Kelp Helps Root Mass in Turf

By Tim Butler, Kevin Frank and Alan Hunter

Kelp, better known as seaweed, has been used as a fertilizer on turf for many years. It is also the most universally recognized natural biostimulant and is the most widely used biostimulant in both agriculture and turfgrass management (Hattori, 1999). It contains many important plant growth regulators, such as auxins, cytokinins and gibberellins. It also contains micronutrients to enhance a plant's ability to resist pest and disease attack (Hattori, 1999).

Blunden (1991) reported that seaweed also contains betaines, substances that behave like cytokinins in most species of marine algae used in the manufacture of seaweed extracts.

Limited research has been carried out on seaweed extract application using a foliar nutrient program, which is commonly practiced within the turfgrass industry. The objectives of this research were to study the effects of pure seaweed extract on turfgrass growth, nutrition and stress tolerance.

Materials and methods

The research was conducted on a USGA golf green from July 2005 to October 2005 at University College Dublin, Ireland. In July, an experiment was initiated using a seaweed extract biostimulant (supplied by Maxicrop) applied biweekly at 2 milliliters (ml) per square meter onto treatment plots measuring 1.5 square feet. Foliar fertilizer was applied at either the recommended nutrient rates of 37, 2.61 and 40.67 kilos [nitrogen (N), phosphorous oxide and potassium oxide] per hectare respectively (for a quick conversion from kilos per hectare to pounds per acre, multiply by 0.9 or at two-thirds the recommended rate).

The foliar fertilizer program used was from a recommended nutrient program for a USGA golf green in Ireland. The nutrients were applied using a hand-held sprayer. The seaweed extract was mixed with water to give a seaweed application volume of 50 milliliters per square meter at each biostimulant application. Control treatments were also used, which only received the two separate nutrient rates. The experiment was set up as a completely randomized design with four replications.

The green was mowed daily at a height ranging between 0.145 inches and 0.156 inches. Irrigation was applied as needed.

FIGURE 1

Turfgrass Dry Weight

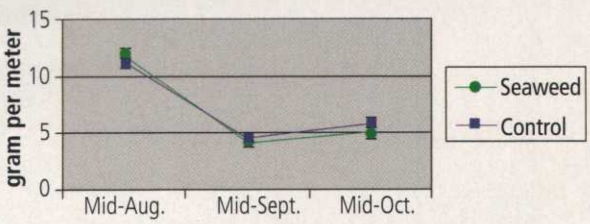
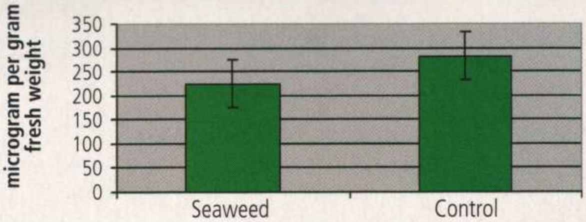


FIGURE 2

Influence of Biostimulant Application on Leaf Proline Concentration



Clippings dry weight, tissue and rootzone nitrate nitrogen, phosphorus, potassium and grass color were determined monthly from mid-August until mid-October. Leaf proline (Bates et al., 1973), soil organic matter (ASTM D 2974-87) and root mass (Doak et al., 2005) were measured in October. The results were analyzed as a factorial experiment (nutrient rate and biostimulant) using SAS, PROC MIXED as repeated measures ANOVA (SAS Institute, Cary, N.C.).

Results

The seaweed extract significantly enhanced grass dry weight compared to the control treatment on the first measurement date, while the opposite occurred on the last measurement date (Figure 1).

On the second measurement date, no significant difference in grass dry weight was detected between biostimulant treatments. The use of biostimulants appeared to have a limited impact on grass growth, particularly as

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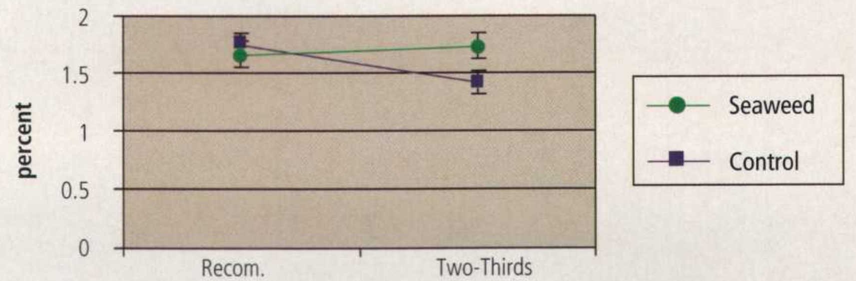
FIGURE 3

Rootzone Organic Matter



Agrium Advanced Technologies

QUICK TIP

Turfgrasses grown in the transition zone must tolerate the varying temperatures that accompany each of the four seasons. Most importantly, they must survive the transition from one season to the next. Preparing your course for these transitions requires adjustments in your fertility programs, which vary from season to season. We all know the importance of potassium in early fall applications, but nitrogen plays a significant role in a plant's ability to uptake this potassium. The fertilizer type that is applied is also important. A late fall fertilizer application with a release dependent mostly on temperature may not be sufficient in providing the plant with adequate nutrients to store carbohydrates.

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temperatures decline in the autumn.

Tissue nitrogen was significantly higher on both the first and second measurement dates compared to the last measurement date for both seaweed and control treatments. The seaweed significantly enhanced leaf tissue nitrogen compared to the control in August only. It is probable that as ambient and rootzone temperatures decreased during late summer/early fall, the beneficial effect of seaweed extract on nitrogen uptake decreased.

