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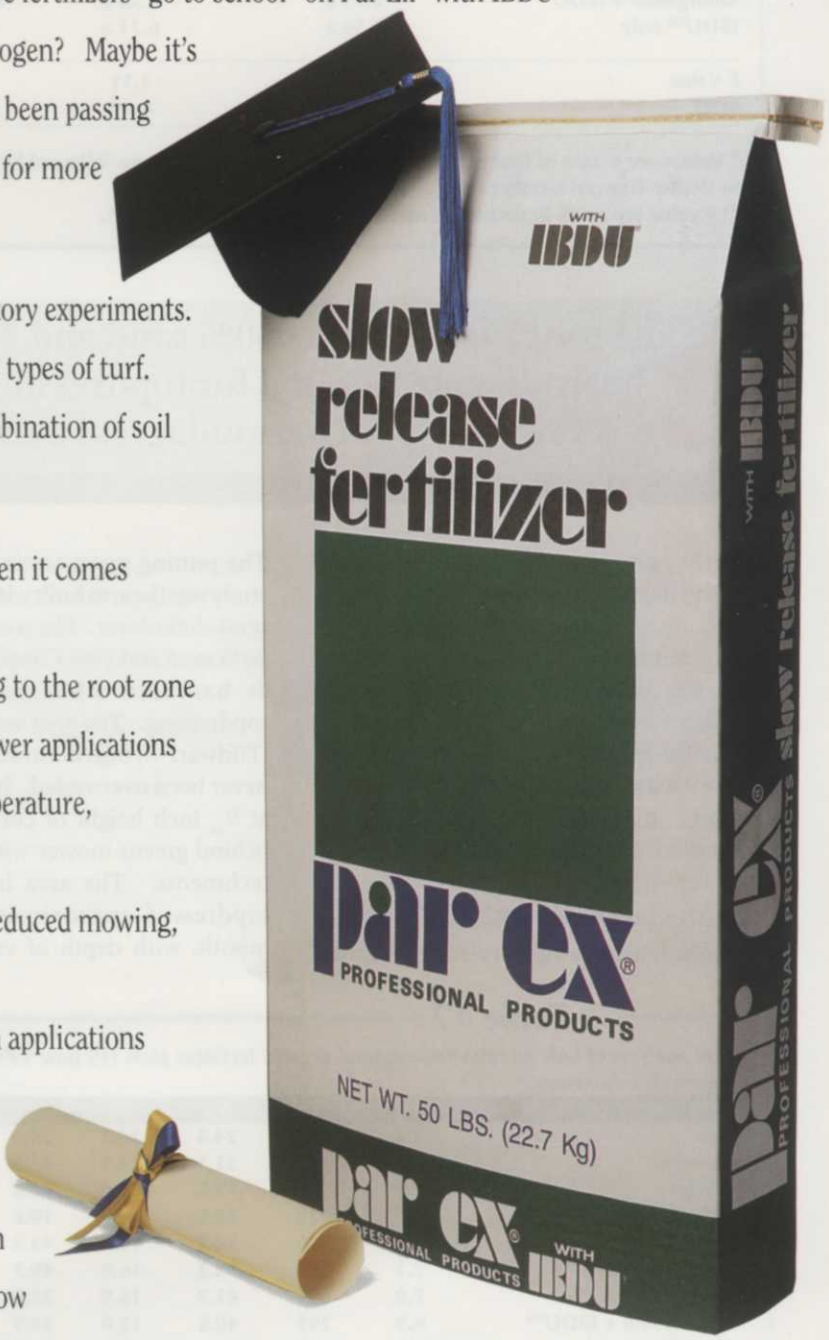


