treatments influenced the amount of organic matter generated by the grass during the course of this study. Treatment apparently did not affect the rate of organic matter decomposition in the thatch either. Or at least the balance between organic matter production by the grass and the rate of decomposition of organic matter was uniform across all treatments.

Higher nitrogen applications resulted in a turf more susceptible to wilt. Plots receiving 6 pounds nitrogen per 1000 square feet annually wilted sooner than those receiving 3 pounds, an observation made previously. In mid-August striking differences in dew patterns were evident. All high nitrogen treated plots had little or no dew. Further, the plots receiving light, frequent sand topdressings had little dew at the 3 pound nitrogen annual rate (Table 3). The 6 cubic foot treatment every 6 weeks also had significantly less dew than other low nitrogen plots. There was little treatment effect on stimpmeter readings taken twice during the growing season. To convert these stimpmeter readings to feet divide the millimeters by 25.4 to get inches, then by 12 to convert the number to feet.

Several effects of treatment on soil tests were evident (Tables 4 and 5). One of the concerns with aggressive topdressing programs is how to collect the soil samples when a significant layer has developed. How deep should the sample be taken? Since the depth of the "thatch" layer (thatch and topdressing material) which has been accumulating over the six years of this study has reached about 1.5 inch should this be sampled separately? Data in Tables 4 and 5 suggest some differences occur in soil tests among treatments. It is suggested that until the thatch/topdressing layer reaches 3/4 inch in depth that the thatch be discarded, using only the soil below for the soil test. As the thatch soil layer exceeds 1 inch or more it would be wise to sample that layer separately. When the layer reaches over 2 inches that sample will suffice for soil testing purposes in most circumstances.

In this study the pH of the "thatch" is lower than in the soil below. The untreated check plots are a special case in evaluating soil tests. Note the phosphorus (P), potassium (K), calcium (Ca) and magnesium (Mg) tests are higher in the thatch than in the soil below on the untreated plots. This is most likely caused by the lower bulk density of the thatch which is high in organic matter in contrast to the thatch/topdressing layer found on topdressed plots. If one were to compare these numbers on an area basis there would likely be only small difference in level of available nutrients. Thus sampling depth and technique are very important on thatchy or heavily topdressed turfs. Follow the guidelines suggested above under such soil conditions. Another significant difference was the lower available potassium levels on the higher nitrogen treated plots. When using higher nitrogen levels or when practicing sand topdressing it is wise to use more frequent and higher annual rates of potash. This is needed to provide a turf which is more stress tolerant.

A second topdressing study using soil or peat as amendments for sand topdressing was initiated in 1986. Topdressing materials used in this study were provided by the Great Lakes Minerals Company. The grass was Penncross creeping bentgrass mowed at 3/16 inch at the Hancock Turfgrass Research Center. Plot size was 4 feet by 10 feet with 3 replications. Treatments outlined in Table 6 were utilized. The TDS-50 is a sand primarily in the medium and fine sand ranges. The 80:20 mix is 80% sand and 20% peat on a

Table 5. Effect of topdressing program on soil tests of a Penneagle creeping bentgrass green. Treatments initiated in 1982. Hancock Turfgrass Research Center. Averages for 3 replications.

Topdressing Treatment			N Rate	Ca		Mg	
Soil	Frequency	Rate		Thatch	Soil	Thatch	Soil
			lbs/1000				
Sand	3 weeks	3	3	1291cd*	1452a	264bd	236a
Sand	6 weeks	6	3	1064d	1280a	191d	240a
Sand	Spring/Fall	12	3	1176cd	1345a	201d	247a
Sand/soil	Spring/Fall	12	3	1853bc	1440a	310bc	263a
None	-	-	3	3704a	1363a	523a	241a
Sand	3 weeks	3	6	1459bd	1470a	221cd	228a
Sand	6 weeks	6	6	1232cd	1363a	218cd	260a
Sand	Spring/Fall	12	6	1204cd	1238a	206cd	247a
Sand/soil	Spring/Fall	12	6	2077b	1375a	361b	260a
None	-	-	6	3978a	1452a	590a	249a

* Means in columns followed by same letter are not significantly different from each other using Duncan's Multiple Range test (5%).

Table 6. Effect of topdressing a Penncross creeping bentgrass green with Great Lakes Minerals topdressing mixes on thatch and stimpmeter readings. Study initiated spring 1986. Hancock Turfgrass Research Center. Averages for 3 replications.

Treatment			Organic matter in "thatch"		Stimpmeter reading
Mix[y]	Rate	Frequency	%	grams	cm
	cu ft/1000				
TPS-50	3	3 weeks	9.0bc*	1.20de	190ab
	12	Spring/Fall	7.3bc	1.12e	178b
80:20	3	3 weeks	11.0ab	1.39bc	182ab
	12	Spring/Fall	9.6a-c	1.41b	190ab
60:20:20	3	3 weeks	12.8a	1.62a	191ab
	12	Spring/Fall	9.9ac	1.38bc	185ab
Check	-	-	13.2a	1.27cd	185ab
TDS-50	12	Spring/Fall	7.0c	1.16de	194a

* Means in columns followed by same letter are not significantly different from each other using Duncan's Multiple Range test (5%).

