

RESEARCH NOTES ON AGRICULTURAL CAPITAL FORMATION
AND TECHNOLOGICAL CHANGE

The Ohio State University
ESALQ/University of São Paulo

No. 1

Subject: Fertilizer-Brazil

Researcher: William C. Nelson

Date: December 1, 1970

Location: Piracicaba, Brazil

These notes report on preliminary findings of a continuing re-
search project. The data and conclusions are tentative and
formal reference to them should be cleared with the author.

I - Objectives -

The major objective of this research is to determine the factors which have stimulated the farm operator to increase their use of fertilizer in Southern Brazil. The specific factors analyzed are: (1) the economic environment which includes product and input prices; credit availability and interest rates, and liquidity levels; (2) the infrastructure which consists of credit facilities, dealer services and extension services; and (3) the management levels as measured by experience, education, social interaction and adoption of improved practices. Secondary objectives are to determine the crop response to fertilizer and optimum levels of fertilization, and to relate the consumption of fertilizer to capital formation on the farm.

II - Area Description -

This study is based on 154 farm interviews which were carried out in July 1970, as part of a larger study on agricultural capital formation. The interviewing was done in the municipios of Guaira, Jardinópolis and Sales de Oliveira. Guaira is located in the extreme northern portion of São Paulo and borders with the state of Minas Gerais.

Jardinópolis and Sales de Oliveira are adjoining municípios which border with the município of Ribeirão Preto in the northern part of the state. As shown by Table 1, the major crops are similar in both areas.

Table 1. Percentage Distribution of Crops With Respect to Cultivated Area.

	<u>Guáira</u>	<u>Jardinópolis & Sales de Oliveira</u>
Cotton	45%	27%
Rice	7	15
Corn	25	45
Soybeans	22	4
Other	<u>1</u>	<u>9</u>
Total	100%	100%

Source: Ribeirão Preto Divisão Integral Regional Agrícola production estimates for January, 1970.

The similarity in the cropping patterns of the municípios studied is further revealed in Table 2. Ninety percent of sample farmers in the Jardinópolis-Sales area produced small amounts of other types of crops. These were primarily citrus fruits, manga, mandioca, and coffee.

Table 2. Percentage of Sample Farms Which Produced Specific Crops.

	<u>Guáira</u>	<u>Jardinópolis & Sales de Oliveira</u>
Cotton	62%	50%
Rice	84	88
Corn	94	94
Soybeans	42	8
Others	15	90

III - Preliminary Findings -

Both sample areas exhibited a widespread utilization of chemical fertilizer during the 1969/70 agricultural year, when ninety-seven percent of the sample farmers applied chemical fertilizer. As shown in Table 3, both areas exhibit a relatively steady increase in the number of adoptors until 1966/67, when the rate of adoption increased rapidly. This significant increase corresponds to the introduction of FUNFERTIL during this period and relative decrease in fertilizer prices.

Table 3. Utilization of Chemical Fertilizers, 1960/61-1969/70

	<u>Guáira</u>			<u>Jardinópolis & Sales de Oliveira</u>		
	<u>Yes</u>	<u>No</u>	<u>N.R.^{a/}</u>	<u>Yes</u>	<u>No</u>	<u>N.R.^{a/}</u>
1969/70	96%	3%	1%	98%	2%	0%
1966/67	65	21	14	68	11	21
1963/64	48	28	24	54	14	32
1960/61	30	38	32	47	20	33

a/ = No response, or did not know

Although the adoption process of fertilizer is essentially complete, a complete fertilizer package is not being universally applied. As shown in Table 4, only forty-five percent of the farm operators have

Table 4. Adoption of Soil Analysis and Utilization of Lime

<u>Item</u>	<u>Guáira</u>		<u>Jardinópolis & Sales de Oliveira</u>	
	<u>Yes</u>	<u>No</u>	<u>Yes</u>	<u>No</u>
Soil Analysis	54%	46%	35%	65%
Usage of Lime	56	44	65	35

analyzed their soils and only sixty percent have ever used lime on their land. Further analysis of the data should show whether optimum economic levels of fertilizer are being used.

