Symposium: Environmental, Agricultural and Socio-Economic Issues
Volos, Greece, april 3 to 7, 2000
Workshop: Farming and Rural Systems Methodologies

METHODOLOGY OF FARMING SYSTEMS CLASSIFICATIO

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Abstract

This paper shows the results obtained from the production system analysis of two agricultural regions in São Paulo State – Brazil. Both have different levels of modernisation. To typify the existing farmers two methods were used: The Multiple Correspondence Analysis (MCA) and the Agrarian System Diagnoses. The methods appear to be adequate to the proposed objectives and the conclusion is that it complements one another and alouds to obtain a more detailed and deeper knowledge of the farming systems.

1. Introduction

This work is a piece of an ample research[1], which the aim is to discuss the socio-economic and environmental impacts on watersheds. Those impacts as result of the Brazilian agriculture modernisation process.

This process began post world war II and as result there was partial, inadequate or unequal development according to the region, product and producer. Despite this process has been a giant step towards increasing productivity, innumerable disastrous consequences occurred in physical and social medium. The Brazilian field modernisation didn't consider the natural and social conditions for the production activity.

In other hand, the changes in technological pattern had integral support from the State, which decided to intervene decisively in the agriculture technology generation policy, since the 70's. The new pattern wasn't sufficiently capable to give answers to the serious sector problems, even though all the hope to solve the socio-economic matters have been deposited in technological strategies and policies mainly by increasing production and productivity. The technological component assumed a distinguished role in the large agricultural policy context, and even been a resultant of contradictions of social interests inside the state structure, was a reflex of the hegemony of dominant groups.

The São Paulo State was the stage for the massive application of this new production pattern, registering important regional differentiation and specialisation. So, the Paulista's agricultural sector rapidly modernised as a hole, accentuating the social and agrarian regional contradictions.

Based in that differentiation, the main idea of this work is trampled on evaluation of environmental and socio-economic impacts in different stages of the Paulista's agricultural

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[1] "The modernisation of agriculture in São Paulo State: Evaluation of environmental and socio-economic impacts in Watersheds Compared Study".

modernisation. But also, searched for the possibility of methods more appropriate for the natural resources management and technological patterns of development regionally adapted to environment and socio-economic conditions (RELATÓTIO FINAL).

Considering the fact that watersheds are considered an adequate analyses unit for environmental planning and managing the studies seek the different stages of agriculture modernisation development in watersheds of representative technological region.

Therefore two regions in São Paulo State well sketched in the means of predominant agriculture were chosen considering the production technical characteristic. The first diversified and modern had the Leme District as analysis area and the second a traditional and monocultural area had Itapeva District as example. In each of these districts the selected watersheds were those which showed adequate parameters to the main objectives of the work.

The start was the characterisation of the natural resources and agriculture production structure inside the selected watershed limits. The identification of the production systems of the sampled properties was done and considered as the basis for characterising the livestock and crop systems predominant at the watershed level.

The Leme district localised in the Northwest region of São Paulo State has characteristic related to the uses of modern technology and a diversified agriculture activity, that goes from crops linked to agroindustry like sugar-cane, orange and cotton, to food crops like rice, beans, corn and manioc. For the study five (5) watersheds were selected in an area of 6.858,51 ha, in the West Side of the district due to the diversities in soils, landscape, crops and social occupation. In result there's a more diversified production situations. In order to typifies the farmers of the selected watersheds were used statistical procedures by multivaried analysis.

The Itapeva District, in the Southeast region of São Paulo State, was selected because of its traditional agriculture with low technology level (animal Traction) associated to the low inputs, and the production is fundamentally for subsistence. The watershed chosen consists in an area of 1774 ha, formed by a stream of the Apiaí-Guaçu River, the São Tomé Stream. Inside the watershed selected, the classification of the farmers' types was obtained through the agrarian Systems Fast Diagnoses Methodology. A Historical differentiation of the production units and its reproduction capacity took place, and after discriminatory variables were chosen to typify the farmers. These variables are related to the production logic (capitalist, family-farming), the capital accumulation paths, and the crop and livestock systems.