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## Table 9

Percentage of disease (Bipolaris leaf spot), soil pH and root weights resulting from evaluation of natural organic fertilizers on the FGCSA Research Green from May 1992 through April 1993. *

| | % Disease | pH | | Root Weight (grams) | | |
|---|---|---|---|---|---|---|
| Treatment | 10 Feb 93 | 6 Nov 92 | 3 May 93 | 16 Aug 92 | 30 Nov 93 | 1 Mar 93 |
| Eco | 16.25 a | 6.84 a | 6.86 ab | 14.733 a | 12.433 a | 16.885 a |
| Sustane | 23.75 a | 6.80 a | 6.91 a | 22.272 a | 14.284 a | 29.030 a |
| Ringer | 16.25 a | 6.73 a | 6.81 ab | 19.478 a | 14.926 a | 24.151 a |
| Milorganite | 7.50 a | 6.82 a | 6.63 ab | 17.393 a | 14.093 a | 22.830 a |
| Eco + IBDU | 16.25 a | 6.66 a | 6.49 ab | 23.869 a | 15.058 a | 23.721 a |
| Sustane + IBDU | 10.00 a | 6.78 a | 6.55 ab | 20.075 a | 17.539 a | 24.809 a |
| Ringer + IBDU | 8.75 a | 6.81 a | 6.85 ab | 21.419 a | 14.481 a | 28.128 a |
| Milorganite + IBDU | 8.75 a | 6.56 a | 6.67 ab | 14.454 a | 13.631 a | 28.171 a |
| IBDU™ only | 7.50 a | 6.71 a | 6.40 b | 20.700 a | 13.834 a | 24.038 a |
| F Value | 1.74 | 1.11 | 1.88 | 0.92 | 0.61 | 0.89 |
| MSD | 16.37 | ----** | 0.50 | ---- | ---- | ---- |

* Values are means of four replicate plots. Means within a column followed by the same letter are not significantly different (P=0.05) according to Waller-Duncan k-ratio t test.
** F value too small to determine mean significant difference (MSD).

**The root zone mix was 80% sand and 20% Canadian peat moss, as has been all material used for topdressing. The area was planted with Tifdwarf hybrid bermudagrass and has never been overseeded.**

fertility program which used the IBDU™ blend described previously. These products are not intended to be used as fertilizers but rather as biostimulants for plant growth. Studies on cool-season turfgrass sod in Virginia have indicated a potential role for these products to enhance root growth and strength and, more importantly, to enhance the plant's ability to survive during stress periods.

## Materials and methods

**Study area and general maintenance:** The putting green section used for this study was the area built without the coarse sand choke layer. The root zone mix was 80% sand and 20% Canadian peat moss, as has been all material used for topdressing. The area was planted with 'Tifdwarf' hybrid bermudagrass and has never been overseeded. It is maintained at $^{3}/_{16}$ inch height of cut using a walk-behind greens mower with groomer attachments. The area is verticut and topdressed approximately once per month, with depth of verticutting dependent on thatch layer thickness. Pesticides used, date of application and application area are listed in Table 2. Every effort is made to spot treat pest problems rather than use a blanket treatment in order to minimize any potential damaging effects to the soil microbial populations by the pesticides.

**Experimental plan:** Each plot was 6.5 feet by 10 feet (65 sq. ft.) with four replicate plots per treatment. The experimental design was a randomized complete block. The treatments are listed in

## Table 12

Soil analyses of bulk samples from natural organic fertilizer plots (15 June 1993) as conducted by the University of Florida Analytical Research Laboratory. *

