

APPENDIX D

SOIL CHEMISTRY REPORT, SITE 7NC-G-143

REPORT NUMBER
R027-037

A&L EASTERN AGRICULTURAL LABORATORIES, INC.
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SEND TO:
LOUIS BERGER
INTERNATIONAL INC
POB 270/100 HALSTED ST
EAST ORANGE NJ 07019-0270

GROWER:
DRAWYER CREEK SOUTH SITE

SAMPLES
SUBMITTED BY:
ROBERT JACOBY

SITE 7NC-6-143

DATE RECEIVED 01/24/97
DATE OF ANALYSIS 01/27/97

SOIL ANALYSIS REPORT

DATE OF REPORT 01/28/97

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SAMPLE NUMBER	LAB NUMBER	ORGANIC MATTER % ENR RATE lbs./A	PHOSPHORUS		POTASSIUM K ppm-K RATE	MAGNESIUM Mg ppm-Mg RATE	CALCIUM Ca ppm-Ca RATE	SODIUM Na ppm-Na RATE	pH		HYDRO-GEN H meq/100g	Cation Exchange Capacity C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED)			
			P1 (Weak Bray) ppm-P RATE	P2 (Strong Bray) ppm-P RATE					SOIL pH	BUFFER pH			% K	% Mg	% Ca	% H
278	01961	9.9 140VH	9 L	11 VL	75 L	53 L	530 L		3.9	6.5	4.5	7.8	2.6	5.7	34.0	57.7
289	01962	7.3 140VH	5 VL	7 VL	55 L	44 L	430 L		4.3	5.7	2.5	5.2	2.7	7.1	41.7	48.5
305	01963	4.5 134VH	4 VL	6 VL	61 M	28 VL	220 VL		4.4	6.7	2.5	4.0	4.0	5.9	27.8	62.3
310	01964	3.8 121VH	4 VL	6 VL	56 M	29 L	220 L		4.5	6.7	2.1	3.5	4.1	6.8	31.1	58.1
313	01965	2.0 86M	6 VL	8 VL	59 M	24 L	150 L		4.3	6.8	1.4	2.5	6.0	8.0	30.0	56.0

(SEE EXPLANATION ON BACK)

SAMPLE NUMBER	NITRATE NO ₃ ppm-NO ₃ -N RATE	SULFUR S ppm-S RATE	ZINC Zn ppm-Zn RATE	MANGANESE Mn ppm-Mn RATE	IRON Fe ppm-Fe RATE	COPPER Cu ppm-Cu RATE	BORON B ppm-B RATE	EXCESS LIME RATE	SOLUBLE SALTS mmhos/cm RATE	CHLORIDE Cl ppm-Cl RATE	MOLYB- DENUM Mo ppm-Mo RATE	PARTIAL SIZE ANALYSIS				
												% SAND	% SILT	% CLAY	SOIL TEXTURE	

This report applies to the sample(s) tested. Samples are retained a maximum of thirty days after testing. Soil Analysis prepared by:

A & L EASTERN AGRICULTURAL LABORATORIES, INC.
Robert Jacoby
C. NEWMAN

CODE TO RATING: VERY LOW (VL), LOW (L), MEDIUM (M), HIGH (H), VERY HIGH (VH), AND NONE (N).
ENR - ESTIMATED NITROGEN RELEASE
MULTIPLY THE RESULTS IN ppm BY 2 TO CONVERT TO LBS. PER ACRE OF THE ELEMENTAL FORM.
MULTIPLY THE RESULTS IN ppm BY 2.4 TO CONVERT TO LBS. PER ACRE K₂O
MULTIPLY THE RESULTS IN ppm BY 4.6 TO CONVERT TO LBS. PER ACRE P₂O₅
MOST SOILS WEIGH TWO (2) MILLION POUNDS (DRY WEIGHT) FOR AN ACRE OF SOIL 6 1/2 INCHES DEEP

