SUMMARY AND CONCLUSIONS

Summary

This study is presented as a subsidy to the studies of agricultural regionalization in the state of São Paulo, and more particularly to the Secretary of Agriculture. The main objective of this study is to analyze the locational characteristics of agricultural variables through measures of geographical association. The adequacy of the State administrative regionalization under criteria of homogeneity and geographical contiguity, is ascertained by the application of one of these measures. Simultaneously, new regionalization alternatives that best satisfy these criteria are proposed. This study is particularly relevant to the agencies involved with the problem of agricultural development, since knowledge about the homogeneous characteristics of the agricultural regions and sub-regions will be very helpful in developing regional plans and adopting technical guidelineas based on these same characteristics.

Based on the Regional Agricultural Divisions (DIRA), and Agricultural Sub-regions of the Secretary of Agriculture of the State of São Paulo, an attempt was made to estimate a set of geographical association indices for variables related to population (rural, urban, and total), area, rural properties, crops (perennial and annual), pastures (natural and improved) beef and milk cattle raising.

The following measures of geographical association, at the DIRA and Sub-regional levels, are analyzed: Coefficiente of Geographical Association; Concentration Index; Dispersion Diagram; Locational Quotient; Location Curve; Redistribution Coefficient; Transference Ratio; Relative Growth Graph.

In order to study whether there were substantial changes in population distribution between the years 1960 and 1970, the results of the demographic census of 1960 and 1970 were compared, applying the following measures: Redistribution Coefficient, Transference Ratio, and

Relative Growth Graph. Also, in view of the existence of a high demographic concentration in the municipio of São Paulo and surrounding area, with uneven distribution between rural and total population, we chose to present estimates that excluded the DIRA of São Paulo or the Sub-regions of the Capital and of Santos in calculating some measures of geographical association. The results thus obtained seemed to acquire a greater validity for the analysis of distribution of rural population.

Next, one of the measures of geographical association - Locational Quotient - was used to test the homogeneity of the division of the State into Administrative Regions, with regard to agricultural characteristics. Based on this latter analysis, some alternatives to the present regionalization are presented. In this way, Locational Quotients were estimated referring to the following variables of each of the forty-eight State Sub-regions:

rural population in relation to total population;
rural population in relation to total area;
total population in relation to total area;
number of farms in relation to total area;
number of farms with more than 1000 ha in relation to total farms;
number of farms with less than 10 ha in relation to total farms;
cultivated area in relation to total area;
perennial crop area in relation to cultivated area;
pasture area in relation to total area;
natural pasture area in relation to total pasture area;
number of beef cattle in relation to total number of cattle.

In order to make all variables for a single Sub-region comparable, they were standardized with the help of the computer. Also,

using the computer, the correlation coeficients between al pairs of Sub-regions were estimated, resulting in a total of 1,128 correlation coefficients; it was assumed that the higher the coefficient, the greater the homogeneity between two Sub-regions. For purposes of Sub-region grouping, a condition of geographical contiguity and positive correlation among them was required.

Aplying the above methodology, the following results were obtained, relative to the analysis of agricultural variables, with an emphasis on rural population and agricultural regionalization of the State.

Rural population

The rural population of the State of São Paulo represents a relatively small portion (19.4%) of total population of the State. The distribution of rural population throughout the State territory shows some marked characteristics. Thus, in the Sub-regions of the Capital and of Santos, with high demographic concentration (8,311,263 inhabitants), the rural population represents a small percentage of the total population (1.7%). On the other hand, greater total demographic density usually corresponds to greater rural demographic density, such as is the case of the DIRAs of São Paulo, Campinas and Paraiba Valley.

Between the years 1960 and 1970, excluding the Sub-regions of the Capital and of Santos, total population increased 13.9% and rural population decreased 23.9%. It is strange to note that the decrease in rural population was less accentuated near the main urban centers. It should also be noted that a reduction in rural population does not necessarily mean a smaller amount of agricultura labor force, given the increasing participation of rural workers in the urban centers. However, supposedly in many Sub-regions of the State - especially those where total population has decrease there was a considerable reduction in agricultural labor force;this is the case in the following sub-regions presented in a decreasing order according to total population reduction: Lins, Tupã, Adamantina, Fernandópolis, Dracena, Mirassol, Penápolis, Catanduva, Marília, Jaú, Presidente Presidente, Assis and Ourinhos.

