ORGANIC MATTER IN ROADSIDE AGRONOMY

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A plant cover can be established on some slopes without introduction of additional organic matter. Successful, and at the same time economical, results can be achieved by selection of proper (for a given situation) hardy plant species, correct type and amount of commercial fertilizer, and by sound judgment in selection of methods of soil preparation, water conservation, planting and mulching.

The steepness of slope, its height, the type of soil the slope is made of, the local climate, and exposure are factors of limitation as to how far one can depend on satisfactory results without use of organic matter. The soil improvement qualities of organic matter are well known. However, there are several facts of specific interest to roadside slope planters that ought to be mentioned here.

The moisture holding capacity of a given material high in organic matter depends a great deal on its lignin content. Lignin is the "sponge" of the organic matter. The materials high in lignin and low in cellulose, like peat moss, or partly decomposed sawdust, can hold moisture to as much as ten times their dry weight.

The availability of moisture to plants often depends upon the state of decomposition of the organic matter. When the material is so far decomposed that it loses its fibrous texture and becomes granular, the amount of capillary water decreases.

On the other hand, the thoroughly decomposed organic matter material is a valuable amendment in tight clay soils. The combination of organic colloids with mineral colloids promotes granulated soil structure.

In short: - raw humus improves sand; fine humus improves clay. However, in order to get the clay started more quickly on its way to improvement, a supplementary mixing of straw or hay into clay will help. A temporary sponge like structure will result.

Sources of Organic Matter

Topsoil: Average topsoil as it is used in roadside planting contains some organic matter, generally between 3 to 5 per cent, seldom as much as 10 per cent. For example, the topsoil of Carrington loam (one of the best soils of Iowa) averages 5 per cent. On the other hand, topsoil of Cecil clay loam (red clay of Piedmont) averages only 1/2 per cent. Because of its loose structure topsoil allows good root penetration, and when it is laid thick enough, it will grow a good grass cover--but at what price? Are there farmers hauling topsoil to improve the fertility of their depleted or eroded fields? By working the topsoil into the raw soil of slopes the improvement comes mostly from actual digging. Moisture holding capacity of soil remains about the same. Potential fertility of topsoil is too low to be considered as fertilizer.

To summarize: There is little or no need in topsoil to establish plant growth on gentle slopes provided mulching is used. On steep and dry slopes, something more potent than average topsoil is needed to support plant growth. To justify any large scale topsoiling, it must be done very cheaply.

<u>Materials High in Organic Matter:</u> Peat-moss, forest litter, rotten wood, old or composted sawdust, composted straw and weeds, decomposed pomace, and various locally available materials contain from 70 to 90 per cent organic matter. When mixed with about 3/4 of mineral soil, these materials make a filler for pockets or trenches on dry, steep slopes that will hold sufficient amount of moisture through summer.

An experiment carried out on very dry slopes in Shenandoah National Park this summer demonstrated that pockets filled with filler material made of 1/4 rotten sawdust and 3/4 mineral soil hold plenty of moisture after three weeks without rain. Earthworms were abundant. On some slopes the pockets filled with high-grade topsoil (8 per cent organic matter) were about as dry as the rest of the bank. No earthworms were found in topsoil pockets. Little topsoil was added to the sawdust mixtures for inoculation purpose.

Experience in Shenandoah National Park shows that it is cheaper in the long run to go as far as 30 miles after rotten sawdust, rather than haul topsoil from within 3 to 4 miles. One can haul about 10 times, or more, of organic matter per load of rotten sawdust than per load of topsoil. Labor saving in loading and unloading in terms of organic matter is to be considered. Mixing of sawdust with mineral soil is the extra labor in case of sawdust.

Composting

To be used as soil amendment, the materials high in organic matter must lose thru decomposition most of their cellulose. The reason for this is the nitrogen deficiency caused by the bacteria decomposing cellulose. For quick decomposition of material high in cellulose, addition of nitrogen with some phosphorous and a little potassium is generally required. The plant food consumed by the bacteria is preserved in proteins and other organic compounds and later gradually released to plants. This is, by the way, a good method of fertilizer application, especially in sandy soil. Less fertilizer is lost through leaching and locking into unavailable compounds, and that used is doing two jobs - helping decomposition and later feeding plants.