EXPLANATION OF SOIL ANALYSIS REPORT

% ORGANIC MATTER AND ESTIMATED NITROGEN RELEASE (ENR)

The % Organic Matter content is determined chemically on the dried screened soil sample. However, the total organic content may be somewhat higher than reported because larger pieces of plant and animal residues are screened out prior to analysis. Only a part of the total nitrogen in the organic matter of a soil will become available for plant use during the growing season. Many factors such as soil moisture, soil temperature, the soil's physical condition, and the amount and type of crop residues present all have an effect on bacterial action. Therefore the ENR value is only a guide to the nitrogen supply available for the growing crop. For additional information on nitrogen release and recommendations guides, see pages 5-12 in our book, "Soil and Plant Analysis."

Results: The results for the major and minor plant food elements are reported in parts per million (ppm) on an elemental basis.

Conversions: To convert to lbs./A, the type of soil and tillage depth should be considered. Most mineral soils weigh approximately 2 million pounds (dry weight) for an acre of soil 6" to 7" inches deep. An acre of soil 10 inches deep weighs approximately 3 million pounds. In the past, most laboratories that reported results in lbs. per acre were considering 2 million lbs. of soil per acre (results in ppm x 2 = lbs. per acre). However, with deeper tillage practices used today many growers are dealing with nearly 3 million lbs. of soil per acre.

CONVERSION TABLE

Results in ppm	2 Million lbs. of soil per acre 6"-7" in deep	Results in ppm	3 Million lbs. of soil per acre 9"-10" in deep
P x 2	= lbs. per acre of P	P x 3	= lbs. per acre of P
x 4.6	= lbs. per acre of P ₂ O ₅	x 6.9	= lbs. per acre of P ₂ O ₅
K x 2	= lbs. per acre of K ₂ O	K x 3	= lbs. per acre of K ₂ O
x 2.4	= lbs. per acre of K ₂ O	x 3.6	= lbs. per acre of K ₂ O
Mg x 2	= lbs. per acre of Mg	Mg x 3	= lbs. per acre of Mg
Ca x 2	= lbs. per acre of Ca	Ca x 3	= lbs. per acre of Ca
S x 2	= lbs. per acre of S	S x 3	= lbs. per acre of S
S x 6	= lbs. per acre of SO ₄	S x 9	= lbs. per acre of SO ₄
B, Zn, Mn, Fe, Cu, Mo x 2	B, Zn, Mn, Fe, Cu, Mo lbs. per acre of B, Zn, Mn, Fe, Cu, Mo	x 3	= lbs. per acre of B, Zn, Mn, Fe, Cu, Mo

PHOSPHORUS

Two different tests are made and reported for availability of phosphorus in the soil sample.

Weak Bray (P₁)—This method determines the amount of readily available phosphorus in the soil. A level of at least 20 ppm of P is desired for average crop production and a level of 30 ppm of P is desired for top yields of most crops.

Strong Bray (P₂)—This method determines the amount of readily available phosphorus plus a part of the active reserve phosphorus in the soil. A level of at least 40 ppm of P and preferably 60 ppm of P or more is desired for good yields of most crops.

SODIUM BICARBONATE (P)—This method determines the amount of readily available phosphorus in calcareous soils (having free lime present). A level of at least 10 ppm of P and preferably 15 ppm of P or more is desired for good yields of most crops. For additional information on phosphorus availability and recommendation guides, see pages 13-21 in our book, "Soil and Plant Analysis."

CATION EXCHANGE CAPACITY (CEC)

The cation exchange capacity (C.E.C.) is a measure of the capacity of a soil to hold exchangeable cations. These include Hydrogen (H⁺), Calcium (Ca⁺⁺), Magnesium (Mg⁺⁺), Potassium (K⁺) and Sodium (Na⁺).

C.E.C. is measured in terms of milliequivalents (meq.) per 100 grams of soil. It depends largely on the amount and type of clay present and the organic matter content. The larger this value, the more cations the soil is able to hold against leaching.

