

THE JOURNAL OF AGRICULTURE OF THE UNIVERSITY OF PUERTO RICO

Issued quarterly by the Agricultural Experiment Station of the University of Puerto Rico, for the publication of articles by members of its personnel, or others, dealing with any of the more technical aspects of scientific agriculture in Puerto Rico or the Caribbean Area.

Vol. XXXVIII

July 1954

No. 3

Lack of Residual Influence from Subsoil Fertilization of A Sugarcane Plant Crop upon the Succeeding Ratoon Crop¹

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INTRODUCTION

In a previous paper (2)³ the beneficial effect of subsoil fertilization on sugar yields of a sugarcane plant crop was reported. Yield increases of over 15 percent in a low productive soil were attributed to subsoil fertilization. In that work some of the plots received all the fertilizer on the topsoil, as is customary in sugarcane fields, while in others the fertilizer application was split equally between soil and subsoil (16–26 inches depth).

The results of this work helped to clarify the apparent discrepancies found in current literature concerning the practical aspects of deep tillage. Although the breaking of plowpans and loosening of tight subsoil layers have proven beneficial to crops in some of the older agricultural areas, no effects on crop yields have been reported from deep tillage in various other places. In the report cited (2) the increases in crop yields could not be attributed to deep tillage, as such, but rather to the more favorable fertility level of the subsoil following treatment.

It was then said (2): "Furthermore, in soils with subsoils in favorable physical condition, the addition of plant nutrients will also promote better root development. If the conditions that influence root extension are favorable both from the standpoint of tilth and nutrient availability, better crop

¹ This is the third in a series of articles by the same authors, the first two of which were published under the general title "Tillage Tests." The previous articles in the series were: I, Effect of subsoiling and mole drainage upon the minimum infiltration capacity of a heavy claypan soil of the Tropics, *J. Agr. Univ. P. R.* **36** (2) 179–85 1952; and II, The beneficial effect of subsoil fertilization on sugarcane yields, *J. Agr. Univ. P. R.* **37** (1) 35–43 (1953).

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³ Numbers in parentheses refer to Literature Cited, p. 127.

yields are likely to be obtained." It was further stated that: "The residual effect of the original subsoil fertilization remains to be determined in succeeding ratoon crops. It might prove advantageous to fertilize the subsoil yearly."

This paper reports the data obtained on the first-ratoon crop of the previously mentioned experiment where a study was conducted to determine the residual effect, if any, of subsoil fertilization of the plant crop upon the succeeding ratoon crop, i. e., 28 months after the establishment of the treatment differentials.

EXPERIMENTAL PROCEDURE

A summary of some of the relevant field information derived from this experiment is given in table 1. Additional details for each soil treatment are given in table 2. The treatment differentials were established some 28 months prior to the harvest of the ratoon crop herein reported. In treatments Nos. 3, 5, 7, and 9, a 13-3-12 fertilizer was applied to the subsoil at the rate of 1,000 pounds to the acre. In treatments Nos. 4, 5, 8, and 9, an application of limestone, at the rate of 1,000 pounds to the acre, was made at the subsoil breakpoint. Two applications of the same fertilizer were made later, to a total of 2,000 pounds to the acre. The first and second surface applications of fertilizer were at only half the rate for plots fertilized at the subsoil as for those that had not previously received this subsoil treatment. The ratoon cane was fertilized uniformly with sulfate of ammonia at the rate of 1,200 pounds to the acre about 2 months after harvesting the plant crop and aligning the trash in alternate banks. Other agronomic practices

TABLE 1.—*Summary of soil-fertilizer treatments and other field information from the tillage-experimental field in east-central Puerto Rico*

Item	Information	Item	Information
Design	Triple lattice	Mean differences in	
Replications	9	plant-crop yields	
Plot size	200 x 20 feet	favoring subsoil	
Sugarcane variety	P.O.J. 2878	fertilization	14 cwt. of sugar
Soil type	Caguas silt loam	Date of treatment	Jan. 17-24, 1951
Summary of fertilizer		Date of planting	Feb. 7-21, 1951
treatments:		Date of plant-crop	Apr. 21-26, 1952
Nos. 1, 2, 4, 6, 8	2,000 lb. of a 13-3-12	harvest	
	fertilizer to top-	Date of ratoon-crop	June 12-15, 1953
	soil	harvest	
Nos. 3, 5, 7, 9	1,000 lb. of a 13-3-12		
	fertilizer to sub-		
	soil + 1,000 to		
	topsoil		

