TURF PLANT RESPONSES AND SOIL CHARACTERIZATIONS IN SANDY CLAY LOAM AND CLAY LOAM SOILS AUGMENTED BY INTERLOCKING MESH ELEMENTS - 1992

S.I. Sifers, J.B Beard, and M.H. Hall

The objectives of this long-term study were to assess the effects of four mesh element inclusion treatments on the turfgrass injury and playing surface characteristics when amended into sandy clay loam and clay loam soils.

One study area consisted of a **sandy clay loam** (65.12% sand, 23.44% clay, and 11.44% silt) and the second study area of a **clay loam** (46.96% sand, 28.88% clay, and 24.16% silt) to form the root zone.

A subsurface drainage system was constructed with 100 mm (4 in.) diameter drain lines in trenches spaced at 1,200 mm (4 ft.) intervals. The trench was backfilled with pea gravel around the drain lines, followed by a 150 mm (6 in.) soil zone. Then the five mesh treatments in three replications were installed in the upper 150 mm (6 in.). The mesh elements were 50 by 100 mm (2 x 4 in.) rectangles with 10 mm square apertures as manufactured by Netlon, Ltd. from polypropylene. Off-site mixing of the mesh element-root zone mix and the no-mesh root zone were followed to maximize mix uniformity.

The area was planted to Tifway bermudagrass (*Cynodon dactylon* x *C. transvaalensis*) in July of 1991. A preplant fertilization was incorporated in the upper 25 mm (1 in.) at a rate of 1 kg (2.2 lb) each of nitrogen (N), phosphorus (P), and potassium (K) per 100 m^2 (1,000 ft^2). Vegetative sprigs were broadcast at a rate of 0.4 m^3 per 100 m^2 (16 bu/1,000 ft^2), lightly topdressed, and fertilized at a rate of 1 kg phosphorus (P) per 100 m^2 (2.2 lb/1,000 ft^2) to encourage rapid establishment. The area was irrigated via perimeter popup, gear-driven sprinkler heads positioned at 3.5 m (11.5 ft) spacings. Turf establishment was achieved in September of 1991.

The cultural practices imposed on the experimental area were representative for hybrid bermudagrass sports fields. Mowing was twice weekly at 13 mm (0.5 in.) cutting height using a reel mower, with clippings removed. The nitrogen (N) fertilization rate was 0.45 kg N 100 m^{-2} (0.9 lb N/1,000 ft^2) per growing month, which extended from April to September. Phosphorus (P) and potassium (K) were maintained in the high range based on annual soil tests. Irrigation was practiced as needed to prevent visual turf wilt. No pesticides were applied and no turf cultivation or vertical cutting was practiced.

The methods and apparatus used to assess the influence of randomly oriented interlocking mesh elements were identical to those used in the earlier high-sand studies and are described in detail in several papers. Briefly, the apparatus used for **divot simulation** earlier was an adjustable horizontal swinging pivot bar with a golf club head attached to the terminal end. The **compression displacement, turf tear, and traction** apparatus was a steel disc with cleats or studs which was dropped from 60 mm (2.4 inch) height and rotated with a torque wrench to create tear and traction pressure readings. **Ball bounce** was assessed using a vertical support of 3 m (9.8 ft) in height from which a soccer ball was dropped without spin or impulse and was expressed as the ratio of height bounced to height dropped. **Surface hardness** was measured using the Clegg Impact Soil Tester. **Turf quality** was visually assessed in terms of both uniformity and high shoot density. Assessments were made at 6-week intervals beginning in June of 1992. Three individual simulations were imposed within each subplot, except for ball bounce where five simulations were dropped.

RESULTS AND DISCUSSION

No turf quality differences were noted among treatments throughout the study. There also were no visual symptoms of turfgrass injury caused by disease or insect activity.

SANDY CLAY LOAM STUDY

TURFGRASS INJURY:

The **divot opening lengths** for the no-mesh and the 5.0 kg m^{-3} mesh density up-to-the-surface were significantly larger than the three other mesh element treatments of 2.5, 3.75, and 5.0 kg m^{-3} during all three assessments. Effects varied from 33 to 39% longer for the no-mesh and 28 to 57% longer for the 5.0 kg m^{-3} up-to-the-surface treatment.

One explanation for this response is that the mesh elements are close to the surface and those extending laterally outward from the divot simulation head are pulled sufficiently to cause lateral turf tears that radiate outward from the divot opening perimeter, thereby causing increased turf damage and an allied slowing of the divot opening turf recovery rate. These data indicate the desirability of placing a 25 mm (1 in.) layer of sandy clay loam over the top of the mesh matrix where divoting will occur. Note that 25 mm is the maximum depth.

Divot opening width was different in the summer and fall observations, with the no-mesh and 5.0 kg m^{-3} up-to-the-surface treatments being widest. No major differences were found in divot opening depth.