| Treatment | pH | Ca | Mg | K | P | Zn | Cu | Mn | Fe | Na | Cl |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Eco | 7.2 | 322 | 24.4 | 14.1 | 24.0 | 7.76 | 1.09 | 9.12 | 18.98 | 7.3 | 0.0 |
| Sustane | 7.0 | 392 | 31.1 | 14.4 | 47.5 | 9.26 | 1.22 | 12.54 | 24.59 | 7.4 | 0.0 |
| Ringer | 7.1 | 334 | 19.6 | 12.4 | 34.6 | 5.64 | 1.02 | 10.13 | 24.72 | 7.3 | 0.0 |
| Milorganite | 6.9 | 236 | 50.5 | 16.9 | 19.6 | 9.61 | 2.26 | 10.27 | 19.81 | 6.7 | 0.0 |
| Eco + IBDU™ | 6.9 | 356 | 54.2 | 19.7 | 43.3 | 7.55 | 1.24 | 13.13 | 22.84 | 7.9 | 0.0 |
| Sustane + IBDU™ | 7.1 | 398 | 53.2 | 16.0 | 49.7 | 10.14 | 2.44 | 14.07 | 22.58 | 7.0 | 0.0 |
| Ringer + IBDU™ | 7.0 | 309 | 41.3 | 15.9 | 33.9 | 7.77 | 1.09 | 11.36 | 19.14 | 6.2 | 0.0 |
| Milorganite + IBDU™ | 6.9 | 295 | 40.5 | 12.8 | 34.9 | 9.13 | 1.44 | 10.51 | 24.78 | 7.0 | 0.0 |
| IBDU™ only | 6.9 | 225 | 40.9 | 9.7 | 26.2 | 5.06 | 0.93 | 7.24 | 18.72 | 6.5 | 2.0 |

* The water extractable ions and Mehlich-I extractable elements were determined according to standard laboratory procedures. Elements are listed as mg per kg soil (ppm).

## Table 10

Percentage of disease (Bipolaris leaf spot), soil pH and root weights resulting from evaluation of cytokinin-like products on the FGCSA Research Green from May 1992 through April 1993. *

| | % Disease | pH | | Root Weight (grams) | | |
|---|---|---|---|---|---|---|
| Treatment | 10 Feb 93 | 6 Nov 92 | 3 May 93 | 16 Aug 92 | 30 Nov 92 | 1 Mar 93 |
| Enersol | 5.00 b | 6.65 a | 6.66 ab | 18.577 a | 12.635 a | 27.435 a |
| Pana Sea Plus @ 2 weeks | 8.75 b | 6.61 a | 6.43 ab | 21.987 a | 15.559 a | 26.129 a |
| Pana Sea Plus @ 4 weeks | 5.00 b | 6.61 a | 6.71 a | 21.873 a | 16.162 a | 25.971 a |
| Kelpak | 17.50 a | 6.64 a | 6.25 b | 22.164 a | 14.264 a | 33.026 a |
| IBDU™ only | 7.50 b | 6.71 a | 6.40 ab | 20.700 a | 13.834 a | 24.038 a |
| F Value | 3.81 | 0.26 | 2.40 | 0.22 | 0.56 | 1.21 |
| MSD | 8.67 | ----** | 0.44 | ---- | ---- | ---- |

* Values are means of four replicate plots. Means within a column followed by the same letter are not significantly different (P=0.05) according to Waller-Duncan k-ratio t test.
** F value too small to determine mean significant difference (MSD).

**For each application date, the fertilizers were applied first, by hand, and then immediately irrigated with . . . water.**

Table 1. Nitrogen was applied at the rate of 18 pounds per 1000 sq. ft. per year, with 1 pound per month applied during the summer (May through October) and 2 pounds applied per month during the winter (November through April). This is the average nitrogen rate used in southeastern Florida (see July/August 1992 issue of *The Florida Green*). The summer nitrogen rate was applied at 0.5 pound every two weeks and the winter nitrogen rate at 1.0 pound every two weeks. For each application date, the fertilizers were applied first, by hand, and then immediately irrigated with 0.12 to 0.14 inches of water. Those treatments that were mixtures of natural and synthetic fertilizers were mixed in the laboratory before applying to the field plots.