IV - Conclusions -

It appears that the process of adoption of fertilizer has been completed in this area of Brazil although some operators may still be in an experimenting stage. The increase in the rate of adoption corresponded to decreasing real fertilizer prices and the emergence of the FUNFERTIL credit program in the 1966-67 time period. But, the "demonstration effect" and large scale advertising of fertilizer companies during this time may have also stimulated fertilizer usage. The data on soil analysis and lime usage leads one to believe that additional effort is still needed in the areas of private and public extension work to promote a more rational and profitable utilization of fertilizer. Introducing farmers to the practice of using fertilizer, however, at least in this area is no longer necessary.

V - Future Research -

Further research will be undertaken to substantiate this adoption pattern by tenure status, farm size, enterprises and management levels in these municipios and other areas. In addition, future research will aim at quantifying the relative effects of prices, credit, management, etc., on fertilizer usage in a variety of farm situations.

Crop response to fertilizer application will be analyzed in order to determine optimum rates of application and to compare them to actual and recommended rates.

The author welcomes suggestions from the readers of this note as to specific questions or policy issues which they might like to have included in the final data analysis.

Source: Nelson, William C., "An Economic Analysis of the Farm Level Factors Related to the Utilization of Fertilizer in Southern Brazil" (Ph.D. dissertation in progress) - Dept. of Agric. Economics & Rural Sociology, Ohio State Univ., Columbus, Ohio (Completion about July 1971).

RESEARCH NOTES ON AGRICULTURAL CAPITAL FORMATION
AND TECHNOLOGICAL CHANGE

The Ohio State University
ESALQ/University of São Paulo

No. 2

Subject: Credit & Fertilizer -
Brazil

Researcher: William C. Nelson
Date: December 23, 1970
Location: Piracicaba, Brazil

These notes report on preliminary findings of a continuing research project. The data and conclusions are tentative and formal reference to them should be cleared with the author.

I - Objectives -

The major objective of this research is to determine the factors which have stimulated farm operators to increase their utilization of fertilizer in Southern Brazil. The project objectives are outlined in detail in Research Note No. 1.

II - Area Description -

This study is based on 154 farm interviews which were carried out in July, 1970 as part of a larger study on agricultural capital formation. The interviewing was done in the municípios of Guaira, Jardinópolis, and Sales de Oliveira, all located in the northern part of the state of São Paulo. The principal farm enterprises in this area are cotton, rice, corn and soybeans. A more detailed description of the area is given in Research Note No. 1.

III - Preliminary Findings -

As shown in Table 1, the percentage of farm operators using credit and fertilizer has increased substantially during the last ten years. During the first part of this period, 1960/61 to 1966/67, the percentage

increase in the utilization of fertilizer and institutional credit was approximately equal, seventeen and twenty-one percent in Guaira and

Table 1. Percentage of Farm Operators Using Chemical Fertilizers and Institutional Credit for Fertilizer Purchases, 1960/61 - 1969/70.

	<u>Guaira</u>		<u>Jardinópolis & Sales de Oliveira</u>	
	<u>Fertilizer</u>	<u>Credit</u>	<u>Fertilizer</u>	<u>Credit</u>
1969/70	97%	70%	90%	57%
1966/67	79	39	89	28
1963/64	72	28	86	24
1960/61	62	18	80	22

nine and six percent in Jardinópolis and Sales de Oliveira. The period from 1966/67 to 1969/70 exhibits a more dramatic change. In Guaira, the number of farm operators using fertilizer increased eighteen percentage points while credit usage jumped thirty-one percentage points during the period. In Jardinópolis and Sales de Oliveira a similar pattern occurred, the number of fertilizer and credit users increased nine and twenty-nine percent, respectively.

A more detailed picture of the fertilizer and credit situation in the 1969/70 agricultural year is given in Table 2. In this table, all three municipios are grouped and differentiated by size categories instead of municipios.

