Native Materials Can Be Used

By **D. L. FONTENOT, JR.,** Soil Scientist

The object of this paper is to provide you with data you may not now have, and to stimulate your interest in the potential adaptation of some native or local material, or by-products, to your needs—both *physical* and *financial*. To you who have just completed or perhaps started new green or tee construction, the question may be — why use anything but soil, sand, and peat moss? Why further complicate a difficult job with other less known materials?

If there were no problems or questions of costs, availability of suitable soil and sand on or near your golf course, plant nutrient needs and balance, proper ratios of soil, sand, and peat, we could dismiss these further considerations. Unfortunately, the above, and many more, are questions that must be answered. Perhaps the most difficult final problem in construction is total cost. Has anyone here done golf course construction, the way he desired it be done, that did not cost more than expected?

The potential uses of native materials or by-products is by no means intended to result in a short-cut or second-rate job of construction. However, there are many "buts" along with additional knowledge and local adaptation if the practical goals are to be achieved.

Let's not forget that construction and maintenance on a golf course is not limited to new or reconstruction of greens and tees. Some others are: landscaping, nursery sites, fairway improvement, topsoil for erosion control and the like. All involve soil or soil mixtures for a specific purpose.

Of the many available materials in Louisiana, I will discuss only five. They are poultry house manure, sawdusts, lightweight aggregate (calcined clay), sugar mill compost (filter press), and washed sand.

To those of you who keep up with authoritative sources of golf green construction material recommendations, it is realized the above materials are not normally included. There are several good practical and scientific reasons for this fact. Some of the reasons are:

1. The large number of native or by-product material in any regional area or state.

2. Lack of detailed knowledge or research on these materials.

3. Materials with the same name may be extremely variable depending on production methods, storage conditions and age.

4. Users may not have knowledge or experience to use the materials properly and effectively.

5. It is easier to make specific mixture recommendations and have them followed by using soil, sand, and peat mosses.

6. Some of the materials may not be available in sufficient amounts for completing all present or future construction. Uniformity of materials or mixtures is very important and desirable.

7. Sometimes these materials require special equipment, know-how, or technique of mixing, and fertilization.

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8. Some recommendations involving mixtures do not fully consider the costs vs. benefits in terms of alternate substitution of less expensive materials or mixtures.

Each of the five materials listed above will be considered in outline form.

POULTRY HOUSE MANURE

Source

Commercial chicken broiler houses.

Location

Largely in north, central, and east sections of Louisiana.

Availability

In 1964 the State produced over 29 million broilers with estimated 147,000 tons of manure and litter.

Cost

Variable, often free for cleaning houses.

Potential

As a source of plant nutrients, organic matter (peat moss substitute) minor elements.

Uses and Conditions

Dressing for tees, nurseries, and weak turf areas in fairways and around clubhouse.

The writer used this product with good results during June 1965 in reconstruction of one green and several tees using one-third by volume of manure, mason sand, and silt loam topsoil. These materials were dry and put on in layers. Excellent mixing was achieved with an offset chopper disk. Two hundred pounds of 20% superphosphate and 100 pounds of 60% K_20 was added prior to sprigging to 328 bermuda.

The soil contained no grass or weed seed and neither did the manure or sand, but the green was treated with methyl bromide to destroy original common bermudagrass cover, nematodes, and to reduce turf diseases. A fungicide program was discussed in the event it was needed. As of October 15, 1965, none was needed. It is well to point out that a new bermudagrass green responds to high nitrogen levels between late April and October. No additional nitrogen was planned for fall overseeding.

Remarks

Has real value in renovation of tees in the spring by mixing two inches of manure with the top 5-6 inches of tee. Smooth and seed if needed.

If tried as part of a mixture for topdressing greens, the mixture should be composted with soil and sand for two to three months, or the manure run through a grinder.

If air dry, nitrogen may reach over 2%. Value as fertilizer is from $5. to $10. per ton. From this standpoint only it is not usually economically competitive with commercial mineral fertilizers. As a source of organic matter it is excellent.

Chemical Analysis

Kind	Moisture	Nitrogen	P_205	K_20	Per Ton Equivalent
Broiler manure litter*	24.6%	1.7%	1.8%	1.5%	400 lbs. 8-8-8
Hen manure-litter*	36.9%	1.3%	2.7%	1.4%	450 lbs. 6-12-6

*From an *Evaluation of Poultry Manure As a Fertilizer* by M. B. Parker of Georgia Mountain Experiment Station, Blairsville, Georgia.

SAWDUSTS

Source

Very extensive in all parts of the State having a lumber industry. Old piles can be found even if sawmill has long been moved.

Availability

Usually in unlimited amounts.

Cost

Usually available without cost.

