

cod 2501

Methodology and General Data Description:

Farm Level Capital Formation in

Sao Paulo, Brazil

Occasional Paper No. 47

by

Kelso L. Wessel
William C. Nelson

December, 1971

Reproduced by
**NATIONAL TECHNICAL
INFORMATION SERVICE**
U S Department of Commerce
Springfield VA 22151

BIBLIOGRAPHIC DATA HEET	1. Report No. BR-338.1-W515	2.	3. Recipient's Accession No. FD-219725
Title and Subtitle "Methodology and General Data Description: Farm Level Capital Formation in Sao Paulo, Brazil"			5. Report Date December 1971
Author(s) Kelso L. Wessel, and William C. Nelson			6.
Performing Organization Name and Address Ohio State University, Research Foundation Columbus, Ohio 43210			8. Performing Organization Rept. No.
2. Sponsoring Organization Name and Address Department of State Agency for International Development Washington, D.C. 20523			10. Project/Task/Work Unit No. Proj. 901-11-995-026
			11. Contract/Grant No. AID/csd-2501, Proj. 901-11-995-026
			13. Type of Report & Period Covered Paper 6/69-12/71
			14.
i. Supplementary Notes			
j. Abstracts			
<p>The focus of this research paper is on the capital formation process on farms, with special emphasis on the role of credit and technology in bringing about rapid changes in agricultural production and/or productivity. An agricultural survey was made of 383 farms in Sao Paulo, Brazil in 1970 in order to obtain the necessary farm level data.</p> <p>Several homogenous groups were identified among this large cross section of farms. These groups reflected farm characteristics of size, type, technology, tenure, market orientation, management level and mechanization. Analyses were made of farm organization, income, consumption, savings, investment and other distinguishing characteristics to show the production-income-growth process for each group of farms.</p> <p>Research and analysis was also directed toward assessing the influence of external factors such as input-output prices, inflation, government credit programs, land tenure arrangements, technical assistance and education.</p>			
7b. Identifiers/Open-Ended Terms			
*Capital investments, Brazil , *Financial management, Brazil			
7c. COSATI Field/Group 338			
8. Availability Statement		19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 44
		20. Security Class (This Page) UNCLASSIFIED	22. Price 4.95

**Agricultural Survey of 383 Farms
in Sao Paulo, Brazil, 1970**

- I. Background
 - A. Research Linkage
 - B. Initiation and Timing of Research

- II. Statistical Population
 - A. Area
 - B. Farms

- III. Survey Design
 - A. Sample Selection
 - B. Data Collection

- IV. Preliminary Statistical Summary
 - A. Tenure
 - B. Type of Farming
 - C. Size
 - D. Financial

I. BACKGROUND

The Ohio State University (OSU), through a contract with the United States Agency for International Development (USAID), is engaged in research pertaining to "Rural Capital Formation and Technological Change". Basic farm level research is being planned for several countries with the main thrust in Brazil and India. The focus of this research is the capital formation process on farms with special emphasis on the role of credit and technology in bringing about rapid changes in agricultural production and/or productivity.

A. RESEARCH LINKAGE

The Department of Agricultural Economics and Rural Sociology at OSU has several faculty members who have had experience in less developed countries and/or are specialists in the economic development of agriculture. The Department has also traditionally had approximately one-third of its graduate students completing their thesis research on subjects related to international agricultural development. ✓

The value of research linkage was well known, consequently it was felt that the impact of this particular project would be much greater if the total process of planning, field work, and analysis were linked to people and institutions within Brazil.

The Department of Rural Sciences at the Escola Superior de Agricultura "Luis de Queiroz" (ESALQ), University of Sao Paulo, at Piracicaba has been actively engaged in teaching and research at the graduate level for several years. Under the auspices of another USAID contract, the Department of Rural Sciences has been one of several departments at ESALQ which OSU has been working with in

a combined effort to provide graduate training at the Master of Science level.

In pursuance of this common interest the two Departments, at OSU and ESALQ, agreed to cooperate in research activities in the State of Sao Paulo concerning rural capital formation and technological change.

An important aspect of any research project is the training and experience gained. Graduate training in the United States has always been linked to on-going research projects of universities. It was felt that interested graduate students at ESALQ should be included in all phases of the research for the training and/or data which would be helpful in preparing their dissertation.

ESALQ engages in some extension activities; however, extension service is not a part of the University program as in the United States, but is directed by the State Secretary of Agriculture. It seemed logical that extension personnel at the municipio, regional, and state levels would be interested in the results of the research project. It was also foreseen that the cooperation of extension personnel would be tremendously valuable in designing and conducting the field work.

The utility of research is enhanced greatly if the results are disseminated. To facilitate this a mailing list was made up of researchers, scholars, and administrators. The progress of the project, in the form of research notes, individual reports, and the final report are to be made available to several scores of people.

It was decided that a major effort would be directed toward obtaining a better understanding of the diversities that exist in Brazilian agriculture. A secondary effort would be to obtain an adequately sufficient and diversified base of information which would satisfy data needs for several faculty and students, at both ESALQ and OSU. Finally, during 1970, data were also being collected in the State of Rio Grande do Sul which would tie in with data obtained there in 1965. It was felt that the same basic format should be followed in Sao Paulo as was being used in Rio Grande do Sul.

It was concluded that the farm level data in Sao Paulo should be from a sufficiently large cross section of farms so several homogeneous groups could be identified. These groups would reflect farm characteristics of size, type, technology, tenure, market orientation, management level, and mechanization. Analysis will be made of farm organization, income, consumption, savings, investment, and other distinguishing characteristics to show the production-income-growth process for each homogeneous group of farms.

Research and analysis are also directed toward assessing the influence of external factors such as input-output prices, inflation, government credit programs, land tenure arrangements, technical assistance, and education.

B. INITIATION AND TIMING OF RESEARCH

Research design and methodology are important components in a graduate training program. Students at both OSU and ESALQ were involved in the planning and formulation of the interviewing schedule and field work. The entire graduate class, of more than 20 students, in Economics and Rural Sociology at ESALQ participated in the planning and formulation stages of the research during the semester preceding the actual field work. Eight of these students assisted in the field interviews and, of these, six decided to write their M. S. thesis using data from the interview schedule.