PERCENT BASE SATURATION

The balance for the soil cation recommended by most soil scientists is 65 to 75 percent calcium, 10 to 15 percent magnesium, and from 2 to 5 percent potassium.

The percent base saturation is calculated from the C.E.C. and percent saturation of Ca, Mg, K, H, and Na is reported to assist you in determining the balance of cations in your soil. For additional information and recommendation guide, see pages 25-29 in our book, "Soil and Plant Analysis."

pH

Soil pH: The soil pH is measured on a 1:1 soil to water solution. The soil pH measures the active soil acidity to alkalinity. Mineral soils should have a pH of 6.0 to 7.0 for most crops, while a pH range of 5.0 to 5.5 is adequate for high organic soils.

Buffer Index: The buffer pH is determined with the Shoemaker, McLaren, and Pratt (SMP) buffer solution. The lime requirement is determined by the depression of the buffer pH by acidity in the soil sample. The amount of limestone needed to neutralize the acidity present has already been determined and the following table is a general guide, but variations from other published guides may occur due to differences in limestone fineness, neutralizing value, and plow depth.

SALT pH:

In areas where the SMP buffer is not used a salt pH is determined. The salt pH of the soils is measured by adding 0.01 molar calcium chloride to the soil's solution. Soils which are highly leached and sandy soils may have a salt pH value as much as one whole unit lower than the soil pH, (i.e., 6.0-5.0). The soil pH value of soils of average salt content may be lowered from 0.4 to 0.8 units by using the calcium chloride. Depressions of the soil pH amounting to 0.1 units and less upon the addition of calcium chloride occurs when soils are exceedingly high in their content of salts. For additional information on soil pH and liming guide, see pages 30-33 in our book, "Soil and Plant Analysis."

LIME REQUIREMENT

Buffer pH	Tons/Acre Limestone		Organic Soils	
	Mineral Soils Plow Depth 6" inches	Plow Depth 9 inches	Plow Depth 6" inches	Plow Depth 9 inches
7.0	none	none	0	0
6.9	none	none	0	0
6.8	1	1.5	0	0
6.7	1.5	2	0	0
6.6	2	3	0	0
6.5	2.5	4	0	0
6.4	3	4.5	1	1.5
6.3	3.5	5	2	3
6.2	4	6	2.5	3.5
6.1	4.5	7	3	4.5
6.0	5.5	8	4	6
5.9	6	9	4.5	6.5
5.8	6.5	10	5	7.5
5.7	7	11	5.5	8
5.6	8	12	6	9
5.5	9	13	6.5	10

If the soil pH is above 6.5, no buffer index will be determined since lime would not be needed for most crops. Crops raised on organic soils (soils containing 30% or more organic matter) usually do not benefit from liming unless the soil pH is less than 5.3.

ADJUSTMENTS FOR TYPE OF LIMING MATERIAL

Two primary factors affect the actual amount of a given liming material required to achieve the desirable effect on soil pH. The total Nutrient Power (TNP, also referred to as Calcium Carbonate Equivalent) and the fineness of the liming material are these factors. The following table will serve as a guide to make these adjustments.

Lbs. to equal 1 ton of Limestone	Hydrated TNP	Ag Super fine	Ag Pulverized Base	Ag Ground	Ag Fine Meal	Ag Course Meal	Ag Granulate Slag
		1900	2000	2300	2900	3400	2700
F %	140-160	90+	90+	90+	90+	90+	90+
I P							
N A	100 MESH	100	80	60%	40	30	20
E S	60 MESH	100	95	70%	50	40	30
N S	20 MESH	100	100	85%	70	60	50
E I							
S N							
S G							

If the TNP is less than 90, multiply amount from above by these percentages:

TNP	%
80-89	115
70-79	130
60-69	150

LIMING:

Apply lime only after the soil has been tested. Too much lime can be as harmful as too little. Lime must be thoroughly mixed with the soil for maximum effectiveness. If both magnesium and calcium are needed, apply dolomite lime to help supply magnesium.

