

HELP

material is first dispersed before passing the liquid through sieves of varying mesh size. The silt and clay fractions not retained by the sieves are measured separately by mixing with water and measuring the quantities which have settled after a set time. The organic matter content of the soil is determined by igniting a soil sample and measuring the loss in weight.

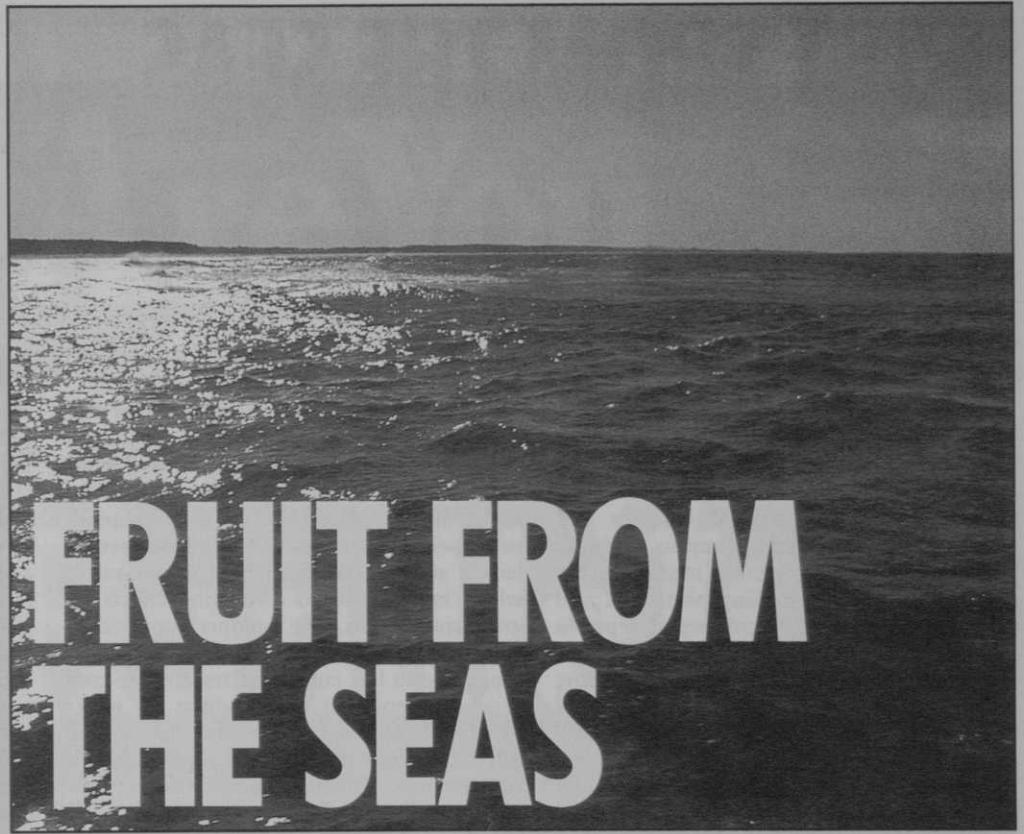
Sands can be tested to assess their compatibility with the soil and to derive a suitable mixing ratio. Hydraulic conductivity tests will provide some indication of the performance of the rootzone mixture in the field. Measurements are made by determining the rate at which water descends through a column of soil.

Again, physical testing of this nature is not intended as a substitute for the hand and eye of the agronomist, but it does provide objective information to support initial impressions.

New tee and green constructions can fail simply because an inappropriate turf is employed. For minor projects, samples of turf can be examined at the STRI or the golf club, but for larger construction projects (e.g. new golf courses) examination of the mature, cultivated turf at point of harvest will facilitate quality control. Where seeding is the preferred option for establishment purposes, the extensive cultivar testing programme at the Institute evaluates the suitability of different cultivars for specific purposes. The ranking of these cultivars enables choices to be made based on which criteria are most important.

In summary, the role of the STRI golf course agronomist is to provide a totally unbiased, objective assessment of all the conditions needed to realise the potential of the golf course. His support of the green staff should be unquestioned and if necessary the frequency of visits can be adjusted to meet the demands of particular courses. Unfortunately, there are no quick fixes in golf course management, therefore I would urge golf clubs to establish sound policies from the outset rather than accepting sub-standard golf for six months of the year!

● The author, Jonathan Tucker, is a consultant agronomist with the STRI.