The measures of geographical association for the rural population indicate that, with the exception of the DIRA of São Paulo, rural population distribution throughout the State is similar to total population distribution. This means that changes in concentration of rural population are followed by similar changes in concentration of total population. Including the DIRA of São Paulo, however, there is a marked imbalance between distribution of rural population and total population. These results are obtained using the Geographical Association Coefficient, Concentration Index, Dispersion Diagram, Locational Quotient, and Localization Curve.

A more detailed observation of the results obtained with the measures of geographical association shows that, excluding the DIRA of São Paulo, those of Presidente Prudente, São José do Rio Preto, Araçatuba, Sorocaba and part of Bauru, where 40% of the State total population live, cover 50% of the rural population of the State. Fifty percent of the rural population live in the DIRAs of Campinas, São José do Rio Preto, Presidente Prudente, Paraiba Valley and part of the DIRA of Bauru which comprise 43% of the State area. These are the areas of higher relative concentration of rural population.

In view of the fact that rural population in the state decreased in absolute terms between the years 1960 and 1970, the intensity of the changes that occurred in the distribution of rural population in the DIRAs is determined by estimating the coefficient of Redistribution, the Ratio of Transference and the Relative Growth Graph.

These measures of geographical association indicate that the rural population of the DIRAs did not undergo substancial modifications. In the DIRAs located closer to the state capital (Sorocaba, Campinas and Paraiba Valley) there was a small shift of the rural population into the DIRAs while in the others this shift was leaving the DIRAs. Consequently, in the DIRAs of Sorocaba, Campinas and Paraiba Valley the relative growth of the rural population and of total population was higher than the state averages, while in the DIRAs of Presidente Prudente, São José do Rio Preto, Bauru and Araçatuba, it was lower than state averages; the

DIRA of Ribeirão Preto showed a relative growth of total population higher than the state average, but lower than state average for rural population relative growth.

Other agricultural variables

The Locational Quotient was also employed for the variables referring to farms, annual and perennial crops, natural and improved pastures and beef and milk cattle raising, to determine which DIRAs are above and which are below the state average in relation to these variables.

In the ratio number of farms/total area and farms with less than 10 ha /total farms, the concentration of small farms around the state capital is evident. The DIRAs of São Paulo, Campinas, Paraiba Valley, and Sorocaba are above the state average. In the ratio farms with more than 1,000 ha /total farms, the DIRAs that are located farther from the state capital have the highest quotients. Such is the case of Araçatuba, Ribeirão Preto, Presidente Prudente and Bauru. This indicates a concentration of large farms in these areas.

In the estimation of Locational Quotient for crops, it is observed that in the ratio cultivated area/total area, the DIRAs located near the state capital have lower relevance (Paraiba Valley and São Paulo) excepting the DIRA of Campinas. In the ratio perennial crop area/cultivated area, the DIRAs of São Paulo, Bauru, São José do Rio Preto and Presidente Prudente are above the state average. In the ratio annual crops/cultivated area, the DIRAs of Paraiba Valley, Sorocaba, Ribeirão Preto, Araçatuba and Campinas are above the state average. It should be added that, by definition, the DIRAs that are above average in the ratio perennial crop area/cultivated area, are below the average in the ratio annual crop area/cultivated area.

Estimating the Locational Quotient for pastures, in the ratio pasture area/total area, the DIRAs located farther from the state capital have higher quotients (Araçatuba, Presidente Prudente, Bauru and São José do Rio Preto), with the exception of the DIRA of

Paraiba Valley. In the ratios natural pasture area/pasture area, and improved pasture/pasture area, there is an inverse relationship as to magnitude of the DIRA quotients; in the first ratio the DIRAs of the Paraiba Valley, Campinas, São Paulo, Sorocaba, and Ribeirão Preto are higher than the state average; in the other ratio, i.e., improved pasture area/pasture area, the DIRAs of Araçatuba, Presidente Prudente, São José do Rio Preto and Bauru are higher than the state average.