The liquid cytokinin-like hormonal

## Table 11

Soil analyses, from check plots, conducted by University of Florida Analytical Research Laboratory in Gainesville. *

| Sample | pH | Ca | Mg | K | P | Zn | Cu | Mn | Fe | Na | Cl |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 May 1992 | | | | | | | | | | | |
| 1-3 inches | 7.2 | 288 | 64.9 | 37.1 | 27.6 | 6.88 | 0.86 | 21.52 | 16.89 | 9.4 | NT |
| 4-6 inches | 7.3 | 118 | 36.8 | 16.3 | 12.0 | 0.90 | 0.20 | 1.92 | 12.12 | 4.1 | NT |
| 22 July 1992 | | | | | | | | | | | |
| 1-4 inches | 6.6 | 214 | 29.0 | 11.4 | 27.9 | 1.64 | 0.47 | 3.94 | 7.39 | 4.3 | 4.0 |
| 30 October 1992 | | | | | | | | | | | |
| 1-4 inches | 7.2 | 246 | 38.5 | 14.6 | 24.9 | 4.16 | 0.76 | 6.48 | 20.67 | 4.7 | 2.0 |
| 15 June 1993 | | | | | | | | | | | |
| 1-4 inches | 6.9 | 225 | 40.9 | 9.7 | 26.2 | 5.06 | 0.93 | 7.24 | 18.72 | 6.5 | 2.0 |

* The water extractable ions and Mehlich-I extractable elements were determined according to standard laboratory procedures. Elements are listed as mg per kg soil (ppm).

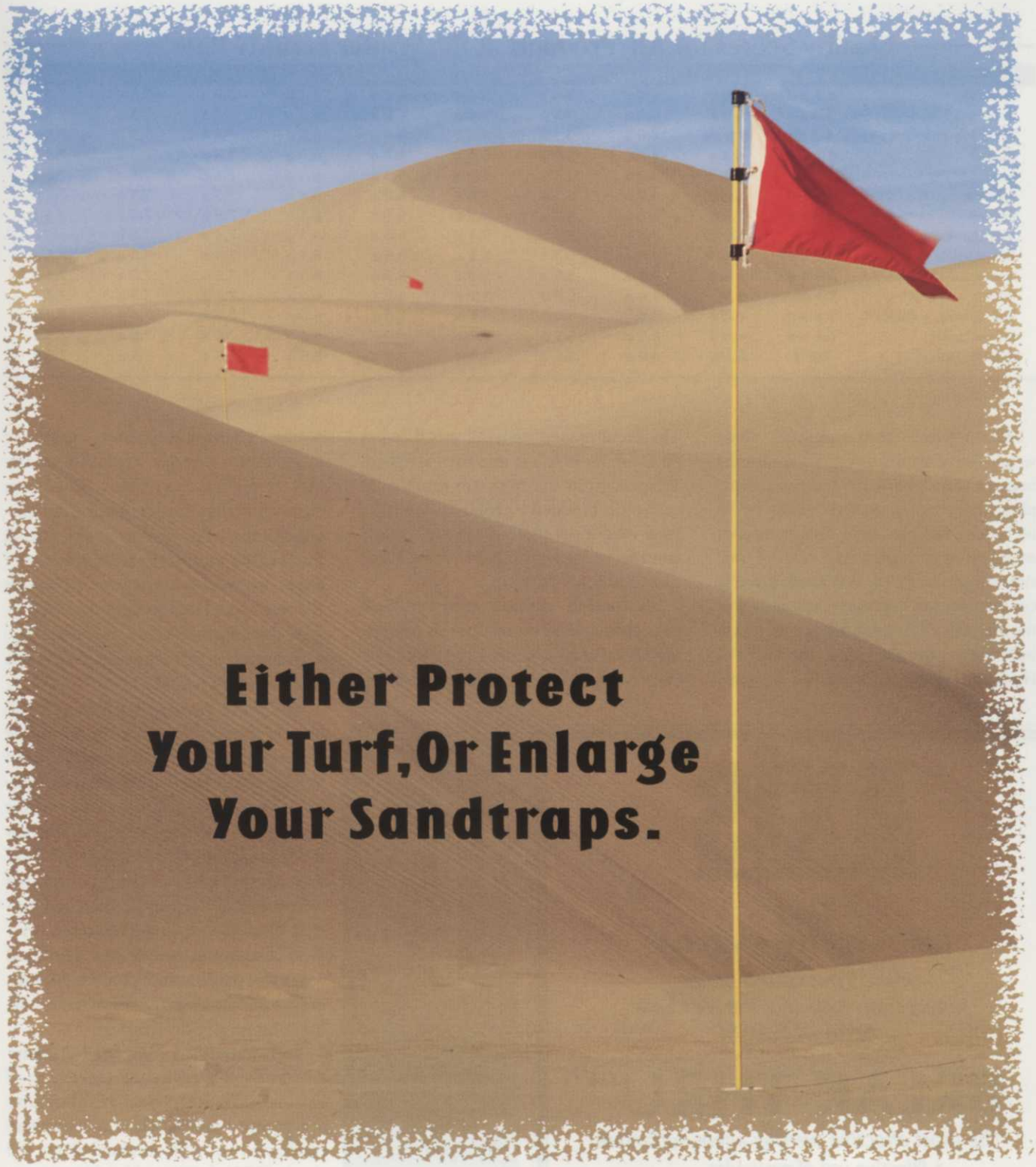
**During the first year of this project, the only disease observed was a leaf spot caused by a Bipolaris species which is one of the "Helminthosporium" group of fungi. Percentage of each plot affected by the leaf spot was determined. Blue-green algae were also prevalent during the winter months. The quality scores during the 1992-93 winter reflect the presence of algae. Symptoms of the root rot disease Bermudagrass Decline, caused by the fungus *Gaeumannomyces graminis* var. graminis, were not observed during this twelve-month period.**

