

Characterization of Selected Mineral Soils Used for Sugarcane Production ¹

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Approximately 20% of the Florida sugarcane crop is grown on sandy soils adjacent to the Everglades Agricultural Area (EAA). These soils are coarse to fine-textured sands with varying amounts of organic matter. Because of the close proximity of bedrock, water-impeding pans, or seasonally-high water tables, these soils are often subject to flooding. Therefore, drainage and irrigation are essential. The different U.S. soil classification orders found in these areas are Entisols, Mollisols, and Spodosols. However, Spodosols of the aquod suborder are the dominant soils used for sugarcane production. Variability in the mineral soils is high. As an example, in Hendry County where sugarcane is largely grown on mineral soils, no more than 9.3% of the soils present in this county account for any one soil series (Table 1). Due to this high variability, sugarcane grown on these mineral soils requires intensive water, fertility, and crop management. A well designed, constructed, and maintained water control system that allows adequate field drainage and also provides for subsurface irrigation is a major management concern on these soils.

Sand is comprised of particle sizes ranging from 0.05 to 2 millimeters. A sandy soil contains at least 70% sand, less than 15% clay, and less than 30% silt, by weight. The organic matter content varies. Generally, these soils have low nutrient and water holding capacities.

SELECTED SANDY SOIL DESCRIPTIONS AND CLASSIFICATIONS

Basinger Fine Sand

(Siliceous, hyperthermic Spodic Psammaquents)

This is a nearly level, poorly drained, deep, sandy soil of broad grassy sloughs. The water table is within 10 inches of the surface for 2 to 6 months in most years and within 10 to 30 inches for the rest of the year.

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In a representative example, the surface layer is gray fine sand about 6 inches thick. The subsurface layer is composed of approximately 19 inches of light brownish gray sand, followed by about 4 inches of dark grayish brown fine sand. The subsoil is dark yellowish brown fine sand about 25 inches thick. A pale brown fine sand extends to a depth of 72 inches or more.

Permeability is rapid in all layers. The water holding capacity is very low. The organic matter content is very low throughout and natural fertility is low.

Boca Fine Sand

(Loamy, siliceous, hyperthermic Arenic Ochraqualfs)

This is a nearly level, poorly drained soil that has a loamy subsoil and is underlain by fractured limestone at a depth of 24 to 40 inches. This soil is found in broad, low flat areas and in poorly defined drainageways between the Everglades and coastal ridge. Under natural conditions the water table is within 10 inches of the surface for 2 to 4 months and is below the underlying limestone during the dry periods.

In a representative example, the surface layer is a very dark gray fine sand about 7 inches deep. The next layer is a light gray fine sand about 20 inches deep. The subsoil is brown sandy loam about 6 inches thick with gray and brown mottles. At a depth of about 33 inches, a 2 inch layer of soft marl rests directly on limestone that contains numerous solution holes.

Permeability is rapid in the surface and subsurface layers and moderate in the subsoil. The water holding capacity is low or very low in the surface and subsurface layers and medium in the subsoil. The organic matter content and natural fertility are low.

Hallandale Sand

(Siliceous, hyperthermic Lithic Psammaquents)

This is a nearly level, poorly drained, sandy soil underlain by limestone at a depth of 7 to 20 inches. This soil is on broad, low flat areas between the Everglades and the coastal ridge. Under natural conditions, the water table is within 10 inches of the surface for 4 to 6 months during most years and within 10 to 30 inches the rest of the time, except during extremely dry periods. Water may cover the surface for 1 to 2 months.

In a representative example, the surface layer is dark gray sand about 4 inches deep. The underlying material is very pale brown sand that rests on hard, fractured limestone boulders at an average depth of about 16 inches. The depth to the limestone is greater than 20 inches in solution holes and in fractures between boulders.

Permeability is rapid and the water holding capacity is low in the surface layer. Organic matter content and natural fertility are low.

Holopaw Fine Sand

(Loamy, siliceous, hyperthermic Grossarenic Ochraqualfs)

This is a nearly level, poorly drained soil that has a thick sandy surface layer and a loamy subsoil at a depth of 40 to 72 inches. Under natural conditions, the water table is within 10 inches of the surface for 2 to 6 months during most years. Depressions are covered by water for 6 months or more in most years.