TABLE 2.—*First ratoon-crop sugar yields for each treatment at tillage-experimental field in east-central Puerto Rico, showing other treatments occurring in the same group according to statistical design used*

Treatment identification No.	Soil treatment ¹	Other treatments in the same group	Sugar yields
			<i>Cwt. per acre</i>
1	Check (usual land preparation)	2, 3, 4, 5, 7, 9	82.9
2	Subsoiling	1, 3, 5, 6, 7, 8	80.1
3	Subsoiling with fertilizer on subsoil	1, 2, 4, 6, 8, 9	75.1
4	Subsoiling with lime on subsoil	1, 3, 5, 6, 7, 8	82.7
5	Subsoiling with fertilizer and lime on subsoil	1, 2, 4, 6, 8, 9	88.8
6	Subsoiling and mole drainage	2, 3, 4, 5, 7, 9	82.6
7	Subsoiling and mole drainage with fertilizer on subsoil	1, 2, 4, 6, 8, 9	85.9
8	Subsoiling and mole drainage with lime on subsoil	2, 3, 4, 5, 7, 9	81.3
9	Subsoiling and mole drainage with lime and fertilizer on subsoil	1, 3, 5, 6, 7, 8	70.8

L. S. D. between means of treatments within the same group:

At the 5-percent level 7.72
At the 1-percent level 10.32

L. S. D. between means of treatments not within the same group:

At the 5-percent level 8.13
At the 1-percent level 10.86

L. S. D. between any treatments, irrespective of grouping system (approximate):

At the 5-percent level 7.98
At the 1-percent level 10.66

¹ Given 28 months prior to the second sugarcane harvest reported here.

were performed as is customary in ratoon-cane cultivation in east-central Puerto Rico.

The plant crop was harvested 14 months after establishing the treatment differentials and the first ratoon crop 14 months after harvesting the plant crop. At the time of harvest the cane from each plot was weighed in the field and samples of 20 canes each were taken at random from each plot. They were milled by a hydraulic Squier mill at the Station and the juice samples analyzed.

RESULTS AND DISCUSSION

The mean sugar yields of the first-ratoon crop for each treatment are given in table 2. Each treatment is described, and other treatments occur-

ring in the same group with each respective treatment are indicated. There were no significant differences between the mean yields of plots that received all the fertilizer on the topsoil and those on which the fertilizer application was split equally between topsoil and subsoil. In the plant crop, harvested 14 months earlier, significant differences were measured between the mean sugar yield of all plots receiving fertilizer in the subsoil and those receiving fertilizer only on the topsoil (2,3).

However, it is evident from the ratoon-yield data that the application to the subsoil of a 13-3-12 fertilizer at the rate of 1,000 pounds to the acre, even though it benefited the plant crop, did not have any significant residual effect upon the succeeding ratoon-crop yield. The possibility of using larger quantities of fertilizer for the original application should be considered for future studies in areas like the one where this experiment is established, and where soils have a moderate exchange capacity of around 10 or 12 m.e., with not more than 50-percent base saturation (1).

SUMMARY

Data are presented here on sugar yields obtained with a ratoon crop growing on a heavy-claypan soil subjected to different tillage treatments some 28 months prior to the harvesting date. In a previous harvest—that of the original plant crop 14 months following treatments—significantly greater differences were measured favoring the plots which received half of the fertilizer on the subsoil over those receiving all the fertilizer on the topsoil. However, the data herein reported for the following ratoon crop indicate no residual effect from the original subsoil fertilization which could be measured in terms of sugar yields.

RESUMEN

Se presentan aquí datos sobre la producción de azúcar de un primer retoño de caña en un suelo pesado con un "claypan", sometido a varios tratamientos 28 meses antes de la recolección de la caña. En una cosecha anterior—la de la plantilla original efectuada a los 14 meses después de dados los tratamientos al terreno—se midieron diferencias significativas en los rendimientos. Estas diferencias favorecían las parcelas donde la mitad del abono se aplicó en el subsuelo y la otra mitad en la superficie, al compararlas con las que recibieron todo el abono en la superficie del suelo. Sin embargo, los datos que se informan aquí indican que la aplicación original del abono al subsuelo no tuvo ningún efecto residual sobre los rendimientos de azúcar del primer retoño.

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