Potential

As a substitute for peat moss.

Uses and Conditions

In new green and tee construction. Also, as a mulch for ornamental plants and as composting material. Its major advantage is availability and low cost. On the other hand, it is low in potential plant nutrients and *must be properly supplemented with additional nitrogen* (24 pounds of nitrogen per ton of fresh, dry sawdust), and sometimes phosphate. It decomposes under the same conditions faster than peat mosses. The release of added and natural nitrogen is, therefore, more rapid than in peat moss soil mixtures.

Sawdusts available in this State are not toxic to plants and grasses even when occupying one-third of the volume of the mix. Soil reaction or pH is little affected by additions of sawdust. Cypress sawdust has the lowest pH of any encountered in Louisiana.

Weight and Other Comparisons

The weight of a unit volume of sawdust or peat depends mainly on the amount of compaction and moisture content. A cubic yard of uncompressed dry sawdust weighs about 200-300 pounds. Saturated with water, the weight is from 1,000 to 1,500 pounds. This means it is capable of absorbing up to 500% of its dry weight of water. This is slightly below the percent for good peat mosses.

What about "peat"? Although not a product listed for discussion, it well could be. One parish, Terrebonne, according to its soil survey, has over 533,000 acres of peat and muck of sedimentary origin. Depths are from a minimum of one foot to more than ten feet. Organic matter is 35 to 70%; pH between 6.0 to 7.3, and the percent nitrogen up to 2.5. If you think this organic material is variable, look at some published data in the table following. Commercial peats are sometimes classed as (1) moss peats (2) raw peats (3) cultivated peats (4) sedimentary peats.

The point I am trying to make is that by just ordering so many bales of "peat" you could expect about the same variation as ordering 50 pounds of unspecified meat.

A casual study of the peats available in the Alexandria, La., area revealed that there are 12 brand or trade names available, of which five were imported. A standard bale was 6 cu. ft. and weighed from 51 to 75 pounds.

Recommendations for use were on a volume basis only. No analysis or moisture was shown on the label. Commercial classification was sometimes omitted or was not specific. Labels were strictly for sales appeal. Prices varied for 6 cu. ft. bale from $3.40 to $4.75. Moist peats, sacked in 100-pound plastic bags (about two bushels), sold for $1.89 to $2.50.

Cost Comparisons

I have data and experience in construction of only one green where sawdust was substituted for peat moss. Two greens were constructed at the same time, one using 14% sawdust, the other 10% peat moss by volume; in amounts—24 cu. yds. of sawdust and 17 cu. yds. (76 bales).

COMPARISON OF PEAT TO SAWDUST

Lignin or Lignin-like Materials	N %	P_2O_5 %	K_2O %	Ash %	pH	Water % Holding	Cellulose %
18 to 28% (fine sawdust)	0.2	0.1	0.2	0.4 to 0.9	4.5 to 5.0	545	47 to 58
Coarse sawdust	0.2	0.1	0.2	0.9	5.0	240	47 to 58
18 to 19% (sphagnum peat (p. moss)	0.5 to 1	Less 0.1	Less 0.1	4 to 5	3.0 to 4.5	700 to 1500*	13 to 17
35 to 49% (lowmoor peat)	1.5 to 3.5	Less 0.1	Less 0.1	5 to 40	3.5 to 7.0	300* to 800	3 to 5

*Influenced by degree of drying.

On estimated dry weight basis, 6,000 pounds for sawdust and 5,950 for peat. Cost delivered at greens — sawdust $24. — peat moss at $4. per bale, $306. Approximately $10 was spent on *additional fertilizer* for the green containing sawdust.

Observations during and after two full years did not reveal any difference between the two greens.

LIGHT AGGREGATE (Calcined Clay)

This discussion and data presented *are only for* aggregate produced from *Red River* clays near Alexandria, La., and processed there.

Sources

Plants at Alexandria and Erwinville, La.

Availability

Unlimited.

Cost

$4.75 cubic yard FOB Alexandria, La., in bulk.

Potential

As part of the mix for construction of greens and tees and as part of topdressing material where more aeration is needed.

Much data is available on calcined clays and in most cases such data would be generally applicable to aggregate.

Experience In Use

Used as replacement for one part of sand in new green construction. Final 12 inches of surface soil contained 15% by volume. Two-year observations and comparison with greens constructed without aggregate indicate the following facts:

1. Aggregate green is considerably more firm when wet.

2. Water intake rate and movement through the soil equals or exceeds other greens.

3. pH about 0.4 higher than non-aggregate green.

4. Cup changing somewhat more difficult especially when green is very dry on surface. However, soil remains in cup changer the same as other greens.

5. Fertilizer appears to leach more readily as a result of the higher percent of non-capillary pores. Smaller and more frequent fertilizer applications are suggested.