Specifically this paper intends to prove, considering the methodologies used, that it's not two antagonistic methods, but that they complement one another in a way to obtain a more detailed and deeper knowledge of the system production analysis. Besides, it should be shown up that this classification process has as main goal to facilitate the different actions to be developed with the farmers, searching for the transfer of more adequate techniques to the natural resources management.

Next will present the procedures and the obtained results with both methods, respectively used in each area of study, followed by the final considerations.

2. Methodological Procedure to Typifies Farmers

2.1. The Multiple Correspondence Analysis Method (MCA)

The Multiple Correspondence Analysis Method – MCA (ESCOFIER, 1988; JUDEZ, 1979/80) followed by the WARD Classification Method (EVERITT, 1981) was adopted to typify the farmers of Leme district.

The MCA can be defined as an application of a Correspondence Factorial Analysis (CFA) to a data disjunctive table, it's a multidimensional method that alouds the confrontation

of a complex amount of information in opposition to simple descriptive statistic where is possible just to cross only one or two variables. Simplifies huge data tables and represents grouping, opposition and tendencies graphically. The table is composed with two kinds of information: the individuals (farmers) and the qualitative variable modalities that are converted into a disjunctive table been represented by lines and columns respectively.

The fieldwork was a questionnaire consisted of 1052 variables grouped in five blocks[2] applied to 61 farmers. The first data unit adopted was the farm property (land legal property unit) changed later on to farm holding which consists in all the land/area under management of one farmer continuous areas or not. The first field-test detected an incompatibility between the production system manage unit and the property geographic limits. That's because the manage-unit could use totally or parts of one or more properties or in contrary the same property could cover more than one manage unit. The farm holding definition is a relational function between the resource use unit and the decision unit.

The first application of the MCA to the original database wasn't satisfactory. The strong correlation with technology of variables large number made the results interpretation more difficult as well the distinctions inter and intra types identity. Also, couldn't establish satisfactory relations between technology, manpower and destiny of plant production. This problems led to a new statistic procedure selecting and grouping variables related to the same theme[3] in a way to get a refined result that emphasises the most remarkable production systems characteristics in each one. For the second time the MCA was applied and satisfactory results obtained with the definition of two main factorial axis (F1 and F2) that explains the associated inertia of 9,63% and 17,38% respectively. The WARD Classification Method was applied to the axis to obtain the farmers grouping by there similar characteristic. Therefore 6 groups of farmers types representatives were identified in the region: urban cattle breeder and citriculturist (Type 1); Cattle breeder and high level technology cotton farmers (Type 2), without rural productive dynamic (type 3), non specialised farmers with self consumption animal breeding (type 4), specialised farmer without animal breeding (Type 5), and Dairy cattle farmers with self consumption agriculture (Type 6). The main characteristics resume is in Table 1.

[2] Farm identification; farm formation (the property inside limits); farm formation (property outside limits); Farm characterisation; and Animal and plant production characterisation.

[3] The theme variables created were: Farm Localisation; Farmers Land Strategy; Social Relations; Rural/Urban Relation; Production Support Instruments; Soil Uses; Permanent Constructions; Implements, Machinery and Animal Uses; Technology in Plant Production; and Animal Production Stocks, Technology and Commercialisation.

Table 1. Farmers Types general Characteristics of Leme District, São Paulo – Brazil, 1997.

