Response of Sea Isle 2000 Paspalum to Mowing Height and Nitrogen Fertility as a Putting Surface Under Semi-Arid Conditions: Two Year Report

David M. Kopec, James H. Walworth,
Jeffrey J. Gilbert, Greg M. Sower and
Mohammed Pessarakli.
University of Arizona
Tucson, Arizona

Introduction

Paspalum vaginatum is a warm season (C4 photosynthetic pathway) grass which has had limited use in turf. The cultivars *Excalibur* and *Adelaide* have been used with some success in southern California, Texas, and gulf areas of the southeastern United States. Attributes of this species include: 1) moderate growth rate, 2) heat tolerance, and 3) salinity tolerance. Limitations to date have included: 1) vegetative establishment requirements, 2) scalping tendency, and 3) yellow-green turf color.

Collections made and evaluated by Dr. Ronnie Duncan at the University of Georgia have resulted in the identification of genotypes (clones) which have been selected for improved turf-type growth habits, resistance to insects and diseases, and establishment rate (R. Duncan, personal communication). Two of these clones are slated for commercial propagation and release. Sea Isle 2000 is a single clone cultivar intended for greens use, and Sea Isle 1 is a single clone cultivar intended for fairway and tee use. This report addresses research investigations for Sea Isle 2000, performed from 1999-2000 and 2000-2001 seasons.

The research objectives were to: 1) investigate the response of Sea Isle 2000 to mowing heights, and to 2) determine the response of this grass to nitrogen fertilization. Previous literature and correspondence with scientists and turf managers alike express the observations that P. vaginatum is a low nitrogen user, compared to most bermudagrass cultivars. If applied at "bermudagrass type rates and frequencies," P. vaginatum has been reported to produce excess scalping and thatch. With the investigation of the turf performance of newer cultivars (which have shorter internodes), it is imperative to investigate the response of new cultivars to various levels of nitrogen. P. vaginatum has only been found on greens as contaminants, sometimes becoming a feral species (in tropical and subtropical areas). Likewise, it is necessary to determine mowing height responses on clones which have short internodes and are subjected to frequent and close mowing. Evaluating these two variables together allows for the identification of fertilizer/mowing combinations which provide an acceptable turf, especially in an arid environment.

Materials and Methods

<u>Establishment:</u>
During the summer of 1998, Sea Isle 2000 was established vegetatively by plugging. Two x two inch plugs on one foot centers were installed on USGA sand based green, featuring a 12-inch root zone with a two inch choker layer. The turf was fertilized every 7-10 days with quick release N fertilizers. By September 1998, there was 98% stolon cover, with plug centers sporting a vertical growth habit.

Starting in the early spring (May) 1999, the dormant turf was mowed several times weekly, in order to remove upright growth (plug centers) without injuring the turf. A 22" reel mower was used to lower the turf from 1.0 inch to 3/8 inch in 1/8" increments. The turf was triple mowed at each height to train a lateral growth profile and remove upright dormant turf. From April 1 to May 1, 1999, the turf was mowed with a 22" Jacobsen greens mower in

This is a part of the University of Arizona College of Agriculture 2004 Turfgrass and Ornamental Research Report, index at: http://cals.arizona.edu/pubs/crops/az1359/

similar fashion to reduce the mowing height from 3/8" to 9/64". Then, a Toro Series 5 Tournament greens mower was used to obtain a uniform height of 1/8" (base height). Light topdressings and two vertical mowings were used in April and again in May during the process to promote surface smoothness and to provide a medium for new stolon growth. After that, mowing heights were adjusted according to treatments described below.

Field Design and Treatment Allocations:

A split plot field design was employed, with mowing heights as the main plot, and nitrogen fertilizer level as the sub-plots. Mowing heights were selected to cover a broad range of mowing heights, representing standard (1/8"), elevated (5/32"), and low maintenance greens (3/16"). These levels would be similar to long-term regular (non-tournament) mowing heights of a low growing dwarf-bermudagrass (TiffEagle – Champion at 1/8"), Tifdwarf (5/32"), and Tifgreen 328 (3/16").

Mowing height (main plots) were 14' x 12' and replicated three times. Four fertilizer nitrogen levels were assigned at random (3' x 12' subplots) within each of the twelve mowing height blocks. Nitrogen treatments were comprised of monthly applications of ammonium nitrate (34-0-0) at the rates of 0.25, 0.38, 0.50 and 0.75 lb N/1000 ft^2 per growing month. Potash was applied monthly at 0.50 lb K/1000 ft^2, while phosphorus was applied at 0.50 lb/every other month. All plots were hand-watered after application from a calibrated 2.5 foot width Gandy drop spreader prior to the next mowing. Plots were mowed 6x weekly as mowing heights were maintained by interchanging cutting unit heads adjusted for each respective mowing height. Turf was not over seeded between years, as this would confound nitrogen uptake and seasonal responses to fertility and mowing.

Turf Responses:

Turfgrass agronomic responses included approved NTEP visual evaluations of color, quality, density, texture, and other ratings (when applicable). Ball roll distance (BRD) was measured monthly, by recording three releases in each of two directions from a standard USGA stimpmeter. Shoot counts were made by counting stolons from a 2.0-inch diameter plug cutter. Root samples were taken once per summer using an O.J. Noer Sampler to a depth of 4.0 inches. The top portion was removed with a knife at crown level and the number of upright stolons were counted and recorded. After shoot removal, roots were hand-washed over a three tier set of 1/16" screening and dried at 35ºC for one week in a convection oven. Root weights were recorded to the nearest 0.01 gram dry weight. The averages of three sub-samples/plot were used for statistical analysis. Midpoints of the second and third fully expanded leaves were measured one time in September of year two with a 6x comparator within 1/10 of 1 mm at the leaf midpoint. Ten shoots per plot were measured and averaged per plot.

Disease-type-patch symptoms occurred in early May 2000. Sunken patches of dark green water soaked turf, with highly visible white mycelial strands (stroma like) appeared on the underside of leaf blades and surrounded on the upper part of the stolons. These features mimicked the appearance of spittle bug-type symptoms, but with the white matt being very dense. Patches (6-8") would coalesce and slightly thin the turf. Disease ratings were taken as 1) the number of patches/plot, 2) severity index (1-6, 1=none, 4=moderate, 6=severe), and 3) percent plot infestation (0%-100%, visually estimated).

