FERTILIZERS ON FINE TURF
Facts *Not* Fiction

By P. Hayes, Ph.D, NDA, C.Biol, F.Inst.Hort. and J.H. Arthur, B.Sc.(Agric.)

TOO many misleading statements are being made about the use of fertilizers on fine turf and especially suggestions that there is no agreement by scientists on what fine turf requires. This is partly caused by the different demands on different grasses and what applies to golf greens does not apply to football pitches.

Some of this controversy is being created by those seeking to increase the sale of fertilizers, who are (rightly, from their viewpoint) concerned about the very low turnover on fertilizer sales made to golf courses and who deny all the evidence available about the harmful results on the quality of the turf by excessive use of the wrong type of fertilizer.

It must be clearly understood that we are concerned in golf greenkeeping primarily with two fine turf species *Agrostis* and *Festuca* and 'all the rest are weeds.'

An incontrovertible fact is that the fertilizer usage of those golf clubs with courses in the best order is very, very small – generally little more than £250 per annum per 18 holes and often less. This is borne out by recent checks and is further supported by the fact that the percentage sales of fertilizers in relation to other products by the leading suppliers to golf greenkeeping is little more than ten per cent of their turnover.

Confusion is a bad basis for any sales campaign and any forecast based on a combination of wild exaggerations of the number of golf *courses* in the UK (there are many more *clubs* than courses) and pious hopes that fertilizer sales can be boosted to levels that were used last year on one particular venue, fail to take into account that such gross over-use leaves a legacy of annual meadow-grass dominance and of resultant and almost uncontrollable disease and, looking to the future, excessive thatch production.

One fact beyond debate is that annual meadow-grass (*Poa annua*) is the cause of most problems in greenkeeping. Whether its dominance is avoidable or preventable, may be more subject to debate (though many good greenkeepers can claim to have this pernicious and ubiquitous weed under control).

What is unarguable is that this variable, but basically short-lived species, may give good playing conditions in the few months when it is growing actively, but (as we have seen all too often in the poor growing conditions this spring, with a very delayed start to growth) it is quite incapable of producing tolerable surfaces under 'winter' conditions – and the winter of '85/'86 extended from October to May.

Soft, thatchy, sickly, diseased, uneven, foot-printed, slow, soggy putting surfaces, suffering from wear and winter die back, are succeeded by prolific seeding and drought and wear susceptibility. Panic remedial measures all too often merely aggravate the problem.

The link between *Poa annua* invasion or dominance and the application of phosphatic and potassic fertilizers has been reported for at least 65 years and known for many years before that.

The following two quotes are taken from literature:

'Annual bluegrass (*Poa annua*) invasion was favoured by P and K fertilization and the effect of one was enhanced by the other.' (D.V. Waddington, T.R. Turner, J.M. Duich and E.L. Moberg 1978).

'Phosphorus applications significantly increased *Poa annua* in all plots. Phosphorus interacted with nitrogen by increasing *Poa annua* populations at all N levels, although intermediate levels of N in all combinations with P caused greater increases in *Poa annua* than plots without P.' (R.L. Goss, S.E. Brauen and S.P. Orton 1975).

A bibliography is given at the end of this article *(see page 15)*.

One incontrovertible elementary principle, on which the whole of the science and practice of greenkeeping is based, is that the vegetative cover of any area in the temperate zones of the world is governed by two factors. One is the soil itself, its physical and chemical characteristics. The second is the management, both natural – e.g. rainfall – and applied, to which that soil is subjected.

If those natural conditions that occur where fine turf dominates are altered, the grass type alters rapidly in response. Such alteration can be very varied from the effects of traffic to the application of fertilizers.

The basic tenet of greenkeeping, which is beyond argument, is that if those conditions that are found wherever fine turf is the dominant vegetative cover are copied, then fine turf will dominate. The basic factors that are the only ones common to such widely varying ecological environments as acid moorland and alkaline limestone heath and downland; tidally flooded salt marshes and arid sandy links; thin acid sandy heathland and heavy clay parkland, in all of which *Agrostis* and *Festuca rubra* form the largest part of the turf cover, are very low soil fertility, particularly in regard to basic nutrients, such as phosphate and potash, coupled with no impediment to deep root development (in other words, free draining and uncompacted soils).

The same fine grasses grow just as well on acid as alkaline soils, on all soil types from sand to clay and over a wide range of soil moisture contents, provided soils are well aerated, drained and *low* in phosphate and potash.

Alter those conditions – for example, by compaction in a track across fine fescue links turf, or increasing fertility, with rabbit scalds as well as NPK fertilizers, and in comes *Poa annua*, which can only be kept out by the more desirable perennial finer textured grasses if 'fertility' is kept very low. This simple logic does not seem to be within the powers of understanding of those involved in selling fertilizers.