To maximize student participation in the total research project, the interview schedules were completed during July, 1970--the month of vacation between semesters at ESALQ. July was also the end of the harvest season for all major crops grown in the area except coffee and sugar cane. Harvesting of coffee is generally completed in late August and sugar cane by the end of December. Production data obtained for these two crops reflects the 1969 harvest.

II. STATISTICAL POPULATION

The first step in the research project was to delineate the statistical population which had all of the characteristics necessary to satisfy the research objectives of several individual people both at ESALQ and OSU. Individual projects required that the data be from farms specializing in annual crops and beef cattle. The faculty at ESALQ wanted the observations to reflect the major agricultural products in the State of Sao Paulo. The faculty at OSU wanted farms which exhibited various rates of capital formation.

A. AREA

STATE. The State of Sao Paulo has always been the hub of Brazil in terms of either agricultural production or industrial output. Because of the six to seven million people in the City of Sao Paulo, the state is also the most populous in the Federation with an estimated 18 million inhabitants. During the past decade, the population of the state has increased by more than 40 percent. In terms of total land area, the state, with 247,896 sq. km., ranks below several other states.

In terms of crop land, production, and value of product, the six most important crops in the State of Sao Paulo are corn, coffee, rice, peanuts, sugar cane, and cotton. Sao Paulo is the leading producer in the country for three of these six products and ranks no lower than fourth in the other three (Table 1). As can be seen, Sao Paulo is among the leading producers of all the principal crops in Brazil. Therefore, any meaningful study of capital formation in the agricultural sector of Brazil should include the State of Sao Paulo.

REGION. The State of Sao Paulo is divided into nine regional administrative divisions of agriculture each known as DIRA (Divisoes Integrais Regionais Agricolas). The number of municipios (roughly counties) and the area in each DIRA vary. Within the state, the DIRA of Ribeirao Preto is one of the most important regions in the production of the principal crops (Table 2).

The DIRA of Ribeirao Preto, which consists of 80 municipios, is located in the northeastern corner of the state and is bordered on both the east and the north by the State of Minas Gerais (Map 1). The region is readily

Table 1. Comparison of State of Sao Paulo With Brazil for Selected Crops, 19

Crop	Brazil			Sao Paulo			Rank Within Brazil
	Area (Has.)	Production (Tons)	Value (\$Cr000,000)	Area (Has.)	Production (Tons)	Value (\$Cr000,000)	
Corn	9,653,757	12,693,435	1,730	1,317,595	2,114,931	304	3
Coffee	2,570,899	2,567,014	2,039	762,325	732,000	663	2
Rice	4,620,699	6,394,285	1,691	709,017	774,097	275	4
Peanuts	613,332	753,863	267	479,193	565,772	199	1
Sugar Cane	1,672,101	75,247,090	1,241	495,704	25,887,374	429	1
Cotton	4,194,676	2,110,775	1,048	469,767	551,493	300	1
Edible Beans	3,633,264	2,199,974	1,060	230,933	128,237	89	7

Source: Anuario Estatístico do Brazil, Instituto Brasileiro de Estatística, 1970. Anuario i Sao Paulo, Secretaria de Economia e Planejamentos, Departamento de Estatística, Sao 1970.

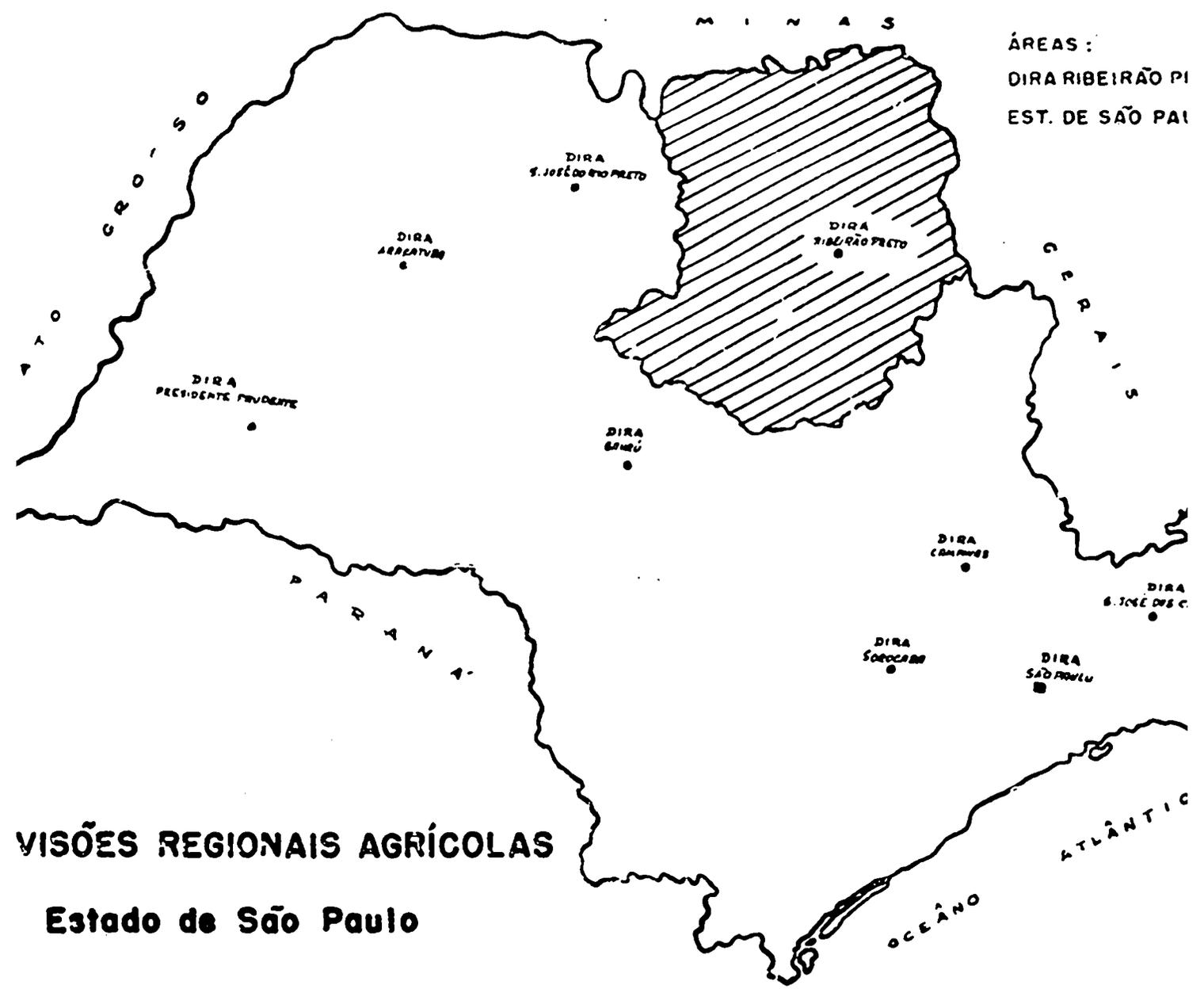
Table 2. Comparison of the Distribution of Rural Properties in the State of Sao Paulo, the DIRA of Ribeirao Preto and the Sample Farms According to :

