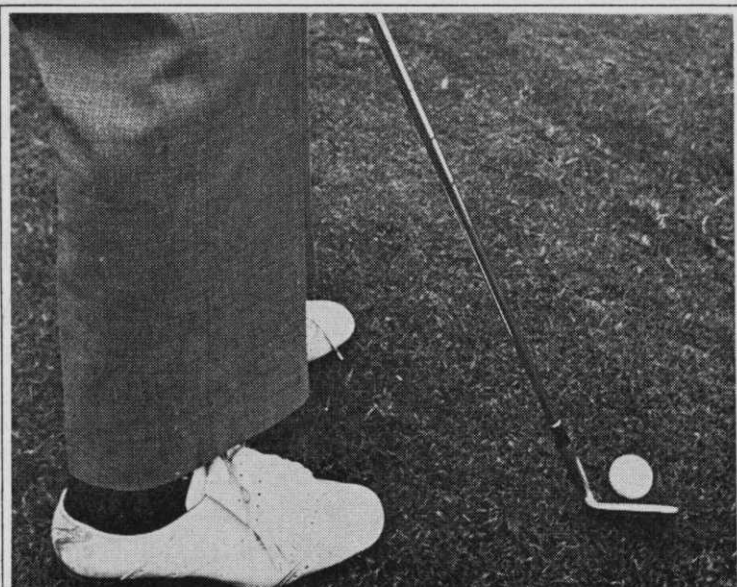
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[Deep cultivation from Page 15]

- Better root growth leading to better soil structure.
- Improved incorporation of top dressings.
- Improved drought resistance.
- Improved wear resistance and, therefore, frequently, reduced costs of maintenance and end renovation.

If adequate drainage conditions are absent there are limits to the benefits which can be obtained by these procedures. Most sites need a full drainage system, but on occasion the provision of deep sumps filled with aggregate has helped considerably.

The choice of implement for a particular application is, as usual, dependent on the tractor available, and obviously the type of tractor also affects the number and frequency of applications.

An agricultural type tractor with grassland tyres and provided with a three point hydraulic linkage is the most suitable. The linkage allows the

implements to be raised for turning with consequent reduction of adhesive loads on the driving wheels.

It is, of course, important to use the implements when surface conditions are not too wet to cause difficulties at the surface, but with the soil sufficiently moist to get adequate penetration. For this and other reasons the operation offers the greatest benefits when used on a preventative basis, and should not be undertaken only when drastic remedial measures become essential.

A particular aspect might be the relationship between what is now conventional aeration as discussed here and present work with slitting, trenching and back filling procedures. It is considered, for example, that the movement of surface water towards such supplementary drainage ways will be assisted by regular spiking.

Study of actual case histories facilitates useful practical conclusions and it is hoped that users of this equipment may have useful contributions to offer regarding their own experience.

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Trials and findings

A further report on the work of the Sports Turf Research Institute at Bingley

Some of the first trials by the Institute (in 1929) were on the subject of fertilisers and many of these were kept on as demonstration plots until 1964. The trials were on the value of various standard fertilisers with and without sulphate of iron on fine turf established from seed and on existing meadowland turf. Further differently orientated and organised trials on similar materials were initiated in 1937, 1939 and 1948. The general picture that emerged was:—

- (a) Turf needs a balanced fertiliser with nitrogen the most important plant food, phosphate second and potash third.
- (b) Sulphate of ammonia is a very good nitrogenous fertiliser for turf, having a marked effect in

keeping down disease, worms and weeds including annual meadow-grass and in producing a firm playing surface but long continued exclusive use leads to poor rooting, fibre formation and lack of drought resistance.

Organic nitrogen fertilisers help drought resistance but continued exclusive use leads to a soft, easily damaged turf prone to weed and worm invasion and susceptible to Fusarium patch disease. Alkaline type fertilisers encourage weeds, worms and disease, especially if used regularly.

- (c) A suitable fertiliser for fine turf

[Turn to Page 22]



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RANSOMES



Ransomes-Hahn Tournament Triplex



Trials and findings

[From Page 19]

is based on a balanced mixture of organic and inorganic (but non-alkaline) fertilisers. For general sports ground turf where organic matter and re-cycling of plant foods result from return of cuttings a granular fertiliser based on inorganic is suitable.

- (d) Sulphate of iron is a useful turf conditioner but can be over-used.