In a representative example, the surface layer is dark gray fine sand about 5 inches deep. The subsurface layer is about 43 inches thick with the upper 10 inches being light brownish gray fine sand; the next 10 inches is light gray fine sand that has a few yellow, brown, and gray mottles and the lower 23 inches is a gray fine sand. The subsoil is grayish brown sandy loam about 22 inches thick. Below this, there is grayish brown sandy loam containing carbonate nodules to a depth of 80 inches.

Permeability is rapid in the surface and subsurface layers and moderately rapid in the subsoil. The water holding capacity is low to very low in the surface and subsurface layers and medium in the subsoil. Organic matter content and natural fertility are low.

Immokalee Fine Sand

(Sandy, siliceous, hyperthermic, Arenic Haplaquods)

This is a nearly level, poorly drained, deep, sandy soil that has a dark-colored layer below a depth of 30 inches that is weakly cemented with organic matter. Under natural conditions, the water table is within 10 inches of the surface for 2 to 4 months during wet periods, within 10 to 40 inches for 8 months or more in most years, but it is below 40 inches in dry periods.

In a representative example, the surface 5 inches is very dark gray fine sand. The subsurface layer is about 35 inches thick with a gradation from gray fine sand to light gray fine sand. Below this is a black fine sand, weakly cemented with organic matter to a depth of about 70 inches. Loose brownish gray fine sand continues to a depth of 80 inches or more.

Permeability is rapid to a depth of 37 inches, moderate to about 79 inches, and rapid below that. The water holding capacity is medium in the weakly cemented layer and low in all other layers. Natural fertility is low.

Myakka Sand

(Sandy, siliceous, hyperthermic Aeric Haplaquods)

This is a nearly level, poorly drained, deep, sandy soil that has a dark colored layer, weakly cemented with organic matter, above a depth of 30 inches. Under natural conditions, the water table is within 10 inches of the surface for 1 to 5 months in most years. It is within a depth of 10 to 40 inches for 6 months or more in most years and recedes to below 40 inches during extended dry periods.

In a representative example, the surface layer is very dark gray sand about 6 inches thick. The subsurface layer is gray sand and extends to a depth of about 26 inches. Black and dark reddish brown sand, weakly cemented with organic matter is found between a depth of 26 to 60 inches. Below this is a grayish brown sand that extends to a depth of 80 inches.

Permeability is rapid to a depth of 26 inches, moderate to about 47 inches, and rapid below this depth. The water holding capacity is medium in the dark colored, weakly cemented surface layer and very low in all other layers. The organic matter content and natural fertility are low.

Oldsmar Sand

(Sandy, siliceous, hyperthermic Alfic Arenic Haplaquods)

This is a nearly level, poorly drained, sandy soil that has a dark colored, weakly cemented layer below a depth of 30 inches and an underlying loamy layer. Under natural conditions, the water table is within 10 inches of the surface for 1 to 3 months during most years. It is within 10 to 40 inches for 6 or more months in most years and recedes to below 40 inches in extended dry periods.

In a representative example, the surface layer is very dark gray sand about 6 inches thick. Next is a subsurface layer of light gray to grayish brown sand that extends to a depth of about 38 inches. The next layer is black sand weakly cemented by organic matter, followed by a layer of dark grayish brown sandy loam. Below the loam layer is a brown loamy sand that overlies layers of mixed sand, shell, and marl at a depth of about 50 inches.

Permeability is rapid in the sandy surface and subsurface layers, moderate in the weakly cemented sand and sandy loam layer, and rapid below this. The water holding capacity is very low to a depth of about 34 inches, medium to a depth of about 46 inches, and low below that. Organic matter content and natural fertility are low.

Pineda Sand

(Loamy, siliceous, hyperthermic Arenic Glossaqualfs)

This is a nearly level, poorly drained, sandy soil overlying loamy soil material. It is found in broad, low flatwoods and grassy sloughs. Under natural conditions, the water table is within 10 inches of the surface for 1 to 6 months in most years and within 10 to 30 inches in most years. Water covers depressions for 1 to 3 months each year.

In a representative example, the surface layer is dark grayish brown sand about 10 inches thick. Below this is about 6 inches of light gray sand. The next layer is yellowish brown sand about 16 inches thick. A grayish brown sandy loam that has vertical sandy tongues that extend from the layer above begins at a depth of about 32 inches. The underlying material is a mixture of light gray sand and shell fragments that extends below a depth of about 50 inches.