Hectares	Sao Paulo				Ribeirao Preto		
	Properties		Area		Properties		A
	Number	Percent	Hectares	Percent	Number	Percent	Hectares
0 - 9.9	94,712	32	392,049	2	4,640	17	23,70
10 - 29.9	91,293	31	1,699,714	7	7,522	28	143,09
30 - 199.9	89,777	30	6,550,377	29	11,403	42	901,66
200 - 2999.9	19,709	7	10,537,722	47	3,668	13	1,940,77
3000 +	<u>477</u>	<u>--</u>	<u>3,381,594</u>	<u>15</u>	<u>51</u>	<u>0</u>	<u>319,99</u>
Total	295,968	100	22,561,456	100	27,284	100	3,329,24

Hectares	Sample Farms			
	Properties		Area	
	Number	Percent	Hectares	Percent
10 - 30	69	78	1,372.4	2
31 - 200	180	47	15,494.1	79
201 - 3000	<u>134</u>	<u>35</u>	<u>63,927.4</u>	<u>19</u>
Total	383	100	80,793.9	100

Source: Anuario Estatístico, Secretaria de Economia e Planejamentos, Governo do Estado do S. Paulo, 1969, page 43 and preliminary analysis of field data, 1970.

MAP 1



VISÕES REGIONAIS AGRÍCOLAS

Estado de São Paulo

accessible to the major marketing and political centers of Brazil by air, train, or motor vehicle. The main paved road from the City of Sao Paulo to Brazilia passes through the region. Paved roads also cross the region east-west connecting Rio de Janeiro to the western part of the State of Sao Paulo.

Geographically and economically, the DIRA of Ribeirao Preto is located in the heartland of agriculture in both the state and the country.

The terra roxa legitima (LR)--legitimate red soil--is the famous soil for growing coffee and sugar cane in Sao Paulo. This soil is characterized by its red color and friability throughout the profile. This type soil constitutes approximately 50 percent of the land in the region and is found in all of the municipios. Twenty other soil types can be found within the region.

The general climate of the region is subtropical with a wet summer and dry winter. A valley passes northwesterly through the region and a few areas with higher elevation cause some climatic variation in a few of the municipios.

The temperature of the region varies between 16° and 22° C. with July being the coldest month. Frost is very rare and occurs only in the municipios with high elevation.

The annual rainfall varies between 1,100 and 1,700 mm. January is the wettest month and frequently ten times as much rain falls as during the month of July.

Topography varies from flat to hilly at altitudes from 300 to 1,000 meters above sea level. The best red soils are found in the gently rolling area and are very conducive to the production of coffee, sugar cane, cotton, rice, and corn.

The distribution of the number and area of rural properties in the DIRA of Ribeirao Preto very closely reflects that for the State of Sao Paulo. There is a slightly greater proportionate number of properties and area represented by the extremes of the distribution in Sao Paulo than in the DIRA. (See Table 2). This is probably due to the influence of the large ranches in the north and western part of the state as well as the influence of subsistence farming in some mountainous municipios in the south.

MUNICIPIOS. The State Department of Agriculture divides each of the nine DIRA into several subregions. The DIRA of Ribeirao Preto has eight subregions (Map 2). Administratively, there is a Director of Extension for each DIRA, a Coordinator of Extension for each subregion, and an Extension Agent for each municipio. However, not all of the municipios had an Extension Office. There were 50 Extension Agents in the region; therefore, many municipios which had an Extension Office had more than one Agent.

Of the 80 municipios in the DIRA, only 50 had active Extension Offices. Another nine municipios had the physical facilities, but there were no Agents available.

The success of a research project of this magnitude depends upon the cooperation of many persons, especially the Extension personnel. For this reason, precontacts were made at the regional, subregional, and municipio levels before choosing the area from which the sample was to be selected.

Based upon the contacts with the above named personnel, it was decided that the required characteristics of the sample could be met by drawing from the ten municipios of Altinopolis, Barretos, Batatais, Colombia, Guaira, Jardinopolis, Pontal, Ribeirao Preto, Serataozinho, and Sales de Oliveira.

DIVISÃO REGIONAL AGRÍCOLA de RIBEIRÃO PRETO

Sub-Regiões Agrícolas

ARARAQUARA
BARRETOS
BEBEDOURO
FRANCA

ORLÂNDIA
RIBEIRÃO PRETO
SÃO CARLOS
TAQUARITINGA



área 3.611.252 ha.

There were several reasons why these municipios were chosen. First, there existed within these municipios farms specializing in coffee, sugar cane, beef cattle, and annual crops (See Table 3). Second, within each enterprise group, the farms were relatively homogeneous with respect to soil type, soil quality, and topography. Third, for the actual interviewing, the field research team could locate in three different cities and cover the area with a minimum of travel. Finally, the Extension Agents in these municipios were keenly interested in the study and expressed a genuine desire to participate in the research project.

B. FARMS

TYPES. A pivotal aspect in the study of capital formation in the agricultural sector is to determine whether capital is accumulated equally easy on all types of farms. Three general types of farming can be identified within the region selected: those specializing in 1) ranching, 2) annual crops, and 3) perennial crops. Of course, there are also many farms which cannot be classified as specializing in any one of these categories.