From 1961 to 1968 there were trials on the important subject of slow release nitrogen fertilisers to replace and/or improve on natural organics—the materials in the first place being of the urea-formaldehyde type about which there were glowing reports from the U.S.A. Results were disappointing; about a third of the nitrogen was released very quickly and the remainder very slowly if at all, whilst the effect on turf quality was similar to that of natural organics. New investigations to find a good slow release nitrogen fertiliser were started up in 1966, using several promising materials suggested to us, but again results were disappointing. It may be that the perfect nitrogen fertiliser will never be found—but we are still searching and trials with another new slow release nitrogen product have started this year.

Top Dressing

Work on this subject started right at the beginning and articles on compost dressing and the sterilisation of it for golf greens appeared in the Journals for 1930 and 1932. Some of the results of top dressing trials, e.g. with different kinds of sand, were never reported but simply incorporated into the advisory service as has happened frequently over the years.

Trials on mowing were first carried out in 1931 and further trials on different aspects of the subject have

been carried out from time to time since—indeed in a way they are still going on because an important aspect of the present day cultivar trials is the examination of performance under different heights of cut. For fine turf it has been shown that return of cuttings whilst having some advantages, e.g. in the re-cycling of plant foods, is on balance detrimental in that it encourages weeds, worms and disease. On coarser turf practical convenience usually dictates the return of cuttings. Grasses vary in the height of cut they will tolerate—perennial ryegrass needs $\frac{3}{4}$ -1 in. while bent will stand as close as $\frac{3}{16}$ in. Close mowing does reduce root development, of course.

Scarification

Not much experimental data has been published on this subject but the importance has been clearly demonstrated in trials on fine turf and manufacturers have been influenced to produce suitable equipment.

Aeration

There have been numerous trials on aeration, some reported, some not. It has been shown that hollow tine aeration is of great advantage in reducing compaction, encouraging root growth and getting water away from the surface. It does, however, facilitate invasion by weeds and, if over-done, produces too soft a surface. Solid tine forking is less efficacious in many ways but can be carried out very frequently without apparent detriment and is particularly useful on large areas where disposal of hollow tine cores presents difficulty.

Pest Control

- (a) Early trials on materials for

[Turn to Page 33]

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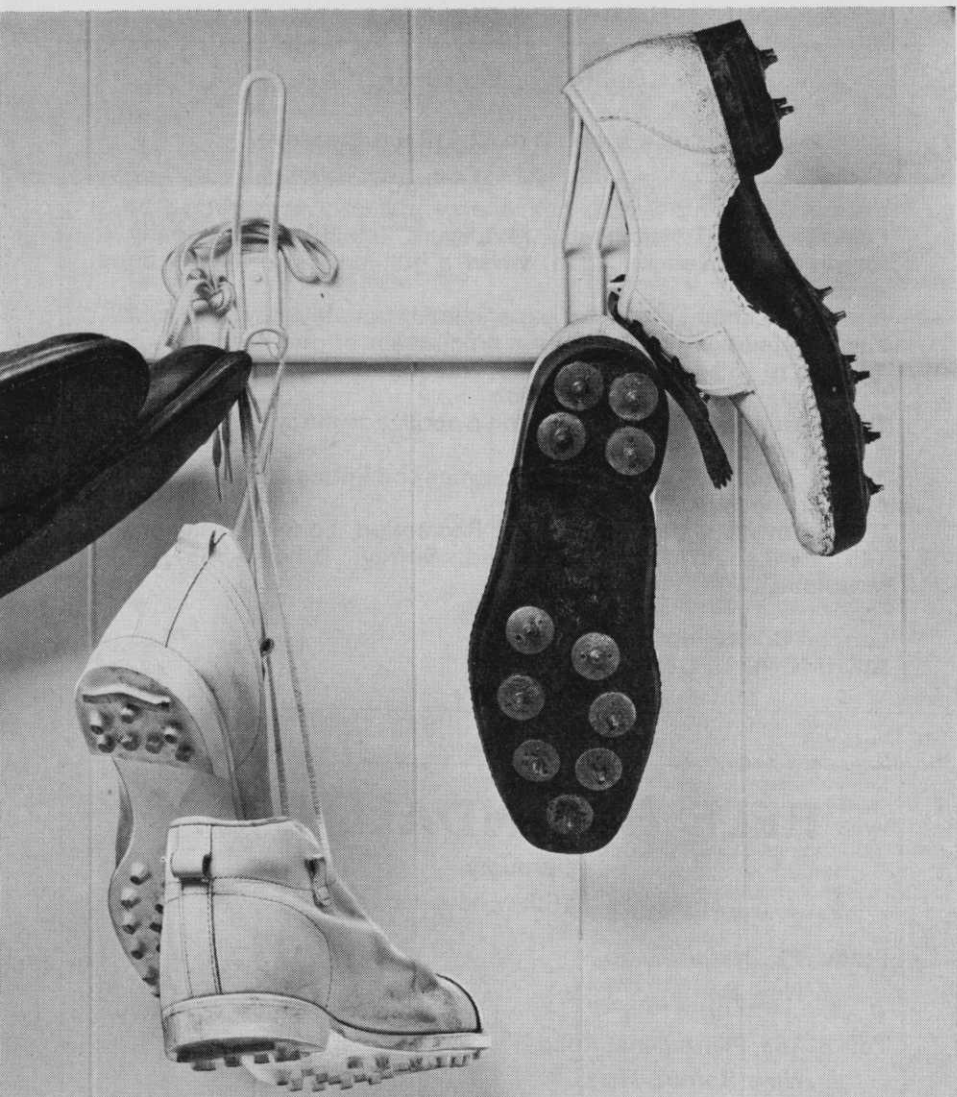
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SECTION NEWS