Turfgrass clippings were taken once per month, approximately 2 weeks after each fertilization. Sampling dates in 2000 were June 28, July 26, August 28, September 26, and November 6. In 2001, sampling dates were May 18, June 20, July 18, August 24, September 19, and October 19. Clippings represent 2 days growth as dry weight, from a 20.75" x 14' swatch of turf, for each of the 36 individual plots. Clippings were dried at 65°C until weight loss ceased, and weighed to determine dry matter production. Clippings were ground in a Wiley Mill. Tissue from the first, third, and fifth sampling date each year were ashed, dissolved in 2N HCl, and analyzed for total N and S in a CNS analyzer, and for total P, K, Ca, Mg, B, Cu, Fe Mn, Na, and Zn by ICP. Samples from the second and fourth and sixth (in 2001 only) sampling dates were analyzed for total N only. In 2000, the samples from the second date were destroyed in an laboratory ignition accident before they could be analyzed.

Soil Analyses:

Soil samples were collected on the same dates as tissue clippings. Five sub-samples were collected from each plot in 2000 and ten in 2001. Cores were taken to a depth of six inches in 2000 and to four inches in 2001. Turf was removed from the top of each core. Soils were dried at 65°C for 24 hours and mixed thoroughly before analysis. The first sample each season was analyzed for NH_4-N and NO_3-N via steam distillation and titration following extraction with 1N KCl; pH in a 1:1 soil:water extract; EC in saturated paste; K, Ca, Mg, and Na with ICP following extraction in ammonium acetate buffered at pH 7.0; P by ICP following sodium bicarbonate extraction; Cu, Fe, Mn, and Zn extracted with DTPA via ICP; B and SO_4-S by ICP after extraction with hot water. Soil samples collected all other dates each year were analyzed for NH_4-N and NO_3-N as described above.

Statistical Analysis:
All data were subjected to the analysis of variance technique using the split plot model where the rep x mowing (error A) source of variation was used to test the main effect of mowing height. Linear orthogonal contrasts were used to test for linear and quadratic effects for mowing, and the linear, quadratic and cubic effects for fertilizer rates, as well as for the interaction of the two. Contrast results are selectively discussed, based on results found. LSD values were calculated for the main effects of mowing and fertilization rates, and interaction means are provided for the discussion of relevant treatment results and examining select treatments as mow height/fertilization combinations. Statistical alpha levels for ANOVA sources of variation, linear contrasts, and LSD values was P = 0.05.

Results and Discussion

Turfgrass Color
Year 1
Sea Isle 2000, a light-medium color turfgrass, responded to mowing height on two of five dates in the first year. Mean color scores among mowing heights ranged from 5.7 to 6.9 (averaged over fertilizer treatments) (Table 1). At the 1/8” height, mean color scores of less than six occurred on two of five evaluation dates (July and October). On all five evaluation dates in 2000, the 5/32” mowed turfs had mean scores of 6.0 or greater. The 5/32” height ranked highest in color in July and October, the two months when differences between mowing heights were statistically significant.

Fertilizer rate had a greater effect than mowing height, as this source of variation was significant on four of five evaluation dates (all dates except July 2000). The greatest range for color occurred in September [6.0 – 7.6]. The 0.25 lb N treatment had the lowest color score every month, and scores increased with increasing nitrogen application rate (Table 1). On every date, paspalum receiving 0.75 lb N produced a treatment with the highest numerical color rating. For the 0.25 and 0.38 lb N/1000 ft^2 rates collectively, seven out of the ten possible scores were 5.9, or less. The 0.25 lb N rate provided a color of 6.0 on only one occasion (September) in year 1, while the 0.38 lb N rate produced mean color scores of 6.0 or greater on two of five evaluation dates in 2000. At the higher rates of 0.50 and 0.75 lb N, nine of ten possible mean scores produced mean color values of 6.0 or greater. The 0.75 lb rate of N had a mean score of 7.6 in September 2000 (Table 1).

The linear contrast for fertilizer rate main effects was significant for all five evaluation dates in 2000. In general, fertilization had a greater effect on turfgrass color than did mowing height in year 1.

Year 2
In year two (summer 2001), both mowing height and applied nitrogen fertilizer main effects were significant for turfgrass color. Color scores ranged from 5.6 (1/8” in July) to 7.3 for the 3/16” height of cut in May and August 2001 (Table 1). The mowing height effect was significant on five of six evaluation dates, in all months but July. Increased mow heights generally led to increases in turfgrass color. The greatest differences occurred between the 1/8” to 5/32” heights. In May, June and July, 5/32” turf color was not different from that of 3/16” turf, however, the 3/16” cut turf was noticeably darkest in August, September, and October. At 1/8”, turf color scores were below 6.0 in July and September.

As in the previous year, fertilizer rates significantly affected turfgrass color. This occurred for four of six months in year two: May, August, September, and October. The color ranges between treatments was 5.4 (0.25 lb N in July) to 7.9 (0.75 lb N) in May. The lightest colored turf was seen in July. The linear contrast for fertilizer rates was significant for all months except July.

Two-year summary
Sea Isle 2000 produced a light to medium color turf as a green. Color ratings increased with increasing mowing height. The increases were significant seven out of eleven rating dates, but the trends were consistent even when not significant. In both years, turf color responded positively to fertilization rate, with improved color at the higher levels of fertilization (Appendix –A). In general, turf color was lightest in July (monsoon period), averaging less

than 6.0 in both years. Turf color scores were noticeably greater in October 2001 than in October 2000, probably due to unseasonably warm temperatures in the fall of 2001. The 1/8" height turf required a arte of 0.50 –N/M to maintain a color score of 6.0 or greater, while the 5/32" turfs required 3/8 lb –N/M. The 3/16" turf required only 0.25 lb –N/M to maintain a mean color score of 6.0 throughout the test. The 1/8" turf required an applied –N- rate of 0.25 lbs. N/M to maintain a color of 6.0 or greater, while the 5/32" height required 0.38 lbs N/M. The 3/16 " required an applied fertility rate of 0.25 lbs –N-/M to maintain a color score of 6.o or greater throughout the test.

<u>Turfgrass Quality:</u>
<u>Year 1</u>
The mowing height main effect was non-significant on four of five evaluation dates in 2000. It was significant only at the end of October, when 5/32" turf appeared better than the 1/8". All mowing heights (when averaged over fertilization rates) provided mean quality scores the first year of 6.0 to 7.3 (Table 2).

Quality scores for the fertility main effect ranged from 6.2 to 7.3, averaged over mowing heights. The fertilizer main effect was significant on one date only (June). At that time the quality rating was inversely related to fertilizer rates (the best quality rating coincided with the lowest nitrogen fertilizer rate). In August, September, and October, quality improved as nitrogen application rate increased, although all differences were non-significant (Table 2).

No significant interaction between mowing height and fertilizer application rate was observed.

