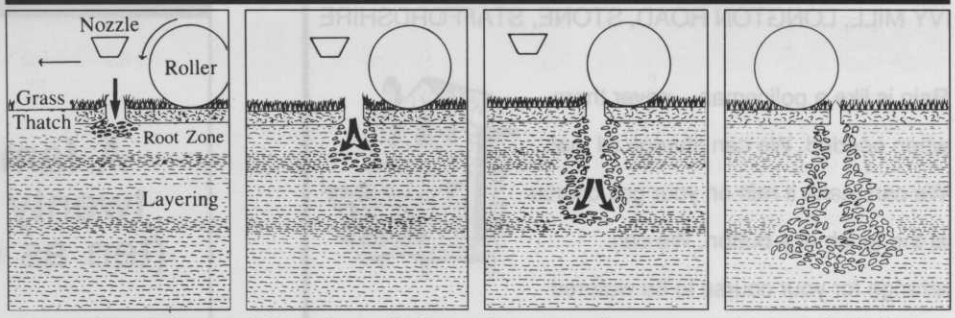
Shot in the dark

How water-injection cultivation works



1. Bursts of energized water are shot down into target zone, penetrating turfgrass and thatch. (Light arrows indicate direction of equipment and roller travel.)

2. Force of energy begins to spread below surface, loosening surrounding soil and helping to break up any layering.

3. Impact continues to spread outward as burst travels deeper. Roller begins to smooth minor turf and thatch disruption resulting from burst's initial impact.

4. At target depth of 4-8 inches (using standard nozzles), remaining energy dissipates when soil resistance attenuates further impact. Roller completes smoothing.

Heralding Water Injection Cultivation, a technical breakthrough

A major problem in golf course management until now has centred on the need to find the right balance between maintaining quality and flexibility of greens and the pressure to keep putting surfaces playable. This problem has been compounded by the fact that since traditional core aeration is stressful to the turf, it can usually only be applied in spring and autumn when recovery is most rapid.

A new technique developed by Toro now offers all the advantages of conventional methods – without the drawbacks. Known as water-injection cultivation (WIC), it offers less stressful and more effective cultivation, thereby ensuring greater flexibility in turf management.

The main complaint about core aeration is the disruption it causes to the putting surface. Player complaints and green committee pressure have often forced many Clubs to cut back or eliminate aeration, with an inevitable negative impact on the quality of such greens. Even when aeration is carried out, the benefits can disappear long before the procedure can be repeated. Recent University research in the USA has shown that the effects of spring hollow-core tining are almost gone by August.

Unlike conventional methods, water-injection cultivation does NOT disrupt the putting surface. Entry holes, in fact, are almost invisible shortly after treatment. As a result, aeration programmes can be continued and expanded.

The benefits of what happens below the surface are equally significant. Water injection cultivation penetrates twice as deep as hollow-tine techniques. This offers two major advantages. One is the potential for increased root penetration resulting in a stronger plant. The second is the penetration of the compaction pan that may develop as the result of repeated cultivation to a uniform depth.

It should be noted that water-injection cultivation is not designed to replace conventional core aeration, since coring

is still the best method for incorporating sand into the green profile as well as for thatch management. Where water injection cultivation scores so impressively is in enabling aeration programmes to be maintained when conventional methods are not feasible or desirable. The long-term benefits can be measured in terms of improved soil structures, healthier greens and fewer disease problems – with a subsequent reduction in the need for fungicide applications.

The equipment needed for water-injection cultivation is the Toro HydroJect 3000, which incorporates a pump; an accumulator; a single valve and set of nozzles. Once the unit is filled with water (it uses approximately 150 gallons to aerate a 7000 square foot green), the positive displacement pump maintains a constant 5000 psi water pressure on the system accumulator, which acts like a capacitor in an electrical circuit. Output from the accumulator is controlled by a valve which, when opened, releases water to the nozzles in short cycles of a few milliseconds. On reaching the nozzles the water is pulsed at a very high velocity numerous times a second, enabling it to penetrate from four to eight inches into the soil with a single shot. The unit is actually capable of penetrating the soil up to 20 inches or deeper with repeated shots.

The Toro HydroJect 3000, seen here in action at Westurf '91, deploys two additional swing-up wheels for transportation

As the pulse of water enters the ground, its action is similar to that of a bullet. The entry point on the surface is about 1/8 inch in diameter and horizontal dissipation takes place deep into the soil below; where adjacent layers of soil are shattered by the pressure of the water – the system does not rely on physical impact, abrasion or erosion of the soil.

Considerable engineering problems – to ensure high performance, reliability and safe operation – had to be overcome in building the HydroJect 3000. All connections, for example, are hard-coupled throughout and extensive use is made of stainless steel and other corrosion-resistant materials.

Exhaustive tests of the system have been conducted during a three-year research project at Michigan State University. This provided conclusive proof that plots undergoing water-injection cultivation had a more uniform turfgrass quality than plots which did not receive this treatment. Compared to both hollow-tine cultivation and non-cultivation, plant growth also improved – in the case of hollow-tine cultivation, the difference was probably due to the loss of crown tissue.

The research demonstrated water-injection's potential for encouraging deep rooting, which should increase the stress tolerance of turf. Soil physical properties were improved compared to non-cultivated plots and were similar or superior to the traditional vertical hollow-tine method. Using water injection, soil was cultivated deeper in the soil profile compared to hollow-tine cultivation and soil strength measurements showed that it was effective to a depth of four inches – hollow-tine cultivation was effective to only two inches.