EXCESS LIME:

A visual rating of free lime present. Soils having high amounts of free lime available will have associated problems in the availability of major and minor elements and difference in choice or amount of soil amendments.

SOLUBLE SALTS:

For information, refer to page 61 of our book, "Soil and Plant Analysis."

SULFUR:

All crops need sulfur. The higher the nitrogen uptake by a crop, the greater the need for sulfur. A level of 15-20 ppm of available sulfur should be maintained for most crops. For additional information on availability of sulfur and making recommendations, see pages 22-24 in our book, "Soil and Plant Analysis."

MICRONUTRIENTS

The available levels of micronutrients are rated from very low to very high. However, applying the recommended amount of a certain minor element with a low rating will not necessarily insure a crop response because of the many factors which may influence micronutrient response. Some of these factors which influence response are: rapidly changing soil pH, excessive applications of N-P-K, soil physical problems, soil moisture extremes, excessive leaching, crop variety, and plant population. For additional information on why plants need micronutrients, their availability, interactions with other nutrients and a recommendation guide, see pages 31-45 in our book, "Soil and Plant Analysis."

APPENDIX E

BOTANICAL RECOVERIES ANALYSIS, SITE 7NC-G-143

FLORAL ANALYSIS: DRAWYER CREEK SOUTH SITE (7NC-G-143), NEW CASTLE COUNTY, DELAWARE

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INTRODUCTION

The Drawyer Creek South site (7NC-G-143), New Castle County, Delaware is a multi-component prehistoric site, that was occupied periodically from the Archaic through the Woodland II period. Twenty-five flotation samples from the site were submitted to *Lake States Archaeological & Ecological Consulting* for archaeobotanical analysis. The analysis was directed toward identifying subsistence activities, site seasonality, and feature function. Unfortunately, due to the mixed nature of the deposits, no conclusions regarding subsistence trends through time can be posited from the assemblage.

ANALYTICAL METHODS

The Drawyer Creek South archaeobotanical assemblage was derived from 25 flotation samples (26.5 liters) that were collected from three features and four excavation units. For purposes of quantitative comparison, only the flot collected samples are considered in this analysis. Variations in the distribution and density of these remains reflect differences in feature function and subsistence activities. These data also may provide information regarding the prehistoric environment.

Flotation samples were processed at the Louis Berger & Associates, Inc. laboratory facility, using a Dausman closed-tank system. Light fraction materials were recovered in a # 40 (0.04 mm) mesh and heavy fraction in a # 20 (0.8 mm) mesh.

Materials recovered from the flot samples were sorted under low power binocular magnification (10x). All wood and bark charcoal, carbonized nut, and other floral remains > 2 mm in size were recovered from these samples. The < 2 mm residue was then scanned and all categories of floral remains that were not represented in the > 2 mm component of any given sample were separated out. For consistency and inter-site comparison, only the > 2 mm wood, bark and nut remains were used for counts and weights.

Randomly selected charcoal fragments from each sample were identified to the most specific taxon possible. Unfortunately, due to their diminutive size, many of the wood charcoal fragments could not be identified to genus. Seed and nut remains were identified to genus and species whenever possible, although some specimens could only be identified to family. Identifications were made with the aid of modern comparative collections and with identification keys (Martin and Barkley 1973; Montgomery 1977; Core *et al.* 1979).

Only carbonized seeds are considered prehistoric in this study because uncarbonized materials are rarely preserved at open-air sites in temperate environments. Preservation of unburned material can occasionally occur under unusual conditions such as anaerobic contexts, or in association with copper sulfates and high pH (Lopinot and Brussell 1982); these conditions are not present at the Drawyer Creek South site. Further, the epidermis was present on many of the seeds and the embryos were fresh, indicating that they were modern contaminants. Modern seeds can be introduced into archaeobotanical assemblages by several sources, including bioturbation (Stein 1983) and during collection and processing of samples (Minnis 1981).

