TEXAS-USGA ROOT ZONE MIX SPECIFICATIONS

PART I

The greatest problem encountered in maintaining turfgrasses on sports fields and greens is soil compaction. This pressing together of soil particles into a more dense mass results in impaired drainage of excess water and a loss of proper aeration needed to provide oxygen for healthy root growth. As a consequence, there is a decline in turfgrass health, vigor, and recuperative ability following turf injury from traffic stresses.

Soil compaction and the resultant negative effects can be minimized by selection of a high-sand root zone of the proper particle size distribution and associated key physical and chemical characteristics. The result is minimum proneness to compaction, adequate drainage of excess gravitational water, and proper aeration to provide needed oxygen for root growth and related soil biological activity.

However, such high-sand root zones are very droughty due to poor water retention capacity unless a perched hydration zone, such as achieved through the Texas-USGA Method, is used in the construction specifications. In addition, high-sand root zones tend to have a low cation exchange capacity (CEC), thus, the leaching of essential plant nutrients is a greater concern, particularly during the initial years following construction. This potential problem can be minimized through the use of slow-release nutrient carriers and/or the timely use of foliar feeding techniques.

Composition of the 300 mm (12 in.) settled depth of root zone mix should be selected based on specific physical tests conducted in a reputable Physical Soil Test Laboratory. The test report specifies the particular materials and the percentages in which they are to be mixed.

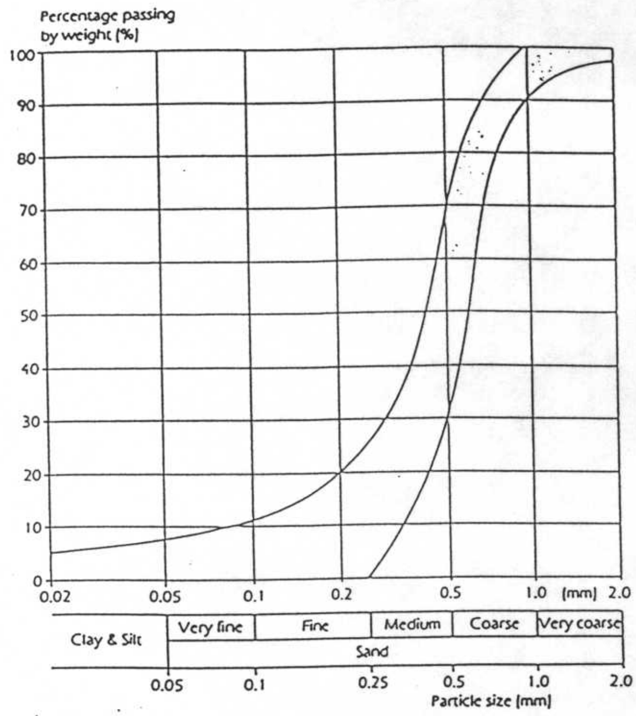

Figure 1. Grading analysis particle size distribution for the Texas-USGA root zone mix.

Composite Root Zone Mix
Particle Size Distribution

The suggested specifications for the particle size distribution of the root zone mix are shown in Table 1. Figure 1 is a graphic illustration of the same data as a grading analysis distribution.

Table 1. Suggested guidelines for particle size distribution of the Texas-USGA root zone mix.

Gravel	Very Coarse	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt and Clay
>2 mm	1 - 2 mm	1.0 -0.05 mm	0.50-0.25 mm	0.25-0.10 mm	0.10-0.05 mm	<0.05 mm
Maximum 3% Ideal 0%	Maximum 7%		Minimum 50%	Maximum 17%		Maximum 3% clay 5% silt
Maximum Not more than 10% of total		Desired range 65% Minimum 75% Optimum		Maximum Not more than 25% of total, preferably 10% of total		

COMPONENT DESCRIPTIONS OF ROOT ZONE MIX

It is important that the three components selected for the root zone mix be free of toxic levels of materials such as heavy metals, persistent crop herbicides, and industrial organic chemicals. Minimal amounts of soluble salts, boron (B), and sodium (Na) are preferred.

Sand Component. Angular, hard, washed, screened silica sand is strongly suggested. Avoid high pH calcarious sands. The preferred sand component particle size is: 100% below 1.0 mm (18 mesh), 65% below 0.5 mm (35 mesh), 25% below 0.25 mm (60 mesh), and 5% below 0.05 mm (270 mesh). Mesh sieve size refers to the US Standard of the (USDA).

Organic Matter Component. It is suggested that the organic matter source selected be well decomposed and have no more than 15% ash or mineral content, preferably less than 10% mineral content. Examples include peat humus and reed-sedge peat. The organic material should be shredded to ensure mixing uniformity, but not to the degree that the material is pulverized thereby causing reduced soil water infiltration.

Soil Component. A sand, loamy sand, or sandy loam topsoil is suggested. The soil should be shredded to insure mixing uniformity and should be screened to remove stones and other debris.

COMPOSITE ROOT ZONE MIX PHYSICAL AND CHEMICAL PROPERTIES CRITERIA

The physical or chemical properties preferred for the root zone mix are summarized in Table 2.

Mix Water Infiltration Rate. The preferred water infiltration rate for a laboratory compacted root zone mix is in the range of 150 to 300 mm per hour (6 to 12 in./hr.). The rate in the laboratory tests should not exceed 600 mm per hour (24 in./hr.). The upper limit is designed high enough to account for the normal on-site reduction in infiltration rate that occurs during the first 3 to 4 years, due to increases in roots and organic materials.

Mix Aeration Porosity. An acceptable total pore space volume is between 40 and 55%. The preferred distribution would be 22% capillary and 25% noncapillary pore space. Noncapillary pore space should be not less than 15%. The measurements are made on a root zone mix that has been allowed to percolate water for 8 hours and then is drained at a tension of 400 mm of water.

Mix Water Retention Capacity. An acceptable laboratory-established capacity would be between 12 and 25% by weight on a 105 to 111°C-oven dry soil basis. The available water in the soil is estimated to be that held at a tension of 400 mm of water, which is the approximate distance from the surface to the drain line.

Mix Bulk Density. The preferred root zone mix should have a bulk density of 1.4 grams per cc.

Table 2. Suggested physical and chemical guidelines for the composite root zone mix.

Physical/chemical property	Units	Acceptable range	Preferred
Infiltration rate of compacted mix	mm per hour (in./hr.)	150-600 (6-24)	150-300 (6-12)
Total pore space Noncapillary pore space Capillary pore space	% by volume	40-55 15-30 15-25	47 25 22
Water retention capacity	% by weieght (mm H_2O/10 mm of soil)	12-25 (1-2)	18(1.5)
Bulk density	grams/cc	1.2-1.6	1.4
Soil reaction	pH	6.0-6.5	5.5-8.0
Soil salinity (electrical conductivity)	EC x 10^{-3} (millimhos/cm)	<4	0-1
Soi sodium (Na)	ESP	<15	—