TOPDRESSING MIXTURES

The Green Section's Position

by THE USGA GREEN SECTION STAFF

MUCH INTEREST has been generated in recent years concerning the use of sand for topdressing greens. This interest was given renewed impetus by the work of Madison, Paul, and Davis, as reported in the May, 1974, issue of the USGA *Green Section Record* article entitled "Consider a New Management Program for Greens." Topdressing with sand alone is not new, it was common practice years ago when the Scottish influence was strong on the U.S. golf course scene, a practice carried over from the Scots' native land. Since that time we seemed to have turned a complete circle from straight sand to mixtures containing as much as one-third sand, one-third soil and one-third organic matter, and now we are back again to mixtures containing a high percentage, if not 100 per cent sand.

The Green Section's firm position is that materials applied as topdressing must be as carefully prepared as soil mixtures for putting green construction. This can be done only after extensive laboratory tests by trained soil scientists. These facilities and services are available at nominal cost through universities and state experiment stations. Why not take full advantage of the scientific approach? It is the safest way to insure progress in converting a problem green into one that performs satisfactorily. If a putting green is

Results of lab tests on four individual sand samples. Could you have determined these important qualities by observation or feel? Note especially the striking differences in water infiltration rates.

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TABLE 1

Particle Size Analysis

Soil Mix Materials	Gravel >2mm (>9 mesh) %	Total Sand (9-300) mesh %	Silt .002-.05mm (<300 mesh) %	Clay <.002mm %	SAND FRACTIONS					Organic Matter %
					Very Coarse 1-2mm (9-16 mesh) %	Coarse 0.5-1mm (16-32 mesh) %	Medium 0.25-.5mm (32-60 mesh) %	Fine 0.1-.25mm (60-140 mesh) %	Very Fine 0.05-.1mm (140-300 mesh) %	
Sand A	0.0	94.7	1.8	3.5	0.0	0.3	15.2	75.7	8.8	
Sand B	1.2	89.4	7.2	2.2	0.2	0.8	20.4	63.8	14.8	
Sand C	0.4	98.0	0.6	1.0	0.5	7.4	68.3	23.1	0.7	
Sand D	0.0	98.3	1.7	0.0	2.3	58.8	31.6	6.1	1.2	

Physical Measurements

Mixes Examined (% by Volume)			Bulk Density g/cm³	% Pore Space		Infiltration Rate — Inches of H_2O/Hour	Percent Moisture Retention at Pressure Indicated				pH of Mixture	Lime Needs[1] lbs/1000 sq. ft.
Sand	Soil	Amendment		Capillary	Non-Capillary		40 cm of H_2O	1/3 atm.	2/3 atm.	1 atm.		
Sand A			1.39	17.5	30.0	14.3	12.6					
Sand B			1.45	20.2	25.1	3.9	13.9					
Sand C			1.37	7.0	41.5	52.1	5.1					
Sand D			1.28	5.5	46.5	120.8	4.3					

[1] Lime values indicate rates of pure calcium carbonate (100% neutralizing value) uniformly incorporated to a six-inch soil depth. Adjust rate of application according to neutralizing value of material used and depth of soil to which it is applied.

poor because of its soil, a good program of topdressing can greatly improve it. One rule of thumb handed down through the years is that a topdressing mixture similar to the soil presently under the green must be used to maintain a uniform profile. Although this is a good general rule, it is not without exception. If the original soil is unsatisfactory, there is no advantage in perpetuating its use. If it is too heavy and drains poorly to begin with, there is little chance that permanent improvement can be made by adding a topdressing mixture of the same quality.

Selecting a commercial topdressing or mixing your own is not easy. It is a decision that cannot be taken lightly. Many of the commercial topdressing mixtures contain too much silt and/or clay to be acceptable for use on greens. Usually the purveyor provides a statement indicating the per cent of sand, soil and organic matter contained in the mixture he offers; however, no details are given as to *the kind of sand, the kind of soil, the kind of organic matter* involved. Sands are not all alike **(Table 1)**, nor are all soils and organic materials **(Table 2)**, and well suited for use in topdressing mixtures. These are vitally important characteristics to know about when selecting materials for use on greens. They have a great bearing on the make-up of a topdressing mixture and on the eventual long-term behavior of a putting green. As an example, **Table 3** provides information on top mix variability using different ratios of a sand and soil. It bears careful study.