<u>Year 2</u>
As was the case in year one, mowing height did not affect overall quality of the turf. Quality mean scores ranged from 6.0 to 7.2 across all months, with monthly averages ranging from 6.5 to 7.0 (Table 2).

The main effect of fertilizer rates was more pronounced in year two, and the quality response to nitrogen application rates was significant for turfgrass quality on five of six dates. Averaged across mowing heights, turfgrass quality was highest at 0.75 lb N in May and June. In August, September, and October quality ratings were inversely related to nitrogen fertilizer application rate. During these months, the highest quality ratings were in plots receiving lesser amounts of nitrogen. In July little or no differences resulted from applied fertilizer rates.

<u>Two-year summary</u>
Sea Isle 2000 produced an acceptable quality turf, but it is of lesser quality than that of an ultra-dwarf bermudagrass (observation only). Mowing height had no consistent or significant influence on visual quality, nor was there an interaction between fertilizer application rate and mowing height. Fertilizer responses were different in the two years. In year one, response to nitrogen was negative early in the season (June), and positive (although not statistically significant) later in the year (September and October). In year two, response was positive in early summer (May and June) and negative later (August, September, and October). No explanation is suggested for the contrasting visual quality responses to nitrogen application rate. It should be noted that September and October of 2001 produced the highest mean daily temperatures for both months, on record. Across both years, the 1/8" turf required a base line of 0.50 lbs –N-/M to yield quality score of 6.0, or greater. At lower N rates, July quality performance was less than would be expected. Quality performance scores were not dependent on applied fertilizer rates within mowing heights (Appendix –B).

<u>Texture</u>:
<u>Year 1</u>
Visual estimates of leaf width were used to determine turfgrass "texture." Mowing height did not influence visual texture scores in the four months scores were assigned to plots. The range of mean texture scores ranged from 5.8 to 6.8, across all mowing heights (Table 3). Leaf widths were comparable to that of Tifgreen 328 (observation only). All heights produced the narrowest and most desirable leaf texture scores in July (monsoon). A distinct leaf texture improvement due to mowing height was not realized under the conditions of this test.

Fertilizer rates were significant for leaf texture in June and October, due to the fact that the highest rate of nitrogen caused a wide leaf texture (low texture ratings) compared to lower fertilizer rates. The general trend occurred for lower amounts of nitrogen to produce a slight reduction in leaf width (higher texture scores). This trend was not significant in July or September. In October, the response was inconsistent, as texture ratings for 0.25, 0.38, 0.50, and 0.75 lb N were 6.3, 6.7, 6.6, and 5.9, respectively (Table 3).

The interaction of mowing x fertilizer was non-significant on all dates.

Year 2

In year two, results were similar to those of year one, as mowing height did not have an affect on visual texture. Mean visual density scores in year two ranged from 5.8 to 6.9 among mowing heights, and monthly averages ranged from 6.2 to 6.7, with the narrowest leaves occurring in September (Table 3).

When averaged over mowing heights, fertilizer rates affected visual texture scores, with significance occurring on five of six evaluation dates. In May, July, August, September, and October, an increase in fertilizer tended to decrease visual leaf width values (i.e. produced leaves with a coarser texture). However, in June the lowest texture score was evident on the 0.25 lb N plots, and the highest to the 0.75 lb N plot (Table 3). There was no statistically significant interaction between mowing height and fertilizer application rate.

Leaf widths were measured in the second year. There was little variation for leaf width (1.4 – 1.7 mm at 2nd leaf and 1.4 – 1.8 mm for the third leaf) among all twelve treatment combinations. Neither main effects, nor the interaction of mowing height x fertility were significant.

Two-year summary

In neither year did mowing height affect the visual texture appearance of paspalum. In both years there was a slight but inconsistent trend for lower amounts of nitrogen to reduce leaf width (i.e. to produce higher texture scores), and conversely for higher levels of nitrogen to produce leaves with a coarser texture. Mowing height and nitrogen application level did not interact. At 1/8", increased N rates were inconsistent in affecting visible textural perception. At 5/32" higher N rates tended to produce more larger (wider) leaves in the canopy. At 3/16", there was little or no effect of N rates on apparent texture. Sea Isle 2000 seems to produce two distinct leaf widths within the canopy. The magnitude of expression is most likely micro-environmental. At 1/8", increased –N- rates were inconsistent in effect for influencing visual turf texture. At 5/32" the highest –N- rate of 0.75 lbs.-N/M tended to produce wider looking leaves. At 3/16", applied –N- had no effect (Appendix –C).

It remains to be seen as how this grass will respond to different frequencies and degrees of vertical mowing, topdressing and grooming.

Visual Density:

Year 1

The mowing height effect was significant only during September, as the 1/8" mowed plots tended to have a lower visual density at that time. All mowing heights had acceptable scores, ranging from 6.3 – 7.2, which is a narrow range of separation. No regular trends relating visual density to mowing height were observed (Table 4).

For nitrogen rates, the mean density scores ranged from 6.3 to 7.4. The fertilizer main effect was significant only for July and October. In July and August, the middle value rates of 0.38 and 0.50 lb tended to produce a more visually dense turf. In late October, the highest N rate of 0.75 lb N had the greatest visual density (Table 4).

Year 2

In year two, the mowing height effect was significant in June and August. In general, the 5/32" height produced the most visually dense turf, however in August the highest density turf was observed in plots cut at 1/8". In May 1/8" cut turf produced a slightly thin looking turf (mean = 5.9), although the 1/8" cut produced an acceptably dense turf in June, and throughout the rest of year two (Table 4).

Among fertilizer rates, a positive linear effect occurred between N rates applied and visual density scores early in the season (May/June). In August, September, and October of year two lower rates of nitrogen produced a dense looking turf, although differences in September and October were not significant. There was no interaction between mowing height and nitrogen application rate (Table 4).

Two-year summary

Although mowing height significantly affected visual density ratings on three occasions, no consistent trends were observed. Across both years, the 1/8" height cut turf maintained visual density mean scores of 6.0 or greater, at the minimum rate of 0.50 lbs –N-/M. There were no consistent trends for applied N rates affecting density within each mowing height during this test (Appendix – D). From a visual standpoint, Sea Isle 2000 is variable in visible leaf texture, and to a lesser extent, turf density.

Biomass Clipping production:

Year 1

Mowing height significantly affected clipping dry weights for all five months in 2002. On three dates, clipping weights were least at the 5/32" clipping height (June, September and November 2000). In June and November, the 1/8" clipping height produced most clippings (as it did in July and August, although those differences were significant only at the 10% level) (Table 5). In September 3/16" produced the most clippings. Overall, clipping production was greatest in July, when dry mass produced was almost three times as much as that of June or August, and roughly twice that of September.