A nationwide round-up of news from the branches

be maintained. Surface disturbance by sand slitting and trenching machines would result in the green being out of play for a few weeks depending on the time of the year. Drawing the question time to a close, the Chairman reminded members that Colin Head would be back again in March. The meeting then closed with the raffle and a round of applause for the speakers.

A warm welcome to the following:—

B. Streeter (Flackwell Heath). A. Phipps-Jones (Welwyn Garden City). R. A. Speed (Sidcup) J. S. Philip (Links G.C. Newmarket) and D. B. Reid (of the West Herts G.C.).

The away match against the Midland Section will be on Thursday 31st July at The Finham Park Golf Club. Interested members, please contact.

There are still a large number of members behind with their 1974-75 subscriptions. Last reminders have been sent out to all and if remittances have not been received by 30th April it will be presumed that they wish their membership with the Association to be terminated and their names will be erased from the mailing list.

Southern Section

Chairman:

F. W. FORD
(South Herts.)

Hon. Secretary:

F. W. FORD
68 Salcombe Gardens,
Mill Hill, London, NW7
Tel: 959 2847

THE Spring Tournament will be held on Wednesday 14th May, at the South Herts Golf Club, Totteridge Lane, N.20. There are no entry forms. Members to write in to me stating in BLOCK LETTERS name, club and h'cap. New members and members who have not previously played in a Section 36 hole Medal will play off scratch in the First Year Competition and must include with their entries three cards signed by their club or Artisan Secretary. Closing Date Monday, 28th April and entries will be accepted from paid up members only.

The January talk by Colin Head of Chipman Ltd. entitled "New Techniques in Turf Drainage" attracted over 40 Members. The highlight of the talk for me anyway, was the new technique in installing a complete drainage system in a golf green in conjunction with sand slitting without removing the top. Sand injected slits 12" apart above a drainage system 22" deep could be a great rejuvenating possibility for some of my water-logged Greens!, providing a porous top to the slits and communication between the slits and drains can

Midlands Section

Vice Chairman:

V. W. SMITH

Hon. Secretary:

A. KITE
5 Lullington Close,
Sutton Coldfield,
West Midlands.

THE Spring Tournament will be held at the Beau Desert Golf Club, Hazel Slade, Cannock, Staffs, on Tuesday, May 13, by kind permission of the captain and directors of the club. The closing date for this event is April 20th. I would like once again to remind

you that failure to contact me personally will result in you being excluded from this Tournament. It is important that members assemble no later than 9.30 am for this event.

A forum was held at the Edgbaston Golf Club on January 7. The panel was made up from P. Wyatt, R. Parker, R. Pilsbury, D. Morgan, V. W. Smith and A. Kite. Among the questions debated were:

The rapid price increases of fertilisers for use on golf courses;

The possible use of reclaimed soil and lime from factory plants that process sugar beet;

Whether or not the cost or need does warrant the use of motorised bunker rakes and drag mats on British courses;

Are there any plans among the firms making renovation plant to produce a machine to hollow tine deeper on fine sports turf?