Permeability is rapid in the sandy layers and moderately rapid in the loamy layer. The water holding capacity is very low in the sandy layers and medium in the loamy layer. Organic matter content is low, and natural fertility is low.

Riviera Sand

(Loamy, siliceous, hyperthermic Arenic Glossaqualfs)

This is a nearly level, poorly drained soil that has a thick sandy subsurface layer that tongues into a loamy subsoil at a depth of 20 to 40 inches. This soil is found in broad, low areas. Under natural conditions, the water table is within 10 inches of the surface for 2 to 4 months in most years and within 10 to 30 inches for most of the remaining year, except during extreme dry periods.

In a representative example, the surface layer is very dark gray sand about 5 inches thick. Below this is a subsurface layer of light gray fine sand that tongues into a loamy subsoil at a depth of 20 to 40 inches.

Wabasso Fine Sand

(Sandy, siliceous, hyperthermic Alfic Haplaquods)

This is a nearly level, poorly drained, sandy soil that has a black weakly cemented sand layer over loamy soil material. This soil is found in broad, flatwood areas. Under natural conditions, the water table is within 10 inches of the surface for 2 to 4 months during most years and between 10 and 40 inches most of the remainder of each year, except during extended dry periods.

In a representative example, the surface layer is very dark gray sand about 6 inches thick. The subsurface layer is gray and light gray fine sand about 19 inches thick. The next layer is dark reddish brown sand, weakly cemented with organic matter, about 20 inches thick. Below this is light gray sand and shell fragments that extend to a depth of 72 inches or more.

Permeability is rapid to a depth of 22 inches, moderate to 38 inches, and rapid below this. The water holding capacity is low in the upper 22 inches and below 38 inches and medium in between. The organic matter content and natural fertility are low.

PHYSICAL AND CHEMICAL PROPERTIES

Table 2 provides a convenient listing of some typical physical and chemical properties for the various soil types described above collated from the Hendry county soil survey (1991).

REFERENCES

Soil Survey of Hendry County, Florida (1991). USDA Soil Conservation Service in cooperation with University of Florida, Institute of Food and Agricultural Sciences.

Table 1. Soils and area percentages (total 313,366 ha) in Hendry County, FL.

Soil Name	Type	Description	Proportion in County (%)	Soil Name	Type	Description	Proportion in County (%)
Basinger	sand		6.9	Myakka	sand		3.6
Boca	sand	depressional	2.2	Okeelanta	muck		0.4
Boca	sand		6.6	Oldsmar	sand	depressional	0.1
Chobee	sand	limestone	1.3	Oldsmar	sand		7.2
Chobee	sand	depressional	2.7	Oldsmar	sand	limestone	4.0
Dania	sand	muck	0.9	Pahokee	sand		0.8
Delray	sand	depressional	0.9	Pineda	sand		0.9
Gator	muck		1.7	Pineda	sand	limestone	2.3
Gentry	sand		1.0	Pineda	sand	depressional	0.2
Hallandale	sand	depressional	0.9	Plantation	sand	mucky	2.2
Hallandale	sand		5.1	Pompano	sand		0.4
Holopaw	sand		3.4	Riviera	sand		0.7
Holopaw	sand	limestone	3.8	Riviera	sand	depressional	2.3
Holopaw	sand	depressional	1.7	Riviera	sand	limestone	3.3
Immokalee	sand		9.3	Riveria	sand	limestone	1.5
Jupiter	sand		1.0	Terra Ceia	muck	sandy	0.4
Jupiter	sand	rock	0.6	Tusawilla	sand		1.9
Lauderhill	sand	muck	2.2	Wabasso	sand	limestone	2.8
Malabar	sand	high	1.2	Wabasso	sand		1.8
Malabar	sand		2.5	Winder	sand		0.1
Malabar	sand	depressional	0.2	Winder	sand	depressional	2.3
Margate	sand		3.2	Other			1.4
Myakka	sand	depressional	0.1				

Table 2. Selected typical physical and chemical properties of sandy soils used for sugarcane production.