Because of the nature of the research project and the interest of the participating researchers, it was determined that the sample should include an adequate number of observations from the following types of farming specializing in the enterprises indicated:

<u>Type of farming</u>	<u>Enterprise specialization</u>
1) ranching	beef cattle
2) annual crops	corn, rice, cotton, and general, and
3) perennial crops	coffee and sugar cane.

Table 3. Utilization of Land, by Subregion, DIRA
of Ribeirao Preto, 1966

Subregion	Annual Crops	Perennial Crops	Pasture	Reforest- ation	Native Forest	Not Used	Total
<u>Included in Study</u>		(percentages)					
Ribeirao Preto	34	5	30	9	4	18	100
Orlandia	39	2	31	1	16	11	100
Franca	10	6	67	1	10	6	100
Barretos	24	4	51	1	10	10	100
<u>Not Included in Study</u>							
Taquaritinga*	29	9	50	2	2	8	100
Bebedouro*	35	12	33	4	4	7	100
Araraquara	14	6	58	4	9	9	100
Sao Carlos	13	2	48	6	24	7	100

* The most common perennial crop in these two municipios was citrus fruit.

This distribution would permit an analysis of farms specializing in the major crops in the State of Sao Paulo, with the exception of peanuts, as well as Brazil.

SIZE. All of the individual projects in this research required farms of existing or potential economic capability to provide the operator an acceptable level of living. This meant the farm had to be large enough for a full-time operator without the necessity of off-farm employment for either he or his family. Similarly, it was decided that extremely large farms would be incorporated or absentee owned; therefore, they should not be permitted to enter into the sample.

Through a priori knowledge and precontacts in the field, it was decided that an economically viable farm unit would be not less than ten hectares. The population was further restricted in size by eliminating farms which were incorporated or whose operators were engaged in nonagricultural enterprises on the farm (i.e., sugar mills, pinga factories, etc.). Also, the number of very large farms is small; therefore, the applicability of the research results would be limited. For this reason, farms of more than 3,000 hectares were not included in the study. Farms in the ten to 3,000 hectare range represented the types of farming upon which most of the agricultural population were residing and accounted for most of the agricultural production in the state. It was further felt that the population should be stratified so an adequate number of different size farming operations would be included in the sample. Based on the statistical requirements for subsample size and a priori knowledge of farming in the region, three subgroups were chosen:

- 1) small--ten to 30 hectares,
- 2) medium--31 to 200 hectares, and
- 3) large--201 to 3,000 hectares.

The three subgroups of farm size were believed to have, among other things, the following characteristics:

- Small
- 1) Unmechanized crop production.
 - 2) Use of only family as permanent labor.
 - 3) Only small amounts of temporary hired labor used.
- Medium
- 1) Mechanized crop production (i.e., one or more tractors owned).
 - 2) Permanent nonfamily labor residing on the farm as either direct hire or sharecropper.
 - 3) Use of seasonal hired labor.
- Large
- 1) Mechanized crop production.
 - 2) Permanent labor including an administrator, an accountant, and other direct hire persons as well as sharecroppers.
 - 3) The owner could have substantial nonfarm business interests.
 - 4) The owner could reside in town for part or all year.

Each subgroup sample for each enterprise specialization was expected to consist of approximately 25 farms.

III. SURVEY DESIGN

The survey design was contingent upon the sample design. Various types of sample design were discussed. Three designs appeared to be most appropriate for this particular research project: 1) draw a stratified random sample from the land ownership roll in each municipio, 2) use the local Extension Agent to identify farmers in each of the size and enterprise strata--then use that farm as the center for cluster sampling, or 3) draw a two-way stratified sample from the IBRA (Instituto Brasileira de Reforma Agraria) roll.

It was felt that the level of accurateness and completeness of the municipio rolls would not permit the two-way stratification required. The cluster sampling design was ruled out because of the bias toward "better" farmers with whom the Extension Agents usually associate. Also, it would be more difficult to predetermine the number of farms in each cluster which would fall into each strata. The discrepancies found between IBRA data and actual observations are well known. However, the data are obtained from every individual property in Brazil and include location of the farm, address of the owner, type of ownership, educational level of owner, family size, labor force, land use--including owned and rented, value of crops produced, value of livestock, and credit use.

The major objection to using the IBRA data was that the most recent survey had been made in 1966. Despite the law which says that any changes in the farming operation, as given in the survey, must be reported to IBRA annually, it was known that this did not always occur. However, it was felt that the IBRA rolls offered the best possibility of the three alternatives.

A. SAMPLE SELECTION

CRITERIA. It was determined that the sampling procedure should be based upon six criteria.

- 1) The sample should be chosen randomly without bias toward progressive or traditional farm operators. This would assure that statistical tests of significance could be used in the analysis.
- 2) The sample should be stratified according to size of farm. It was assumed that different sizes of farms differed with respect to capital formation; therefore, stratification would assure a sufficient number of observations from each size group.

- 3) The sample should be stratified according to farm enterprise. It was assumed that capital formation differed on farms according to enterprise specialization; therefore, stratification would assure adequate representation of the major enterprises in the region.
- 4) The farms should be owner-operated. Again, the assumption was made that owner-operated and renter-operated farms would exhibit different characteristics with respect to capital formation. The lack of time, funds, and personnel prevented interviewing both types.
- 5) A majority of the land should be utilized in some productive enterprise. This was done to eliminate land held for speculative purposes.
- 6) The sampling procedure should facilitate making precontacts and the interviewing.