products were applied according to schedule (see Table 1) using a backpack $CO_2$ boom sprayer with 40 p.s.i. at the handle. These products were applied in an appropriate amount of deionized water. If a product was scheduled to be applied the same day as the fertilizers, they were instead applied the following day so they would not be affected by the irrigation cycle. These treatment plots and the check plots were fertilized with the IBDU fertilizer blend at the same nitrogen rate and using the same schedule as the natural organic fertilizer treatments.

**Evaluation - quality scores:** Quality scores were determined based on grass color and density using a scale of 1 to 10 with 10 being a perfect score. On each date, two persons rated the plots. Those scores were then averaged together for statistical analysis. The plots were rated one week after each nitrogen application. Some scores are missing, usually due to cultural practices (for example, heavy topdressing) that interfered with the rating procedure.

**Evaluation - clipping weights:** Clippings, from plots that had not been cut for 48 hours, were collected from each plot once each month from a 22 in. (mower-width) by 9 ft. area (16.5 sq. ft.) for July and August 1992 and from a 22 in. by 6 ft. area (11 sq. ft.) for the remaining months. Sample size was reduced beginning September 1992 due to initiation of root sampling. Clippings were dried at 60 C and then weighed. When possible, we tried to rate and collect clippings on the same day or subsequent days.

**Quality scores were determined based on grass color and density using a scale of 1 to 10 with 10 being a perfect score. On each date, two persons rated the plots. Those scores were then averaged together for statistical analysis. The plots were rated one week after each nitrogen application. Some scores are missing, usually due to cultural practices (for example, heavy topdressing) that interfered with the rating procedure.**

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## Quality Scores for All Products at the Winter Fertility Rate