Soil Series	Depth (inches)	CEC ¹ (meq/100g)	BS ² (%)	OC ³ (%)	pH Range	Water Holding Capacity ⁴ (in/in)	Depth to Restrictive Layer (inches)	Land Capacity Class 5	Estimated Sugarcane Yields (tons/acre) ⁶
Basinger	0 - 4	0.8	25	-	4.5 - 7.8	.03 - .07	25	IV W	40
	4 - 25	0.3	-	<0.1	4.5 - 7.8	.03 - .07			
	25 - 36	1.4	-	0.5	4.5 - 7.8	.03 - .07			
	36 - 72	1.1	25	-	4.5 - 7.8	.03 - .07			
Boca	0 - 5	7.4	57	0.3	5.1 - 7.3	.05 - .10	29	III W	40
	5 - 29	1.1	52	-	5.1 - 7.3	.02 - .05			
	39 - 34	-	-	0.3	6.6 - 8.4	.10 - .15			
	0 - 6	3.4	38	0.5	5.1 - 6.5	.02 - .10			
Hallandale	6 - 15	0.6	17	-	5.6 - 8.4	.03 - .05	15	VII W	35
	0 - 4	2.8	32	0.7	5.1 - 7.3	.03 - .07			
	4 - 42	0.3	76	0.1	5.1 - 7.3	.03 - .07			
	42 - 47	11.3	44	0.5	6.4 - 8.4	.01 - .15			
Holopaw	47 - 60	6.1	67	0.2	6.4 - 8.4	.05 - .10	42	IV W	35
	0 - 4	9.1	73	1.9	4.5 - 7.3	.05 - .08			
	4 - 37	1.5	40	0.9	4.5 - 6.5	.02 - .05			
	37 - 79	13.8	6	1.4	3.6 - 6.0	.10 - .15			
Immokalee	0 - 7	2.2	47	1.4	4.5 - 6.5	.02 - .05	26	VII W	30
	7 - 26	0.7	86	<0.1	4.5 - 6.5	.02 - .05			
	26 - 47	8.2	41	1.7	4.5 - 6.5	.01 - .15			
	47 - 72	2.0	90	0.3	4.5 - 6.5	.02 - .05			
Myakka	0 - 7	4.9	39	0.8	4.2 - 5.3	.02 - .05	34	VII W	35
	7 - 16	1.1	43	0.2	4.1 - 5.3	.02 - .05			
	16 - 37	0.4	35	0.1	4.4 - 5.3	.10 - .15			
	0 - 5	3.5	40	0.7	5.3 - 7.0	.02 - .05			
Oldsmar	5 - 11	0.9	36	<0.1	4.7 - 7.1	.02 - .05	34	VII W	45
	11 - 21	0.9	27	<0.1	4.5 - 6.9	.10 - .15			
	0 - 2	9.6	65	1.4	5.9 - 7.2	.05 - .08			
	2 - 7	1.6	50	0.25	5.5 - 6.9	.05 - .08			
Pineda	7 - 20	0.5	60	0.05	5.3 - 6.9	.11 - .15	28	VII W	45
	0 - 2	9.6	65	1.4	5.9 - 7.2	.05 - .08			
Riviera	2 - 7	1.6	50	0.25	5.5 - 6.9	.05 - .08	28	VII W	45
	7 - 20	0.5	60	0.05	5.3 - 6.9	.11 - .15			

Table 2. Selected typical physical and chemical properties of sandy soils used for sugarcane production.

Soil Series	Depth (inches)	CEC ¹ (meq/100g)	BS ² (%)	OC ³ (%)	pH Range	Water Holding Capacity ⁴ (in/in)	Depth to Restrictive Layer (inches)	Land Capacity Class 5	Estimated Sugarcane Yields (tons/acre) ⁶
Wabasso	0 - 8	6.8	8	-	3.6 - 6.5	.02 - .05	22	III W	45
	8 - 22	0.1	-	-	3.6 - 6.5	.02 - .05			
	22 - 38	20.2	59	-	5.1 - 7.6	.10 - .15			

¹ CEC = Cation Exchange Capacity (average to depth indicated)

² BS = Percent Base Saturation (average to depth indicated)

³ OC = Percent Organic Carbon (average to depth indicated)

⁴ in/in - Inches of Water per Inch of Depth

⁵ Land capability classes categorize soils by their suitability for use as cropland. I=few limitations, II=moderate limitations, III=severe limitations, IV=very severe limitations, V=limitations that nearly preclude use for commercial crop production. The subclass w indicated that water in the soil may interfere with crop growth (this may be improved by artificial drainage).

⁶ Sugarcane yields given are estimates under good management practices and may vary with variations in climate and management practices. They reflect the relative productive capacity of each soil.