Some materials are high in tannic and other organic acids. This acidity can easily be counter-acted by addition of lime.

The rosin present in sawdust of resinous trees is not toxic to the bacteria with exception of rare cases where pine oil is being produced inside an old sawdust pile. However, the resinous wood is attacked only by a limited number of bacteria and in a very leisurely fashion; so the process of resinous sawdust decomposition is slow. There are indications, just the same, that neutral reaction, enough nitrogen, favorable moisture, air and temperature conditions will greatly speed up the activities of bacteria decomposing the resinous sawdust.

Though moisture is very important for successful composting, one should not "overflow" the compost. Unnecessary leaching and anaerobic conditions will result. Full hygroscopic saturation with little capillary saturation for moisture reserve is the best.

The most favorable temperature for quick decomposition is between 80° and 120° F. When temperature goes above 120° only a limited number of thermophylic bacteria is at work. Also, there is considerable loss of nitrogen through ammonia evaporation. When the temperature is below 80°, there are more bacteria species present. However, the total number of bacteria is small and the activity is sluggish.

The recent work at Shenandoah National Park in composting of sawdust with apple pomace and clover chaff indicates that a satisfactory decomposition of sawdust can be achieved within 6 to 8 months. The similar decomposition of sawdust in condition of sawdust pile takes from 8 to 12 years, depending on whether the pile is located in a dry or moist situation.

The proportions of materials in the compost pile mentioned above (about 50 truckloads, total material) is as follows:

Sawdust (mixed hardwood and some pine)	- 4 parts (by bulk)
Apple pomace	- 1 part (by bulk)
Clover chaff	- 1 to 2 parts (by bulk)
Lime (94 per cent calcium hydroxide)	- 1/30 parts (by bulk)

Some experimental composting of sawdust with various types and proportions of commercial fertilizer is now being contemplated.

Composting of straw is well known. However, the writer will venture an opinion that one should not carry the decomposition of straw quite as far as it usually is done. For roadside planting purposes partly decomposed straw will be better. It holds more moisture.

Some Recent Analysis of Interest

The Division of Soil Physics and Chemistry has made an analysis of sawdust and pomace sample submitted by the writer--all calculations on dry basis.

Samples of sawdust taken from a pile of chestnut sawdust about 8 years old in North Carolina:

	Nitrogen %	Ash %
The outside crust	0.79	21.30
The center of pile	0.40	4.93
The bottom layer	1.03	23.70