Characteristic	**Type 1**	**Type 2**	**Type 3**	**Type 4**	**Type 5**	**Type 6**
Type Name	Cattle Breeders (Urban) and citriculturist	Cattle Breeders and Cotton Farmers (technology high level)	Without rural productive dynamic	Non specialised farmers with self consumption breeding animals	Specialised farmers without animal breeding	Dairy farmers with self consumption agriculture
Main income sources	Urban (liberal professionals)	Plant and animal production	Various	Agriculture	Agriculture	Cattle (sometimes retire sold)
Main Activity	Mix Cattle Dairy and meat	Cotton	Various	Diversity (cotton, grass, corn and rice)	Cotton and Corn	Cattle or mix
Farm holding Average Area	< 37,5 ha	between 37,5 ha and 70,4 ha	< 14,0 ha	between 14,0 ha and 70,4 ha	between 37,5 ha and 605,0 ha	> 70,4 ha
Farm holding Composition	Simple (without rent or share farming)	Complex (with rent or family or others share farming)	Simple	Complex (with family arrangements)	Complex (with family arrangements)	Various (includes land transfer for rent)
Rural Credit Uses	No	Investment (50% of the farmers) and costs (90% of the farmers)	No	Investment (20% of the farmers) and costs (70% of the farmers)	Investment (4% of the farmers) and costs (71% of the farmers)	No
Manpower	Familiar and employee balance	Familiar predominance	Varied	Familiar with temporary employees	Familiar with temporary employees	Familiar with partnership cases
Technology Level	Medium to low	Medium to high	Low	High	High	High
Planting Intensity	16 to 79% of total area	> 80% of total area	Without information	16 a 90% of total area	> 80% of total area	< 9% of total area

Source: Research data.

The position projected in a co-ordinate axis alouds to see the classification of those farmers (Figure 1).

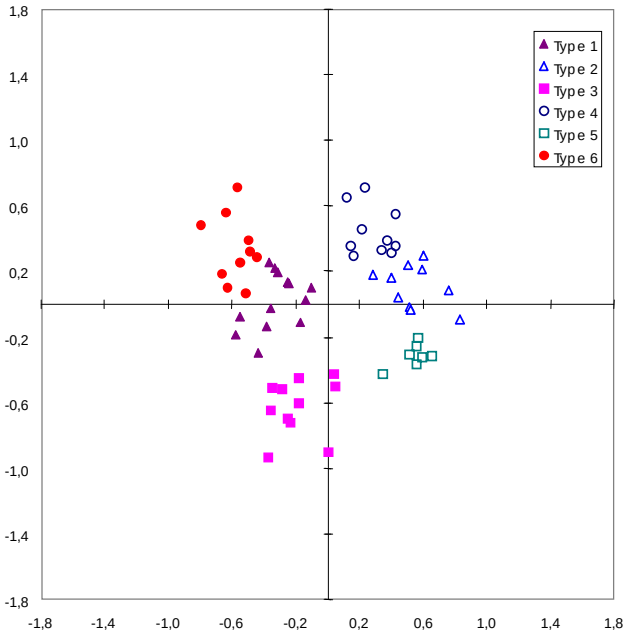

Figure1. Graphic representation of the researched farmers of Leme district among axis F1 and F2
Source: research Data.

Comparatively the Types 2,4 and 5(the graphics right block) and 1,3 and 6 (graphic left block) are similar in the family farm logic, the production strategy and the plant production technology. In the first block (Types 2,4 and 5) the farmers never rents their own land and most of them extend their land someway by family arrangements or renting from others. Their main income is from rural economy activities and there's no urban income. They're co-operative participants and uses rural credit. They grow cotton, the productive process is amply mechanised and complementary manual field cleaning is used. In the second block the types 1 and 6 have farm holdings own areas and the farmers don't use rural credit. This can characterise property simple reproduction that means without enlarging neither the production area nor the investments (the case of small farmers) or a relative resource abundance, meaning that the farmer has land and resources enough for production. The type 3 has none production dynamic with no relevant animal or plant production volume and are represented in the negative zone of both.

2.2. The Agrarian System Diagnoses Method

The rural systemic study consists in several observation levels and scales. The main concepts are related to systems: agrarian, production, plant and animal, and also to the first transformation and technical routine[4]. The farm unit is a frontier between the physical limits of the property and it's constitutive elements represented by the plant and animal systems and for the capital stocks in machinery, equipment and fertilisers.