Aggregate was used with cane compost soil (filter press) in pot tests as a soil mix. This phase will be discussed under cane compost soil.

Remarks

Light aggregate is an inexpensive source of calcined clay especially valuable where construction materials need greater non-capillary pore space. Also, note the available plant nutrient and lime content of this aggregate.

Chemical Data of Composite Sample of Dry Light Aggregate 10 Days After Grinding[1]

Available phosphorus, ppm[2]	60
Available potassium, ppm	172
Available calcium, ppm	6120
Available magnesium, ppm	1525
Reaction pH	10.0[3]
$CaCO_3$ (limestone) equivalent	7.1%

1Analysis done by Louisiana Agricultural Experiment Station.

2Parts per million.

3pH reduced to 8.2 when in contact with moist air. Oxides and hydroxides changed to less alkaline materials. Although data is being requested for the *available* ppm after lowering of pH, it is not ready. It is expected they will be lower for the above reasons.

Selected Physical Data Compared To Mason Sand

	Weight Cu. Ft.	% Water Held By Weight 3 Hrs. After Free Draining
Mason Sand	100	18.1%
Lightweight Aggregate	53	42.8%

SUGAR MILL COMPOST SOIL (Filter Press)

General

This material is actually composted material. Each compost pit is expected to vary, often in extremes. Basically this soil material contains soil washed from the mill cane, bagasse (cane fiber), chemicals used in making sugar, ash, carbon, and organic matter provided by plants growing in the pit.

Other factors influencing such a compost are the amount and kind of materials going in the pit, age of compost, depth of pit, water management, amount and kind of vegetation growing in pit, place of discharge of mill residues in the pit, changes in chemicals and sugar manufacturing processes with time, and others.

Does it appear hopeless, too complicated, too variable? I think not. The evaluation procedure described below may change your opinion and justify mine.

The pit studied, and from which soil was later used, is located at Meeker, La. (Meeker Sugar Cooperative, Inc.) After receiving approval from mill officials to make the study, and to use the pit contents without cost, the job was started—but not before all information related to or influencing the pit material was obtained from key mill personnel. Then the steps taken were in this general order:

1. Made the equivalent of a detailed soil survey of the 5-acre pit (leveed area).
   a. Recording depths and extent of major layers, vegetation (weeds).
   b. Made simple field chemical tests.
   c. Made a large scale map and recorded pertinent data.

2. Based on conditions found above, took composite soil samples.

3. Took 30-pound samples from the pit for pot or other studies.

4. Sent samples to LSU for analysis.

5. Checked on other analyses and past uses of this compost.

6. Evaluated all data and information and made recommendations.

This involves a lot of words but not too much work. Timing and follow-up are very necessary. The following conclusions were reached:

1. The compost material was, although stratified, very uniform in profile and total depth (3 feet).

2. Removal of the compost should be down to original soil (3 feet).

3. Good mixing was obtained through loading, dumping (disking in our case) and/or screening or shredding.

4. No serious weeds or grasses were present. Tie-vines, coffee weeds, but *no* common bermudagrass, crowfoot, or crabgrass.

5. No problem of toxic substances, nematodes, turf insects or diseases.

6. This compost material was *not satisfactory* or *suitable* unless cut or mixed with sand, aggregate, cinders, or other non-plastic material for green or tee construction.

7. The composted material was excellent for construction when properly diluted or cut with the above.

8. No peat or other organic material was needed or desired in green or tee construction.

Chemical Data With Comparisons

	Composted Soil From Cane Mill Pit ppm[1]	Fertile Red or Mississippi River Bottom Sandy Top Soil ppm	Unfertilized Hill Sandy Soil ppm
Available phosphorus	400 +	180	40 or less
Available potassium	453 +	220	80 or less
Available calcium	4534 +	2800	500 or less
Available magnesium	450 +	280	50 or less
Reaction pH[2]	5.7 (7.2)	7.0	5.0 to 6.0
Organic matter	12 to 18%	1.8%	0.7 to 1.0%

1Parts per million.

2Initial low pH due to organic acids and only temporary.

Physical Data With Mason Sand Mixes

	Dry Weight Cu. Ft.	Relative % Water Held	% Sand[1]
Pure compost	52.3	62.8	28
1/2 sand-1/2 compost	84.5	31.1	
2/3 sand-1/3 compost	89.8	28.2	
Mason sand	100	18.1	

1Includes fine sand, cinders, carbon, and strongly aggregated soil. Actual sand may be as low as 10%.

As of this date no laboratory evaluations of the movement of water through various mixtures and compaction have been made. This was not done because more reliable information was available locally. All 19 greens at the Rapides Golf and Country Club at Alexandria, La., were constructed using compost from the Meeker Sugar Mill. These greens are not tiled and rest on heavy clay with a ten-inch cinder base.