The first two items give the average size of the farms and amount of crop land for the three size strata. The percentage of crop land decreased from seventy-five percent to the small size group of fifty-percent for the large size group.

Fertilizer application per cultivated hectare increases as the farm size increases, as does the cost per ton of fertilizer. Due to these two factors, the farmers in the first strata spend only sixty-percent of the amount spent by farmers in the third strata for fertilizer per hectare. If cost of fertilizer is a good indicator of nutrient value, the larger operators are applying sixty percent more NPK per hectare than the smaller operators.

Table 2. Fertilizer and Credit Situation in the Municipios of Guaira, Jardinópolis and Sales de Oliveira 1969/70

	<u>Farm Size in Hectares^{a/}</u>		
	<u>10-30</u>	<u>31-200</u>	<u>201-3000</u>
A. <u>Land Area</u> (Hectares)			
1. Total Area/Property	20.0	92.4.	582.9
2. Cultivated Area/Property	15.0	62.9	302.7
B. <u>Fertilizer Usage</u>			
1. Tons/Cult. Hect.	0.243	0.264	0.315
2. Price/ton (Cr\$) ^{b/}	225	233	281
3. Cost/Cult. Hect. (Cr\$)	54.67	74.82	88.71
C. <u>Source of Funds</u> (Cr\$/Cult. Hect.)			
1. Self-Financed	19.94	29.51	33.31
2. Institutional Credit	13.33	35.20	48.82
3. Non-Institutional Credit	21.40	10.11	6.58
D. <u>Source of Funds</u> (%)			
1. Self-Financed	37	40	38
2. Institutional Credit	24	47	55
3. Non-Institutional Credit	39	13	07
4. Non-Institutional Credit as a Percent of Total Credit	52	22	11

^{a/} The number of properties in each category is 36, 74, and 44 for the size categories of 10-30, 31-200, and 201-3000 hectares, respectively.

^{b/} One U. S. dollar equals approximately 4.25 cruzeiros.

Items C and D, Table 2, deal with the source of funds used to purchase fertilizer. Although the percent of fertilizer purchases financed by credit remains relatively constant in all three size strata, sixty percent, the ratio between institutional and non-institutional credit usage changes rapidly as farm size increases. Sixty-two percent of fertilizer credit to small operators originates outside of the formal banking institutions. In contrast to this situation, the formal banking system appears to be meeting the needs of the large farm operators who obtained non-institutional credit for only eleven percent of their credit needs.

IV - Conclusions -

Although the percent of cultivated hectares decreased, both quantity per hectare and cost per ton of fertilizer increased significantly as farm size increased. It is not possible to state without further analysis whether this trend toward higher fertilizer applications is directly related to the apparent increased availability of institutional credit to the larger farms or to other factors such as management ability, access to information, transportation bottlenecks, etc.

The number of utilizers of fertilizer and institutional credit has increased significantly during the past ten years with a dramatic jump during the last three years, especially in institutional credit.

Perhaps this is due to government emphasis on fertilizer through the credit subsidies of the FUNFERTIL program. But the institutional credit system has not yet reached the small farmer, even in this agricultural area, one of the most developed in Brazil. The small farmer is financing the majority of his fertilizer purchases through dealers and individuals which normally are assumed to charge much higher rates of interest

and require shorter repayment periods. For all farmers in this sample, fifteen percent of fertilizer credit still originates from non-institutional sources.

V - Future Research -

A future research note will describe the credit and fertilizer marketing facilities available in these municipios. This note will include an inventory of facilities, description of the selling and transportation procedures, services offered to the farmer by dealers and terms of credit from both institutional and non-institutional sources. Further work will be undertaken to determine the effects of the characteristics of the farm operators on his utilization of fertilizer and credit relative to the importance of the agri-business sector.

Source: Nelson, William C., "An Economic Analysis of the Farm Level Factors Related to the Utilization of Fertilizer in Southern Brazil" (Ph.D. dissertation in progress) - Department of Agricultural Economics & Rural Sociology, Ohio State University, Columbus, Ohio (Completion about July 1971).