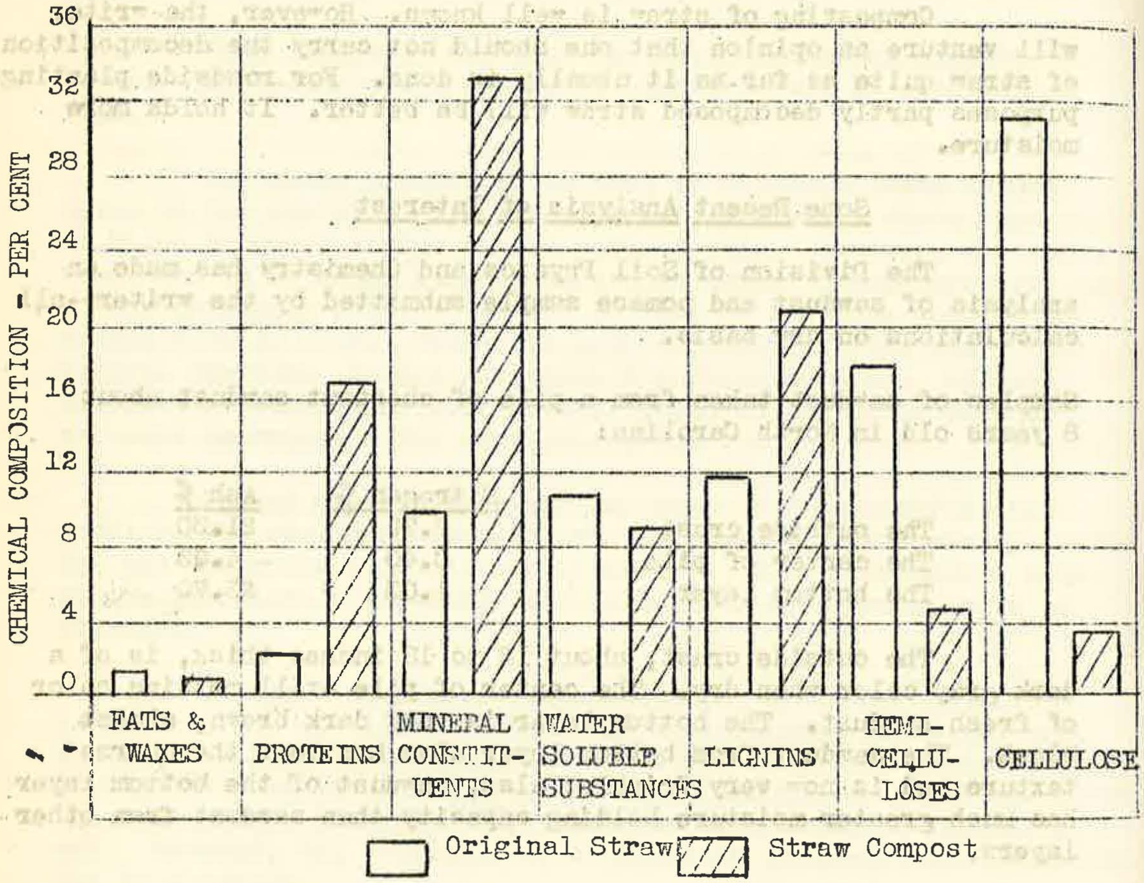
The outside crust, about 12 to 18 inches thick, is of a dark gray color when dry. The center of pile still retains color of fresh sawdust. The bottom layer is very dark brown, almost black. The sawdust from bottom layer also has lost the coarse texture and is now very friable; also, sawdust of the bottom layer has much greater moisture holding capacity than sawdust from other layers.

Samples of fresh and 1-year old pomace were analyzed:

	Nitrogen %	Ash %
Fresh apple pomace from Waynesboro, Va.	0.87	1.69
Fresh apple pomace from Front Royal, Va.	0.85	2.07
The pomace one year old from Waynesboro, Va.		
Crust of the pile	1.79	3.72
Center of the pile	1.39	2.86

Both sawdust and pomace are acid and therefore seem to hold ammonia form nitrogen a long time. The increase of per cent of nitrogen and ashes is due to loss of carbohydrates in the process of decomposition.

CHANGES IN CHEMICAL COMPOSITION CREATED BY COMPOSTING



Comparative chemical composition of straw and compost prepared from it (After Waxman and Garretson)

The changes represented in the above drawing can be considered typical to any compost materials high in cellulose. However, in case of manure composts the proteins will be higher at the beginning of the process and lower at the end. In case of woody materials, such as sawdust, the lignin content will be higher.

The compost as given on the drawing resulted after 273 days at a temperature 37° C (about 100° F.), in the presence of added inorganic nutrient salts.

All the gains and losses are relative, with the exception of proteins where gains are also absolute, largely as a result of the synthesis of microbial proteins from the inorganic nitrogen added to the compost.

The bacteria breaking down the cellulose requires nitrogen at a rate one part to every twenty parts of carbon for quick results. In case of coarse sawdust or shavings, however, a rate of one nitrogen to thirty or forty carbon will be more economical; reasons: higher proportion of lignin, coarseness of material, the cellulose is not as quickly available as in straw.

The process of composting can be summarized as reduction of cellulose.