Nitrogen application levels significantly affected dry matter production in June, August, September, and November. The linear contrast was significant in three of the four summer months as clipping production increased with fertilizer rate. In general, there was about a 20% difference in clippings between the low (0.25) and high (0.75) lb N rate (Table 5). In June, there were no differences between the higher three rates of nitrogen (0.38, 0.50, and 0.75 lb N) The July sampling date produced more than twice the clippings of other months, and all fertilizer treatments produced similar clipping weights. In August, only the 0.75 lb N treatment produced significantly more clippings than other treatments. In September, 0.25 lb N produced less dry matter than other treatments, and 0.75 lb N produced the most clippings. By the November 6 sampling date, there were no differences between fertilizer main effect treatments for dry matter clipping production, as fall temperatures greatly reduced total overall growth (Table 5). At no time was there an interaction between mowing height and applied nitrogen for dry weight clipping production.

Year 2

Again, clipping production was affected both by mowing heights and fertilizer rates in year two. Both of these main effects were significant on five evaluation dates in 2001. The 1/8" height ranked first for clipping production in four of six months, but during the most active growing months of June and July, the 5/32" mow height produced considerably more clippings than the other two mowing heights, resulting in a significant quadratic contrast. For the remaining three months of August, September and October, the shorter mowing heights produced the greatest clipping production (Table 5).

Nitrogen application rate significantly affected clipping dry weight in all months except September. In every other month the linear contrast was significant, with 0.25 lb N producing the least clippings, and 0.75 lbs N producing the most. Differences between the two mid-range N application rates, 0.38 and 0.50 lb N, were not statistically or biologically significant (Table 5).

A statistically significant mowing height x fertilizer interaction occurred in June of year two. Positive responses to increasing nitrogen application rates became greater as mowing height increased. Clipping weights in plots fertilized with 0.75 lb N were 31 and 34% greater than those receiving 0.25 lb N, in plots mowed at 1/8" and 5/32", respectively. In plots mowed at 3/16, this difference was 68% (Table 5).

Two-year summary

Nitrogen application rate was clearly the most important factor affecting dry matter production. Increasing nitrogen rate consistently increased dry matter production. These differences were significant in eight out of eleven months of this study. The effect of mowing height was significant in six out of eleven months, but trends were variable. Sometimes shorter mowing heights produced the greatest amount of dry matter; sometime the greatest production was produced by the higher mowing height. Within mowing heights, applied N increased clipping production in May, June and July in year two only (Appendix E).

Shoot Counts:

Year 1

Shoot counts were affected by fertility rates, but not by mowing heights. The response to fertility was quadratic, with the least number of shoots occurring at 0.50 lb N/1000 ft^2, and the most occurring just below and above this rate (Table 6). Among the 12 treatments of mowing/fertility, the range for shoot counts was 130.7 to 165.8 shoots per plug (Appendix –F). The mowing height x fertility rate interaction was not significant. The greatest shoot density was produced by the 1/8' mow height, when fertilized at either 0.25 or 0.75 lbs –N-/M.

Year 2

In year two, mowing height had a greater effect then did applied nitrogen rates as main effects. Shoot counts decreased with increasing mowing height. The low mowing height of 1/8" produced the greatest shoot counts at

140.2 shoots/plug, versus 114.9, and 111.8 shoots/plug for 5/32” and 3/16” mow heights, respectively (Table 6). As in year one, the response to fertilizer N rates was quadratic, although the smallest number of shoots was produced at the 0.38 lb N rate. The mowing height x fertility rate interaction was not significant.

Two-year summary

Shoot count was affected by mowing height in the second year only, and by applied fertilizer N in year one only. Shoot counts decreased with increasing mowing height in year two. The highest and lowest nitrogen application rates produced higher shoot counts than mid-range rates (Table 6). Interactions between mowing height and fertilizer rate were non-significant . Within mowing heights, applied N did not affect shoot density counts in either year (Appendix –F).

Tissue Nutrient Content

Year 1

Clipping composition in the first year was inconsistently affected by mowing height. In June, mowing height affected calcium, iron, boron, and potassium; in August magnesium, iron, manganese, and potassium, and in November sulfur, phosphorus, boron, and potassium. July samples were lost in a laboratory accident, and no significant differences were observed in September.

Nitrogen application rate affected sulfur in June, sulfur, magnesium, magnesium, manganese, and zinc in August, and magnesium, iron, potassium and sodium in November but, trends were inconsistent (high levels of nitrogen did not consistently increase or decrease levels of these nutrients). In August, September, and November, increasing the level of nitrogen fertilization increased clipping nitrogen concentration. A similar trend was observed in June, although differences were not significant.

Year 2

As in the first year, second year nutrient concentrations of paspalum clippings were inconsistently affected by mowing height. Phosphorus and sulfur concentrations were higher as mowing height increased in May; nitrogen increased with mowing height in June and October; potassium levels were greater in paspalum mowed at higher heights in July. No differences were noted in August. In September, turf mowed at higher heights contained more nitrogen, phosphorus, potassium, and sulfur, but contained less manganese and iron than that of turfs mowed shorter.

As expected, and as observed in 2000, increasing nitrogen fertilizer application rates consistently resulted in turfgrass clippings with higher concentrations of nitrogen. In July, increasing rates of nitrogen fertilizer increased tissue magnesium, and in both July and September, increasing rates of nitrogen fertilizer increased tissue zinc and sodium. Nitrogen tissue contents were always significantly different between the 0.25 and 0.75 lb. N/M rates, when averaged over mowing heights.

Two-year summary

When significant and non-significant trends are combined, it appears that mowing height affects tissue concentrations of several nutrients. Often sampling dates, tissue nitrogen levels increased six times, three of them statistically significant and decreased once, as mowing height was increased. Potassium levels increased significantly five out of six sampling dates as mowing height was increased. Similarly, phosphorus concentrations increased five out of seven dates, but increases were significant on only three dates. Less consistent increases were seen in concentrations of sulfur, magnesium zinc, and sodium. Iron levels decreased with increasing mowing height four our or six sampling dates, significantly on two dates.

As noted, increasing levels of nitrogen fertilizer consistently increased tissue nitrogen levels. In addition, zinc levels increased four out of six dates, three of them significantly. Sodium levels increase five out of six dates, and three of the increases were statistically significant. Potassium and sulfur increased three out of six dates, significantly on just one date.