Data showed that with time and continued traffic there was a need to retreat the soil eventually – whichever method was used. However, with the disruptive and injurious nature of hollow-tine cultivation, it is imprac- ➡ 32

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tical to consider this on a frequent basis. Since water-injection cultivation appeared to be the aggressive cultivator, yet caused significantly less damage, it can be used on a more frequent basis to manage compaction-prone soils. The shape of the channel created by water-injection cultivation varied with soil texture and strength. A long, slender channel is created in soils of low strength, while soils of higher strength have a reduced channel depth although the channel will have a larger diameter at its lower end.

Jim Murphy, leader of the research project, concluded that water-injection cultivation was much more effective than non-cultivation in improving soil physical conditions, such as bulk density, aeration porosity and saturated conductivity. Compared to hollow-tine cultivation, it ensured greater depths and, consequently, management of a larger soil volume. This offers the facility to break through and disrupt subsurface layers – like a cultivation pan – which inhibit water and gas movement as well as deep root growth. And since all this can be achieved with less turf damage than is possible with vertical operating hollow-tine cultivation, it is a more feasible method for frequent cultivation of compaction-prone soils – including before or during conditions considered too stressful for other methods.

● For further details and an address to write for full technical data, see back cover.

Presenting the case for water, water everywhere

From the increasing pre-occupation of greenkeepers, course developers and pundits generally with the subject of water, golf could perhaps light-heartedly be classed as almost an aquatic sport.

Certainly a drought can change the whole playing complexion, whilst at the same time being responsible for serious turf deterioration. Yet a high proportion of courses in the UK lack any adequate water storage, though drought conditions continue, with last year's rainfall being the lowest since 1976. It is understood that a licence application may well fail if water storage is not provided. Indeed, abstraction of water may be prohibited for periods as much as three months.

The National Rivers Authority therefore encourages on-course storage. The average use of water on a course for greens and tees is some 20,000 gallons per day, say four million gallons over seven months. Virtually no rain at all would mean relying on finding something like five million gallons.

The cost of abstracting water from borehole or stream is given in pounds per million gallons:

	WINTER	SUMMER
Wessex	17.73	53.19
South-West	29.52	39.36
Southern	59.46	336.96

Cost of abstracting water from main supply = £2350 per million gallons.

Water storage, now of increasing importance in course irrigation, fits neatly into the operations of OCMIS Irrigation, the Martock, Somerset based company who have enjoyed considerable success as irrigation specialists in agriculture and fineturf.

Their infrastructure includes expert consultation and design and in keeping with their policy of keeping abreast with the latest developments they monitor and study the subject world-wide.

An immediate plus is their close affinity with the water companies, which at first might appear routine enough, but in reality means a saving of several days of reconnaissance and consultation, mapping out the nearest boreholes etc. and having access to records. Liaison with the electricity companies is equally well advanced in facilitating sources of single-phase power where three-phase is not available.

The use of attractively landscaped lakes as storage is one possibility where there is enough water available for topping-up purposes, another being the use of special irrigation tanks.

Such tanks need to be well sited, either above or below ground level.

It is in this respect that OCMIS have achieved great success in agriculture and are on course to repeat this in golf, where almost a month's supply of water can be easily stored on or adjacent to the course.

Joint Committee sets out to improve the lot of the greenkeeping profession

The great cause begins

by ERIC SHIEL

The R and A creation of the Joint Golf Course Committee is a major boost to the well being and future of the greenkeeping profession. With the formation of this committee the R and A have extended their horizons beyond the playing of the game into concern for the surface upon which the game is played.

The message to greenkeepers is that help is coming to them in a way that could not have been imagined as little as five years ago. But for the intervention of a green committee chairman, the much acclaimed discussion document 'The Way Forward' might never have seen the light of day. Thanks also to the ghost of Old Tom Morris or someone of that ilk, Eddie Park took his duties at Lindrick Golf Club seriously. Devoted to the teachings of Jim Arthur, then Championship Agronomist to the R and A, Park saw his problems as endemic to the game. As the Lindrick course gradually gained its self respect, so the great cause began.

Armed with this experience and knowing the extent of the problems by personal visits to the many Clubs around the British Isles, Eddie Park approached the Home Unions for their support. With little prompting they readily agreed and the R and A gladly pitched in.

Number one priority for this Joint Committee is to find ways to improve the lot of the greenkeeping fraternity. This will be by way of enhancing educational opportunities, recruitment policies to encourage quality entrants into greenkeeping and provision of higher technical standards. This technical knowledge will come out of the committee's panel, which will be a gathering of the best minds specialising in the likes of agronomy, science, course design, nature conservancy, environmental issues and allied subjects. The Sports Turf Research Institute will be highly visible in these deliberations.

Greenkeepers can only benefit from these initiatives. Independent voices and influential organisations will be speaking and working on their behalf. There will be little need for greenkeepers to blow their own trumpets. The policy shapers for the future of golf courses in Britain and Ireland will be Tim Taylor, R and A; Peter Wilson, English Golf Union; Gerry O'Brien, Golfing Union of Ireland; Lindsay Stewart, Scottish Golf Union; and John Vaughan Evans representing the Welsh Golfing Union. The ultimate philosophy is that greenkeepers deserve more attention and support, not to forget consideration. Club members will have to understand that if they want good looking courses, playable 12 months a year with no temporary greens (barring Mother Nature) and no mats on tees, they will have to start backing the greenkeeper like never before. Everything to do with providing all golfers with the best possible playing conditions at the most reasonable cost on traditional British courses will be addressed by the Joint Golf Course Committee. BIGGA will play a major role. Keep a watchful eye in Greenkeeper International for further reports.

● Eric Shiel, the Executive Director of the Joint Golf Course Committee, is a native of Carnoustie recently returned from America, where for nine years he was with the USGA Green Section in charge of regional affairs and public golf: in his own words – 'taking golf to the people'.