It is fully accepted that the actual minimal levels of phosphate and potash have not yet been fully assessed. What is beyond argument is that by far the bulk of golf greens (and fairways) in the UK show far too high phosphate and potash levels and over many years there has been no known reported case of fine turf being damaged by deficiencies of these elements.

Investigations in 1982 at Bingley (reference the *Journal Of The Sports Turf Research Institute*, volume 61, pages 136-140) of soil sample analysis results from 1,800 golf greens showed that, even by agricultural ratings, virtually all soils were far too high in phosphate and potash levels. Less than five per cent showed phosphate levels lower than 60 ppm and there is considerable corroboration from analysis of good-quality golf greens that a figure as low as 30 ppm is *more* than adequate.

No less than 27 per cent of all results showed figures for phosphate in excess of 330 ppm. Similar figures were obtained with potash and the picture with bowling greens was even more exaggerated. Similar data has been produced in West Germany.

There is no argument about nitrogen being essential, but some disagreement, perhaps, regarding the amounts required, though all would agree on the value of slow-release sources.

This link between high phosphate and potash levels and *Poa annua* dominance has been known all this century, yet fertilizer manufacturers have turned a Nelsonian eye to published research. From the earliest days, even before the First World War, Dr C.M. Murray, working in the winter rainfall areas of South Africa, had observed and reported on this link.

Norman Hackett, whose crusade in the early 'twenties against the agricultural influences that have bedevilled greenkeeping all this century finally resulted in the establishment of the Research Station in 1929, then the Board of Greenkeeping Research and, since 1951, the Sports Turf Research Institute – backed then, as now, by the Royal and Ancient Golf Club of St Andrews – wrote hundreds of reports to golf clubs condemning the use of phosphate and potash, advising the use of nitrogen only.

Much corroborative evidence of the increase of *Poa annua* in relation to phosphatic and potassic fertilizer applications was available from the trial plots at Bingley, started in 1929. Published in 1975, an eight-year research programme at Washington State University, (Goss, Brauen and Orton) proved that combinations of phosphate at all nitrogen levels increased *Poa annua* in bent grass putting green turf and, incidentally, that high sulphur levels reduced *Poa annua*

Acid theory

This is the basis of the old acid theory based on sulphate of ammonia and iron, which came into disrepute in the 1930s due to over-enthusiastic applications without correcting associated aeration and irrigation problems. Acidification locks up available phosphates and it is this that reduces the *Poa annua*.

Conversely, we can deduce from US research into the management of *Poa annua* turf (USGA report on *Poa annua* management: Michigan State University Agricultural Experiment Station report number 352 April 1978) that the cultural programme to support a healthy *Poa annua* turf must be based on moderately high levels of soil phosphorus and especially high potash.

Botanical analyses published in the *Journal Of The Sports Turf Research Institute*, volume 57, pages 41-48 show severely decreasing *Agrostis* and *Festuca rubra* percentages in the composition of fine turf swards with increasing applications of phosphate and potash (see figures 1 and 2).

It must be clearly understood that all these comments are made in relation to golf greenkeeping and not to sports turf based on, for example, perennial ryegrass and to normal (not 'sandy only') greens construction.

Space must be devoted briefly to contentions that trace elements play an important role in fine turf management. Whether this is true or not, it is certain that supplies of such micronutrients do not need to be supplied in fertilizer form.

It is very debatable whether any golf greens have ever shown any manurial deficiency of macro, let alone micronutrients, as most micronutrients are supplied in conventional fine turf fertilizers, such as dried blood and hoof and horn, and/or top dressing, though they certainly have been starved of air and light and, less commonly, of water (though by far the biggest problem with irrigation was in excessive applications).

It could be claimed that fine turf owes its existence to toxic chemicals! In 1980, H.W. Woolhouse wrote: 'It may seem a trifle odd to suggest that some of the finest scenery in Western Europe owes its existence to metal toxicity, but it is a fact that much of our heath and moorland exists on soils where the concentration of pure aluminium would be toxic to crop plants.'

Most of our best golf courses were laid out on land so basically infertile that it could not be used agriculturally and, yet, many farmers and agricultural advisers have spent all their energies trying to destroy such 'infertile' conditions – and where they have succeeded, they have also destroyed those very grasses that make our best courses. It is no accident that annual meadow-grass is greenkeeping's worst enemy and the most difficult weedgrass to control.

There is a vast library of statements by noted scientists, agronomists and enthusiastic observers all this century, including such names as Professor Sir George Stapledon of pre-war Aberystwyth grassland research fame, who have contended that good agricultural grassland husbandry and sound greenkeeping are diametrically opposed in aims and, therefore, methods.

