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CONTINUED STUDIES OF THE SOILS OF SAN SALVADOR ISLAND

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ABSTRACT

The ancient "slash and burn" farming method, which offers a basis for productive farming practices in regions with poor soils, is the method used on San Salvador Island, as well as many other locations in the Bahamas, and the rest of the world. The current study is aimed at the determination of nutrient level changes during the slash and burn cycle. Three agricultural sites are being studied. A comparison of soil nutrient levels at these sites over a period of several years should provide valuable information on the effect of the slash and burn cycle on soil fertility.

INTRODUCTION

Geological research in the Bahamas has mostly been done by North American geologists, with many early workers having connections with the oil industry. Much of this early research, conducted in the late 1940s, was directed more toward carbonate sedimentation than land area research. In 1968, the Bahamas commissioned an integrated land resources survey from the British government. By 1974, the thirteen major islands had been included in this survey, consisting of landform and groundwater studies, and the development of large and medium-scale maps. (Fairbanks, 1975)

Little research has been done concerning the soil and agriculture on San Salvador. The importance of soil and agriculture suitability studies for agricultural development has long been recognized, yet many workers still regard such studies as, at best, of only peripheral value. As agriculture was the island's main productive occupation (Shattuck, 1905), without these studies, very costly mistakes have been made (Landon, 1991).

Limestone rocks of the Bahamas have not been changed by the weather enough to produce good deep soils. Therefore, an important part of the soil is the pieces of decayed plant material and ash from slash and burn method farming (Landon, 1991). Our research is designed to monitor changes in nutrient levels in agricultural soils on San Salvador during the slash and burn cycle. As such, our research has been a detailed survey characterizing soils on working farms and investigating soil variability over time (Landon, 1991).

Three tracts of land were chosen to be studied. North and South Fields are located off the Queen's Highway, south of Sugar Loaf Settlement, and New Field is on the trail from the Bahamian Field Station to the Reckley Hill Pond (Fig. 1). Soil samples were collected from the North Field in May, '95 and February, '96. Samples were taken from the South Field in Sept. '93, May, '94, Feb. '95, May '95, Feb. '96, and April '96. Specimens were collected from the New Field in April '96 before burning, May '96 after burning, and in Oct. '96.

Preliminary data on soil nutrients are presented here. It will be necessary to continue sample collection and analysis for several years before establishing any definitive conclusions on the trends in soil fertility.

PROCEDURE

Field Analysis.

Samples were collected at three fields in various locations on San Salvador Island. Samples were collected using a stainless steel scoop after the surface litter was removed. Soil was taken from at least ten locations in each field and then combined to ensure that the samples were representative.

Laboratory Analysis.

The soil was transferred to plastic bags and brought back to Elmira College for analysis. The samples were analyzed using methods developed at Cornell University (McClenahan and Ferguson, 1989), (Greweling and Peach, 1965). Potassium,

Soil Data for the North Field

Nutrient	May-95			Feb-96		
	lb/acre	# of Trials	%RSD	lb/acre	# of Trials	% RSD
Potassium	238.2	18	44.4%	166.5	12	26.5%
Nitrate	168.5	18	26.4%	3.5	12	123.0%
Ammonia	111.9	18	12.0%	23.4	12	44.3%
Phosphorus	11.7	18	13.7%	20.6	12	24.5%

% RSD is the percent relative standard deviation between the results of each trial

Figure I

Soil Data for the South Field

Nutrient	Sep-94	May-94	Feb-95	May-95		
	lbs/acre	lbs/acre	lbs/acre	lbs/acre	# of Trials	% RSD
Potassium	383.3	444.8	475	879.5	18	25.50%
Nitrate	no data	197.6	51.5	141.2	18	37.30%
Ammonia	no data	58	30.6	124.9	18	18.40%
Phosphorus	no data	no data	no data	12.9	6	12.10%

	Feb-96			Apr-96		
	lbs/acre	# of Trials	% RSD	lbs/acre	# of Trials	% RSD
Potassium	178.2	12	21.50%	671.6	36	63.60%
Nitrate	20.5	12	24.10%	140.8	36	77.80%
Ammonia	38.4	12	4.30%	173.5	36	108.70%
Phosphorus	15.1	12	10.30%	71.2	36	162.20%

%RSD is the percent relative standard deviation between of the results of each trial

Figure II

Soil Data for the New Field

Nutrient	April 1996 - Before Burn			May 1996 - After Burn		
	lb/acre	# of Trials	%RSD	lb/acre	# of Trials	%RSD
Potassium	568.8	9	3.5%	4079.2	9	2.1%
Nitrate	53.4	9	23.3%	70.5	9	6.8%
Ammonia	124.9	9	13.1%	365.2	9	4.2%
Phosphorus	15.8	9	23.7%	64.4	9	10.2%

	October. 1996		
	lb/acre	# of Trials	%RSD
Potassium	393.9	9	5.4%
Nitrate	159.2	9	5.5%
Ammonia	72.8	9	1.3%
Phosphorus	59.7	9	11.6%

%RSD is the percent relative standard deviation between of the results of each trial

Figure III

nitrate, ammonia, and phosphate concentrations were determined colorimetrically. The Nessler method was used for the determination of ammonia, brucine was used for nitrate, and ammonium molybdate was used for phosphate. Potassium determination was executed through the use of sodium cobaltinitrite, and all trials were centrifuged before spectrophotometric analysis.

RESULTS

Data from the North Field show greater amounts of potassium, nitrate, and ammonia in May compared with February. However, the concentration of phosphorus is greater in February. (Figure I)

Data for the South Field indicate that there is a pattern of concentration changes for nitrate and ammonia. Consistently greater concentrations of these two nutrients are found in April/May, compared with February in all the years tested. Potassium levels increased from the initial test date in September of 1994 through and including May 1995. The February 1996 sample shows a distinct decrease from the previous test date and the subsequent test date of April 1996. Data on phosphorus concentrations denote an increase through all test dates. (Figure II)

Concentrations of potassium, ammonia, and phosphorus in the New Field were higher in the post-burn sample (May, '96) than in the pre-burn sample (April, '96). Concentrations of these nutrients had decreased in October, '96. There was a larger decrease in potassium and ammonia, than in phosphorus. Nitrate concentrations increased steadily during all testing dates. (Figure III)

DISCUSSION

Data from May 1995 and February 1996 show a higher concentration of phosphorus found in the North and South Fields in February. Both fields also show a decrease in potassium, nitrate, and ammonia found for these test dates. The decrease in these nutrients is as expected because the field was used between May and February to grow crops and the plants have used the soil nutrients.

South Field data suggests a cycling of the nutrient levels with higher levels in April/May and lower levels in February. This is evident in the data of nitrate and ammonia levels. Except for February 1995, data for potassium concentrations, too, suggests that this theory may be correct. Phosphorus levels, on the other hand, indicate a steadily increasing concentration in the soil.

New Field data is consistent with expectations for a field utilizing slash and burn farming, in that all the nutrient levels in the soil increased after the burning of the vegetation in the field. Levels of potassium, ammonia, and phosphorus are lower in the October sampling due to the use of the field for farming. Nitrate levels increased at this testing for unknown reasons.

The data and conclusions presented here are very preliminary and represent only the beginning of what we plan to be a long term project. We hope to develop a soil fertility profile for these fields as they go through the slash and burn cycle. The project will continue for at least three more years and the number of analyses will be increased. The use of atomic absorption spectroscopy for the analysis of metals will be expanded. Data from this study will be compared with the results of other studies conducted in the Bahamas.

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