Estimation of the Locational Quotient for cattle showed that the ratio number of beef cattle/total number of cattle and number of milk cattle/total number of cattle are opposite. The DIRAs of Araçatuba, Presidente Prudente and Bauru, which are located farther from the state capital, are above the state average in the first ratio while the DIRAs located closer to the state capital (Paraiba Valley, Campinas, São Paulo) are more relevant in the other ratio.

Regionalization

The present administrative division of the state is tested through the estimation of the correlation coefficients between all pairs of Sub-regions from the results obtained by the Locational Quotient. Under the assumption that the higher the coefficients, the greater the homogeneity between two Sub-regions, the adequacy of this administrative division under a regionalization criterion involving agricultural variables, is verified. The results obtained in some DIRA's show many negative correlations and correlations statistically equal to zero, which is evidence of substantial differences among the Sub-regions that compose these DIRAs. Since these Administrative Regions were not established with the specific purpose of adapting to agricultural conditions, this is an expected result.

For this reason, based on the existing Administrative Sub-regions, an attempt was made to present a grouping alternative that would satisfy homogeneity and geographical contiguity criteria. A regionalization based on agricultural variables was proposed. The results obtained in this grouping indicate a homogeneity relatively

greater than that observed upon testing the present administrative division. It should be noted that this proposal of alternatives for an agricultural regionalization does not aim at achieving administrative adequacy, but simply the indication of contiguous and homogeneous agricultural areas, and does not imply a negative criticism to the state administrative division. Since this division aims to meet administrative purposes, it is probably perfectly valid.

The review of Administrative Regions according to agricultural homogeneity criteria shows that some of them are reasonably adjusted (such as the DIRAs of Araçatuba and Paraiba Valley) while others are considerably heterogeneous (such as Bauru and Ribeirão Preto).

The alternative presented permits an adequation of the existing Administrative Sub-regions according to agricultural homogeneity criteria. The proposed regionalization is summarized in Chapter 6. According to this alternative, the Sub-regions of the DIRAs of Araçatuba and Paraiba Valley will constitute Regions 1 and 8, respectively, with no alterations. The DIRAs of Bauru and Ribeirão Preto presented the biggest restrictions, with a high number of negative correlation coefficients and correlation coefficients equal to zero. Consequently, the Sub-regions of the DIRA of Bauru will form Regions 2 and 4, while the Sub-regions of the DIRA of Ribeirão Preto will constitute Regions 4 and 5. The Sub-regions of the DIRA of Presidente Prudente will join Region 2. The other DIRAs show few restrictions and their Sub-regions will integrate the 8 Regions proposed. It should be noted that this alternative for an agricultural regionalization proposes eight Regions, approximately the same number as the existing Administrative Regions.

Conclusions

The geographical distribution of the variables studied in this research shows pecualiar characteristics of the various parts of the State. These characteristics seem to be highly correlated to the high demographic concentration existing in the capital of the State and surroundings. This area is one of the most important consumer

markets of food and raw materials and producers of manufactured goods in Latin America. Therefore, its existence strongly regulate the use of resources and farm production specialization in a great area around it.

Such aspects could be established in this research. Taking as a basis the Regions (DIRAs) and Administrative Sub-regions of the State Secretary of Agriculture it is found that the population of the State is highly concentrated in the Sub-regions of the Capital, Santos, Campinas, Mogi das Cruzes, Sorocaba, São José dos Campos e Jundiaí. On the other hand, there is a high demographic rural density in the Sub-regions of Jundiaí, Campinas, Mogi das Cruzes, Bragança Paulista, Sorocaba, Tatuí e São José dos Campos, reflecting a concentration of small farms in these Sub-regions. As a rule, the areas located near the capital, such as the Sub-regions of Bragança Paulista, Mogi das Cruzes, Santos, São José dos Campos, Sorocaba, Registro e the Sub-region of the capital itself, present a relatively small cultivated area. This might be partly explained by the existence of extensive urbanized areas in those sub-regions. On the other hand, it should be noted that much land in this area is not cultivated due to speculative purposes or due to better employment opportunities in the cities. In some cases, there are extensive pastures devoted to milk cattle raising, such as in the Paraiba Valley.