'Ask a farmer – or agricultural adviser – what to do and then go and do exactly the opposite' is a saying that goes back to the 1920s. In fact, greenkeeping has

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been bedevilled by the influence of farmers and advisers who, stimulated by the need for increased production during two world wars, found out how to increase grass (and crop) yields by liming and the use of NPK fertilisers and promptly, and wrongly, applied the same principles to greenkeeping, automatically destroying the very grasses that made good turf for golf.

Always remember we are not looking for a crop of silage or hay, but a fine textured sward giving tight lies. It was the inability of most greenkeepers to control agricultural influences by imposing their own knowledge and skills on well-meaning amateurs and vested trade interest pointed firmly in the wrong direction that caused the cyclic disasters and recoveries that have bedevilled greenkeeping all this century.

Today, better education and the rise of a highly professional body of men at the top of the greenkeeping profession, backed by the crowd of skilled and trained young men thrusting up from below, gives us hope that, at last, greenkeeping will be controlled by those who know their grasses and their management.

Too many trade-inspired greenkeeping articles are based on totally wrong deductions, inaccurate observations and confusion with agricultural high-level grassland production methods.

No-one denies the need for nitrogen and especially slow-release nitrogen. The only debate is on how little is needed in golf greenkeeping. Remember, perennial ryegrass has no place on any golf course, so we are not concerned in golf with the different demands of this 'agricultural' species.

Too many claims are made that fine turf suffers from manurial deficiencies – when, in reality, these deficiencies are of air! Traffic and resultant compaction and wear are the most serious current greenkeeping problems.

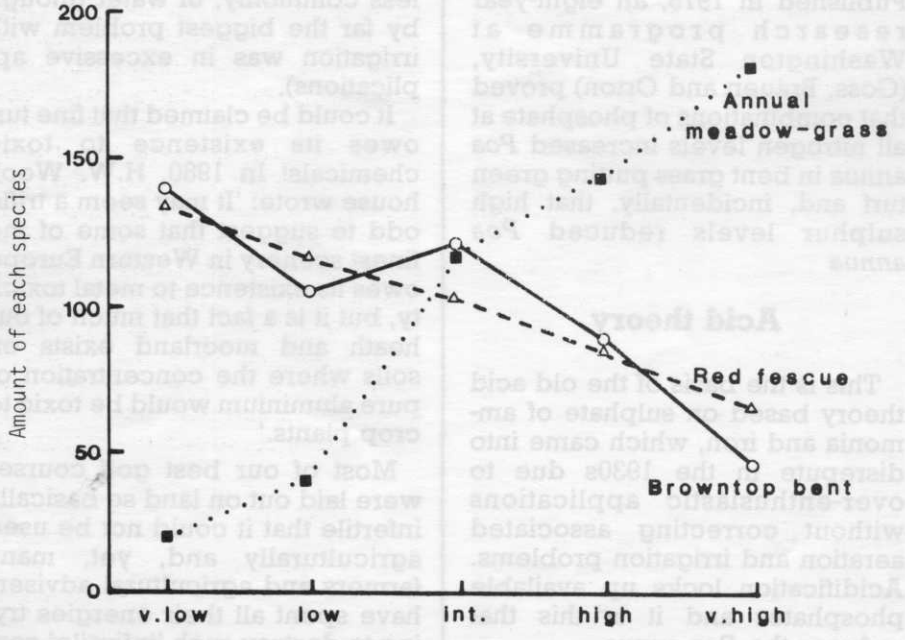

Figure 1

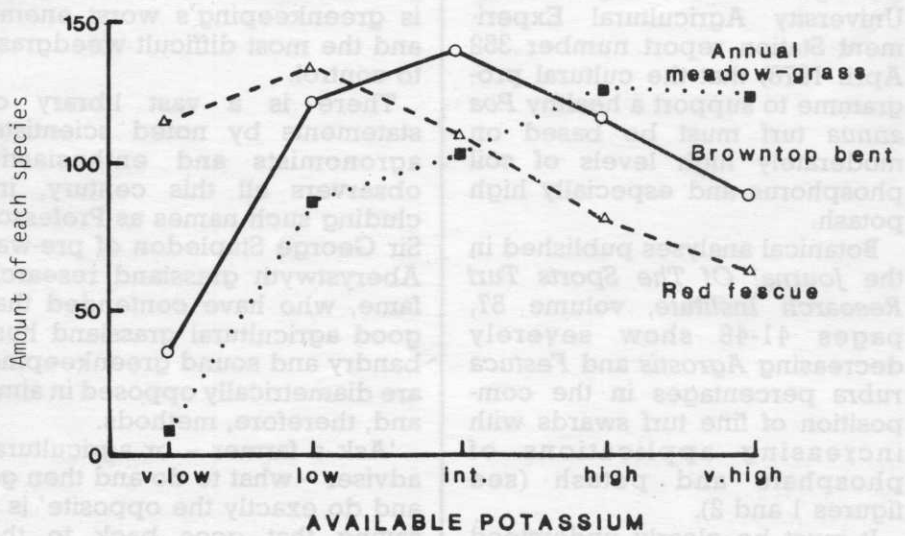

Figure 2

Ref. Kamp (1981)