The importance of the noted nutritional shifts remains to be demonstrated. It is not surprising that increasing nitrogen fertilization increases uptake of other nutrients, because the plant is growing faster and transpiring more rapidly, bringing more nutrients to the root via mass flow. The same argument may hold true for paspalum mowed at higher heights, as these plants retain more photosynthetic and transpirational leaf surface when mowed. The decrease of iron concentration with increasing mowing height is in contrast with the behavior of other nutrients and does not fit this pattern

Root Weight

Year 1

Both the main effects of mowing height and fertilizer nitrogen rates were not significant variables for root weight production. The dry root weights/plug followed the same pattern as the shoot counts, decreasing from 5/32" to 3/16" (0.73 gm; 0.59 gm, respectively), although root weight differences were not significant (Table 6). As was also the case with shoot counts, the 0.50 lb N rate had the lowest biomass produced in root mass. These differences again, were not statistically different. Interactions between mowing height and fertilizer application rate were not significant.

Year 2

As was the case in year one, neither main effect of mowing height or fertilizer rate affected root production on a dry weight basis. Root weights were generally within 10% or less of each other within and between both main effects (Table 6). Rankings for root mass and shoot counts were not correlated. Rhizome depth was measured in year two only, as the bottom margin of the distinct horizontal layer of radial rhizomes (Table 6). Rhizome depth was not affected by mowing or applied N rates within individual mowing heights (Appendix-F).

Two-year summary

Root weights tended to follow similar patterns as shoot counts in year one, but not in year two, and in no case were differences between treatments statistically significant. In year one, root weights decreased with increased applied N at the 1/8" height, and increased slightly as fertilizer rates increased at the 3/16" height. In year 2, there were no trends at all for fertilizer response for root production within any single mowing height (Appendix-F).

Disease:

Year 1

Pock marked blotches appeared in patch like patterns in the first week of May of 2000. Fungal isolates did not produce resting stages, spores or other secondary structures while in culture. Koch's postulates were thus not attempted. However, fungal mycelium was most readily and easily seen throughout and at the edge of all patches on all plots. Further research is necessary to evaluate the disease susceptibility of Seashore paspalum in a semi-arid environment.

It was decided to delay the fertility treatments in May 2000 until the condition could be halted and/or corrected. An application of Heritage, followed 5 days later by Fore (both at full 1x corrective rates) arrested the problem in about two weeks. Samples taken before application of fungicide produced mycelia similar to that of white patch disease, which is generally a low fertility disease. The green had been fertilized once in early April at 0.25 lb N/1000 ft2, about thirty days before the scheduled May 5 application of the first N fertilizer treatment applications. Disease ratings reported here were measured in September, after a moderate vertical mowing revealed the former infection centers.

The numbers of (equivalent 6" radius) rings were counted on each plot in September. Disease severity scores were assigned to plots using a visual scale of 1-6 based on symptom expression and loss of turf within patches. Also, a visual estimate of percent plot infestation (0-100%) was assigned to all plots as well. For number of rings and percent plot infestation, mowing height, fertility level, and the interaction of the two, all sources of variation were non-significant at P==0.05 (Table 7). The number of rings/plot would be significant at P=0.09.

Although the main effect of mowing height was not statistically significant, the quadratic contrast was significant for the number of rings present, as lower mowing heights increased the number of rings. There were two and one half times more rings at 1/8", that at 3/16". For mowing height, the percent plot disease (0-100%) infestation estimates responded in quadratic fashion, as again the 3/16" height of cut had a much lower plot infestation area present than the other lower heights of cut (50% less). Fertility (when averaged over all mowing heights) had no effect on percent plot infestation or the number of rings.

Year 2

In July of year two, patches similar to those of year one appeared, although minus the presence of visible surface mycelium. Circular to oblong patches of "sunken" and darker colored turf first appeared, followed by 35% thinning of the turf within the patch's themselves. Percent plot disease was much greater than in the previous year, but again, the main effects of mowing height and applied fertilizer were not significant (Table 7). The 3/16" height had the least amount of expression. This caused a significant linear and quadratic effect for mowing height on symptomatic expression for both years. Within each year, the plot percentage showing symptomatic expression nearly doubled as mowing height was reduced. The greatest amount of patch-type symptoms at the 1/8” turf occurred at the 0.25 lb. –N/M treatment in year 1, and at any of the higher applied nitrogen rates in year 2 (Appendix –F).

Ball Roll Distance:

Year 1

Ball roll distance (BRD) was measured on eight events in Year 1. Five measurements were taken immediately after a simple double mowing, and three after double mowing followed by rolling in one direction with a 685 lb barrel roller.

Mowing height as a main effect was significant for BRD on seven of eight measurements. Mean BRD values ranged from 58.4” to 94.1” among mowing heights, when averaged over fertilizer application rates (Table 8). The 1/8” mowing height produced the longest BRD values on six of eight measurement events. When mowed only (without rolling), in July and August, the 5/32” mowing height was better for BRD than 3/16”, but not during the late summer or early fall (September, October).

When subjected to mowing and rolling, the 1/8” turf produced on average an 8” increase in August, a 1” increase in September, and a 12” increase in late October. The greatest BRD for 1/8” turf was 105.8 inches in late October (Table 8). The increase in BRD was linearly related to a decrease in mowing height on all dates (mowed, and mowed and rolled), and the quadratic contrast was significant for both rolled and unrolled turf in September, and October (Table 8). Perhaps the taller turf when rolled provided a smoother surface than the intermediate cut turf at that time.

Fertilizer N rate generally had effect little effect on BRD. It was significant statistically for two measurements only (28 July – no roll, and 31 October – no roll, as the 0.25 lbs./M turfs had a 2-3” greater BRD than other applied N levels). There were no significant interactions for BRD in year 1.

Year 2

As was the case in year one, mowing height as a main effect had a much more dramatic effect on BRD than did fertilizer rates (Table 9). In year two, there were twelve ball roll events (one mowed, one mowed/rolled, per month), and each BRD event proved to have height as a significant main effect. Each increase in mowing height increment decreased BRD roughly six to eight inches. In each case again, the response was linear, as decreased heights provided greater BRD values, whether turf received supplemental rolling, or not (Table 9). In general, rolling added about 6 inches to BRD, over identical non-rolled plots.- in May and June for the 1/8” turf, which decreased to 3-4 inches in later months. Fertility (as in year one) had no statistical or biological effect on BRD.

The greatest BRD values were achieved in June (for both unrolled and rolled turf) at the 1/8” height. At this time, BRD values for 1/8” unrolled and rolled turf were 100.4” and 107.9”, respectively. When unrolled, increases in BRD at 1/8” occurred with increases in N fertilization, but this effect was eliminated when rolling was added (Table 9). While the 1/8” turfs always ranked highest in BRD, fertility response within the 1/8” cut turf was of little or no consequence (Appendix D). When observed seasonally across all mow heights, unrolled turf BRD values in year two ranged from 64.9 (3/16” in June) to 100.4” (1/8” in June of year two) (Table 9). When the green was rolled, BRD values ranged seasonally from 69.4” (3/16” in July) to 107.9” (1/8” in June). Across all BRD events, the increase in mowing height caused a decrease in BRD values, for both rolled and unrolled turfs. In general, the greatest difference in BRD occurred between the 5/32” and 3/16” mowing heights. In general, BRD was greater and more consistent from month to month in year two than in year one.