It's time to unravel the mysteries surrounding 'stimulating seaweed,' reckons MIKE SAULL

Seaweed extracts have long been labelled as 'muck and mystery' products. And up until recently, greenkeepers fell into one of two categories – enthusiastic disciples or downright sceptics. Now though, the tide has changed, and far from being left washed up on the shoreline, extracts are being added into spray programmes on an increasing number of courses.

So what has brought about the change of heart and the increasing number of converts? Well, it appears as if some manufacturers are now able to back their claims with positive independent research. Furthermore, seaweed extracts suit the growing move away from completely inorganic based fertiliser programmes. Finally with increased pressure on turf from drought and numbers of golfers, greenkeepers recognise they need a fundamental rethink of how sprays can manipulate grass growth and in particular rooting. Seaweed extracts in their view are useful plant growth stimulants and not necessarily fertilisers. The move however is made at a time when scientists remain divided over the potential role of seaweed extracts on turf.

Most seaweed extracts (and for that matter granular meals) are derived from marine brown algae, usually *Ascophyllum nodosum*. The foliar applied products available are either true extracts or suspensions of finely divided algae. For example, Maxicrop, SM3, Marinure and Seamac, are produced by either a water extraction or by use of an aqueous alkali hydrolysis process. Others such as Kelpak and Goemar are suspensions.

There is a growing number who feel that the organic component of seaweed extracts is having a very real positive effect on stimulating plant growth. This is separate from and in addition to the valuable effects of added fertilisers in seaweed mixes. Claims surrounding the use of this base material include better rooting and tillering,

increased resistance to stress conditions, reduced incidence of fungal attack and improved seed germination.

In the past it was felt that the effects of this seaweed extract could be explained by the content of trace elements. However, the quantities of dissolved solids in unformulated extracts that would be applied annually to turf are very small, and researchers have now shown that the trace elements present in seaweed extracts form an insignificant proportion of annual turf requirements.

Because of the small amount of material applied per hectare, the substances in seaweed which produce the beneficial results must be active at very low concentrations. Now, scientists at two of the UK's leading fundamental research centres are homing in on the organic constituents of the one major extract. "Cytokinins are growth stimulants naturally produced at the growing tips of plants," says Prof Gerald Blunden at the University of Portsmouth. "Amongst other activities, they can stimulate cell division and photosynthesis."

Evidence suggests that these compounds can increase major plant nutrient uptake with reports of increases in nitrogen, phosphorous, potassium, calcium, manganese, magnesium, iron and zinc being cited in the literature.

Many researchers have noted cytokinin-like activity when seaweed extracts have been applied in field trials. However, it seems likely that other compounds will also have a role to play. Because of the differences in cytokinin levels recorded for the same seaweed extract using different bioassay procedures, it could be that the extracts might contain other compounds which behave like cytokinins.

Betaines are one possible group of compounds and *Ascophyllum* is known to yield two → 46

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45 → different types. They are found within the plant cell and active over the growing season.

The Portsmouth University researchers claim to have made a major breakthrough which confirms the cytokinin like effect of the betaines in certain circumstances. They found that low concentrations of betaines can increase plant chlorophyll by up to 400%. In field conditions this could mean quicker growth and greener looking plants. "It also probably explains why greenkeepers report a greening of grass after spraying extracts. This is a very major advance in our understanding of how extracts can work, though not all extracts are likely to work in the same way," says Prof Blunden.

At the University College of Wales, the research team led by Dr John Norrington-Davies has been looking at the effects of the same extract on root and shoot growth. They have now been able to confirm the effects first recorded on barley in experiments with ryegrass. In a controlled hydroponic environment, the researchers found that commercial rates of the base extract trebled the weight of grass roots over the five week duration of the experiment. In addition, the grass produced 50% more leaf area, while shoot dry weight increased by nearly 200%. Even at low concentrations – 1.0ml/litre, the extract improved tillering after just two weeks – an effect which lasted right throughout the experiment.

The research workers are now trying to isolate the various organic compounds found within the extract to determine what their specific role is on plant growth. "We do need further research before we can be more specific" says Dr John Norrington-Davies. "But it appears as if cytokinins are the most likely key to responses seen. However, they are unlikely to be capable of producing the full responses seen in the field and other compounds such as betaines could also be important. There is an increasing body of information available to show that the use of extracts is beneficial, even though the reasons for the responses are not fully understood," claims Dr Norrington-Davies.