Economy dictates that the source of supply for each ingredient should be available locally, otherwise transportation charges will be high for materials of this weight. Before sand, soil and organic material is purchased it is advisable to:

(1) Prepare individual and representative samples of each material. This requires taking random samples from various areas of the stockpile, mixing them to make one representative sample and placing each composite sample into separate strong containers to insure they will reach the testing laboratory intact.

(2) If soil is taken from a field, core samples should not exceed six inches in depth. When the contractor moves in with his equipment, be sure to insist that he does not take soil from below the 6-inch depth at mixing time.

TABLE 2

Variability Encountered in Organic Amendments for Topsoil Mixtures

Organic Material and Source	pH	Titratable Acidity to pH 6.5 meq./100 grams	% Ash
Sewage Waste (Calif.)	7.3	0.0	67.3
Muck — Peat (Ind.)	5.8	5.0	25.8
Muck — Peat (N.C.)	3.8	5.6	73.2
Moss Peat (Ore.)	4.0	30.7	3.9
Sedge Peat (Wis.)	6.0	1.4	12.8
Moss Peat (Ga.)	6.2	2.8	19.4
Lignified Wood (Calif.)	5.6	1.5	1.0
Rice Hulls (Tex.)	6.4	0.0	24.3
Cotton Gin Trash (Tex.)	8.3	0.0	43.3

Editor's Note: The percent ash shown represents inorganic residue including sand, silt and clay.

TABLE 3

The Influence of Native Soil on Various Properties of a Sand-Soil Mixture

Ratio of Components		Silt Plus Clay %	Bulk Density	Pore Space		Water Infiltration Rate (inches/hour)
Sand[1]	Soil[2]		g/cc	Capillary	Non-Capillary	
10	0	2.1	1.36	13	36	10.4
9	1	3.0	1.30	14	37	8.8
8	2	3.9	1.39	17	30	4.0
7	3	4.8	1.41	25	22	2.2
5	5	6.6	1.47	39	6	0.1

[1] Sand contained 22.7, 36.3, 30.0, 7.3, 1.6, 0.0, and 2.1 percent of very coarse, coarse, medium, fine, very fine, silt and clay, respectively.

[2] The soil contained 88.8% sand, 6.3% silt and 4.9% clay.

Editor's Note: Note almost zero water infiltration when equal parts sand and soil are mixed.

(3) Have a laboratory test made — one that provides information on the physical properties of the ingredients separately and in mixture. It is important to know the moisture retention qualities of the mixture, what the water infiltration rate is, what measure of resiliency (bulk density) is to be expected, whether the mixture will permeate established turf quickly and not interfere with the roll of the ball nor dull the mower, the particle size distribution of sand, etc.

(4) Be assured that adequate quantities of the exact same materials are available after laboratory recommendations are received. It is sheer folly to send one material to the lab and then use another in the mixing process. It is also wrong to alter the mixture to your specifications, i.e., to "improve" on the lab recommendations. It just won't work!

The question now arises, "What do I do when the prepared topdressing is all used up?" There is no assurance that you will be able to purchase the exact same sand, soil and organic matter endlessly; therefore, it is imperative that a lab test be run each time you purchase new materials. If the exact materials are not available, you want to be assured that the important qualities of the final mix are relatively close, and this can only be done by laboratory test. A recommendation based on scientific soil laboratory procedure will insure that the physical qualities will be as close to the original mixture as possible. Also, the ideal material is not always obtainable in every part of the country, and so it is sometimes necessary to settle for an "acceptable alternative." It is advisable to purchase and stockpile quantities of each material for mixing as time and labor permit. It is also good practice to allow a mixture to age by composting it for two months or more with occasional turning before it is applied to the turf. Its qualities then are better preserved when spread over the putting surface. If the topdressing is to be applied soon after mixing, the organic matter should be left out of the mixture.