[y] TDS-50 is 100% sand; 80:20 is 80% sand, 20% peat; 60:20:20 is 60% sand, 20% peat and 20% loamy topsoil.

volume basis; the 60:20:20 mix is 60% sand, 20% peat and 20% loamy topsoil. Plots receiving coring treatments were topdressed with sand after coring twice a year. Frequent quality ratings taken during the season are given in Table 7. Some amendment (peat or peat and soil) with the sand resulted in higher quality ratings on certain dates, but not on others. The twice a year treated plots often ranked better than the light frequent treatments. As pointed out earlier infrequent sand topdressing usually results in layers which create management problems in the future. Turf color ratings taken from these plots during the growing season reflected the same observations as from the quality ratings.

After two years of these topdressing treatments there have been some differences in the amount of organic matter found in the thatch layer as seen in Table 6. Those treatments receiving the soil-based mix had higher organic matter contents. When plots were cored previous to sand application the organic matter content was lower than most other treatments. There was no meaningful effect on stimpmeter readings on these plots.

Three different studies on the use of Sand-Aid in the management of putting greens were initiated in 1985 at the Hancock Turfgrass Research Center. The first was established on a Penncross creeping bentgrass putting green growing on a pure sand base (Purrwick). Plot size was 4 feet by 6 feet with 3 replications. Sand topdressing was applied at approximately three week intervals at the rate of 3 cubic feet per 1000 square feet. Sand Aid was included at the rate of 5 or 10% of the topdressing rate by volume as outlined in Table 8. Coring treatments with a Ryan's Greensaire were made three times a year: spring, summer and fall. At the time of coring, Sand Aid was applied at rates of 15 or 30 pounds Sand Aid per 1000 square feet on each date. The Sand Aid and sand were worked into the turf by brushing on these small plots. Evaluations for this study are given in Tables 9 through 11.

Sand topdressing alone has resulted in poorer quality turf on most dates compared to most other treatments (Table 9). Adding Sand Aid with the sand topdressing improved quality ratings compared to sand topdressing alone on all dates especially at the 10% by volume rate of application. When core cultivaton was practiced there was no consistent effect from Sand Aid applications on turf quality. Turf color ratings (not shown) were relatively consistent with quality ratings, but differences were smaller than with qualtiy ratings.

Effects of treatments on the thatch layer (Table 9) pointed out that sand topdressing results in a faster buildup of the sand/thatch layer than from no treatment as would be expected. When the plots were cored there was no difference between the depth of the thatch layer and the untreated plots. It is interesting to note that cored plots had less total organic matter than either topdressed or check plots. This is likely due to the small amount of thatch removed with coring and to the reduced growth caused by the injury and exposure caused by coring.

Rooting in the Sand Aid treated plots was evaluated by sampling the amount of roots in a 2 inch by 2 inch tube pushed into the soil. Three samples from each plot were separated into the 0-1, 1-2, 2-3, and 3-6 inch depths to determine if treatments influenced rooting. Sampling was done on August 30 (Table 10). Small or no differences in rooting were found.

Table 7. Effect of topdressing a Penncross creeping bentgrass green with Great Lakes Minerals topdressing mixes on turfgras quality ratings. Study initiated spring 1986. Hancock Turfgrass Research Center. Averages for 3 replications.

Treatment			Overall Quality Ratings (9 = best)							
Mix[y]	Rate	Frequency	4/7	4/10	6/18	7/6	7/17	8/14	9/8	10/29
	cu ft/1000									
TDS-50	3	3 weeks	5.2d*	6.2b	6.8a	6.0c	7.0a	7.2ab	7.5ab	5.3c
	12	Spring/Fall	6.3c	7.8a	5.3b	6.0c	6.8ab	7.5a	7.5ab	7.0b
80:20	3	3 weeks	5.5d	6.7b	7.0a	6.5ab	7.3a	7.8a	7.5ab	5.3c
	12	Spring/Fall	7.0b	8.0a	6.5a	6.7a	7.0a	7.3ab	7.3b	7.8a
60:20:20	3	3 weeks	5.5d	6.5b	7.2a	6.2bc	7.5a	7.2ab	7.7a	5.2c
	12	Spring/Fall	7.0b	8.0a	6.3a	6.2bc	6.8ab	7.5a	7.5ab	7.7a
TDS-50 (cored)	12	Spring/Fall	7.8a	8.5a	5.0b	6.0c	6.2b	6.7b	7.3b	5.7c
Check	-	-	5.0d	6.2b	6.8a	6.2bc	7.3a	7.3ab	7.2b	5.0c

* Means in columns followed by same letter are not significantly different from each other using Duncan's Multiple Range test (5%).

[y] TDS-50 is 100% sand; 80:20 is 80% sand, 20% peat; 60:20:20 is 60% sand, 20% peat and 20% loamy topsoil.