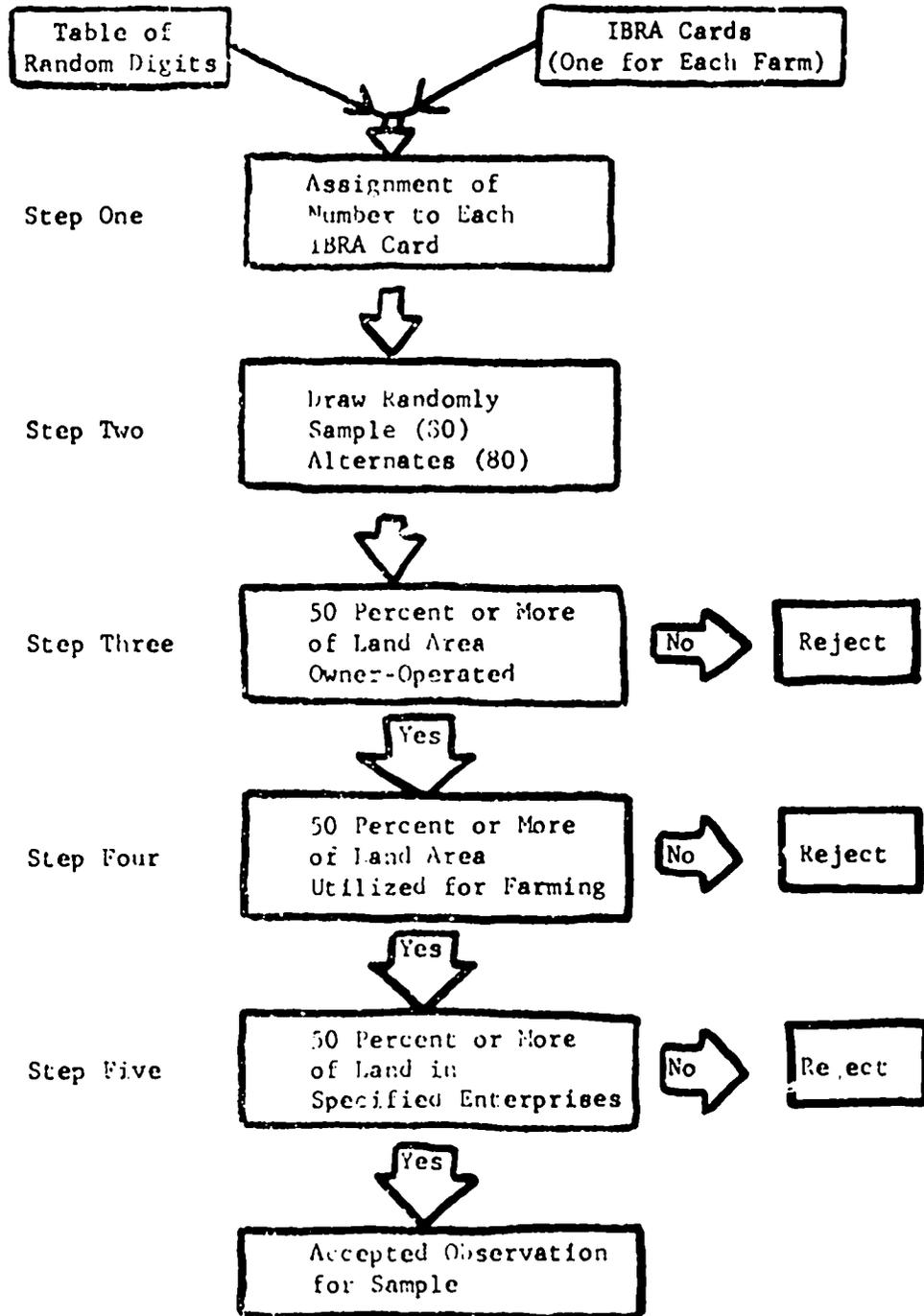
TECHNIQUE. Once the criteria for sampling were determined, it became necessary to formulate some technique for drawing the sample. IBRA maintains a file which has a summary of the data for each farm on a six-by-eight inch card. These cards were obtained for the ten municipios to be included in the study.

The sampling technique involved five steps (Figure 1):

- Step One Every farm within each size strata was assigned a number on its IBRA card.
- Step Two A random table of digits was used to select 80 farms and 80 alternative farms.
- Step Three Landowners who did not operate 50 percent or more of their land were rejected and a replacement drawn.

FIGURE 1

DIAGRAMATIC PRESENTATION OF SAMPLING TECHNIQUE



Step Four If 50 percent or more of the land area was not cultivated, the farm was rejected and a replacement drawn.

Step Five If less than 50 percent of the utilized land was not devoted to specified enterprises, the farm was rejected and a replacement substituted. These enterprises and the predominant Municipios were:

	<u>Enterprise</u>	<u>Municipio</u>
1)	Sugar Cane	Serataozinho and Pontal
2)	Coffee	Altinopolis and Batatais
3)	Annual Crops	Jardinopolis, Guaira, Ribeirao Preto, and Sales de Oliveira
4)	Pasture	Barretos and Colombia

The above process continued until a total of 500 observations were accepted with approximately 100 in sugar cane, 100 in coffee, 100 in pasture, and 200 in annual crops. In each of these groups, the observations were divided approximately equally between small, medium, and large farms.

B. DATA COLLECTION

If a research project is minutely and perfectly planned, the data collection should be routine. This degree of planning is seldom, if ever, achieved; therefore, the data collection becomes more important and difficult.

PRECONTACT. The first precontact was made before the final selection of municipios to be included in the study. Members of the research team, not familiar with the region, spent several days visiting with people in the area and studying the cropping pattern and terrain. Next, a series of conferences were held with the Director of Extension, DIRA of Ribeirao Preto, and his

staff, including Agents from several municipios. The purpose, scope, and utility of the study were explained. Once familiar with the research project, the Extension personnel were able to make valuable suggestions as to which municipios should be included, questionnaire design, and interview scheduling.

After selecting the ten municipios to be included in the survey, another meeting was held which included the research team, the regional Extension Specialists, the Extension Agents from those ten municipios, and the ESALQ students who would be doing the interviewing. Again, the research project and the survey design were reviewed and discussed. Particular attention was given to what types of questions would be needed to obtain the desired kind and quality of data. The possibility of different problems and how they should be handled were also discussed.

Before beginning the field work, the questionnaire was pretested and revised. Although the final version was too lengthy, the timing of the project required that the field work be completed during the month of July, 1970; therefore, the interviewing was begun without further delay.

FIELD WORK. Three persons from OSU and two from ESALQ supervised the field work and 18 students from ESALQ did the interviewing. Interviewing was first completed in the municipios where sugar cane was grown, next for coffee, then for annual crops, and finally for ranching. This scheme reduced the number of vehicles needed for transport, reduced the variance in questionnaire responses due to enumerator error, and made more efficient use of the Extension Agent in each municipio.

All farm operators interviewed were precontacted. This task originally fell to the cooperating Extension Agent within each municipio, however, occasionally other personnel had to assist to keep an adequate number of farms scheduled for the interviewers.