| Treatment | Nov. 3 | Dec. 30 | Jan. 12 | Jan. 27 | Feb. 10 | Feb. 24 | Mar. 20 | Mar. 24 | Apr. 7 | Apr. 21 |
|---|---|---|---|---|---|---|---|---|---|---|
| Enersol | 6.1 a-d | 6.0 a | 4.0 a | 5.5 a | 5.4 a | 6.0 a | 6.5 a | 7.5 a | 7.5 a | 7.5 a |
| Pana Sea Plus @ 2 weeks | 5.8 a-e | 6.0 a | 4.0 a | 5.5 a | 5.4 a | 6.0 a | 6.5 a | 7.5 a | 7.5 a | 7.5 a |
| Pana Sea Plus @ 4 weeks | 6.3 ab | 5.9 ab | 4.0 a | 5.5 a | 5.6 a | 6.0 a | 6.5 a | 7.5 a | 7.5 a | 7.5 a |
| Kelpak | 6.2 abc | 6.0 a | 4.0 a | 5.5 a | 5.1 a | 6.0 a | 6.5 a | 7.5 a | 7.5 a | 7.5 a |
| Eco | 5.3 de | 5.6 b | 4.0 a | 5.5 a | 4.9 a | 6.0 a | 6.5 a | 7.5 a | 7.5 a | 7.5 a |
| Sustane | 6.1 a-d | 5.6 b | 4.0 a | 5.5 a | 5.0 a | 6.0 a | 6.5 a | 7.5 a | 7.5 a | 7.4 b |
| Ringer | 5.8 a-e | 5.6 b | 4.0 a | 5.5 a | 5.0 a | 6.0 a | 6.5 a | 7.5 a | 7.5 a | 7.5 a |
| Milorganite | 5.0 e | 5.8 ab | 4.0 a | 5.5 a | 5.4 a | 6.0 a | 6.5 a | 7.5 a | 7.0 b | 6.5 c |
| Eco + IBDU™ | 5.5 b-e | 5.8 ab | 4.0 a | 5.5 a | 5.2 a | 6.0 a | 6.5 a | 7.5 a | 7.5 a | 7.5 a |
| Sustane + IBDU™ | 6.1 a-d | 6.0 a | 4.0 a | 5.5 a | 5.4 a | 6.0 a | 6.5 a | 7.5 a | 7.5 a | 7.5 a |
| Ringer + IBDU™ | 5.4 cde | 6.0 a | 4.0 a | 5.5 a | 5.6 a | 6.0 a | 6.5 a | 7.5 a | 7.5 a | 7.5 a |
| Milorganite + IBDU™ | 5.8 a-e | 6.0 a | 4.0 a | 5.5 a | 5.6 a | 6.0 a | 6.5 a | 7.5 a | 7.5 a | 7.5 a |
| IBDU™ only | 6.1 a-d | 6.0 a | 4.0 a | 5.5 a | 5.2 a | 6.0 a | 6.5 a | 7.5 a | 7.5 a | 7.5 a |
| IBDU™ only | 6.6 a | 6.0 a | 4.0 a | 5.5 a | 5.3 a | 6.0 a | 6.5 a | 7.5 a | 7.5 a | 7.5 a |

**Evaluation - root weights:** Root weights were obtained every three months beginning in August 1992. At each sampling date, two 6-inch diameter by 4-inch deep samples were obtained from each end of each plot for a total of four sub-samples per plot. A 0.5 inch cap was cut from the top to remove leaf tissue and the majority of the thatch layer. Samples were then processed with the Gillison Hydropneumatic Elutriation System. The accumulated material was dried at 80 C for 36-48 hours and then weighed. Weights from the four sub-samples of each plot are added together to obtain the total weight per plot. Resulting "holes" from sampling were filled with the 80/20 mix used for topdressing.

**Evaluation - disease ratings and soil pH:** During the first year of this project, the only disease observed was a leaf spot caused by a Bipolaris species which is one of the "Helminthosporium" group of fungi. Percentage of each plot affected by the leaf spot was determined. Blue-green algae were also prevalent during the winter months. The quality scores during the 1992-93 winter reflect the presence of algae. Symptoms of the root rot disease Bermudagrass Decline, caused by the fungus *Gaeumannomyces graminis* var. graminis, were not observed during this twelve-month period.