They were constructed six to seven years ago using 60% cane compost and 40% ground cinders. Top-dressing basically same as above. Maintenance was standard for golf courses of this financial status.

Observations and study during this six-year period, under all climatic and playing conditions, are listed below:

1. Permeability rate was no problem.

2. This mixture grows 328 Bermuda and winter grasses in a highly satisfactory manner.

3. No special or unusual physical maintenance practices are required.

4. Requires a minimum of fertilizer and water.

5. Practically no turf disease noted without use of any turf fungicides.

6. Thatch, mat, and worm problems normal.

7. Transition from cool to warm season grass no problem.

8. Weed invasion not serious.

9. Greens have tendency to be less firm than desirable when saturated with water (suggests more sand or cinders in future topdressing).

10. No problem with pin changing.

In addition to the observations listed above, extensive tests have been conducted using potted compost-sand, cinder, and aggregate mixtures. Tests involved puddling mixtures, compaction both wet and dry, then growing both grasses and vegetable plants.

Conclusion

We recommend the compost from the Meeker Sugarcane Cooperative for part of the *mix* for green and tee construction. The mix for the climatic conditions around Alexandria, La., for construction is by volume—one part of this compost and one part sand and *no peat*.

Topdressing may be a ground mixture as above or under certain conditions the sand can be increased two parts. Available evidence does not indicate an increased disease problem following topdressing during fall seeding.

The Alexandria Golf and Country Club has already stockpiled enough of this compost to construct five new greens in 1966. It is also being used as part of the topdressing mix.

WASHED SAND

In most areas of this State, sand is usually the most expensive single major ingredient in green construction. Mason sand is very expensive but is not essential in the soil mix.

Many operating or abandoned gravel pits have large amounts of "washed sand." This is sand or sandy material from which almost all of the gravel and fines have been removed by water and screening. Some of this material has been washed and screened twice. The clay and silt percent is usually less than 5%. Naturally every pit will not be uniform in the percentage of fines or gravel.

Examination of each gravel pit will almost always result in finding a large amount of excellent sand or granular material suitable for the greens soil mix. I have found that this material very often can be purchased for about one-third of the cost of mason sand. Don't forget that the cost of sand is often determined by what it is being used for or with.

The Louisiana Geological Survey Office at Baton Rouge (LSU Campus) can provide at a small cost the locations of operative or abandoned pits in Louisiana.

SUMMARY

Economical and technically sound greens and tees may be constructed or improved by the proper use of native materials and by-products.

I have tried to leave the idea with you that the selection, use, and management of such construction will require additional knowledge and effort on your part. It is often possible to get needed technical information and basic data without cost from state, federal, and other sources, not excluding members of your golf club. It may be necessary in some circumstances to pay for some "know how" or for specific information.

You have heard considerable reference to organic matter additions in golf course construction. It may be well to remember that regardless of the kind added in the mix, it will not remain un-decomposed very long in our climatic zone. Also, the greatest value of organic material, regardless of the kind, comes after it has been altered through decomposition. I am relating the above to soil structure improvement. This in turn influences infiltration and permeability rates and other attributes of a good green or tee.

REFERENCES:

The Use of Sawdust For Mulches and Soil Improvement by F. E. Allison and M. S. Anderson, U. S. Department of Agriculture, Circular No. 891.

Sawdust And Other Natural Organics For Turf Establishment And Soil Improvement by M. S. Anderson, USDA-ARS 41-18.

Composts, Peat And Sewage Sludges by H. W. Reuszer - *Soils - 1957 Yearbook of Agriculture.*

The Case For Temporary Greens

AN OPEN LETTER
To Members of
Northeastern Golf Clubs
Gentlemen:

The question of whether to allow play on regular greens in winter is very difficult to answer precisely and finally because so many variables must be considered. The difficult part is that any one of these variables can change daily, or even hourly and play at such time could cause serious injury. At other times play could be allowed without causing injury.

Speaking from the agronomic point of view, we would say without reservation that it is best to keep winter play off regular greens and to use temporary greens for the following reasons:

(1) So many more golfers play each course now in regular season that injury due to the increased traffic is mounting and off-season play can only add to the total traffic injury problems. This was very evident during the winter-spring season of 1962-63 when many courses suffered severe winter damage. These have been documented in articles written in the USGA Green Section Record for July 1963, September 1963, and November 1964. If you do not have these, we would be pleased to send them to you.

(2) In late fall or early winter when frost enters the ground, turf becomes frozen and the upper fraction of soil becomes moistened with frost. Traffic at these times will break or crack the stiff and frozen blades of