Before a completed questionnaire was accepted, it was checked for internal consistency, error, and clarity. If the questionnaire was not acceptable, the interviewer was requested to recontact the farm operator and rectify the problem. In some cases, as many as three recontacts were made before the questionnaire was completed satisfactorily.

To compliment the farm survey data, separate interview schedules were also prepared for fertilizer dealers, Extension Agents, and bankers. These questionnaires were designed to obtain data pertaining to the marketing infrastructure of the region. Specific questions were directed toward the availability and use of credit as well as the distribution system of fertilizer. Six members of the research team conducted 62 interviews in the ten municipios included in the study. The infrastructure data were obtained about two months after the farm data rather than simultaneously.

POST-FIELD REFLECTIONS. To paraphrase an old adage, "there is many a slip between the cup and the lip". Despite the meticulous planning which preceeded the actual field work, the final result was a slight deviation from the original plan.

The IBRA files indicated that there were 3,802 rural properties in the ten municipios with from 10 to 3,000 hectares of land each. The IBRA data on each property was screened to see if it met the predetermined requirements of the sample. Of the total, 549 properties were selected for the sample--this

quantity was expected to yield about 400 valid interview schedules. However, only 205 observations out of the 549 yielded acceptable schedules. Another 178 interview schedules had to be completed from outside of the original predetermined sample. These replacements were drawn in the field, but not always adhering to the same strict criteria as for the original sample. (Table 4)

The reasons for this discrepancy were many and varied; most frequent was the inability to locate the property owner as indicated on the IBRA file card. Neither the Extension Agent nor property owners in the area had ever known a person by the name given. Approximately one out of every seven observations was eliminated in this manner. An equal number were not contacted because of inadequate cooperation from the Extension Agent in one municipio. Although the IBRA survey had been made only four years previous, about eight percent of the properties in the sample were eliminated because of a change in ownership. These factors, together with other disqualifying reasons, resulted in the acceptance of only 40 percent of the original sample (See Table 5).

Many valuable lessons in research and survey design were learned during the field work. Some of the more important ones were:

- 1) Use of a detailed sampling design increased the time and energy necessary to obtain the sample. However, this was responsible for the distribution of observations according to size and enterprise.
- 2) The lack of accurate area and road maps increased the time required for precontacting farmers and may have rendered the idea of precontacts not worthwhile.
- 3) The vehicles used had "official" license plates from Rio de Janeiro therefore causing some distrust among the farmers.

Table 4 Distribution of Farms in Population
and Sample According to Enterprise
Specialization, DIRA of Ribeirao Preto, 1970 a/

Item	Enterprise					Total
	Sugar Cane	Coffee	Specialized Crops	General Crops	Cattle	
1. Number of properties with 10-3000 hectares in IBRA list	906	642	726	538	990	3,802
2. Number of randomly drawn properties	264	162	190	131	181	928
3. Number of properties which met sampling criteria	97	93	136	99	124	549
4. Number of sample properties yielding acceptable questionnaires	36	47	39	49	34	205
5. Number of sample properties not yielding acceptable questionnaires	61	46	97	50	90	344
6. Total number of questionnaires completed and accepted	75	84	74	80	70	383

a/ Based on information given on the IBRA cards. These data differ slightly from those obtained from the sample farms.

Table 5. Number and Reason Why Properties In Selected Sample of 549 Properties Did Not Yield Acceptable Completed Questionnaires, Sao Paulo, 1970

Reason	Number	Percent of Total Sample
Non-Cooperation of Extension Agent	57	10
Could Not Locate	49	9
Sold Their Land	41	7
Operator Would Not Cooperate	36	6
Lived Outside of Municipio	29	5
Rented All of His Land to Others	17	3
Incapable of an Interview	13	2
Included in Pretest	12	2
Operated Factory on Farm (USINA)	12	2
Completed Questionnaire Was Unacceptable	11	2
Were Traveling	2	-
Other	<u>65</u>	<u>12</u>
	344	60

- 4) More supervisory staff should have been in the field during the interviewing. Laggardness in precontacts and checking questionnaires affected the quantity and quality of completed questionnaires.
- 5) The amount and detail of data sought through the questionnaire was excessive. On occasions, several hours were required to complete the interview schedule.
- 6) More knowledge of farming and interviewing experience on behalf of the interviewers would have been beneficial.
- 7) The logistic problems of field work of this magnitude were probably not adequately realized.

Few sampling designs are implemented without some problems. Successful designs are those which result in the desired characteristics in the sample. To this end, the sampling design used was very successful. Selection of the observations was done randomly and the final sample approximated the desired stratification according to size and enterprise.

IV. PRELIMINARY STATISTICAL SUMMARY

The following section sets forth some of the major descriptive statistical characteristics of the sample. The final sample included fewer small farms (10-30 hectares) than was originally concerned. Despite the many reports and indications, small farms with a viable farming operation were not easily found in the area studied.

A. TENURE

Based on a priori knowledge of agriculture in the area the farms were divided into three groups according to size as follows:

<u>Group</u>		<u>Hectares</u>
I	=	10 - 30
II	=	31 - 200
III	=	201 - 3,000

It was hypothesized that the farms in Group I would be engaged in traditional agriculture, those in Group II would be in the transitional stage of agriculture and those in Group III would be using modern techniques of production.

With the exception of Altinópolis, farms in all three groups in each of the municípios tended to have an average of more land operated than owned. This would indicate a net renting in of land (Table 6). The farms in Guaira, Barretos and Colombia tended to be larger than in the other municípios.