Soil pH values were determined for all plots at six month intervals to determine if the products were affecting bulk soil pH, especially the natural organic fertilizers. The average pH of the Eco, Sustane and Ringer products was 9.0-9.5, whereas the Milorganite product was 4.0. Soil pH was determined by obtaining cores that were 4-inches deep and 1-inch in diameter. The top 0.5 inch was removed. A 1:1 (v:v) suspension of soil and deionized water was made and shaken for 30 minutes. After filtering, the pH of the resulting solution was determined.

**Soil analyses:** A complete soil analysis was conducted by the University of Florida Anlaytical Research Laboratory at 6-month intervals. These analyses were conducted on soil obtained from the check IBDU fertilizer blend treatment plots. Results are presented in Table 11. A complete soil analysis was also conducted in June 1993 on the natural organic fertilizer treatment plots and the plots receiving a mixture of natural and synthetic fertilizers. These results are presented in Table 12. For each treatment, soil samples from each replicate

**Some significant differences in clipping weights were observed for the natural organic fertilizers but not the cytokinin-like products.**

**Few differences were observed in quality, the characteristic of most concern to golf course superintendents, for either the natural organic fertilizers or the cytokinin-like products. For the natural organic fertilizers, differences were observed on seven of the nineteen rating dates but only four of those dates resulted in significant differences between treatments.**

plot were bulked for analysis. Therefore, no statistical analysis was performed on the data obtained.

### Results and discussion

Tables 3 and 4 list the quality scores obtained for the natural organic fertilizer treatments. Tables 5 and 6 list the quality scores obtained for the cytokinin-like hormonal products. Table 7 lists the clipping weights and Table 9 lists the disease rating, root weights and soil pH values obtained for the natural organic fertilizers. Tables 8 and 10 list the same for the cytokinin-like products.

Few differences were observed in quality, the characteristic of most concern to

## Clipping Weights for All Products at the Winter Fertility Rates

| Treatment | Nov. 27 | Dec. 30 | Jan. 27 | Feb. 24 | Apr. 7 | Apr. 21 |
|---|---|---|---|---|---|---|
| Enersol | 5.014 a | 3.651 a-d | 2.537 abc | 3.305 a | 6.556 ab | 4.206 abc |
| Pana Sea Plus @ 2 weeks | 4.095 abc | 4.249 a | 2.707 abc | 3.179 ab | 6.419 ab | 4.650 a |
| Pana Sea Plus @ 4 weeks | 4.217 abc | 3.474 a-d | 2.741 ab | 3.173 ab | 6.051 abc | 4.079 abc |
| Kelpak | 4.000 a-d | 3.777 abc | 2.280 abc | 2.836 ab | 6.267 ab | 4.304 ab |
| Eco | 2.888 ef | 2.941 d | 2.094 bc | 2.369 b | 5.042 bc | 3.310 bcd |
| Sustane | 3.285 c-f | 3.251 cd | 2.013 c | 2.540 ab | 4.868 bc | 3.104 cde |
| Ringer | 3.028 def | 2.868 d | 2.001 c | 2.647 ab | 4.430 c | 2.817 de |
| Milorganite | 2.535 f | 2.954 d | 2.855 a | 2.895 ab | 5.120 abc | 2.081 e |
| Eco + IBDU™ | 3.532 b-f | 3.488 a-d | 2.564 abc | 3.126 ab | 5.754 abc | 3.459 bcd |
| Sustane + IBDU™ | 3.988 bcd | 3.844 | abc 2.297 abc | 2.678 ab | 5.752 abc | 3.460 bcd |
| Ringer + IBDU™ | 3.659 b-e | 4.078 ab | 2.976 a | 2.707 ab | 5.875 abc | 3.970 abc |
| Milorganite + IBDU™ | 3.766 b-e | 3.920 abc | 2.895 a | 2.812 ab | 6.896 a | 3.562 a-d |
| IBDU™ only | 4.192 abd | 3.960 abc | 2.647 abc | 3.278 a | 6.620 ab | 4.580 a |
| IBDU™ only | 4.427 ab | 3.415 bcd | 2.411 abc | 2.990 ab | 5.746 abc | 3.818 a-d |

golf course superintendents, for either the natural organic fertilizers or the cytokinin-like products.