In each case the 1/8” plots and 3/16” plots lie at the extremes of BRD. Among the 1/8” mowed turf, the greatest increases in BRD occurred in June, and July (Table 9, Appendix G).

In year two, the overall ranges and mean BRD values among the interaction (twelve treatments) for mowed only turfs were as follows (Appendix G).

MOWED

Month	*Low : High*	*Difference*
May	(67.0”, 79.6”)	[12.6”]
June	(63.3”, 105.0”)	[41.7”]
July	(65.3”, 93.3”)	[28.0”]
August	(68.3”, 87.6”)	[19.3”]
September	(68.3”, 84.3”)	[16.0”]
October	(69.6”, 86.7”)	[17.1”]

When the turf was also rolled, BRD value ranges were as follows.

MOWED & ROLLED

Month	*Low : High*	*Difference*
May	(66.0”, 85.3”)	[19.3”]
June	(67.0”, 109.3”)	[42.3”]
July	(68.3”, 94.3”)	[26.0”]
August	(71.3”, 88.3”)	[17.0”]
September	(69.6”, 87.0”)	[17.4”]
October	(73.0”, 93.3”)	[20.3”]

The greatest BRD values were achieved in June followed by July. Rolling increased BRD values across the full range of treatments. Rolling provided the greatest benefit in the months of May and October, which represents the slowest growth periods within the accepted growth curve for a warm season grass.

The effect of a single rolling event added about a 6.0” increase for 1/8” mowed turfs in May, June and July, with only a 3-4” increase in September and October of year two (Table 9). It is argued that golfers cannot notice BRD increases of less than 12 inches, in which case, rolling would be insignificant as a management tool. However, rolling may be necessary in Paspalum to obtain and maintain acceptable BRD values

Two-year summary:

Mowing height had a greater effect on ball speed than did applied N fertilizer rates. Increased BRD values were achieved by rolling were greater in year 1 than in year two, noting that summer BRD values were generally greater in year two. The greatest BRD values were obtained in June 2001 of 109 inches. In general, the 1/8’ turf was anywhere from 10 to 22 inches greater in BRD than the 3/16 mowed turf. Rolling added anywhere from 4 to 12 inches in BRD. Note that these rolling events occurred once per month, and were only associated with BRD sampling events in this study. A BRD of 100 inches qualifies with USGA standards as a Medium (just short of fast) for Regular Membership play. However, most BRD performance values at the 1/8” height which averaged about 87 inches would qualify as “Medium” in Regular Play. Under the conditions of this test, (vertical mow/topdress every 14 days) all other BRD values obtained from the 5/32’ and 3/16 heights would be marginal in acceptance. Within each mowing height, fertility did not affect BRD whatsoever (Appendix –G).

Conclusions

1. Sea Isle 2000 tolerated mowing at 1/8" for two years with a Toro Series 5 Tournament Mower using a grooved front roller.

2. Sea Isle 2000 produced a turf which ranged from light to light - medium color turf, depending on mowing height and fertilization. In general, the inherent color of Sea Isle 2000 Paspalum is lighter than that of Tifgreen 328 bermuda (long term observations).

3. Maintenance of an acceptable visible turfgrass COLOR of 6.0 or greater was achievable generally for the following mowing heights at the following applied nitrogen rates: 1/8 = 0.50 , 5/32 = 0.38, 3/16 = 0.25 lbs. N/M.

4. Maintenance of an acceptable visible turfgrass QUALITY of 6.0 or greater was achievable generally for the following mowing heights at the following applied nitrogen rates : 1/8 = 0.50 , 5/32 = 0.25, 3/16 = 0.25 lbs. N/M.

5. SHOOT DENSITY was greatest in BOTH years at the 1/8 ' height and was not influenced by nitrogen.

6. ROOT WEIGHTS were not significantly different from each other due to mowing height, or applied nitrogen fertilizer rates.

7. Sea Isle 2000 produced a visually mixed leaf TEXTURE and DENSITY under the conditions of this text. It produced stiff upright leaves, with two apparent leaf widths detectable by observation. In general, the turf appeared to be similar in appearance and performance to that of Tifgreen bermudagrass. Leaf widths varied between 1.4 and 1.7 mm, on average.

8. BRD was affected more by mowing height than by fertilization rates of nitrogen alone.

9. Ball Roll Distance values under the conditions of this test were slow by USGA stimpmeter standards. A maximum BRD of 109.3 inches was achieved in July of year 2 at the 1/8" height (fast=Tournament Play). Further testing is underway investigating surface management techniques to increase BRD on 1/8" mowed Sea Isle 2000.

10. Clipping dry weight BIOMASS production was related to both mowing height and applied nitrogen, with nitrogen causing a greater clippings more consistently than that of mowing height.

11. Applied nitrogen was not always correlated with CLIPPING nitrogen content, although there was always statistical differences in tissue N content between the high and low N applications of N fertilizer.

12. When significant and non-significant trends were combined, it appears that mowing height affects tissue concentrations of several nutrients. Among sampling dates, tissue nitrogen levels increased six times, three of them statistically significant and decreased once, as mowing height was increased. Potassium levels increased significantly five out of six sampling dates as mowing height was increased. Similarly, phosphorus concentrations increased five out of seven dates, but increases were significant on only three dates. Less consistent increases were seen in concentrations of sulfur, magnesium zinc, and sodium.

13. Iron levels decreased with increasing mowing height four our or six sampling dates, significantly on two dates

14. A DISEASE type condition appeared in both May 2000 and June 2001 which caused pock marked circles and loss of turf density.