[4] **Agrarian System**: The agriculture exploitation modes in a historically constitute space established by the society. It's a result combination of natural, social, cultural, economics and technical facts. **Production System**: It's a combination in time and space of quantities of manpower and production means to obtain different agriculture, plant or animal production. It's the sum of all sub-systems of plant, animal and first transformations. **Plant System**: plant breed homogeneity area, organised succession order. **Animal System**: the same animal species, distributed by age and sex. Both, animal and plant system are submitted defined technique routine. **First Transformation System**: post-cropping procedure done to farm products still in agriculture exploitation unit. As example to peal, select, pack and primer industrialisation. **Technical Routine**: whole logic operations applied to a plant or animal specie. (MAZOYER, 1989 and DUFUMIER, 1996.)

The Agrarian System Method applied to field research at Itapeva district followed five basic principles: 1) sequenced progressive steps from the general to specific; 2) Search to historical explanations to the actual reality principal facts; 3) Create an environment, social and economic stratification (the region global analysis, farmers types and production system); 4) Analysis based on systems (agrarian, production, plant, and animal systems) privileging the relationship between environment, technical and social facts; 5) Non aleatorius sample definition that means selected individuals that have the historical knowledge of how the actual landscape was build.

The global analysis done trough theme maps, landscape reading and interviews aloud to identify the area main heterogeneity considering agroecological and socio-economic potentialities and limits that are or were conditioned to the farmers principal accumulation path and de differentiation of the production systems in geographic space. At the end of this step the preliminary farmers types was establish, where afterwards a detailed survey was carried out to characterise and evaluate the production systems. To detail the production system a quantitative and qualitative survey took place. Referred to the production unit related to the production means (land property, rented or share land and it's localisation; soil quality; herd; machinery and implements) to the different animal and plant systems, and to the manpower occupation (employed or familiar). Then the animal and plant systems were integrated. Several annual calendars of manpower uses, of implements and machinery uses, and monetary inputs and outputs were analysed *vis-à-vis* the fertility flux[5] of the exploitation in time and space and the opportunity costs.

At last the final farm types that express all the rationality, historical evolution and the farmers production specific logic from Itapeva district. The differential variables to typify the farmers were the production logic (Family Farm, capitalist), path for capital stock and the plant and animal systems. It was identified 11 farmers types that belonged to 3 categories (mini-farm, family farms, capitalist farmers) 5 of them occurred in studied area: mini-farm (Type 1), Self-consumption Family Farm (Type 2A), Capitalised Family Farm (Type 3), Business Family Farm (Type 4) and Business Capitalist (Type 5).

The mini-farm (Type 1) main characteristic is that their income from the farm is no enough to guaranty the family survival, to assure their reproduction. Therefore they sell work-power. The basis of this need is the missing productive capital, specially land and machinery. The accumulation is extremely hard, and that leads most of them to employment temporally or permanent or even to leave the countryside (rural exodus).

The type 2A - Self-consumption Family Farm – It's the farmers that couldn't change from animal to motor-mechanic traction during the 70's and 80's, because they weren't enough capitalised. Their production capacity is sufficient for the family reproduction but don't alouds investments in a way to increase their physical productivity by restoring continuously the soil fertility. The rice, corn and beans production is for self-consumption and eventually excesses selling. Their productivity is very low. They're the owner of 12,1 to 48,4 ha land area.

The Capitalised Family Farm (Type 3) is those who gain an ascendant differentiation that can be translated by the change of animal to motor-mechanic traction uses. This passage can be seen as the cause as much as consequence to the farmers' capitalisation. This is mainly because of the time and cumulative effects of acquiring machinery had to their capitalisation capacity. They own between 48,4 to 96,8 ha.