For the natural organic fertilizers, differences were observed on seven of the nineteen rating dates but only four of those dates resulted in significant differences between treatments. No significant differences in quality scores were observed between treatments for the cytokinin-like products.

**Some significant differences in clipping weights were observed for the natural organic fertilizers but not the cytokinin-like products. In general, the largest clipping weights were associated with the IBDU check treatment or mixtures of the natural organic fertilizers with the IBDU blend.**

The primary reason for quality decline in the winter months was from development of blue-green algae as a result of the unusually rainy 1992-93 winter we experienced in southern Florida. In fact, it was so severe and uniform by mid-January, that the entire green was sprayed twice with a fungicide to bring the algae under control.

The differences in quality on 30 December 1992 for the natural organic fertilizers were due to differences in the amount of algae on the plots. In general, the algae was initiated first on the plots treated with natural organic fertilizers, but the algae built up so quickly across the remaining plots that these differences were not apparent two weeks later. Although the initial Bipolaris leaf symptoms were first observed on the plots receiving only natural organic fertilizers, there were no significant differences between these treatments when the plots were evaluated for disease incidence. There were significant differences between the cytokinin-like product treatments. However, since disease incidence was low, there was minimal effect on quality.

Some significant differences in clipping weights were observed for the natural organic fertilizers but not the cytokinin-like products. In general, the largest clipping weights were associated with the IBDU check treatment or mixtures of the natural organic fertilizers with the IBDU blend. There did not appear to be a consistent correlation between clipping weights and quality scores.

While there appears to be a large difference between treatments for root weights, none are significantly different from each other - primarily due to the variability between replicates within a

**While there appears to be a large difference between treatments for root weights, none are significantly different from each other - primarily due to the variability between replicates within a treatment. This was not totally unexpected. The primary reason for obtaining so many sub-samples from each plot was in an effort to reduce variability. However, it is important to note the substantial difference between root weights over time across all treatments.**

treatment. This was not totally unexpected. The primary reason for obtaining so many sub-samples from each plot was in an effort to reduce variability. However, it is important to note the substantial difference between root weights over time across all treatments. Over the two year study period, this could confirm the general opinion that turfgrass on putting greens in southern Florida, especially those that have not been overseeded, is at its optimum health and quality in the late spring and early summer. This is primarily due to the substantial root system that is present during this time period. The root system then declines as the summer progresses. This would be in contrast to the spring root die-off observed in Texas.

This study will be continued for another year at which time a final report will be presented. In addition to the above evaluations, we are also conducting a microbial ecology study to determine the effects of the fertilizer treatments on the bacterial and fungal populations present in the top 3-4 inches of soil. That information will also be presented after the study has been completed.

# Thanks for a lifetime of service

Fernandina Municipal Golf Course was the site of the January meeting of the North Florida Golf Course Superintendents Association to honor Ed Mattson. Mattson, 87, received the NFGCS lifetime achievement award for excellence in golf course operations.

He started working as a caddie at age 9 and then began to work in a pro shop. In 1927 he turned pro and he joined the PGA of America in 1929. He received his Class A card in 1933.

Mattson is responsible for the construction of 33 golf courses, including Fernandina Municipal. He moved to Fernandina Beach in 1957 to oversee the construction of the course. In addition to duties as the superintendent of grounds, he took on responsibilities of teaching pro and general manager. He is one of the original members of the Golf Course Superintendent's Association of America.

On hand to observe the presentation was his wife Mary, the Florida state amateur champion in 1933, 1935 and 1936. She is presently teaching golf in Folkston, Ga.

*Ed Mattson, seated, was given a lifetime achievement award by the North Florida Golf Course Superintendents Association in January. He is flanked by his wife, Mary, and Jim Ellis, left, and Lewis Chaff, right.*