As one moves toward the interior, the picture changes substantially. There are still urban centers of considerable size, such as Limeira, Piracicaba, Ribeirão Prêto, Bauru, São José do Rio Preto, and others. However, their "ascendancy" are confined to the neighboring areas, and they have sometimes appeared and developed supported by a type of agriculture that no longer exists in the region.

In a general outline, the areas of the center, north, northeast of the state may be pointed as those which have the greatest

cultivated area. Such is the case of the DIRAs of São José do Rio Preto, Campinas and Bauru. These areas, with the exception of Ribeirão Preto, in general have medium and small size farms and a relatively dense rural population. Their pastures shelter milk cattle, although some points along the periphery are tending to beef production, as for example the Sub-regions of Barretos, Marilia, Mirassol, Lins, Ourinhos and Tupã.

As you travel westward there is a transition of crop area to pasture area, particularly improved pastures. This is the case of the Sub-regions of Andradina, Dracena, Presidente Venceslau, Araçatuba, Penápolis and Presidente Prudente, where considerable beef herds are found. These areas in general have large farms with low rural and total population densities, with the exception of the Sub-regions of Adamantina and Dracena. Thus, while the DIRAs of Araçatuba and Presidente Prudente present a relatively small cultivated area, which might be partly explained by the extensiveness of the pastures, the Sub-regions of Adamantina, Dracena and Penapolis has a larger crop area.

The southern area of the State is characterized by a relative inexistence of pastures and crops, with extensive unused area, which mitht be explained by the quality of the land, or by the predominence of traditional agricultural techniques without the resources of inputs and mechanization. The cultivated areas are predominantly planted to annual crops in the Sub-regions of Itapeva, Santos, Registro and Botucatu. Natural pastures predominate over improved pastures, especially in the Sub-regions of Santos, Registro, Itapeva, Avaré, Itapetininga and Botucatu. Milk cattle are predominant in these Sub-regions, with the exception of Registro and Itapeva, with a high share of rural population concentrated on large beef cattle farms. This factor accounts for the low rural and total demographic densities, excluding the Sub-region of Santos, where the total population density is

relatively high.

A study of the agricultural regionalization of the State can be made, based on the analysis of the above characteristics. The method employed enables the grouping of the forty-eight Agricultural Sub-regions into eight Regions, characterized by a relatively high degree of homogeneity in all or some of the variables, and according to a geographical contiguity criterion. The final result permits the delineation of the characterized Agricultural Regions as follows.

The Sub-regions of Region 1 (Andradina, Araçatuba and Penápolis) present high homogeneity with respect to the variables considered, and are characterized by high concentration of rural population in relation to total population, predominance of farms with more than 1,000 ha, cultivated area especially with annual crops, high concentration of pasture area in relation to total area, especially improved pastures and predominance of beef cattle herds. Furthermore, the rural and total demographic densities are low, with small number of farms scattered throughout the area, relative inexistence of farms with less than 10 ha, reduced cultivated area in relation to total area, low percentage of perennial crops, small area of natural pastures and reduced milk cattle herd.

The Sub-regions of Region 2 (Adamantina, Assis, Dracena, Lins, Marilia, Ourinhos, Presidente Prudente, Presidente Venceslau and Tupã) present relative heterogeneity with respect to some variables, but high homogeneity on the following characteristics: high concentration of rural population in relation to total population, predominance of improved pastures and high incidence of beef cattle. Also, the total demographic density is low, there is a small number of farms with less than 10 ha and low percentages of natural pastures and milk cattle.