Are the committee and officers of the BGGGA doing enough to improve the standing of the members of the association?

The questions put forward helped to make a lively and interesting forum with most members present airing their views. Mr. V. W. Smith, Chairman, thanked the Edgbaston G.C. for the use of their amenities and the panel and members for turning out and making the forum worthwhile.

North-West Section

Chairman:

E. WALSH
46 Peasley Close,
Longbarn, Padgate,
Warrington.

Hon. Secretary:

H. M. WALSH
34 Kingsfold Close,
Brightmet,
Bolton, Lancs.

SINCERE THANKS to Mr. P. Wyatt of Patissons Ltd. and Mr. K. Vertigan of Sisis Ltd. for the very interesting talks given and films shown when they met our members during December and January. And for the refreshments provided, thank you gentlemen. Thank you also, members, for coming to these talks, the speakers

appreciate your support.

The March talk will be given by F. E. Boyd of Twyfords Seeds Ltd. on Monday, March 3, 7.30 p.m.' Swinton Park Golf Club.

Teeing off times for Sisis Tournament, details of which were given in the December issue, start at 1 p.m. Please arrive in good time to help things run smoothly.

The Spring Tournament will be played over the Royal Lytham and St. Annes Golf Club's course on Monday May 5, 1975, over 27 holes, start first tee 9 am.

A competition for members' guests will also be played over 18 holes. Please let me have your entries and meal requirements as early as possible this is important.

The AGM will take place in the evening when I hope the majority of those taking part in the tournament will attend.

We welcome the following new members and hope their association with us will be a happy one. S. W. Garner, Wilmslow Golf Club, Mobberley, Cheshire; R. J. Barnes, Stockport Golf Club, Offerton, Stockport.

The treasurer informs me that some members have forgotten to pay their subscriptions for 1974-75. Would members please do their best and make Bob happy.

East Midland Section

President:

R. BAILEY
147 Mere Road,
Wigston Magna,
Leics.

Hon. Secretary:

S. FRETTER
4 Queens Drive,
Leicester Forest East,
Leics.

THE ANNUAL dinner—dance was held at the Shakespeare Inn, Braunstone Lane, Leicester on Saturday November 16. There was a very good attendance. Our guests were Mr. and Mrs. Eric James of Poole, Dorset.

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East Midland Section [From Page 29]

Mr. Alan Thornton, retiring treasurer, was presented with the knock out cup, and Mr. R. Willars with the runners-up prize. Also Mr. D. Jack received a cup presented by Toro Ltd. and tea service for the best score in the Spring and Autumn Tournaments.

The annual Spring Tournament is being held at Spalding Golf Club on Wednesday May 14. Please let me know by May 1 if you will be playing and require a meal.

We would like to wish Mr. G. Darby all the best in his new job as Head Greenkeeper in the South of England. It is with regret that we see him leave this section.

Mr. A. Thornton writes: "To all members of the East Midlands Section. I would like to say many thanks for the barometer presented to me at the dinner-dance, and wish Mr. P. McCarron all the very best as the new treasurer."

North East Section

President:

C. N. STOREY
11 Holywell Avenue,
Whitley Bay,
Northumberland.

Hon. Secretary:

G. JEFFERIES
55 Brackenfield Road,
Framwell Gate Moor,
Durham.

THE Spring Competition will be held on the Eaglescliffe golf course, Co. Durham, on Thursday April 24th, by kind permission of their captain and

committee.

This will be an 18-hole event starting at about 1 pm. There are still some subscriptions outstanding; please let me have them before this competition.

Diary Dates

- Mar. 4 South Coast Section Lecture — Huxleys, New Alresford, 7 p.m.
- 5 Southern Section—Whitbreads, 6.30 p.m.
- May 14 Southern Section Spring Tournament — South Herts G.C.
- June 11 Southern Section, Annual General Meeting—West Essex G.C.
- July 31 Southern Section, Midlands v Southern Match —Finham Park G.C.

Midland Section

- Aug. The B.G.G.A. Annual Tournament 11-13—ment will be held on Walsall G.C.
- July 31—Annual match between Midland and Southern Sections, Coventry G.C. Finham Park, assemble 9 a.m.
- Mar. 21—Annual Dinner, Southern Section, Walton Heath.