Approximately one-half of the 383 farms included in the sample were under an owner-operator tenure arrangement (Table 7). The small farmers (10-30 hectares)

Table 6 . Average Area of Land Available, Land Utilized and Land Operated
Selected Municipios by Farm Size, Brazil, 1970

Município	Farm size ^{a/}	Number of Farms	Land Available			Land Utilization	
			Owned (1)	Rented in (2)	Rented out (3)	Cultivated (4)	Pasture (5)
Jardinópolis & Sales de Oliveira	I	23	21.70	0.85	7.00	17.11	2.27
	II	37	70.77	16.22	0.38	68.00	12.80
	III	14	385.13	81.33	---	272.77	175.80
Guaira	I	13	16.77	2.23	0.37	11.37	2.42
	II	37	95.88	6.44	3.66	57.84	26.29
	III	30	603.44	85.35	51.54	316.74	220.84
Matatais	I	5	191.18	---	---	11.37	5.80
	II	19	99.15	---	---	33.22	48.69
	III	22	454.00	35.75	2.20	139.72	294.42
Mtinópolis	I	3	15.57	---	---	11.70	2.82
	II	22	104.67	8.14	4.53	31.38	65.00
	III	13	451.24	---	1.67	75.30	287.14
Montal	I	7	18.15	6.46	---	19.26	2.94
	II	13	58.75	19.90	---	65.95	8.88
	III	7	280.00	17.29	---	222.64	52.89
Mertaozinho	I	18	19.02	---	---	15.56	1.28
	II	23	76.57	9.39	4.14	67.15	9.49
	III	7	433.67	19.36	0.73	357.20	32.91
Marretos & Colombia	I	1	24.20	---	---	---	22.99
	II	27	90.72	7.60	5.53	19.45	57.41
	III	42	498.80	114.15	25.17	102.66	402.64

/ I = 10-30 ha., II = 31-200 ha., III = 201-3,000 ha.

/ Land operated equals columns (1 + 2 - 3) or (4 + 5 + 6). The slight difference is due to rounding error.

Table 7 . Distribution of 383 Sample Farms
According to Size and Land Tenure, Sao Paulo, 1970

Size	Tenure				Total
	Owner- Operator	Partnership	Renter	Other	
(ha)	(Number of farms)				
10 - 30	49	15	1	5	70
31 - 200	94	35	12	35	178
201 - 3200	53	42	8	32	135
Total	198	92	21	72	383

tended to be more prone toward owner-operators than the other two size groups. The tenure arrangement on the large farms (201-3,200 hectares) was almost equally divided among owner-operators, partnerships, and other forms. Very few of the farms in any size group were operated by renters. This tends to indicate that the absentee landlord is not a very serious problem in the region.

B. TYPE OF FARMING

For analytical purposes, the 383 observations were divided into five types of farming as follows:

- 1) Annual crops - more than 50 percent of the tillable land was in either corn, rice, cotton or soybeans.
- 2) Perennial crops - more than 50 percent of the tillable land was in either coffee or sugar cane.
- 3) General crops - more than 50 percent of the tillable land was in crops but neither (1) nor (2) was fulfilled.
- 4) Livestock - more than 50 percent of gross cash farm income was from livestock and livestock products.
- 5) Livestock and crops - none of the above criteria were met.

The 383 farms in the sample were almost equally distributed among the five types of farming, with the exception of livestock and crops which had only 46 observations (Table 8). Between 40 and 60 percent of the farms in each type of farming were owner-operated. Surprisingly, fewer of the general crop farms were owner-operated than any of the other types of farming. Partnerships were found more frequently for specialized farms in perennial crops and general crops. This was probably due to the large amount of capital equipment required for these two types of farming.

Table 8. Distribution of 383 Sample Farms
According to Type of Farming and Land Tenure, Sao Paulo, 1970

Type of Farming	Tenure				Total
	Owner-Operator	Partnership	Renter	Other	
	(Number of Farms)				
Annual Crops	42	8	5	20	75
Perennial Crops	41	28	4	6	79
General Crops	42	27	8	22	99
Livestock	46	16	4	18	84
Livestock & Crops	27	13	0	6	46
	—	—	—	—	—
Total	198	92	21	72	383

Each of the types of farming tended to be concentrated in two or three municípios. In fact, the sampling procedure was designed with this in mind. It was hypothesized that this would result in a more homogenous set of observations for each of the farming enterprises. Farms in Guaira and Jardinópolis tended to be specialized in annual crops. Farms in Pontal and Sertãozinho were devoted mostly to sugar cane while those in Altinópolis were equally divided between coffee and mixed farming (livestock and crops). Livestock farms were concentrated in Colombia, Barretos and Batatais. The two former were mostly beef cattle and the latter dairy cattle (Table 9).

Table 9 . Distribution of 383 Sample Farms
by Municipio and Type of Farming, Sao Paulo, 1970

Município	Type of Farming				Livestock and Crops		Total
	Annual Crop	Perennial Crops	General Crops	Livestock	Crops		
	(Number of Farms)						
Pontal	0	21	4	0	2	27	
Sertãozinho	1	42	5	0	0	48	
Altinópolis	0	12	6	8	12	38	
Batatais	5	3	9	14	15	46	
Colômbia	1	0	0	13	2	16	
Barretos	9	0	1	36	8	54	
Sales de Oliveira	3	0	5	1	2	11	
Guaira	36	1	33	9	1	80	
Jardinópolis	<u>20</u>	<u>0</u>	<u>36</u>	<u>3</u>	<u>4</u>	<u>63</u>	
Total	75	79	99	84	46	383	

C. SIZE

Both recent census and IBRA data indicate that a majority of the farmers in the DIRA of Ribeirao Preto are operating small land holdings. However, as field work progressed, it became increasingly obvious that an adequate number of viable farm operations in the 10-30 hectare size would be difficult to find. Consequently, the final sample included only 70 farms with less than 30 hectares and two observations actually exceeded the upper limit of 3,000 hectares. The distribution of all farms among the different types of farming was very equal; however, within each size group there was considerable variation. The smaller farms tended to concentrate on crop production, both annual and perennial. The larger farms concentrated more on livestock production (Table 10).

To eliminate the bias of the preselected size-groups, the 383 sample observations were divided into three equal-size groups:

Small	=	10 - 64 hectares
Medium	=	65 - 224 hectares
Large	=	225 - 3,350 hectares

As indicated in Table 11, the observations in each of the municipios were not equally distributed among the three sizes. Farms in the municipios specializing in cattle tended to be larger. Farmers in the municipios of Pontal and Seratozinho specialized almost exclusively in the production of sugar cane. Interestingly, with the exception of USINA's, there were relatively few producers in these two municipios who had large holdings of land (225 - 3,350 hectares). Since USINA's were not included in the survey, the sample had a higher proportion of small operators.