Sands need not be white bunker sand. An off-white, tan, grey, or brown sand is suitable and, in fact, preferable to a bright-white sand for topdressing. It is decidedly advantageous if the sand contains some silt and clay. Up to 5 per cent silt and 3 per cent clay maximum is permissible in mixtures that meet the Green Section specifications

TABLE 4

Sand Particle Size Classification Table

	Tyler Scale (ASTM)* (Mesh)	U.S. (Sieve) No. (NBS)**	Sieve Opening mm.	Textural Name	
	4	4	4.76		
	5	5	4.00		
	6	6	3.36	Gravel	
	7	7	2.83		
	8	8	2.38		
	9	10	2.00		
	10	12	1.68		
	12	14	1.41	Very Coarse Sand	
	14	16	1.19		
	16	18	1.00		
Range	20	20	.84	Coarse Sand	Range For
For	24	25	.71		Soil Mixes
Bunker	28	30	.59		And Top-
Use					Dressing
	32	35	.50		
	35	40	.42	Medium Sand	
	42	45	.35		
	48	50	.30		
	60	60	.25		
	65	70	.21		
	80	80	.18		
	100	100	.15	Fine Sand	
	115	120	.13		
	150	140	.11		
	170	170	.09		
	200	200	.07	Very Fine Sand	
	250	230	.06		
	270	270	.05		
	325	325	.04		

*American Standard Testing Materials

**National Bureau of Standards

Editor's Note: A high percentage of sand should be in the range of .25 to 1.0 mm.

for putting greens. These sands are less costly and they blend well with soils beneath greens.

Sand particles should preferably be smooth or round in shape. Particle sizes should fall between .11 and 1 mm with a high percentage falling in the range of .25 to 1 mm (see **Table 4**). If round-shaped particles are not available, sharp sands are suitable and acceptable. Be sure to stay away from sands of soft origin, such as limestone and other calcareous materials. Only sands formed from silica, quartz and other hard rock materials are recommended.

Why should topsoil and topdressing material contain a high percentage of sand? To answer this question we refer you to the article "Principles of Soil Improvement For Drained Putting Greens" by L. Art Spomer in the USGA *Green Section Record*, July 1977. This article illustrates that 75 per cent to 90 per cent sand is required in a sand-soil mixture before physical improvement is realized. The other lesson illustrated is that adding a small amount of sand to a soil decreases pore space, thereby worsening soil quality. This strongly supports our position that without scientific assistance it is impossible to precisely determine the optimum soil mixture regardless of how good the sand, soil and organic matter appear to the naked eye. A soils test by scientists specifically trained in testing mixtures for greens is good insurance that your topdressing mixture will be the best available using materials you are able to obtain locally and economically.

As a general summary, an excellent topdressing mixture in our view must meet the following specifications:

Infiltration rate — 4 to 6 inches per hour (compacted) is ideal with a maximum of 10 inches per hour being acceptable. It is important to know that after grass is established, roots can reduce this rate by up to 80 per cent. Therefore, infiltration rates slightly higher than 10 inches per hour are more acceptable than rates below 4 inches per hour if an alternate choice has to be made because of limitations set by available sand.

Bulk density generally should range between 1.25 and 1.45 g/cm^3. Above 1.45 g/cm^3 the putting surface will be more compact and therefore less resilient, while below 1.25 g/cm^3 the turf will be softer and less enjoyable for maintenance and play. Bulk density limits are 1.20 g/cm^3 to 1.60 g/cm^3.

Water retention for plant use should range between 12 per cent or a minimum of .10 inch and a maximum of 25 per cent or .20 inch water held per inch of soil.

We are often asked our opinion on topdressing with 100 per cent sand. While we have observed good results to date, we are somewhat apprehensive about the long-range impact of a mix without some soil. However, if it is a question of not topdressing at all, or using an inferior product because of the unavailability of quality soil and/or organic matter, then in our view topdressing with straight (100 per cent) sand is acceptable as long as the sand is laboratory tested to insure that it meets the particle size specifications in **Table 4** and conforms with other requirements as prescribed in our specifications for putting green construction.

Coarse Sand	Medium Sand	Fine Sand	Silt and Clay	Organic Matter
.5 to 1 mm	.25 to .5 mm	.11 to .25 mm	Max. 5% silt Max. 3% clay	Quality product should be approximately 70% organic
75% Minimum		Preferred Range 10% Maximum Range 25%		Generally between 10% and 20%. Not required if used after mixing. Include if composted and turned at minimum 2 months before use.

This article was prepared by the Green Section Staff — **William H. Bengeyfield, William S. Brewer, Jr., William G. Buchanan, James B. Moncrief, Carl Schwartzkopf, James T. Snow, Stanley J. Zontek and Alexander M. Radko, Editor.**

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