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Trials and findings

[From Page 22]

leatherjacket control resulted in the production of a preparation which became known as St. Ives leatherjacket exterminator. Later trials showed the value of lead arsenate and, immediately post-war, successful trials with D.D.T. and B.H.C. were reported.

- (b) Earthworms have their pros and cons but it is generally accepted that on balance they are not advantageous. There have been successful trials with mowrah meal, derris, potassium permanganate, calcium and lead arsenate, chlordane and more recently sevin (carbaryl), the latter being of low mammalian toxicity but not long lasting. Arising out of investigations at the Institute and using the Institute's turf plots. Peter Jefferson, who transferred to Nottingham University, carried out research into the various species of earthworm found in turf under different conditions of pH etc.

Weed Control and Grass Growth Control

Trial materials have ranged from lawn sands to selective weedkillers of various types—more recently to selectives suitable for new turf.

Moss control has received a great deal of attention, emphasis being laid on management. Lawn sands containing sulphate of iron and/or mercurous chloride have been fully tested and trials with newer chemicals are in progress.

Annual meadow-grass is something we could do without but despite numerous field trials a really good solution has not yet been found. A very good base for annual meadow-grass work was provided by a research student from the U.S.A. Victor Gibeault, who did a year's

research with us in 1965/66, his salary being covered by a special grant from Messrs. Fisons. We are still actively engaged on the problem, a solution to which is being sought by many people in other countries. There seems to be more hope of a solution being found for eliminating annual meadow grass from seed beds than there is for dealing with it in existing turf.

Keeping swards tidy without mowing has also received attention, numerous trials having been carried out. The most promising product has been maleic hydrazide—which proved only a qualified success. It is, however, commercially available and used to some extent on turf where quality and appearance standards are not too high.

Disease Identification and Control

This is a field that has received attention from the Institute practically continuously. Excellent work by J. Drew Smith and Noel Jackson culminated in the useful book "Fungal Diseases of Turf". Not only has the Institute carried out numerous trials on control of the common turf diseases but it has also been instrumental in identifying diseases not previously reported or identified on turf in Britain, e.g., *Ophiobolus graminis* on *Agrostis* and *Poa* turf (1952), *Helminthosporium sativum* on perennial ryegrass (1953), *Colletotrichum* on annual meadow-grass (1954). At the present time there is a good range of fungicides available, most of which have been tested at Bingley. New materials are tested as conditions allow.

Soil Physics and Related Subjects

Over the last ten years or so there has been a very large amount of research internationally (again especial-

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Trials and findings

[From Page 33]

ly in the U.S.A.) on the subject of producing soil (or at any rate a satisfactory growing medium) of high hydraulic conductivity to facilitate rapid disposal of excess water and yet possessing a sufficient moisture retention capacity and suitable playing characteristics. At Bingley we have not been able to do as much research on this subject as we would have liked but the recent appointment of a soil physicist (and a laboratory assistant) is helping things along. For new golf greens and other areas we have devised laboratory tests aimed at producing satisfactory mixtures of soil, sand and peat. In the U.S.A. some people are working on a similar basis but others have abandoned soil and grow greens on carefully specified sand with a little peat added—there are even a couple of courses with greens like this in Britain.

The particle size of sands suitable for soil amelioration has attracted a

great deal of attention throughout the world. In Mr. Dawson's book "Practical Lawn Craft" he suggests that sharp sand should have at least 60% of its particles between 0.5 and 0.2 mm (avoiding coarse and fine particles). Though looking for sands with a narrow particle-size range, the Institute has tended to look to somewhat coarser sands having in mind availability of suitable sands and to avoid the fines. However, although there is some divergence of opinion (the U.S.G.A. supports 1.0—0.5 mm as the most important range) it now seems to be generally held that there should be even greater concentration on the 0.5—0.2 mm particle size. Important research at Aberystwyth and new work at Bingley, as far as we have gone, supports this view.

The relatively new technique of mechanical and slitting (related to the old French draining and to a common practice of practical men, making sand slits with a spade) was first used in this country at Bingley's suggestion at Twickenham in 1966, when sand was fed into a slit made by a modified sub-soiler. The operation was very successful and similar operations have been carried out at quite a number of places. Various contractors have produced their own equipment so that in recent years some kind of "research" has been taking place all the time.

More on the work at Bingley in future issues of the Greenkeeper.

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