Rate of **divot opening turf recovery** varied by date and by density of mesh elements. The most rapid, complete divot opening turf recovery occurred at the three mesh densities of 2.5, 3.75, and 5.0 kg m^{-3} regardless of the assessment date. The no-mesh treatment and the 5.0 kg m^{-3} up-to-the-surface treatment were 40 to 60% slower in turf recovery than the other mesh inclusion treatments. Expressed another way, they required 2 to 3 weeks longer to obtain the same percentage of turf recovery. Seventy percent turf recovery of the no-mesh and 5.0 kg m^{-3} up-to-the-surface treatment required 7 weeks in June and 5 weeks in August and September.

Lateral cleat turf tear data were variable, with no difference in June at the 10 kg (22 lb.) and the 40 kg (88 lb.) drop weights. Small differences occurred in August and September at the 10 kg drop weight. The 40 kg drop weight resulted in turf tear from cleat-to-cleat for each observation.

PLAYING SURFACE CHARACTERISTICS:

Statistical differences in **compression displacement** occurred at the drop weight of 10 kg (22 lb.), but not at the 40 kg (88 lb.) drop weight. The no-mesh and the mesh up-to-the-surface treatments allowed less surface penetration than the other mesh density treatments. One interpretation of these data is that greater surface compaction had occurred on the no-mesh turf plots and that the mesh up-to-the-surface treatment interfered with instrument penetration.

There were no differences in **traction** measurements attributed to the mesh element treatments, except with the 10 kg (22 lb.) drop weight in September. However, there were differences in absolute values among assessment dates within the year. These traction differences appeared to be related to soil moisture and the resultant depth of penetration of the cleated base into the turf surface zone.

There were few statistical differences in the treatment means for **ball bounce** for any of the test dates. However, the range from the maximum to the minimum for the no-mesh and the up-to-the-surface treatments were 3 to 4 times greater than for the other inclusion treatments. The improved consistency in ball bounce from mesh element augmented treatments is a significant component of surface quality for sports use.

Less **surface hardness** means a safer surface in terms of reduced injuries. Surface hardness measurements varied slightly from date to date. The 0.5 kg (1.1 lb.) and 2.25 kg (5 lb.) hammer weight data indicated statistical differences, with the no-mesh treatment being harder or having a higher CIV than the CIV's of all four mesh inclusion treatments. There was no statistical separation of CIV's for treatment effects using the 4.5 kg (10 lb.) hammer.

The data indicate the benefits of mesh element inclusion in sandy clay loam soils in terms of less surface hardness, but no indication of which is the preferred mesh inclusion density as it affects surface hardness. The variation in CIV results also appeared to be a function of the soil moisture content, with higher moisture levels resulting in lower CIV values.

There were differences in **soil moisture**, with more moisture present in all four treatments with mesh inclusions when compared with the no-mesh treatment.

CLAY LOAM STUDY

Results of measurements on this area were practically identical to those on the sandy clay loam, with some order of magnitude changes that could be attributed to the more dense texture of the soil.

Divot opening dimensions were very similar. The **turf recovery in divot openings** was somewhat slower overall, approximately one week slower, but again the no-mesh and 5.0 kg m^{-3} up-to-the-surface treatments were significantly slower than the other mesh densities by 30 to 50%. The 5.0 kg m^{-3} mesh density treatment was the most rapid in divot opening turf recovery.

The traction, compression displacement, ball bounce, and **lateral cleat turf tear** responses were all very similar to the sandy clay loam observations.

Soil moisture percentages were higher in the mesh treatments, especially in June and August. The higher surface hardness CIV's at all hammer weights were probably more a function of the denser clay loam soil than the moisture content of the soil.

CONCLUSIONS

These results indicate clear benefits to the turfgrass user accruing through the use of mesh elements in both sandy clay loam and clay loam soils via (1) decreased size of divot openings, (2) much faster turf recovery of divot openings, (3) more consistent and predictable ball bounce, (4) lessening of surface hardness, and (5) improved soil moisture. These benefits occurred consistently when a 150 mm (6 in.) depth of mesh elements were placed below the surface by 25 mm (1 in.).

Results from these data with the sandy clay loam and clay loam soils correspond very closely with the data from the earlier long-term assessments using mesh elements in a high-sand matrix system, especially for the divot size and divot opening turf recovery. This research is being continued.

Note: This summary is an excerpt from Texas Turfgrass Research - 1993. Texas Agricultural Experiment Station Consolidated Progress Report 5104-5146. p. 112-115.

REFERENCES

1. Beard, J.B, and S.I. Sifers. 1990. Feasibility assessment of randomly oriented, interlocking mesh element matrices for turfed root zones. American Society of Testing Materials. Standard Technical Publication 1073. pp. 154-165.

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