Prof Blunden sends out one word of warning though. "Too frequently, results reported with one product are assumed to apply equally to another even though they may be manufactured in different ways, from different seaweed types, contain different components and are applied in different concentrations. Users should make sure they are convinced that the products they select live up to the manufacturers claims."

One manufacturer claims that the greatest benefit from its products come from their high alginate content. It thus markets its own extracts as soil conditioners. With around five times more alginate than some other products on the market, the company feels that such a compound is the valuable active component.

They suggest that it works by helping to increase soil microbiological activity and improve soil structure and moisture retention.

Dr David Lawson, chemist at the Sports Turf Research Institute, echoes Prof Blunden's warnings. "We've not carried out research on the use of pure seaweed extracts and I'm not aware of any independent work on the products specifically on turf. We have however looked at seaweed extract/cow manure mixes which have produced conflicting effects on grass species mix. The product appeared to increase the fescue content of the turf. However under a low cut height regime, the converse happened. If the products do effect rooting, then does this have an effect on the turf? They also tend to be applied in hot weather and maybe the water is having a beneficial effect. Between the two, I would speculate that it is the seaweed component of the products we have trialled which is probably more beneficial, but it is too early yet to be more specific."

Professor Gerald Blunden: 'Too frequently results reported with one product are assumed to apply equally to another'



At present around 25-30% of the 600 or so Scottish greenkeepers on the books of Edinburgh based Sports Turf Services use seaweed extract on a regular basis. However the company's NE area manager, Mike Dennis confirms that the number of converts is rapidly increasing. "Until recently, greenkeepers have been keen to use inorganics. Now though, we have turned full circle and there is a move back to naturally based organic type products. Many greenkeepers have made the change simply because they feel that the continued use of inorganic fertilisers is perhaps not giving them the best results. Others feel the need to try other products despite the fact that the scientists cannot be more conclusive at present. If organics were more competitively priced, a lot more would make the change," he says.

Seaweed extracts however are a special case. Mr Dennis sees them being used in conjunction with granular or powder fertilisers as a way of feeding grasses and kick-starting turf growth. They are not necessarily fertilisers and most greenkeepers now recognise and appreciate their use as plant growth stimulants.

"In early springs, it is a waste of time using

granular products as any lush early growth is soon killed-off. Here a high iron content seaweed extract can be used to give good early presentation to the greens without producing lush growth. In years when spring arrives late, the product can give us some breathing space without force feeding the stressed turf. Similar approaches can be used at the end of the season to harden-off grasses and perhaps discourage disease. Here it is pointless using more nitrogen just to produce lush, but weak, growth. With most golfers now accustomed to beautifully presented greens, high iron products are also being increasingly used prior to tournaments. The effects can usually be seen within 24 hours and they can last for six weeks or more," says Mike Dennis, continuing, "in this respect high iron type products can hide a multitude of sins, but they cannot be considered a replacement for a proper programme of inputs. They are not long term products and should not be used as such." The other major use for extracts is on newly sown greens – here basic formulations with limited additional NPK should be used to help tillering and increase shoot density. Applications every six weeks can have a dramatic effect.

"The aim on reseed is to give grass its feet," he says. "It is pointless applying heavy doses of fertiliser at this time because the turf won't use it. You wouldn't give solids to a baby, because it couldn't cope with the food. So, why try to force feed new grass with something it can't utilise efficiently? We have seen treated greens that are much better able to cope with drought stress than unsprayed areas on the same course, and this is probably a function of the improved root growth that extracts produce. This drought resistance characteristic lasts for some years, preventing summer discolouration of greens.

The seaweed extract appears to keep grass green for longer periods and helps retain moisture in the leaf. Where greens look run-down, our first approach is to check soil and leaf tissue for potash and magnesium, but extracts can also have a role to play. Formulated products can be used to replace dry fertilisers and with three recent years where drought has been a major threat, we are much more conscious of the role foliar acting liquids can play. And if budgets allow, they make a lot of sense. A number of greenkeepers are now mixing seaweed extract with liquid organics feeds, thus making their own fertiliser cocktail that includes the beneficial effects of seaweed."

"I feel that seaweeds put a lot of natural goodness back into the soil," he continued, "and despite the fact that we do not yet know what the active ingredients are, extracts are rapidly becoming a regular component of our green and tee management programmes."

● The author, Mike Sauli MSc., is past technical secretary of the Soil and Water Management Association. He is also a soil scientist and now runs his own PR business – Landline PR – based in Shrewsbury.