Something in between the family farmers and the capitalists are the business family farm (type 4) and mix both traces. The family manpower is reduced and has non-participation or participates to little of the productive process. Nevertheless, the farmer lives exclusively of

[5] Fertility Fluxes: nutrients transfers between the environment and the animal and plant systems in a way of agriculture products, agrochemical, plant and animal sub products.

this activity and stills the manager of the production unit. That puts it to the production family logic. It's a very intensive agriculture in the means of manpower and capital. Integrated to the market and dependent in employees.

At last the Business Capitalist (Type 5) that besides using manpower employee defers from the family farmers because of it's production logic. And also have a straight relation with the market for selling or buying products. Agriculture most of the times is not the main income and it isn't the only one. Has to be considered as a capital application *locus* to earn profits, just as other investiments. The cattle breeders are the representatives of this type in the region. They are businessmen, professionals and traders that in this activity sector most of the times because of federal incentive, credit facilities searching for good opportunities to invest or speculate.

The table 2 synthesises the main characteristic of these farmers' types.

Table 2. General Characteristic of Itapeva District farmer-Types, São Paulo - Brazil, 1996.

Characteristic	**Type 1**	**Type 2A**	**Type 3**	**Type 4**	**Type 5**
Type Name	Mini-Farm	Self-Consumption Family Farm	Capitalised family farm	Business family Farm	Business capitalist
Income Main Source	Salary	Agriculture	Agriculture/ Cattle	Agriculture	Cattle
Main Activity	Corn, rice and beans	Rice, Corn and Beans	Corn and Beans or Cattle	Corn, Beans, Soya, wheat, Triticale and Oats	Meat Cattle
Own Area	< 12,1 ha	12,1 ha to 48,4 ha	48,4 ha to 96,8 ha	96,8 ha to 484,0 ha	96,8 ha
Farm Composition	Complex (rent and share farm)	Simple (without rent and share farm)	Simple	Complex	Simple (or with rent edge areas)
Manpower	Family	Family	Family predominance	Family with employee	Temporary and permanent employees
Technology Level	Low	Low	Medium to High	High	High

Source: Research Data.

3. Discussion and Final Considerations

It can be affirmed that the methods (Multiple Correspondence Method and Agrarian System Diagnoses) used in this work with the aim to characterises two agriculture realities in São Paulo State were satisfactory because alouds to evidence, mainly, fundamental differences between regions, and also between farmer types and their production systems. Therefore it's possible to think and elaborate extension action programmes allied to a better natural resources management, to in fact promote the local rural development.

Specifically related to the methods it can be evidenced that while the multivaried method was very efficient to characterise the production systems, the agrarian system diagnoses method considered the historical evolution in the farmers' differentiation going beyond the production system. When this method is used, it's considered the paths of the different farmer types in time and space, in a way that beyond the technological-production

basis to typifies, it's given the privilege to the social-reproductive formation, understood as the farmers family history in all it's dimensions.

This didn't happen because of an intrinsic pre-condition, but in a way that the information and data-raising procedures were structured. In the first case, the research instruments used (field questionnaire and temporal delimitation to collect that information – one agricultural year) had as resultant a technical-productive categorisation, which means, the production system typology. The chose names to identify the types in Leme region is an expression of that: Cattle Breeder and Citriculturist, Cattle breeder and Cotton farmers, without rural productive dynamic, Diversified farmers with self consumption livestock, specialised farmers without livestock, Dairy farmers with self-consumption agriculture.

In Itapeva case the raised historical data (maps and interview) expressed the rationality of the farmers accumulation paths in time and space, So the obtained Typology was beyond the technical-productive parameters, and allows a socio-economic categorisation: small farmers, Subsistence family farming, capitalised family farming, capitalist family farming, and capitalist farming.

That doesn't mean that the methods are antagonistic but that it can be complementary because the agrarian system typology allows the understanding of social, economic, and technical actual conditioning of the farmers, and obtain a more detailed and deeper knowledge of the production systems supported on multidimensional statistic analysis.

With the results of a classification based on complementary methods, a more adequate typology that will permit different extension actions can be obtained, resulting then in more success on the process of technological changes that looks for a more adequate use of natural resources.

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