The Sub-regions of Region 3 (Campinas, Casa Branca, Limeira, São João da Boa Vista and Tatuí) present relative homogeneity with

respect to the group of variables considered, especially the following: high concentration of rural population in relation to total population, high rural demographic density, high concentration of farms per total area, with a consequent predominance of farms with less than 10 ha, high percentage of cultivated area in relation to total area, with a predominance of perennial crops, of natural pasture area and of milk cattle. In this region large farms are scarce, there is a low percentage of annual crops, improved pastures and beef cattle.

Region 4, with a large number of Sub-regions (Araraquara, Barretos, Bauru, Franca, Jaú, Orlândia, Piracicaba, Ribeirão Preto, Rio Claro and São Carlos) does not permit high homogeneity in relation to total group of variables, presenting relative heterogeneity in some aspects but, essentially, its principal characteristics, as distinguished from the others, are as follows: high concentration of rural population in relation to total population, high concentration of milk cattle, low rural and total demographic densities, small number of farms scattered throughout the area, relative inexistence of small farms, low percentage of improved pastures and small beef herds.

The Sub-regions of Region 5 (Bebedouro, Catanduva, Fernandópolis, Mirassol, São José do Rio Preto, Taquaritinga and Votuporanga) in turn, presented a relative similarity in some aspects to those found for the Sub-regions of Region 4. Thus, the main characteristics are as follows: high concentration of rural population in relation to total population, high percentage of cultivated area in relation to total area, low total demographic density, relative inexistence of small farms and predominance of beef cattle.

The Sub-regions of Region 6 (Capital, Bragança Paulista, Jundiaí, Mogi das Cruzes e Sorocaba) are homogeneous in the following aspects: high concentration of rural population in relation to total population, high rural demographic density, high concentration of farms

on total area, with a consequent predominance of small farms, high percentages of natural pastures and milk cattle. On the other hand, there is a small number of large farms, low percentages of cultivated area and pasture area in relation to total area and predominance of beef cattle.

The Sub-regions of Region 7 (Avaré, Botucatu, Itapetininga, Itapeva, Registro and Santos) present relative homogeneity as to the group of variables considered in the following aspects: high concentration of rural population in relation to total population, predominance of farms with more than 1,000 ha and high concentration of natural pastures. Furthermore, rural and total demographic densities are low, there is a small number of farms in relation to total area, few farms with less than 10 ha, low percentages of cultivated area and of pasture area in relation to total area, and small area planted to annual crops.

The Sub-regions of Region 8 (Guaratinguetá, São José dos Campos and Taubaté) present high homogeneity with respect to the variables considered, being characterized by high concentration of rural population in relation to total population, high rural demographic density, high number of farms per total area, predominance of annual crops, high concentration of pasture area in relation to total area, with a predominance of natural pastures, and high number of milk cattle. Also, its density of total population is low, is not noted for either a high percentage of large farms or small farms, the percentage of cultivated in relation to total area is small, with low concentration of perennial crops and improved pastures, as well as small cattle herd.

As can be seen, each of the Regions has its own characteristics with respect to variables considered. These characteristics, conditioned by socioeconomical influences, are reflected in relative homogeneous production relationships for each delimitated

Region. Due to this, governmental or private programs directed to São Paulo agriculture and interested in acting upon similar production structures, may benefit from a regionalization such as the present. This applies to planning of resource allocation for technical assistance, research, credit, supplies and other activities. Thus, a technical assistance work directed to Region 3 (Sub-regions of Campinas, Casa Branca, Limeira, São João da Boa Vista and Tatuí), for example, must give particular emphasis to massive information methods under supervision of an extensive technical network, with some specialization on existing perennial crops. A credit program would concentrate on small and average loans and would have an important component of investments. With some additional information, these Regions could be detailed into areas in which more specific measures could be introduced.

Suggestions for future research

The methodology utilized could be complemented and, perhaps more detailed, applying it at the municipio level. These could then be grouped into Sub-regions and Regions. Also, more sophisticated methods of analysis could be utilized for the grouping of these and of other variables that are relevant to agriculture, in homogeneous Regions.