PERCENT NITROGEN IN TISUUE AS INFLUENCED BY SOIL APPLIED -N-

2000		**June 28**		**August 28**	**September 26**	**November 6**
0.25 lb N		2.98 ns		3.29 b	3.27 c	2.48 b
0.38 lb N		3.35 ns		3.23 b	3.34 c	2.51 b
0.50 lb N		3.32 ns		3.47 a	3.42 b	2.59 b
0.75 lb N		3.48 ns		3.57 a	3.54 a	2.85 a
2001	**May 18**	**June 20**	**July 18**	**August 24**	**September 19**	**October 19**
0.25 lb N	2.78 c	2.51 c	2.55 b	2.75 b	2.50 b	2.46 b
0.38 lb N	2.85 b	2.61 b	2.57 b	2.83 ab	2.59 ab	2.47 b
0.50 lb N	2.85 b	2.66 b	2.59 b	2.87 a	2.54 b	2.52 b
0.75 lb N	2.96 a	2.86 a	2.71 a	2.93 a	2.78 a	2.70 a

**Table 1. Visual Color of a 'Sea Isle 2000' Paspalum Putting Green
Under Select Mowing Height and Fertilization Regimes.
Summer 2000 & 2001, Karsten Turfgrass Research Facility, University of Arizona.**

	2000					*2001*						
	27-Jun	*28-Jul*	*28-Aug*	*27-Sep*	*30-Oct*	*17-May*	*25-Jun*	*23-Jul*	*21-Aug*	*10-Sep*	*6-Oct*	*Avg.*
Mow Height												
1/8"	6.3	5.2	6.3	6.3	5.7	6.5	6.1	5.6	6.6	5.8	6.3	*6.0*
5/32"	6.1	6.3	6.1	6.9	6.3	7.3	6.8	5.8	6.5	6.3	6.8	*6.4*
3/16"	6.0	6.1	6.8	6.6	5.7	7.3	6.8	5.8	7.3	6.8	7.0	*6.5*
Test Mean	6.1	5.9	6.4	6.6	5.9	7.0	6.6	5.7	6.8	6.3	6.7	6.3
LSD	ns	0.44	ns	ns	0.50	0.68	0.65	ns	0.60	0.87	0.60	
Fertilizer Rate (nitrogen /1000 ft^2)												
0.25 lb.	5.8	5.4	5.8	6.0	5.3	6.1	6.4	5.4	6.3	5.9	6.0	5.9
0.38 lb.	5.8	5.7	6.3	6.0	5.4	6.8	6.1	5.8	6.7	6.3	6.3	6.1
0.50 lb.	6.1	6.2	6.4	6.8	5.9	7.3	6.8	5.9	6.9	6.2	6.8	6.5
0.75 lb.	6.8	6.1	6.9	7.6	6.8	7.9	7.0	5.8	7.3	6.9	7.7	*6.9*
Test Mean	6.1	5.9	6.4	6.6	5.9	7.0	6.6	5.7	6.8	6.3	6.7	6.4
LSD	0.80	ns	0.81	0.40	0.67	0.51	ns	ns	0.38	0.69	0.57	

Color = 1-9, 1=dead, 6= fully acceptable, 9 = best posible. Values are the meanof 4 replications
Test Mean = mean of all tretaments on that date event.
LSD= Least significant differeance mean separation statistic. Ns=non significant, no value applicable.

Table 2 . Visual Turf Quality of Sea Isle 2000 Papsalum Under Select Mowinh Heights and Nitrogen Fertilization Summer 2000, Karsten Turfgrass Research Facility, University of Arizona.

	2000					*2001*						
	27-Jun	*28-Jul*	*28-Aug*	*27-Sep*	*30-Oct*	*17-May*	*25-Jun*	*23-Jul*	*21-Aug*	*10-Sep*	*6-Oct*	*Avg.*
Mow Height												
1/8"	6.7	6.3	6.3	6.7	6.0	6.0	6.5	6.3	7.3	6.9	6.7	6.5
5/32"	7.2	6.9	6.6	7.3	7.3	7.2	7.1	6.4	6.8	7.1	6.8	6.9
3/16"	6.8	6.8	7.3	7.0	6.4	6.7	6.8	6.8	6.9	6.8	6.8	6.8
Test Mean	6.9	6.7	6.7	7.0	6.6	6.6	6.8	6.5	7.0	6.9	6.7	6.8
LSD	ns	ns	ns	ns	1.1	ns	ns	ns	ns	ns	ns	
Fertilizer Rate (nitrogen /1000 ft^2)												
0.25 lb.	7.3	6.8	6.6	6.7	6.2	6.2	6.3	6.4	7.4	7.6	7.7	6.8
0.38 lb.	7.0	6.4	6.8	6.7	6.4	6.3	6.8	6.3	7.0	6.9	6.8	6.7
0.50 lb.	6.8	6.7	6.8	7.2	6.4	6.8	6.8	6.8	7.0	6.7	6.4	6.8
0.75 lb.	6.3	6.8	6.8	7.3	7.1	7.1	7.3	6.3	6.4	6.7	6.0	6.7
Test Mean	6.9	6.7	6.7	7.0	6.6	6.6	6.8	6.5	7.0	6.9	6.7	6.7
LSD	0.86	ns	ns	ns	ns	0.80	0.92	ns	0.66	0.73	0.51	

Quality= 1-9, 1=dead, 6= fully acceptable, 9 = best posible. Values are the meanof 4 replications

Test Mean = mean of all tretaments on that date event.

LSD= Least significant differeance mean separation statistic. Ns=non significant, no value applicable.

Table 3. Visual Texture of a 'Sea Isle 2000' Paspalum Putting Green Under Select Mowing Height and Fertilization Regimes. Summer 2000, Karsten Turfgrass Research Facility, University of Arizona.

	2000				*2001*						
	27-Jun	*28-Jul*	*27-Sep*	*30-Oct*	*17-May*	*25-Jun*	*23-Jul*	*21-Aug*	*10-Sep*	*6-Oct*	*Avg.*
Mow Height											
1/8"	6.4	6.8	6.2	6.5	6.3	6.2	6.1	6.8	6.7	6.5	*6.4*
5/32"	5.8	6.7	6.7	6.6	6.8	6.5	6.1	6.0	6.9	6.2	*6.4*
3/16"	6.0	6.7	6.5	6.0	6.4	6.5	6.6	5.8	6.4	6.3	*6.3*
Test Mean	6.1	6.7	6.4	6.4	6.5	6.4	6.3	6.2	6.7	6.3	6.4
LSD	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	
Fertilizer Rate (nitrogen /1000 ft^2)											
0.25 lb.	6.4	7.1	6.8	6.3	6.7	5.9	6.3	6.7	6.8	6.9	*6.6*
0.38 lb.	6.3	6.6	6.3	6.7	7.0	6.6	6.4	6.2	7.0	6.3	*6.5*
0.50 lb.	6.1	6.8	6.4	6.6	6.3	6.4	6.6	6.1	6.2	6.6	*6.4*
0.75 lb.	5.4	6.4	6.2	5.9	5.9	6.7	5.7	5.8	6.7	5.6	*6.0*
Test Mean	6.1	6.7	6.4	6.4	6.5	6.4	6.3	6.2	6.7	6.3	6.4
LSD	0.58	ns	ns	0.67	0.69	0.62	0.73	0.50	ns	0.77	

Texture = 1-9, 1=dead, 6= fully acceptable, 9 = best posible. Values are the meanof 4 replications
Test Mean = mean of all tretaments on that date event.
LSD= Least significant differeance mean separation statistic. Ns=non significant, no value applicable.