RESULTS AND INTERPRETATION

Flotation samples (26.5 liters) from Features 2, 3, and 5 and four excavation units (23, 35, 79, and 82) at the Drawyer Creek South site are included in the floral analysis (Table 1). The flotation samples contained wood and bark charcoal, charred nutshell, seeds, a bud, a peduncle, and unidentifiable organic material.

Densities of wood charcoal are variable among the sampled contexts (Table 2). The high densities of charcoal in Features 2 and 5 suggest that they were used as hearths. Moderate densities of wood charcoal from Excavation Units 35 (Level 2) and 82 (Level 2) are characteristic of kick zones around hearths. Low densities of wood charcoal in the other samples reflect the presence of general occupational refuse across the site.

Identified wood charcoal from the samples, in order of predominance, includes oak/*Quercus* sp. (including the white oak subgenus/*Lepidobalanus* [e.g., white oak/*Q. alba*, chestnut oak/*Q. prinus*] and the red oak subgenus/*Erythrobalanus* [e.g., water oak/*Q. nigra*, willow oak/*Q. phellos*]), hickory/*Carya* sp., ash/*Fraxinus* sp., ring-porous (e.g., hickory, ash and oak) and diffuse-porous (e.g., maple/*Acer* sp., birch/*Betula* sp.) wood, and unidentifiable wood (see Table 1). The overall composition of the assemblage suggests that an transitional lowland/upland forest, including oaks (e.g., water, willow, chestnut, and white oaks), with tulip tree/*Liriodendron tulipifera*, river birch, beech and other trees; a community type distinct to the this region (Braun 1950:268-269). The predominance of oaks suggests that there may have been some cultural selection for woods of better fuel value (cf. Hunt and Rammrath 1978).

Relatively low densities of bark charcoal are present throughout the assemblage (see Table 2). Higher densities do, however, occur in Features 3 and 5, which also contain higher densities of wood charcoal. The densities of bark charcoal suggest that it is an incidental inclusion, representing bark that was adhering to the wood that was burned.

Nutshell, including hickory/*Carya* sp. (e.g., shellbark hickory/*C. ovata* and bitternut/*C. cordiformis*), walnut family/*Juglandaceae* and cf. hazelnut/*Corylus americana*, was recovered from 28% of the samples (see Table 1). It occurs in low to moderate densities (1-2 ct/1 liter) among the majority of the samples (see Table 2). The distribution and density of nuts

suggests that they may represent food refuse. In contrast to the other samples, Feature 5 contains a high density of nutshell. The high density of nuts in this feature, in association with fruit seeds, strongly suggests that nuts were processed in this context. These nuts would be available in upland forest communities adjacent to the site (Braun 1950).

Seeds, including mustard family/Brassicaceae, mulberry/*Morus rubra*, grape/*Vitis* sp., and unidentifiable seeds, were recovered from 20% of the samples (see Table 1). Fruit seeds were concentrated in Features 2 and 5 and in Excavation Unit 82, which appears to be adjacent to a fire related feature that may have been used to prepare plant foods. The other seeds occur in Features 3 and 5. Given their context, they are probably culturally derived. The grape and mustard family seeds would probably be available in the open area surrounding the site. The mulberry was probably collected from an upland forest adjacent to the site.

The flotation samples from the Drawyer Creek South site also contained a bud and a peduncle (a stalk bearing a flower or fruit), as well as unidentifiable organic materials. The source and function of these remains is unclear.

CONCLUSIONS

The floral assemblage from the Drawyer Creek South site indicates that during the course of its prehistoric occupation, nuts and fruits were targeted resources. These plant foods would have been harvested in the late summer and fall. Based on the small sample considered in this analysis, it would appear that the site was used as a seasonal camp.