The seaweed treatment significantly elevated leaf tissue phosphorus levels compared to the control treatment on the first measurement date, but the opposite occurred on the second one. On the final measurement date, no significant difference in leaf tissue phosphorus occurred. Leaf tissue phosphorus concentration was significantly lower on the first measurement date compared to the last two dates for both seaweed and control treatments.

The seaweed extract decreased tissue potassium concentrations compared to the control in August with no significant differences in leaf tissue potassium being found on subsequent measurement dates. On the first measurement date, leaf tissue potassium was lower than the following two measurement dates for the seaweed treatment.

The seaweed significantly enhanced the availability of rootzone nitrate nitrogen compared to the control at both nutrient rates. For both the control and the seaweed treatments, available rootzone nitrate nitrogen concentrations significantly increased as nutrient input increased. It is possible that the seaweed extract increased microbial activity, resulting in increased nitrate nitrogen availability. The results indicate that seaweed extracts are useful in increasing rootzone nitrate nitrogen availability. However, this increase might not be translated into increased tissue N concentrations.

The seaweed treatment gave significantly lower rootzone potassium concentrations compared to the control on the first two measurement dates, although no significant difference in rootzone potassium concentration was found between treatments on the last measurement date. This may imply that the seaweed limited the available potassium supply to the plant.

The seaweed significantly reduced leaf proline concentration compared to the control (Figure 2).

Proline is a measure of stress levels within a plant and proline concentration increases as stress levels increase, suggesting that seaweed extract application may be useful in increasing stress tolerance in turfgrass, such as in drought situations. Quaternary ammonium compounds (such as betaines) are thought to play a pivotal role in cytoplasmic adjustment in response to osmotic stress and in agreement with Rhodes and Hanson (1993). It is possible that these were elevated in seaweed extract-treated plants.

The seaweed significantly increased rootzone organic matter compared to the control treatment at the two-thirds nutrient rate only

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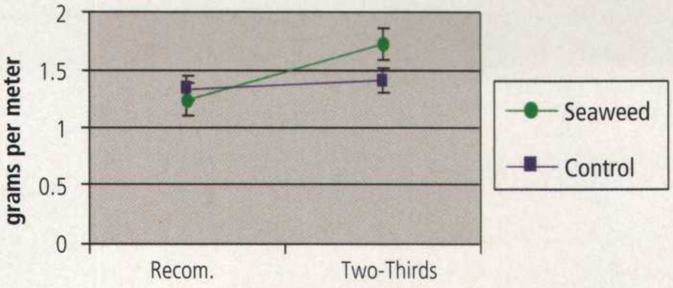
FIGURE 4

Turfgrass Root Mass



Tim Butler (tim.butler@ucd.ie) recently earned his Ph.D. in sports turf science from University College Dublin, Ireland. During his doctorate studies, he spent one year at Michigan State University. Alan Hunter, Ph.D., is a senior lecturer in the School of Biology and Environmental Science at University College Dublin, Ireland. Dr. Kevin Frank is an associate professor in the Department of Crop and Soil Science at Michigan State University.

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(Figure 3). At the recommended nutrient rate, no significant difference in soil organic matter accumulation was found between the biostimulant treatments. No significant differences in organic matter was found between the two-thirds and the recommended nutrient rates for the seaweed extract treatment. But for the control treatment, organic matter was higher at the recommended nutrient rate compared to the two-thirds recommended nutrient rate.

This experiment was fertilized using a foliar fertilizer. It may be possible the seaweed extract may have enhanced plant health at the two-thirds nutrient rate by supplying minerals and nutrients that the plant did not uptake at the recommended nutrient rate because the plant had adequate nutrient supply.

The seaweed extract increased root mass compared to the control, at only the two-thirds nutrient rate, implying that the two-thirds nutrient rate may be the best rate at which seaweed can positively impact root growth (Figure 4). At the recommended rate, nutrient concentrations might be excessive, and the benefits of the seaweed extract either were lost or at best were masked. Further research is required to verify these opinions, particularly in relation to the nutrient rate that appears to maximize seaweed extract benefits.

Similar research using seaweed extracts as well as studies on the influence of microbial inoculants and biostimulants on turfgrass growth and physiology is being carried out at University College Dublin.

JOHN DEERE

QUICK TIP

In preparation for the fall, some superintendents may overseed warm-season turf with cool-season grasses to improve appearance and playability of the golf course. Prior to overseeding, apply a plant growth regulator (PGR) to your course to suppress turf growth in order to give seedlings a quick start. For more information on preparing your turf for the fall, contact your local John Deere Golf & Turf One Source™ distributor or sales representative.

REFERENCES

Blunden, G. 1991. Agricultural uses of seaweeds and seaweed extracts. p. 65-81. In: Faulkner, D.J. and Fenical, W.H. (eds.), Marine Natural Products Chemistry. Wiley London.

Branham, B. 2006. Plant growth regulators for fine turf use [Online]. Available at www.interactiveturf.com/tips/1997_02.htm

Hattori, K. 1999. Biostimulants [Online]. Available at www.greenmediaonline.com/st/1999/0799/799bio.asp

Rhodes, D. and Hanson, A.D. 1993. Quaternary ammonium and tertiary sulfonium compounds in higher plants. Annual Review of Plant Physiology and Plant Molecular Biology 44: 357-384.

SAS Institute. 2001. SAS user's guide. Version 8.2. SAS Inst., Cary, NC.

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