Botany

Claims are made by some fertilizer manufacturers that phosphate and potash *must* be applied, using elementary primary school botany to 'prove' that, without phosphate and potash, plants are stunted or will die. Yet the low levels needed by fine turf (millions of acres growing naturally in temperate zones, including our own links lands, moorlands, downland and heathland, which have *never* received any manurial applications) can be more than adequately supplied from the levels in the soil, *even* where such levels may be depleted by removal of cuttings or as liveweight increase in grazing animals.

No-one advises or uses (or should use) NPK autumn fertilizers, even if low in nitrogen, on any golf course – they merely increase disease and annual meadow-grass. Their use is condemned by all right-minded advisers.

Sadly, the whole problem is affected by the influence of other factors, notably the desire to present courses in lush technicolour for televised tournaments and the inability of too many golfers to evaluate good playing conditions when they are presented to them.

Too many equate colour with quality.

One is reminded of the true story from this very adverse spring of a lady member of a Scottish links club who complained about the bleached colour of the greens to the head greenkeeper. "Madam, if you'd spent all winter lying out in the open as my greens have, you'd be a bit bleached, too," came the reply!

Of course, there are many other factors causing *Poa annua* dominance than the use of P and K fertilizers, but two wrongs do not make a right. Obviously, deep, regular aeration, sensible routine top dressing (in the growing season only) and controlled irrigation are essential aids to fine turf management.

Sarcastic statements in a recent article by the director general of the Fertilizer Manufacturers' Association that, 'as far as is commonly known, no phosphate fertilizer contains seeds of *Poa annua*' are wasted on the ears of skilled greenkeepers who have controlled *Poa annua* within the meaning of the act on their greens and have greens as good in early spring, as well as winter, as in the peak growing periods (the only time when *Poa annua* gives good putting surfaces) – and often in very marked contrast to adjoining courses, with *Poa annua* dominated greens in appalling condition.

We will only get better golf greens and better greenkeeping universally in this country when all concerned accept that the needs of fine turf grasses are diametrically opposed to those of productive agricultural species. As one eminent botanist said, "it amazes me that fertilizer manufacturers think they know better than the fine grasses what those species need, when these grasses have taken a million years to adapt themselves to very low soil fertility conditions."

One can understand only too well that the trade is having a difficult time and that competition is fierce, but the crisis will not be resolved by selling more fertilizers to golf courses. Diversification is one solution. No business can thrive on false standards and erroneous investigations. Estimates of the number of golf courses are widely exaggerated. Few of those in good order or sensibly managed use more than £250 per annum of fertilizers (nitrogen only) as such. Many will use less. It simply does not represent a market that will solve the problems of fertilizer manufacturers facing a recession in agricultural consumption (some would say gross overusage to create surplus production at the cost of the destruction of soil structure and the countryside). So much harm can be done so quickly for so little profit and, as some have already seen, at the risk of losing their reputation for knowledge, as well as integrity.

Correct manurial treatment of golf greens is no less important than correct mechanical treatment and correct irrigation practices and is still very significant. All the evidence supports what has been known by good greenkeepers all this century, that feeding should be restricted to nitrogen only – slow release certainly – and that phosphates and potash are needed in such small amounts that the needs of fine grasses are already oversupplied (often grossly so) in 99 per cent of all British golf greens and fairways.

It is fully admitted, however, that not all advisers have condemned the use of often horrifically high levels of P and K in golf green mixtures in the past.

Research is necessarily a slow process, but work has been going on for some time to ascertain the optimum and lowest levels of basic manurial elements. Meanwhile, it would seem sensible not to try to reverse or decry those basic principles that, over the past two decades, have helped to correct what were very deleterious trends towards total dominance of *Poa annua*, with all its inherent faults and unacceptably poor winter performance.

More discussion is needed, but such discussion should be with specialists and organisations with a lifetime of experience in greenkeeping advisory work. Short-lived theorists or impractical academics should not sway sound greenkeeping practices, accepted by the majority of skilled and highly professional greenkeepers and course managers. Yet no attempt was made by any party to consult with those who really know the problems from all angles and nothing is to be gained by staging public meetings primarily designed to promote sales before private discussions have helped to clarify objections on technical grounds.

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