Table 10. Stratification of Sample Observations to Size and Enterprise Specialization, Sao Paulo, 1970

Enterprise Specialization ^{1/}	Hectares of Land			Total
	10-30	31-200	201-3,000	
	(Number of Farms)			
(A) Perennial Crops:				
Sugar Cane	21	31	11	63
Coffee	5	3	3	16
(B) Annual Crops:				
Cotton	4	7	6	17
Rice	0	3	2	5
Corn	12	22	11	45
Soybeans	1	6	2	9
(C) General Crops	21	51	25	97
(D) Cattle	4	31	49	84
(E) Livestock and Crops	<u>1</u>	<u>21</u>	<u>25</u>	<u>47</u>
Total	70	178	135	383

^{1/} Classification of the farms according to major enterprise was as follows.

- (A&B) Cotton, rice, sugar cane, coffee, corn, or soybeans--more than 50 percent of the tillable land had to be in "one" of these specific crop.
- (C) General crops--more than 50 percent of the total tillable land had to be in crops, but criteria (A) was not fulfilled for any one crop.
- (D) Cattle--more than 50 percent of the gross cash farm income was from livestock and livestock products.
- (E) Mixed farm (cattle and crops)--none of the above criteria were met.

Table 11. Distribution of 383 Sample Farms According to Municipio and Size of Farm, Sao Paulo, 1970

Município	Size ^{a/}			Total
	Small	Medium	Large	
	(Number of farms)			
Pontal	11	10	6	27
Sertãozinho	25	16	7	48
Altinópolis	9	18	11	38
Batatais	13	14	19	46
Colombia	1	8	7	16
Barretos	6	17	31	54
Sales de Oliveira	6	3	2	11
Guaira	25	25	30	80
Jardinópolis	<u>33</u>	<u>18</u>	<u>12</u>	<u>63</u>
Total	129	129	125	383

^{a/} Size was determined by dividing the sample into approximate thirds. The range of hectares in each size group was: Small = 10-64; Medium = 65-224; Large = 225-3,350.

Farms devoted to livestock or livestock and crops tended to be larger, whereas those specializing in crops tended to be smaller (Table 12). This tends to indicate that any analysis of the data based on size should not use a fixed range of hectares as the classification criterion. A small cattle farmer could have more land than a large crop farmer. An analysis of the farming operation based on size should use an economically viable unit rather than absolute amount of land operated for each type of farming.

Approximately one-half of the farmers interviewed were owner-operators. The proportion of owner-operators was greater on small farms than large ones. The reverse was true of partnerships. Not very many renters were found and they tended to be equally distributed among the three size groups. (Table 13). The above leads to several questions. First, in a country where capital is reported to be in such short supply, why do so few farmers rent land? Second, why is the ownership of smaller farms proportionately greater than that of larger farms? Third, what is the tenure pattern of farmers as the size of the farming operation increases? Finally, if the sample was not biased toward small owner-operators, what are the implications of this tenure distribution for programs of credit, extension, increasing productivity, capital formation, etc.?

D. FINANCIAL

More than 50 percent of all farmers interviewed were interested in purchasing more land. The proportion of large farmers who were interested was slightly greater than for small farmers (Table 14). Assuming that this reflects the demand for land, it is interesting to note that the farmers interviewed did not know more about land prices.

Table 12. Distribution of 383 Sample Farms According to Type of Farming and Size, Sao Paulo, 1970

Type of Farming	Size ^{a/}			Total
	Small	Medium	Large	
	(Number of farms)			
Annual crops	30	24	21	75
Perennial crops	37	28	14	79
General crops	45	30	24	99
Livestock	12	28	44	84
Livestock and crops	<u>5</u>	<u>19</u>	<u>22</u>	<u>46</u>
Total	129	129	125	383

^{a/} Size was determined by dividing the sample into approximate thirds. The range of hectares in each size group was: Small = 10-64; Medium = 65-224; Large = 225-3,350.

Table 13. Distribution of 333 Sample Farms According to Land Tenure and Size, Sao Paulo, 1970

Tenure	Size <u>a/</u>			Total
	Small	Medium	Large	
(Number of farms)				
Owner-operator	78	72	48	198
Partnership	29	22	41	92
Renter	7	6	8	21
Other	<u>15</u>	<u>29</u>	<u>28</u>	<u>72</u>
Total	129	129	125	333

a/ Size was determined by dividing the sample into approximate thirds. The range of hectares in each size group was: Small = 10-64; Medium = 65-224; Large = 225-3,350.

Table 14. Interest of Farmers Interviewed
Toward Purchasing More Land, by Size, Sao Paulo, 1970

<u>Interested in Purchasing More Land</u>							
Size	Yes		No		No Response		Total
	(No.)	(%)	(No.)	(%)	(No.)	(%)	
Small	68	53	57	44	4	3	129
Medium	71	55	58	45			129
Large	75	60	50	40			125
Total	214	56	165	43	4	1	383

a/ Size was determined by dividing the sample into approximate thirds. The range of hectares in each size group was: Small = 10-64; Medium = 65-224; Large = 225-3,350.

Of the 383 farmers interviewed, 75 percent used bank credit and 48 percent had made purchases on time (Table 15). A greater proportion of the large farmers used bank credit than the small operators. The opposite was true for purchases on time; 61 percent of all small farmers had made purchases on time, whereas only 41 percent of the large operators used this type of credit.

Table 15. Number of Farm Operators Using Credit
In 1969-70 by Municipio and Size of Farm, Brazil, 1970

Município	Size of Farm								
	Small			Medium			Large		
	Total Number of Farmers	Farmers Using Bank Credit	Farmers Buying on Time	Total Number of Farmers	Farmers Using Bank Credit	Farmers Buying on Time	Total Number of Farmers	Farmers Using Bank Credit	Farmers Buying on Time
	(Number of farms)								
Jardinópolis & Sales de Oliveira	23	14	11	37	32	17	14	12	7
Guaira	13	8	6	37	9	20	30	27	14
Batatais	5	4	1	19	16	5	22	27	7
Altinópolis	3	3	1	22	19	13	13	13	8
Pontal	7	4	5	13	11	9	7	6	4
Sertãozinho	18	4	16	23	16	17	7	5	1
Barretos & Columbia	1	1	0	27	20	6	42	28	13
	—	—	—	—	—	—	—	—	—
Total	70	38	43	178	113	87	135	118	54
Per cent of Total*	115	54	61	111	63	48	130	89	41

* Total sums to more than 100 percent because some farmers used bank credit and also bought on time.