REFERENCES CITED

- Braun, E. L.
1950 *Deciduous Forests of Eastern North America*. The Blakiston Company, Philadelphia, Pennsylvania.
- Core, H. A., W. A. Cote, and A. C. Day
1979 *Wood Structure and Identification*. Syracuse Wood Science Series, 6, Syracuse University Press, Syracuse, New York.
- Hunt, C., and R. Rammrath
1978 *Firewood for Your Fireplace*. Leaflet No. 559, Forest Service, U.S. Department of Agriculture, U.S. Government Printing Office, Washington D.C.
- Lopinot, N. E., and Brussell, D. E.
1982 Assessing Uncarbonized Seeds from Open-Air Sites in Mesic Environments: An Example from Southern Illinois. *Journal of Archaeological Science* 9:95-108.
- Martin, A. C., and W. D. Barkley
1961 *Seed Identification Manual*. University of California Press, Berkeley, California.
- Montgomery, F. H.
1977 *Seeds and Fruits of Plants of Eastern Canada and Northeastern United States*. University of Toronto Press, Toronto, Ontario.
- Stein, J. K.
1983 Earthworm Activity: A Source of Potential Disturbance of Archaeological Sediments. *American Antiquity* 48: 277-289.

Table 2. Standardized Floral Values: Drawyer Creek South Site (7NC-G-143).

Provenience			Flot	Wood Charcoal		Bark Charcoal		Nutshell		Fruit Seeds	Other Seeds
Feature	Provenience Unit	Level	Flot vol	Std Ct	Std Wt	Std Ct	Std Wt	Std Ct	Std Wt	Std Ct	Std Ct
				2	30	1	1.0	17.0	0.01	0.0	0.00
2	30	5	1.0	2744.0	30.29	25.0	0.80	2.00	0.02	3	0
3	34/46	1	1.0	20.0	0.13	2.0	0.01	0.00	0.00	0	2
3	34/46	2	1.5	6.7	0.07	1.3	0.01	0.00	0.00	0	0
3	34/46	3	1.0	27.0	0.67	3.0	0.02	0.00	0.00	0	0
5		2	1.0	129.0	1.42	36.0	0.27	36.00	0.26	6	1
	23	2	1.0	6.0	0.04	2.0	0.01	0.00	0.00	0	0
	23	3	1.0	3.0	0.06	4.0	0.04	0.00	0.00	0	0
	23	4	1.0	3.0	0.02	0.0	0.00	0.00	0.00	0	0
	23	5	1.0	0.0	0.00	0.0	0.00	0.00	0.00	0	0
	23	6	1.5	0.7	0.01	0.0	0.00	0.67	0.01	0	0
	35	2	1.0	37.0	0.19	13.0	0.10	0.00	0.00	0	0
	35	3	1.0	17.0	0.13	1.0	0.01	1.00	0.01	0	0
	35	4	2.0	2.0	0.02	0.0	0.00	0.00	0.00	0	0
	79	1	1.0	4.0	0.02	0.0	0.00	0.00	0.00	0	0
	79	2	0.5	20.0	0.18	2.0	0.02	0.00	0.00	0	0
	79	3	1.0	5.0	0.03	0.0	0.00	0.00	0.00	0	0
	79	4	1.5	1.3	0.01	1.3	0.01	0.00	0.00	0	0
	79	5	1.5	2.7	0.02	0.7	0.01	0.00	0.00	0	0
	82	1	1.0	9.0	0.06	1.0	0.01	0.00	0.00	19	0
	82	2	1.0	41.0	0.37	0.0	0.00	0.00	0.00	6	0
	82	3	1.0	21.0	0.11	0.0	0.00	2.00	0.02	0	0
	82	4	1.0	11.0	0.13	0.0	0.00	2.00	0.01	0	0
	82	5	1.0	2.0	0.02	3.0	0.02	1.00	0.01	0	0
	82	6	1.0	0.0	0.00	0.0	0.00	1.00	0.01	1	0