Table 4. Visual Density of a 'Sea Isle 2000' Paspalum Putting Green Under Select Mowing Height and Fertilization Regimes. Summer 2000, Karsten Turfgrass Research Facility, University of Arizona.

	2000				*2001*						
	28-Jul	*28-Aug*	*27-Sep*	*30-Oct*	*17-May*	*25-Jun*	*23-Jul*	*21-Aug*	*10-Sep*	*6-Oct*	*Avg*
Mow Height											
1/8"	6.9	7.1	6.3	6.6	5.9	6.0	6.8	8.2	7.2	7.3	6.8
5/32"	6.8	7.3	6.9	7.0	7.6	7.5	7.0	7.3	7.2	7.3	7.2
3/16"	7.2	6.7	6.7	6.8	6.3	7.0	7.7	6.5	6.9	7.1	6.9
Test Mean	7.0	7.0	6.6	6.8	6.6	6.8	7.2	7.3	7.1	7.2	7.0
LSD	ns	ns	0.44	ns	ns	0.77	ns	0.64	ns	ns	
Fertilizer Rate (nitrogen /1000 ft^2)											
0.25 lb.	6.9	6.9	6.8	6.6	5.9	6.1	7.2	8.0	7.3	7.4	6.9
0.38 lb.	7.4	7.1	6.8	6.7	6.6	6.7	7.2	7.1	7.0	7.3	7.0
0.50 lb.	7.0	7.2	6.7	6.6	6.7	7.1	7.3	7.0	7.0	7.2	7.0
0.75 lb.	6.6	6.9	6.3	7.3	7.3	7.4	6.9	7.1	7.0	6.9	7.0
Test Mean	7.0	7.0	6.6	6.8	6.6	6.8	7.2	7.3	7.1	7.2	7.0
LSD	0.75	ns	ns	0.68	0.81	0.69	ns	0.62	ns	ns	

Density = 1-9, 1=dead, 6= fully acceptable, 9 = best posible. Values are the meanof 4 replications
Test Mean = mean of all tretaments on that date event.
LSD= Least significant differeance mean separation statistic. Ns=non significant, no value applicable.

Table 5. Clipping Dry Mass Collected From a 'Sea Isle 2000' Paspalum Putting Green Under Select Mowing Height and Fertilization Regimes. Summer 2000, Karsten Turfgrass Research Facility, University of Arizona.

	2000					*2001*						
	28-Jun	*26-Jul*	*28-Aug*	*26-Sep*	*6-Nov*	*17-May*	*18-Jun*	*16-Jul*	*22-Aug*	*19-Sep*	*17-Oct*	*AVG.*
Mow Height												
1/8"	17.7	36.2	12.7	9.6	5.9	13.5	12.0	18.1	14.6	15.4	6.1	14.7
5/32"	1.8	27.3	10.7	8.5	2.9	9.9	29.0	23.1	12.8	13.7	5.0	13.2
3/16"	7.5	25.6	10.0	13.7	4.0	7.4	15.8	17.8	14.2	11.5	3.6	11.9
Test Mean	9.0	29.7	11.2	10.6	4.3	10.3	18.9	19.7	13.8	13.5	4.9	13.3
LSD	2.7	9.6	2.5	1.1	1.1	1.85	1.21	4.64	ns	3.70	0.89	
Fertilizer Rate (nitrogen /1000 ft^2)												
0.25 lb.	7.2	29.5	10.4	9.6	4.2	8.9	16.3	17.3	12.1	13.3	4.4	12.1
0.38 lb.	9.8	30.5	11.0	9.9	4.1	9.7	17.8	19.1	13.5	13.1	4.9	13.0
0.50 lb.	9.0	27.7	11.2	10.7	4.1	10.0	18.3	19.8	13.7	13.2	4.7	13.0
0.75 lb.	9.9	31.2	12.1	12.1	4.7	12.4	23.2	22.5	16.1	14.5	5.6	14.9
Test Mean	9.0	29.7	11.2	10.6	4.3	10.3	18.9	19.7	13.8	13.5	4.9	13.3
LSD	2.1	ns	0.8	1.0	0.6	0.93	1.56	1.85	0.94	ns	0.50	

Cliiping dry weight in grams per plot. Values are the mean of 4 replications
Test Mean = mean of all tretaments on that date event.
LSD= Least significant differeance mean separation statistic. Ns=non significant, no value applicable.

Table 6. Shoot Counts, Root Dry mass, Rhizome Plane Depth and Leaf widths of Sea Isle 2000 Paspalum Undert Select Mowing Height and N Fertilization Regimes, 2000, 2001, Kartsaen Turf Researcg Center, University of Arizona.

	2000		*2001*				
						2nd leaf	*3rd leaf*
	# Shoots	*Root (gm)*	*# shoots*	*Root (gm)*	*rhizome depth (mm)*	*width (mm)*	*width (mm)*
Mow Height							
1/8"	151.5	0.71	140.2	1.6	29.3	1.5	1.5
5/32"	150.4	0.73	114.9	1.4	31.1	1.5	1.7
3/16"	147.8	0.59	111.8	1.6	30.9	1.5	1.6
Test Mean	149.9	0.68	122.3	1.5	30.4	1.5	1.6
LSD	ns	ns	14.26	ns	ns	ns	ns
Fertilizer Rate (nitrogen /1000 ft^2)							
0.25 lb.	149.6	0.71	121.3	1.5	28.9	1.5	1.6
0.38 lb.	155.1	0.69	117.8	1.4	30.5	1.6	1.5
0.50 lb.	138.8	0.58	126.0	1.6	32.3	1.4	1.6
0.75 lb.	156.1	0.72	124.0	1.5	29.9	1.5	1.6
Test Mean	149.9	0.68	122.6	1.5	30.9	1.5	1.6
LSD	15.58	ns	ns	ns	2.79	ns	ns

Shoot counts per plug. Cliiping dry weight in grams per plot. Values are the mean of 4 replications
Root weights = gram dry weight per plug. Values are the mean of 4 reolications.
rhizome depth = mm depth of bottom of main horizontal rhizome plane. Values are the mean of 4 repliactions.
Leaf widths = leaft width in (mm) of 2nd and third fully exapanded leaf, 1/8' above stem attachment. Mean of 4 repliactions
Test Mean = mean of all tretaments on that date event.
LSD= Least significant differeance mean separation statistic. Ns=non significant, no value applicable.

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